

Literature review of community-based information dissemination and environmental prevention strategies utilized to address opiate use and emerging substances

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EXECUTIVE SUMMARY

BACKGROUND

Over the past decade, communities within the United States have been engaging in efforts to prevent opiate misuse and overdose deaths. Nationally, the number of overdose deaths due to opiates has continued to increase (Scholl, 2019) supporting the need for continued efforts to prevent opiate misuse and overdose deaths.

Recent surveillance data highlights a continued threat of methamphetamine, resurgence of cocaine, increase in illicit use of marijuana, and spike in vaping in the United States (DEA, 2019; Johnston et al., 2020).

Taken together, these reports on current substance use patterns in the United States support the need for maintenance of current efforts on opiate misuse, implementation of strategies to prevent vaping and cannabis use among adolescents and young adults, and continued monitoring and acknowledgment of the potential threat of cocaine and methamphetamine use. It is important that prevention practitioners and researchers follow these substance use trends and implement a comprehensive set of strategies to address these different substances. When possible, strategies that are effective in preventing multiple substances should be considered to best utilize limited resources.

METHODOLOGY

To provide prevention providers a tool to address emerging substance use by implementing strategies that they are currently, or recently, have utilized to address opiate use and associated consequences within their communities, a review of the literature was conducted.

First, prevention strategies that had been implemented in North Carolina (NC) to address opiate misuse were identified using the North Carolina Substance Abuse Prevention Block Grant (NCSAPBG) Intervention Categorization Interventions Allowable for All Provider Agencies (last updated on 8-10-18). Then, the peer-reviewed literature was searched for manuscripts that assessed the effectiveness of strategies, utilized to address opioids, on preventing vaping, cannabis, methamphetamine, and cocaine use or intervening variables. For a manuscript to be selected, it must have met the following criteria: (1) test a prevention intervention or strategy that can be categorized as information dissemination or environmental strategy; (2) the strategy must have been previously utilized to address opiates (based on inclusion within the NCSAPBG Master Grid; and (3) address an emerging substance based on epidemiological trends (i.e., vaping, cannabis, methamphetamine, and cocaine). Manuscripts published in PubMed between January 1, 2000 through December 31, 2019 were considered.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The findings from the literature review indicate that strategies should be substance specific and tailored to the needs of the communities. The most promising information dissemination strategies were communication campaigns and public service announcements. It is important that these campaigns have been developed utilizing theory and input from the target population and have demonstrated or show promise of effectiveness. The environmental strategies related to reducing access of substances to adolescents and young adults may be the most promising. An environmental strategy from the opiate, and alcohol, literature that could be relevant for cannabis and vaping products is secure storage when obtained and used legally by adults. However, more suitable strategies for legal (adult) cannabis and vaping products may come from alcohol or tobacco environmental strategies that regulate sale (e.g., outlet density, proximity to schools, etc.).

The dynamic nature of substance use threats calls for timely research on effective strategies that can be utilized by community agencies to protect their communities. Practitioners and researchers should work together to empirically test intervention strategies to ensure that evidence-based strategies can be quickly implemented within communities to minimize the adverse effects of substance use behaviors.

LITERATURE REVIEW OF COMMUNITY-BASED INFORMATION AND DISSEMINATION AND ENVIRONMENTAL PREVENTION STRATEGIES UTILIZED TO ADDRESS OPIATE USE AND EMERGING SUBSTANCES

INTRODUCTION

Over the past decade, communities within the United States have been engaging in efforts to prevent opiate misuse and overdose deaths. Nationally, the number of overdose deaths due to opiates has continued to increase – a 12.0% increase in age-adjusted rate of drug overdose deaths from 2016 to 2017 (Scholl, 2019). It is important that we continue to move the needle on opiate misuse and overdose deaths while also taking the pulse of substance use trends that may be rising.

The most recent Drug Enforcement Administration's (DEA) National Drug Threat Assessment (December 2019) indicates that opiates, in the form of fentanyl, heroin, and controlled prescription drugs (i.e., prescription opioids), are still the greatest substance use threat in the United States. This report also highlights the continued threat of methamphetamine, resurgence of cocaine, and illicit use of marijuana (DEA, 2019).

Substance use prevention efforts commonly target adolescents and young adults to prevent initiation or escalation of substance use behaviors and associated harms. Among adolescents and young adults, the most recent Monitoring the Future survey (Johnston et al., 2020) found that vaping of nicotine and marijuana increased significantly from 2017 to 2019 for 8th, 10th, and 12th graders. While lifetime, annual, and past 30-day use of marijuana did not change, daily use increased significantly. Illicit drug use, including cocaine, methamphetamine, LSD, etc., remained steady for this population, and misuse of prescription drugs (including opioids) continued to decline.

Taken together, these reports on current substance use patterns in the United States support the need for maintenance of current efforts on opiate misuse, implementation of strategies to prevent vaping and cannabis use among adolescents and young adults, and continued monitoring and acknowledgment of the potential threat of cocaine and methamphetamine use. It is important that prevention practitioners and researchers follow these substance use trends and implement a comprehensive set of strategies to address these different substances. When possible, strategies that are effective in preventing multiple substances should be considered to best utilize limited resources.

The objective of this literature review is to identify evidence-based strategies used to address opiate use that may also be effective at preventing other substance use behaviors. The overarching purpose of this literature review is to provide prevention providers a tool to address emerging substance use by implementing strategies that they are currently, or recently, have utilized to address opiate use and associated consequences within their communities.

To this end, we focused on two of SAMHSA's strategy categorizations: information dissemination and environmental strategies (SAMHSA's Focus on Prevention). Information dissemination refers to the provision of knowledge that aims to increase awareness of the nature, extent, and impact of alcohol and other drug use and dependence. It also includes provision of knowledge to increase awareness of available prevention and treatment programs and services. It is characterized by one-way communication from the information source to the audience, with limited contact between the two. Examples include classroom speakers or media campaigns. Environmental strategies aim to establish or change written and unwritten community standards, codes, attitudes, and physical context. Its intent is to influence the general population's use of alcohol and other drugs. Examples include zoning restrictions on tobacco outlets and prescription drug monitoring programs.

A third SAMHSA strategy categorization, community-based processes, is important to mention here as these processes serve as the foundation for communities to have the capacity to disseminate information and implement environmental strategies. Community-based processes consist of ongoing networking activities and technical assistance to community groups or agencies. It encompasses neighborhood-based, grassroots

empowerment models using action planning and collaborative systems planning. Examples include developing coalitions and tasks forces, capacity building, conducting needs assessments, and planning for sustainability.

METHODOLOGY

We developed a protocol to identify and select peer-reviewed manuscripts for the purpose of this literature review. The protocol consisted of specification of a stepwise process which included identifying the inclusion criteria, developing the search strategy, searching for manuscripts in PubMed, screening the search results for eligible manuscripts, and identifying promising strategies.

The first step was to identify prevention strategies to address opiate use. To identify prevention strategies that had been implemented in NC to address opiate misuse, we referred to the North Carolina Substance Abuse Prevention Block Grant (NCSAPBG) Intervention Categorization Interventions Allowable for All Provider Agencies (last updated on 8-10-18), herein referred to as the “NCSAPBG Master Grid”. The rationale for basing the search terms off these strategies is that these strategies are currently, or recently, have being implemented to address opiate use and associated consequences within North Carolina communities.

Next, we conducted a literature to review to assess if the opiate strategies identified in the previous step have been tested for efficacy of other emerging substance use trends (i.e., vaping, cannabis, methamphetamine, and cocaine). For a manuscript to be included, it must have met the following criteria: (1) test a prevention intervention or strategy that can be categorized as information dissemination or environmental strategy; (2) the strategy must have been previously utilized to address opiates (based on inclusion within the NCSAPBG Master Grid; and (3) address an emerging substance based on epidemiological trends (i.e., vaping, cannabis, methamphetamine, and cocaine). The following search terms were utilized to search for the third eligibility criteria: (cocaine OR methamphetamine OR cannabis OR marijuana OR vape OR vaping). Manuscripts published in PubMed between January 1, 2000 through December 31, 2019 were considered. Search terms by strategy, along with number of peer-reviewed manuscripts identified, are presented in Appendix A.

FINDINGS

Information dissemination

Provision of brochures, educational pamphlets, or handouts. There were eight peer-reviewed manuscripts related to the provision of brochures, educational pamphlets, or handouts. One of the studies examined the impact of a fotonovela about methamphetamine and increased knowledge and conversations about methamphetamine (Davis & Jansen, 2020). While eight articles were identified in this search, all utilized a brochure or pamphlet as the control or alternative treatment to another intervention – most often a form of screening and brief intervention (Bernstein et al., 2009; Carter et al., 2016; Davis & Jansen, 2020; Drislane et al., 2020; Knight et al., 2018; Poblete et al., 2017; Rohde et al., 2012; Werch et al., 2005) – which suggests that if utilized brochures and educational pamphlets should not be utilized in isolation.

Health fairs, town hall meetings, and community presentations. There was one peer-reviewed study pertaining to community presentations. This study found that an interactive educational presentation on vaping conducted in a school setting by a medical professional, in this case a PharmD, may be effective at changing perceptions of harm (Morrill et al., 2017).

Communication campaigns and public service announcements. The reviews for communications campaigns and public service announcements were conducted separately and later combined given the overlap between the articles and language utilized within the manuscripts. In total, twenty-seven peer-reviewed studies were identified. The articles focused on cannabis (Alvaro et al., 2013; Brooks-Russell et al., 2017; Comello, 2013; Hanson et al., 2018; Kang et al., 2009; P. Palmgreen et al., 2001; Philip Palmgreen et al., 2007; Slater et al., 2006, 2011; Stephenson et al., 2002), vaping (Pepper et al., 2019), methamphetamine (Anderson, 2010; Anderson & Elsea, 2015; Nanín et al., 2006; Richards, 2014), general illicit substance misuse (Comello &

Slater, 2011; Evans et al., 2017; Ferri et al., 2013; Hornik et al., 2008; Longshore et al., 2006; Scheier et al., 2011; Scheier & Grenard, 2010).

There 11 articles on campaigns aimed to prevent marijuana use identified in our search. These studies were published from 2001 to 2018 which should be taken into consideration given the changing legal climate. The findings from two earlier studies indicate that “Above the Influence” campaign may be effective (Comello, 2013; Scheier et al., 2011; Slater et al., 2011), especially for eighth grade adolescent females (Carpenter & Pechmann, 2011). A study on campaign development, in a state where recreational cannabis is legal, found that messages pertaining to the laws was rated higher than messages about potential harms of use, consequences of use, and alternatives to cannabis among teens and parents (Hanson et al., 2018). Among the more recent campaigns, “Good to Know” was developed and implemented in Colorado (Brooks-Russell et al., 2017). This campaign focused presented four key legal messages: (1) one must be 21 years old to use, buy, or possess recreational marijuana, and it is illegal to give or sell marijuana to anyone younger than 21 years; (2) one can be cited for driving under the influence of marijuana; (3) marijuana may not be consumed in a public place, including federal land and private vehicles; (4) marijuana may not be taken out of the state of Colorado. The evaluation of this campaign suggests that the campaign may be attributed to changes in knowledge about marijuana laws among those who were exposed (Brooks-Russell et al., 2017).

Five of the six articles that addressed methamphetamine focused on “The Meth Project” that was originally implemented in Montana then adopted in other US states. While methamphetamine use declined in Montana following campaign implementation, methamphetamine use was already decreasing when the campaign was implemented and it is not clear if the decline could be attributed to the campaign itself (Anderson, 2010; Erceg-Hurn, 2008). Another study that utilized YRBS data to examine the effectiveness of “The Meth Project” in eight states found little evidence that the campaign reduced methamphetamine use in the full sample but some evidence of decreased meth use among White high school students (Anderson & Elsea, 2015). Two studies examined how to make these campaigns more effective. One found that implementing ads that increase conversations about methamphetamine may increase effectiveness (Richards, 2014) and another found that the images should resonate more with the target population and not increase stigma (Marsh et al., 2017).

Campaigns related to vaping are starting to be examined. One study found that campaigns should not acknowledge scientific uncertainty as it made vaping seem less risky to adults (Pepper et al., 2019).

We searched for studies that had used the opioid specific campaigns - Use as Directed, Generation RX, and Pact 360 – for other substances, and the search did not yield studies on this topic.

No peer-reviewed studies on resource directories, prevention focused websites, email blasts, and newsletters were identified with the search criteria.

Environmental strategies

The majority of environmental strategies that have been implemented to address opiate misuse are related to limiting access of prescription opioids through the implementation of policies pertaining to prescribing and dispensing of opioid medications. While the review of the peer-reviewed literature did not yield published articles that examined the utility of strategies related to prescribing or dispensing of the emerging substances, these strategies may be promising for substances that are also supplied via the medical community. Specifically, these strategies may be beneficial to prevent nonmedical or illicit cannabis as more states legalize cannabis for medical purposes (Abazia & Bridgeman, 2018; Dattani & Mohr, 2019; Grootendorst & Ranjithan, 2019).

Secure storage of prescription opioids is a strategy borrowed from the alcohol prevention field and may be applicable for cannabis (in states where recreational or medicinal cannabis is permitted) and vaping devices. While a study assessing the impact of a storage intervention was not found in the peer-reviewed literature search, there was an article that examined the cannabis storage and disposal practices of oncology patients and caregivers (Brooks-Russell et al., 2020, p.; Sznitman et al., 2016).

CONCLUSION

Current substance use patterns in the United States call for communities to maintain current efforts on opiate misuse while implementing strategies to prevent vaping, cannabis, cocaine, and methamphetamine use among adolescents and young adults. It is important that prevention practitioners and researchers follow these substance use trends and implement a comprehensive set of strategies to address these different substances. When possible, strategies that are effective in preventing multiple substances should be considered to best utilize limited resources. This literature review sought to identify evidence-based strategies used to address opiate use that may also be effective at preventing other substance use behaviors to provide prevention providers a tool to address emerging substance use by implementing strategies that they are currently, or recently, have utilized to address opiate use and associated consequences within their communities.

The findings from the literature review indicate that strategies should be substance specific and tailored to the needs of the communities. The most promising information dissemination strategies were communication campaigns and public service announcements. It is important that these campaigns have been developed utilizing theory and input from the target population and have demonstrated or show promise of effectiveness. The environmental strategies related to reducing access of substances to adolescents and young adults may be the most promising. An environmental strategy from the opiate, and alcohol, literature that could be relevant for cannabis and vaping products is secure storage when obtained and used legally by adults. However, more suitable strategies for legal (adult) cannabis and vaping products may come from alcohol or tobacco environmental strategies that regulate sale (e.g., outlet density, proximity to schools, etc.).

The dynamic nature of substance use threats calls for timely research on effective strategies that can be utilized by community agencies to protect their communities. Practitioners and researchers should work together to empirically test intervention strategies to ensure that evidence-based strategies can be quickly implemented within communities to minimize the adverse effects of substance use behaviors.

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APPENDIX A

Table 1. Search Strategy

Intervention	Search Strategy	Selected (#)
Information Dissemination		
Brochures and printed materials	(brochure* or pamphlet* or "educational pamphlet*" or handout*)	8
Health fairs, town hall meetings, and community presentations	("health fair*" OR "town hall" OR "town hall meeting" OR "community presentation" OR "community meeting")	1
Prevention focused websites, email blasts, and newsletters	((newsletter* OR email* OR website*) AND prevention)	0
Radio & TV public service announcements	("public service announcement*" OR PSA)	4
Resource directories	("resource directory" OR "resource directories" OR "directory")	0
Communication campaigns	("campaign*")	26
<i>Use as directed</i>	("use as directed" AND "prevention")	0
<i>Generation Rx</i>	("generation rx")	0
<i>Pact 360 Rx</i>	("pact 360 rx")	0
Environmental Strategies		
Prescribing Guidelines	prescribing guideline*	0
Dispensing Guidelines	dispensing OR dispense	0
Prescription Drug Monitoring Programs (PDMP)	(pdmp* OR "prescription drug monitoring program*" OR "monitoring program*")	0
Pill Mill Policies	("pain clinic law" OR "pain clinic ordinance" OR "pain clinic policy" OR "pill mill law" OR "pill mill policy" OR "pill mill ordinance")	0
Medicaid Lock-In	("lock-in" OR "lock in")	0
Academic Detailing	("academic detailing" OR "provider detailing" OR detailing)	0
Medication Disposal	<i>Take-Back Events:</i> ("take-back event*" OR "take-back" OR "take back event" OR "take back") <i>Drop-Boxes:</i> (drop-box* OR dropbox OR "drop box") <i>Deactivation Devices:</i> ("deactivation device" OR "deactivation pouch" OR Deterra OR "Dispose RX") <i>Local ordinances:</i> ((dispos* AND law) OR (dispos* AND ordinance) OR (dispos* AND policy))	0
Secure storage	(storage AND prevention) OR ("secure storage") OR ("storage practices") OR (locked)	0

Table 2. References per intervention

Intervention	Reference(s)
Information Dissemination	
Brochures and printed materials	Bernstein et al., 2009; Carter et al., 2016; Davis & Jansen, 2020; Drislane et al., 2020; Knight et al., 2018; Poblete et al., 2017; Rohde et al., 2012; Werch et al., 2005
Health fairs, town hall meetings, and community presentations	Morrill et al., 2017
Prevention focused websites, email blasts, and newsletters	N/A
Resource directories	N/A
Communication campaigns and public service announcements	Alvaro et al., 2013; Brooks-Russell et al., 2017; Comello, 2013; Hanson et al., 2018; Kang et al., 2009; Palmgreen et al., 2001; Palmgreen et al., 2007; Slater et al., 2006, 2011; Stephenson et al., 2002, Pepper et al., 2019; Anderson, 2010; Anderson & Elsea, 2015; Nanín et al., 2006; Richards, 2014; Comello & Slater, 2011; Evans et al., 2017; Ferri et al., 2013; Hornik et al., 2008; Longshore et al., 2006; Scheier et al., 2011; Scheier & Grenard, 2010
<i>Use as Directed</i>	N/A
<i>Generation Rx</i>	N/A
<i>Pact 360 Rx</i>	N/A
Environmental Strategies	
Prescribing Guidelines	N/A
Dispensing Guidelines	N/A
Prescription Drug Monitoring Programs (PDMP)	N/A
Pill Mill Policies	N/A
Medicaid Lock-In	N/A
Academic Detailing	N/A
Medication Disposal	N/A
Secure storage ('Lock your meds', lockbox distribution, locking cabinet installation)	N/A



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Adolescents' Attitudes toward Anti-marijuana Ads, Usage Intentions, and Actual Marijuana Usage

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Abstract

The association of adolescents' appraisals of the anti-marijuana television ads used in the National Youth Anti-drug Media Campaign with future marijuana use was investigated. The 12 to 18 year old respondents ($N = 2993$) were first classified as users, resolute nonusers, or vulnerable nonusers (Crano, Siegel, Alvaro, Lac, & Hemovich, 2008). Usage status and the covariates of gender, age, and attitudes toward marijuana were used to predict attitudes toward the ads (A_{ad}) in the first phase of a multi-level linear analysis. All covariates were significantly associated with A_{ad} , as was usage status: resolute nonusers evaluated the ads significantly more positively than vulnerable nonusers and users (all $p < .001$), who did not differ. In the second phase, the covariates along with A_{ad} and respondents' usage status predicted intentions and actual usage one year after initial measurement. The lagged analysis disclosed negative associations between A_{ad} and usage intentions, and between A_{ad} and actual marijuana use (both $p < .05$); however, this association held only for *users* ($p < .01$), not vulnerable or resolute nonusers. Users reporting more positive attitudes towards the ads were less likely to report intention to use marijuana and to continue marijuana use at 1-year follow-up. These findings may inform designers of persuasion-based prevention campaigns, guiding pre-implementation efforts in the design of ads that targeted groups find appealing and thus, influential.

Keywords

Adolescents; Attitudes; Attitudes toward the ad; Mass media; Advertisements; Marijuana; Prevention

Despite decades of refinement and expenditures in the billions of dollars, mass media campaigns designed to prevent or reduce substance use have met with inconsistent results (Crano, Siegel, & Alvaro, in press). Campaigns have aimed to deter drunk driving (DeJong & Atkin, 1995; Elder et al., 2004; Perkins, Linkenbach, Lewis, & Neighbors, 2010), smoking (Botvin & Eng, 1980; Fishbein, Hall-Jamieson, Zimmer, von Haeften, & Nabi, 2002; Vallone et al., 2010), and use of illicit drugs (Block, Morwitz, Putsis, & Sen, 2002; Hornik, et al., 2008; Palmgreen, Lorch, Stephenson, Hoyle, & Donohew, 2007). Since 1998,

the U.S. has spent over \$1.6 billion in drug prevention campaigns (<http://www.gao.gov/assets/260/251217.pdf>).

Such campaigns are popular because of their promise to reach wide audiences in a cost-effective manner (Farrelly, Hussin, & Bauer, 2007; Goldman & Glantz, 1998). Nationwide, positive prevention effects could benefit hundreds of thousands of would-be or current users (Noar, 2006a, 2006b). Unfortunately, analyses suggest that prevention campaigns have not always fulfilled the high hopes of their designers (Brinn, Carson, Esterman, Chang, & Smith, 2010; Crano, 2010; Crano & Burgoon, 2002; Hornik, et al., 2008). One such instance involves the National Youth Anti-drug Media Campaign (the Campaign). Analyses of data from a four-year panel survey conducted in concert with the Campaign, Hornik and colleagues found little preventive effect. Disturbingly, at some points, greater ad exposure was associated with lower intentions to avoid marijuana use and weaker adherence to anti-drug norms. This result might have been anticipated from the results of examinations of a sample of ads used in the Campaign (Fishbein, Cappella, et al., 2002; Fishbein, Hall-Jamieson, et al., 2002) indicating that while some ads were perceived as more effective than controls, others were associated with increased likelihood to try or use drugs.

A reexamination of the typical unsuccessful media campaign revealed that although some (not all) were based on a guiding theoretical model, these models functioned at a level that was too abstract to provide specific guidance regarding *what* to say in a persuasive message, and *how* to say it (Crano et al., in press). We propose that a more focused consideration of the role of persuasive message design will form the basis for more rapid progress. Examining receivers' reactions to ads, and the relationship between these evaluations and drug use outcomes, the goal of the current study, will allow for more effective and informed development of prevention ads.

Importance of Targets' Message Evaluations

When developing effective drug prevention campaigns, it would seem imperative to consider receivers' evaluations of the persuasive messages to be employed. The answer to the question, "Does it matter if the targets of a persuasive campaign evaluate its messages positively?" seems self-evident, but current practice appears to belie the obvious. Despite budding interest by communication researchers (Cho & Boster, 2008; Slater & Kelly, 2002) and an extensive marketing literature that has established the relation of ad evaluation and subsequent purchase behavior, study of ad evaluation effects has stimulated relatively little interest in prevention circles. In light of the relative ineffectiveness of many mass media drug prevention campaigns (Crano et al., in press; Hornik, Jacobsohn, Orwin, Piesse, & Kalton, 2008), it would seem imperative for behavioral scientists exploring pro-social media to attend to the content and structural aspects of prevention messages. A focus on ad evaluation provides an entry point into such examinations. If it can be established that people's evaluations of ads deployed in prevention campaigns are associated with the advocated or proscribed intentions or behaviors, then researchers can programmatically investigate message features associated with positive evaluations (Fishbein et al., 2002; Kang, Cappella, & Fishbein, 2006; Sayeed, Fishbein, Hornik, Cappella, & Ahern, 2005; Strasser et al., 2009), and use this information in design of persuasive communications.

Ad evaluation in marketing

In the advertising and marketing literatures, ad evaluation has received considerable attention via the construct, *attitude toward the ad* (A_{ad}). A_{ad} is an affective construct (or attitude) embodying people's feelings of favorability toward an advertisement (MacKenzie, Lutz, & Belch, 1986; Mitchell & Olson, 1981; Shimp, 1981). A_{ad} is affected by many factors, including ad exposure (Burke & Edell, 1986), message involvement (Park & Young, 1986), message quality and content (Burton & Lichtenstein, 1988; Hastak & Olson, 1989), and various cognitive (Hastak & Olson, 1989) and affective responses (Batra & Ray, 1986; Burke & Edell, 1989) elicited by the ad (Biehal, Stephens, & Curlo, 1992). Considerable attention has been directed toward A_{ad} as a construct that may mediate purchase (i.e., behavioral) intentions (Homer, 1990).

This research finds that positive A_{ad} plays a pivotal role in the success of persuasive attempts. A_{ad} has been shown to have a significant influence on purchase intentions (Batra & Ray, 1986; MacKenzie, et al., 1986; Mitchell & Olson, 1981; Walker & Dubitsky, 1994), brand choice (Biehal, et al., 1992), and brand choice over time (Shimp & Jokum, 1982). Moreover, A_{ad} explains more variance in purchase intentions than beliefs about product attributes (Mitchell & Olson, 1981) or product preference(s) (Shimp & Yokum, 1980). Studies on ad irritation (Chakrabarty & Yelkur, 2005) and offensive ads (Beard, 2008) navigate similar territory and suggest similar effects. These findings imply that research on ad evaluation in pro-social prevention contexts may prove a valuable addition to prevention efforts.

Substance use status

Identifying adolescents' vulnerability to drug initiation may prove an important step in maximizing benefits derived from scarce prevention resources (Crano & Burgoon, 2002; Crano, et al., in press; Crano, Siegel, Alvaro, & Patel, 2007; Fishbein et al., 2002). Some have attempted to identify youth at greatest risk for drug initiation by parsing the heterogeneous group of nonusers (McCusker, Roberts, Douthwaite, & Williams, 1995; Siegel, Alvaro, & M. Burgoon, 2003; Wakefield, Germain, Durkin, & Henriksen, 2006). These studies have demonstrated important systematic differences between those who are *certain* they will not use a given substance and those who are unsure of their continued abstinence. In recent research, those who were certain of that they would continue to resist marijuana usage – *resolute nonusers* – were significantly less likely to initiate usage than *vulnerable nonusers*, abstinent respondents who were uncertain that they would maintain this status (Crano, Siegel, et al., 2008). Variations of this classification model have been used to predict initiation and use of tobacco (Siegel, Alvaro, & Burgoon, 2003; Wakefield et al., 2006), ecstasy (McMillan, Sherlock, & Conner, 2003), and inhalants (Crano, Gilbert, Alvaro, & Siegel, 2008; Crano et al., 2007).

This study was designed to examine the relationship between respondents' evaluations of marijuana prevention ads, their intentions to use marijuana, and their subsequent marijuana use after accounting for current usage status. We hypothesize that respondents who evaluate anti-marijuana ads favorably will be less likely to intend to use the substance (H1) and less

likely to initiate usage one year later (H2). Further, we expect this negative association to be least apparent among resolute non-users (vs. vulnerable nonusers and users) (H3), insofar as most resolute nonusers are expected to evaluate almost all anti-marijuana ads positively, thereby attenuating the predictive validity of A_{ad} .

Method

Overview and Procedures

Data for this secondary analysis were collected and archived in the National Survey of Parents and Youth (NSPY), a four-year panel survey conducted in concert with the National Youth Anti-drug Media Campaign (<http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/27868/detail>). The sampling methodology was comprehensive and designed to develop a nationally representative sample (Crano, Siegel, et al., 2008; NIDA, 2006). Non-sensitive data were collected via computer-assisted personal interviews. For sensitive data (drug-relevant perceptions and behaviors), an audio computer-assisted self-administered interviewing method was used: respondents completed items privately using headphones and touch-sensitive screens. Respondents were interviewed four consecutive times, at approximately yearly intervals, from November 1999 to June 2004 and received \$20 for each interview. Questions assessed campaign exposure, and beliefs, attitudes, intentions, and behaviors regarding drug use and factors associated with use. Of special relevance to present concerns, measures of cued ad recall and ad evaluations were collected at each of the four yearly measurement rounds. In this research, we examined respondents' evaluations of ads at the first measurement round (T1), and associated these evaluations with intentions to use marijuana and with actual marijuana use one year later at the second measurement round (T2).

There were a dozen English-language ads evaluated by at least two hundred individuals at T1. These represented a number of general ad types: celebrity testimonials, refusal skills, alternatives to drugs, physical harms of use, etc (see Appendix A). As the goal of this study is to examine the value of ad evaluation as a general predictor of use intentions and use, analyses by ad type are beyond the scope of this study. Moreover, the limited number of exemplars for any one ad type in the initial campaign year hampers such analyses and subsequent interpretations.

Respondents

Only respondents with complete data on the main dependent variables (ad evaluations, intentions to use marijuana and marijuana use) were included in the analyses. There were 2993 respondents (1520 males) satisfying these criteria at T1 and T2; 5340 ad evaluations were available for analysis. Those respondents who were removed from the analyses due to missing data on the main dependent variables did not significantly differ from those in the sample on the main independent variables (user status, ad evaluation, and attitudes). Due to the analyses being conducted in the HLM program national weights could not be applied to the data. The ages of respondents ranged from 12-18 with a mean age of 15.06 ($SD = 1.57$). There were 2006 Caucasian, 467 African American, 403 Hispanic, and 117 Asian respondents. Age was entered as a covariate in the analyses below because age is

significantly related to both intentions ($p < .001$) and use ($p < .001$), however, ethnicity was not included as a covariate because it is not significantly associated with intentions ($p > .10$) or use ($p > .10$).

Measures

Marijuana ad evaluations—Respondents evaluated from one to five television ads in the T1 evaluation session, number of ads viewed was not significantly related to intentions to use marijuana ($r = -.01, p = .48$) or marijuana use ($r = -.02, p = .21$), however, it was significantly related with evaluation score ($r = .08, p < .001$) and will be included in the evaluation analysis below as a covariate, but not the analyses on intentions and marijuana use. All ads had been used in the Campaign. Three items were used to indicate subjects' evaluations of each ad: "This ad got my attention," "This ad was convincing," and "This ad said something important to me." Response alternatives ranged from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), $\alpha = .85$. The three item scores were averaged to create a single item for the respondent's evaluation of a particular ad, and were used as input in a multilevel linear analysis, which allowed all data to be used even though subjects viewed different numbers of ads. Therefore, respondents' evaluations of each ad they saw were included in the analyses and we did not average their ad evaluations precluding any issues with ad evaluation agreement.

Marijuana user status—Two T1 items were used to classify youth into one of three mutually exclusive marijuana use categories. Respondents were asked, "Have you ever, even once, used marijuana?" Affirmative respondents were categorized as users ($N = 382$). Remaining respondents were asked, "How likely is it that you will use marijuana, even once or twice, over the next 12 months?" They selected from: *I definitely will not*; *I probably will not*; *I probably will*; *I definitely will*. Nonusers selecting *I definitely will not* were categorized as resolute nonusers ($N = 2308$). All others were categorized as vulnerable nonusers ($N = 303$). Validity of the classification scheme has been supported in earlier research (e.g., Crano et al., 2008).

Attitude toward marijuana—Two items from T1 were averaged to develop a measure of respondents' attitudes toward marijuana use: "Your using marijuana, even once or twice, or the next 12 months, would be?" 1 (*extremely bad*) to 7 (*extremely good*) and 1 (*extremely unenjoyable*) to 7 (*extremely enjoyable*), $\alpha = .61, r = .63, p < .001$.

Marijuana intentions—At T2, respondents indicated their intention to use marijuana with the following question; "How likely is it that you will use marijuana, at least once or twice, over the next 12 months" 1 (*I definitely will not*) to 4 (*I definitely will*).

Marijuana use—Marijuana usage also was measured at T2. Participants were asked "Have you ever, even once, smoked marijuana?" Those responding yes were asked, "How long has it been since you last smoked marijuana?" Respondents answering *no* on the first item received a score of 1; other answers were scored as follows: 2 (*yes, more than 12 months ago*), 3 (*yes, more than 30 days but within the last 12 months*), or 4 (*yes, during the last 30*

days). Validity of this approach has been supported in earlier research (e.g., Crano et al., 2008)

Results

Subjects' evaluations of each of the ads they rated were used as input in a multilevel linear modeling analysis. Their ad evaluations at T1, and their intentions and actual marijuana use at T2, were measured at the individual level (the lowest level in the analysis); age, gender, attitudes toward marijuana, and user status were measured at the second level. Evaluations were nested in adolescents, so the HLM2 model in HLM 7 (<http://www.ssicentral.com/>) was used for all analyses (Raudenbush & Bryk, 2002). HLM2 is used when there are two levels of analysis, with the typical example being students nested with schools. For our analyses we have evaluations nested within respondents (2 levels of analysis) making the HLM2 the correct model for our studies analyses, see the SSI website for more detailed explanations of the models in HLM.

Ad evaluations (A_{ad})

A multi-level hierarchical linear modeling (HLM) analysis was conducted on ad evaluations, controlling for respondents' attitudes toward marijuana, number of ads viewed, age, and gender; user status was the independent variable. The analysis revealed that all predictors were significantly associated with ad evaluations (A_{ad}) at T1. Older respondents were less favorably disposed to the ads ($\beta = -.130, t = -6.00, p < .001$), the more ads that the respondents viewed were associated with more positive evaluations ($\beta = .088, t = 3.96, p < .001$) and females evaluated the ads more positively than males ($\beta = -.087, t = -5.68, p < .001$). Positive marijuana attitudes were associated with less positive ad evaluations ($\beta = -.247, t = 10.87, p < .001$).

In addition to the statistically significant covariates, a significant main effect of the independent variable, user status, was discovered: resolute nonusers evaluated the ads more positively than vulnerable nonusers ($\beta = .085, t = 4.84, p < .001$), and users ($\beta = .058, t = 2.79, p = .005$). Users' and vulnerable nonusers' evaluations did not differ significantly ($\beta = .021, t = .56, p = .579$), see Table 1 for means and standard deviations of ad evaluation for each user status group.

Two additional sets of multi-level analyses then were conducted. The first dealt with the predictive association of T1 ad evaluations and T2 *intentions* to use marijuana. The second was focused on the association of T1 ad evaluations with marijuana *use* at T2. There were two independent variables in each set of analyses (T1 ad evaluations and user status), three covariates (T1 attitudes toward marijuana, age, and gender), and one dependent measure (intentions to use marijuana in the first analysis, and actual marijuana use in the second) assessed at T2. The first analysis (model 1) in each set tested the main effects of user status and ad evaluation on the dependent measure after controlling for respondents' T1 attitudes toward marijuana, age, and gender. The second analysis (model 2) in each set tested the interaction of ad evaluation with user status on the dependent measures, controlling for the three covariates.

Intentions to Use Marijuana at T2

A summary of the models fitted on intentions to use marijuana at T2 is presented in Table 2. Examination of variables in model 1 shows that respondents' T1 attitudes toward marijuana, user status, and ad evaluations were significantly associated with their T2 intentions to use the drug. More positive attitudes toward marijuana were associated with later intentions to use the substance. The significant main effect for user status indicated that users' T2 intentions to use marijuana were significantly greater than those of resolute nonusers and vulnerable nonusers; further, vulnerable nonusers' intentions were significantly greater than resolute nonusers'. Finally, the analysis revealed a statistically significant negative association between ad evaluations at T1 and usage intentions at T2 such that more positive ad evaluation was associated with lower usage intentions. This result was found even after respondents were equated on age, gender, and T1 attitudes toward marijuana.

User status Interaction—The relationship between ad evaluation and intention was not the same for all user groups, and Model 2 was estimated to test differences among them. Analysis revealed a statistically significant interaction of ad evaluation with user status (Figure 1). Examination revealed that the simple slopes associating ad evaluation with later intentions were not statistically significant for resolute or vulnerable nonusers. However, the slope was statistically significant for users. The analysis revealed a significant association between ad evaluation and later intentions to use marijuana only for those who had reported marijuana use at T1. In short, more positive ad evaluation was associated with lower intentions to use marijuana. This result held even after equating respondents on age, gender, and marijuana attitudes.

Marijuana Use at T2

Table 3 summarizes the models fitted on marijuana use at T2. The analysis revealed that respondents' attitudes toward marijuana, age, user status, and ad evaluation at T1 were significantly associated with marijuana use at T2: older respondents showed greater marijuana use, and the more positive respondents' attitudes toward marijuana at T1, the more likely were they to use it in the next year. The user status main effect revealed that users at T1 utilized marijuana at significantly higher levels at T2 than vulnerable or resolute nonusers. Furthermore, respondents classed as vulnerable nonusers at T1 were significantly more likely than resolute nonusers to initiate later usage, see Table 1 for means and standard deviations of marijuana use for each user status group. Ad evaluation also was significantly associated with usage. Evaluations of ads in T1 were significantly, and negatively, associated with usage at T2; more positive ad evaluations at T1 were associated with less marijuana use at T2.

User status Interaction—Model 2 revealed a statistically significant interaction between T1 evaluation and user status on marijuana usage at T2 (Figure 2). Examination revealed that the simple slopes of the associations between ad evaluations and marijuana use were not statistically significant for vulnerable or resolute nonusers. However, for users, the slope indicated a statistically significant association between ad evaluations and less marijuana usage in the next year, even after respondents were matched statistically on age, gender, and

attitudes toward marijuana. Among the users, positive ad evaluation at T1 was associated with reduced use of marijuana at T2.

Discussion

The results of this investigation reinforce findings from the commercial marketing literature, which suggest that A_{ad} is a facilitative factor in media-based persuasion (Batra & Ray, 1986; Walker & Dubitsky, 1994). It makes sense that positively evaluated communications would produce sought-for responses in intentions and message (or product) acceptance. Our study suggests that this relation holds as well in the context of drug prevention—at least where adolescent marijuana users are concerned.

Analysis showed that results involving the background variables – gender and age – were consistent with earlier research (Crano et al., 2008). Older respondents were significantly more likely to intend to use marijuana, and more likely to do so. No differences were associated with gender. In addition, A_{ad} predicted marijuana usage intentions and actual use one year after it was measured. Respondents' intentions and behaviors were significantly associated with variations in their ad appraisals. However, this relation was not as straightforward as might be imagined. The major effects of A_{ad} were found in the subgroup of respondents who had already initiated marijuana use at T1. Among these respondents, positive ad evaluations were followed one year later by reductions in both intentions to use, and actual use of, marijuana. This lagged relation cannot be interpreted causally, as the respondents were not assigned randomly to ad conditions designed to elicit positive or negative reactions, but neither should the possibility that A_{ad} had an effect on later marijuana usage intentions and behavior be dismissed. At a minimum, the results call for research that allows for an unambiguous experimental analysis of the effects of manipulated ad effects on A_{ad} on intentions and usage, with subjects from different points along the marijuana use continuum. The results also point strongly to the likely critical importance of understanding the features of ads that differentially appeal to targets distinguished on the basis of prior usage behavior, current attitudes, and intentions.

Taken as a whole, the results provide provocative insights into the meaning of the negative results found in analyses of the National Youth Anti-drug Media Campaign, which suggested the Campaign failed to achieve the goal of modifying marijuana use among at-risk youth (or vulnerable nonusers, to use our term) (Hornik, et al., 2008; Scheier & Grenard, 2010). Understanding why it failed is critically important. The Campaign's reach was extraordinary. However, as research on the A_{ad} construct has shown, reach alone is not sufficient to guarantee positive persuasive outcomes. At least as crucial as exposure are targets' evaluations of the ads used in the persuasive campaign.

The analyses indicated that not all respondents evaluated the ads equally favorably. Those most in need, the respondents who reported usage at the T1 measure, liked the ads the least. Those on the fence, the vulnerable nonusers, who by definition were contemplating use, liked the ads significantly less than those youth who expressed a resolute opposition to usage, and did not differ from users in their A_{ad} ratings. Thus, the Campaign's ads were least liked by those most in need of help in stopping marijuana use or avoiding initiation. That

resolute nonusers were most positively inclined to the ads may be taken as encouraging, but this is not a new result: prior research has shown that resolute nonusers are uniformly more open to anti-drug messages of all types than vulnerable nonusers or users (Crano et al., 2007).

The cost of failure to appeal to those most in need can be gauged in the analyses of respondents' marijuana intentions and actual usage in the second year of the study. As expected on the basis of prior investigations, ad evaluations were significantly and inversely related to usage intentions, and to actual use. The most counterintuitive result, however, was found in the interaction of user status with A_{ad} on both intentions (Model 2, Table 2) and use (Model 2, Table 3). The analyses showed that attitudes toward the Campaign's anti-marijuana ads (assessed at T1) significantly predicted marijuana intentions and use at the second session, but only for users. Users who admitted liking the ads were less likely than users who did not to continue to use into the second year, even after attitudes toward marijuana were equated between the groups. Among resolute nonusers, A_{ad} did *not* predict later intentions or use, probably because variation in A_{ad} was constrained in this group, the most favorably inclined to the ads in the first place. For this group, predictive validity of A_{ad} was not great owing to respondents' general openness to the ads. This result suggests that the massive Campaign did not necessarily fail. An interpretation consistent with the findings suggests it might have had a positive effect among users who liked the Campaign's ads. This association was statistically significant even after accounting for effects of respondents' age, gender, and T1 attitudes toward marijuana. We realize this causal inference cannot be made confidently, given the limitations of the research design, but at a minimum it points to an opportunity that might have been missed. More attention to ad design could have ameliorated the iatrogenic effects reported in evaluations of the Campaign (Hornik et al., 2008).

Limitations

The most serious limitation of the research results from its quasi-experimental nature, which necessarily constrains the extent to which causal inferences may be drawn. The standard warning that correlation does not necessarily imply causation is well taken, and important, but the opposite side of the coin also should be considered, namely that causation *necessarily* implies correlation (Crano & Brewer, 2002). On the positive side of the ledger, the analysis was based on a nationally representative sample of youth, tied to one of the largest mass mediated drug prevention programs ever launched in the US. Using a dataset of this scope lends generalizability to the results of the study that research involving more limited samples is unlikely to attain. The secondary analytic nature of the study thus imposes some limitations, but it also provides important benefits.

A second issue that might be raised has to do with the classification system used to differentiate respondents. In the case of the nonuser groups, the classification is reasonably straightforward, but the user group could include habitual users of marijuana along with those who experimented once or twice then discontinued use. These individuals are surely different, but they cannot be differentiated by the classification scheme imposed by the secondary nature of the data. To try to offset this problem, we assessed respondents'

attitudes toward marijuana, and used this variable as a covariate in all analyses. It seems reasonable to assume that the attitudes of those who experimented with marijuana and quit after a few exposures would differ from those of habitual users.

Future directions

The next step that logically follows from these findings is to isolate specific ad features that appealed to individuals who fell along different points of the marijuana user continuum. Are there features of ads that particularly appeal to users, resolute nonusers, or vulnerable nonusers? If so, it stands to reason that we would design ads that make use of these features to target specific audiences. Communication scholars have made some inroads into this issue (Kang, Cappella, & Fishbein, 2009; Strasser, et al., 2009; Yzer, Vohs, Luciana, Cuthbert, & MacDonald, 2011); much of this research has been concerned with receivers' emotional responses to ads, but even in this area, much remains to be done. Yzer and colleagues (2011), for example, have shown important relations between adolescents' affective responses to anti-drug ads and their judgments of the ads effectiveness, and Dillard and colleagues have focused considerable attention on perceived ad effectiveness as an indicator of actual ad effectiveness, which could inform researchers and practitioners in the pre-implementation phase of persuasion campaigns (Dillard, Shen, & Vail, 2007; Dillard, Weber, & Vail, 2007).

The research we reported suggests a complementary approach, in which respondents' attitudes toward the ads (A_{ad}) are assessed directly, rather than, or in addition to, subjects' judgments of the ads' effectiveness. In both approaches, the logical next step is to determine the antecedents of these attitudes and judgments. Both approaches have much to offer, and we are hopeful that the present research will provide added impetus to pursue this issue. Such research may pay great dividends in the development of communications designed to prevent the use of dangerous drugs.

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APPENDIX A: Description of campaign ads used in study

Blige

R&B singer Mary J Blige gives a monologue speaking about her previous drug use. She suggests accepting oneself and loving oneself is a way of avoiding drug use.

Brothers

A teenage boy and his younger brother engage in various activities (e.g., playing basketball, eating hotdogs). The older brother smokes some marijuana; his little brother sees him.

Drawing

The ad starts off as a cartoon with the main character drawing his own way out of confrontation with two bigger teenaged drug-using characters. At the end of the ad, the camera pans back to show an adolescent aged male who says his anti-drug is drawing.

Drugskil

Tennis star Venus Williams is practicing tennis and delivering a monologue. She talks about how she dreamed of being a tennis champion when she was a child and she had to work very hard to achieve her dream. She says that “drugs kill dreams”.

Hockey

A teenage boy is playing hockey without protective gear; the ad is fast-paced and contains many cuts. The narrator says that “smoking weed is kind of like playing hockey without your gear” and “don't take a hit you're not ready for”.

Howtosay

Various young people use dramatic ways to say no to drugs.

Music

A cartoon character walks the streets with headphones on. Various aliens attempt to offer it drugs and the music coming out the character's headphones destroy the aliens. At the end of the ad an adolescent boy is shown and says “My name is Alberto and my anti-drug is music.

Nothanks

A group of adolescents are at a party. A young man repeatedly enters a room where a group of his friends are smoking marijuana. In the different scenes, the young man uses different strategies to say no to smoking marijuana.

Okpass2

A group of adolescents are socializing. A young male arrives, takes out a joint, and passes it. Each person in the group passes it—unlit. It gets back to the young male who puts it back in his pocket. The tagline at the end says “friends: the anti-drug.”

Soccer

Professional and amateur women and girls play soccer. Various people talk to the camera about how now is a great time to be a girl. At the end there is a tagline that says “opportunity: the anti-drug.”

Tara

Professional figure skater Tara Lipinski and various adolescent girls talk about past female sports stars; sometimes we see scenes of these stars, other times the actors hold up their pictures. At the end a tagline reads “opportunity: the anti-drug.”

Whatneed

An older male walks up to the camera and asks “hey man, what you need”. An adolescent male responds “I need.” followed by various statements (e.g., a future, a job, to have fun). The narrator at the end of the ad says “next time a pusher asks you what you need, let him know.”

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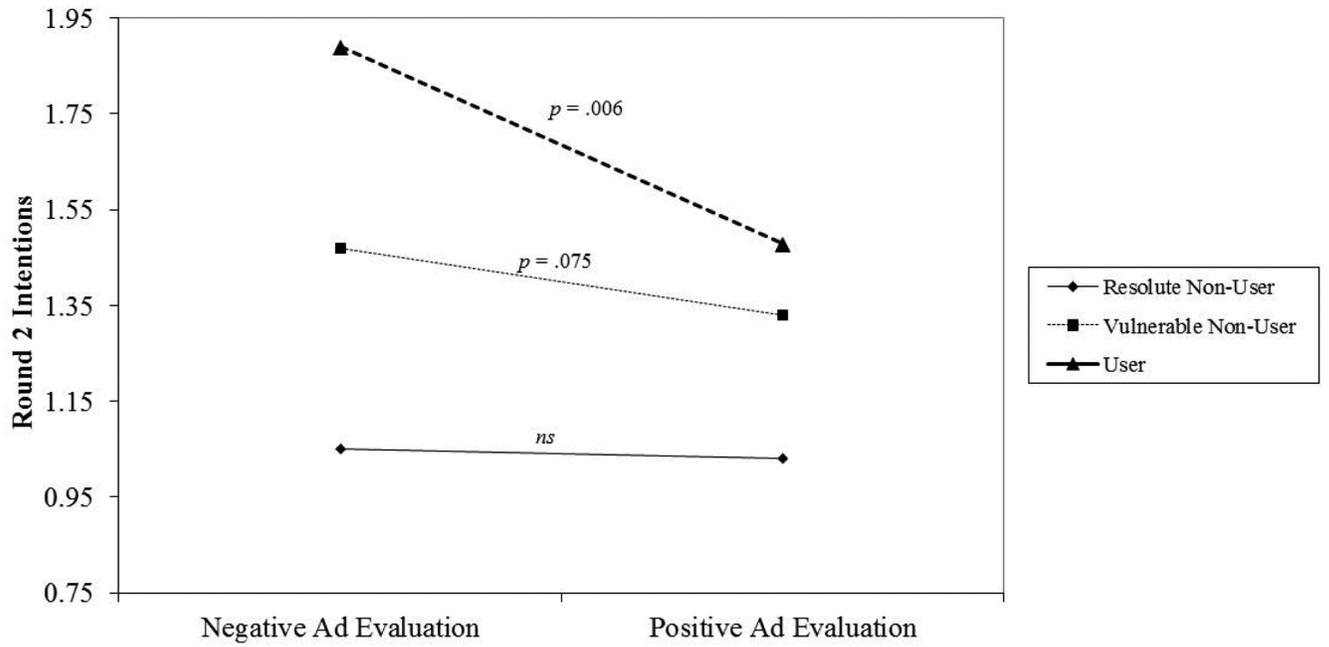


Figure 1. Simple slopes for the interaction between user status and PSA evaluation on intentions to use marijuana at Round 2.

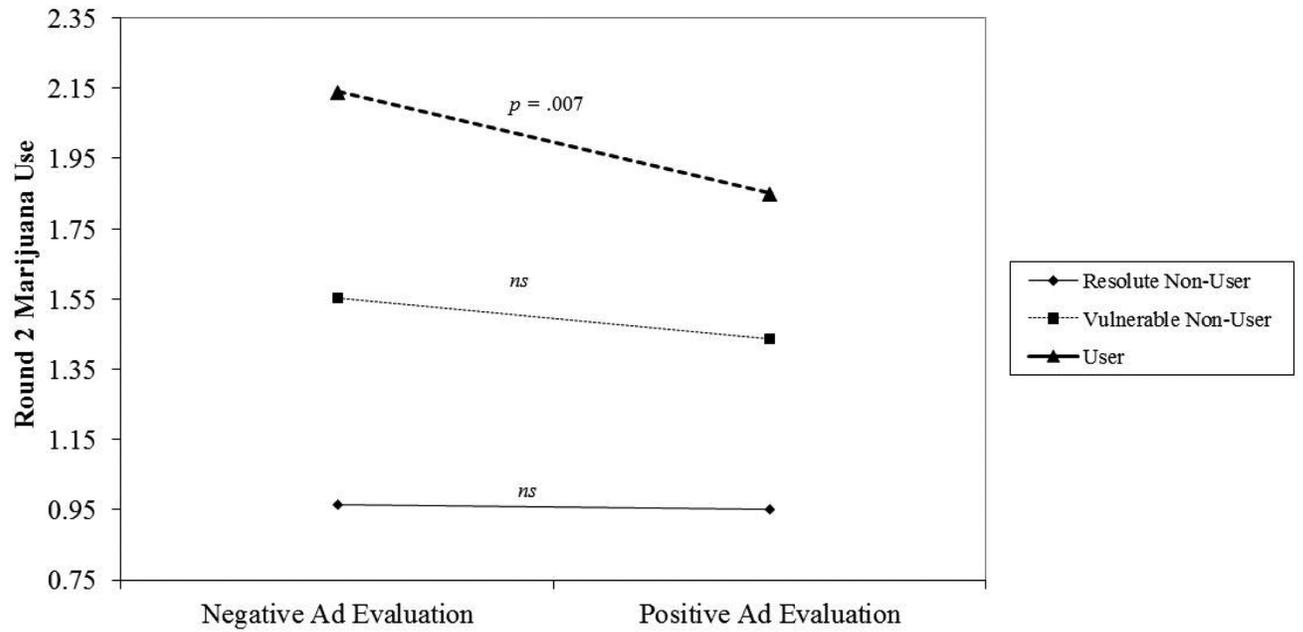


Figure 2. Simple slopes for the interaction between user status and PSA evaluation on marijuana use at Round 2.

Table 1

Means and standard deviations of ad evaluation and marijuana use by user status.

User Status at T1	Ad Evaluation at T1		Use at T2	
	<i>M</i>	<i>Sd</i>	<i>M</i>	<i>Sd</i>
Resolute non_users (<i>N</i> = 2308)	4.00	0.83	1.20	0.65
Vulnerable non-user (<i>N</i> = 303)	3.50	0.87	1.88	1.15
Users (<i>N</i> = 382)	3.33	1.03	2.95	1.00

Notes. T1 = measured during first year of data collection, T2 = measured during second year of data collection. Use at T2 was coded 1= no lifetime use, 2 = used marijuana more than 12 months ago, 3 = used marijuana within last year but more than 1 month ago, and 4 = used marijuana within past month. Higher Ad Evaluation scores reflect more positive ad evaluation.

T2

HLM model of Intentions to Use Marijuana at Round 2

	Intentions to Use Marijuana			
	Model 1		Model 2	
	β	t	β	t
Ad Evaluation	-0.050	-3.02**	-0.034	-2.25*
Status R vs. V	0.194	8.30***	0.186	7.74**
Status R vs. U	0.324	10.74***	0.295	9.75***
Status V vs. U	0.255	4.55***	0.224	3.92***
Attitude toward marijuana	0.231	7.67***	0.216	7.13***
Age	0.016	0.68	0.019	0.83
Gender	0.009	0.51	0.008	0.479
Interaction			-0.071	-3.92***
Resolute			-0.012	-0.69
Vulnerable			-0.087	-1.79 [†]
User			-0.128	-2.78**

Notes. R = resolute non-user, V = vulnerable non-user, U = user, N = 5340 at level 1, N = 2993 at level 2

[†]
p < .01

*
p < .05

**
p < .01

p < .001

Table 3

HLM model of Marijuana Use at Round 2

	Marijuana Use			
	Model 1		Model 2	
	β	t	β	t
Ad Evaluation	-0.031	-2.02 *	-0.023	-1.52
Status R vs. V	0.175	6.82 ***	0.177	6.55 ***
Status R vs. U	0.498	19.83 ***	0.484	18.72 ***
Status V vs. U	0.531	10.39 ***	0.504	9.26 ***
Attitude toward marijuana	0.143	5.34 ***	0.136	5.02 ***
Age	0.102	4.58 ***	0.104	4.66 ***
Gender	-0.011	-0.66	-0.011	-0.68
Interaction			-0.037	-2.65 **
Resolute			-0.018	-1.06
Vulnerable			-0.024	-0.48
User			-0.111	-2.73 **

Notes. R = resolute non-user, V = vulnerable non-user, U = user, N = 5340 at level 1, N = 2993 at level 2

*
p < .05**
p < .01***
p < .001



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Does Information Matter? The Effect of the Meth Project on Meth Use among Youths*

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Abstract

Are demand-side interventions effective at curbing drug use? To the extent demand-side programs are successful, their cost effectiveness can be appealing from a policy perspective. Established in 2005, the Montana Meth Project (MMP) employs a graphic advertising campaign to deter meth use among teens. Due to the MMP's apparent success, seven other states have adopted Meth Project campaigns. Using data from the Youth Risk Behavior Surveys (YRBS), this paper investigates whether the MMP reduced methamphetamine use among Montana's youth. When accounting for a preexisting downward trend in meth use, effects on meth use are statistically indistinguishable from zero. These results are robust to using related changes of meth use among individuals without exposure to the campaign as controls in a difference-in-difference framework. A complementary analysis of treatment admissions data from the Treatment Episode Data Set (TEDS) confirms the MMP has had no discernable impact on meth use.

Keywords

Methamphetamine use; Meth Project; Anti-drug campaigns; Youth

“In 2005 Montana had one of the highest rates of methamphetamine use in the country, and all of the problems that go with it...An aggressive public awareness campaign was the answer.”

The Economist

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I. Introduction

The annual economic burden of methamphetamine (“meth”) in the U.S. was recently estimated to be \$23.4 billion; this translates into roughly \$26,000 for each individual who used meth in the past year or around \$74,000 for each dependent user (RAND 2009). Methamphetamine use is the dominant drug problem in Western and Midwestern United States (Rawson et al. 2002). Based on a 2007 survey of law enforcement officials, 47% of county sheriffs reported meth as their number one drug problem. That was more than marijuana (22%), cocaine (21%), and heroin (2%) combined (National Association of Counties (NACO) 2007). In 2005, approximately 4.3% of the U.S. population and around 4.5% of high school seniors reported having used methamphetamines (National Institute on Drug Abuse (NIDA) 2006). In communities plagued by meth use, addicts place a substantial burden on healthcare facilities, county jails, and state and federal penitentiaries (Gonzales 2006; NACO 2006). Taxpayers bear significant medical and dental costs associated with incarcerated meth users (Sullivan 2006). Because of the consequences associated with methamphetamines, it is important to understand whether or not interventions aimed at reducing use have a causal influence on consumption.

There are primarily three methods to decreasing drug use: enforcement, treatment, and prevention (Dobkin and Nicosia 2009). Enforcement efforts generally take the form of government intervention and target the supply-side of drug markets. Drug treatment is a demand-side intervention that aims at reducing use and rehabilitating current users. Prevention, also a demand-side intervention, commonly takes the form of raising awareness and providing information to potential and current users through education programs, community action, and anti-drug campaigns. This paper studies the prevention mechanism by examining the effectiveness of an anti-methamphetamine campaign. In 2005, Montana adopted a graphic advertising campaign, the Montana Meth Project (MMP), with the intent of curbing meth use. The objective of the MMP was and remains to educate Montana’s youth about the harmful consequences of meth use. Methamphetamine abuse has been a major problem for Montana. In 2006, roughly 50 percent of the jail population was incarcerated for meth-related offenses and over half of the parents whose children were in foster homes used meth (McGrath 2007).

A large literature has been devoted to examining the impact of advertising and health campaigns on the use of harmful substances. The majority of this research has focused on the effects of tobacco and alcohol advertising bans. Along similar lines, other research has examined the influence that anti-substance publicity and campaigning has had on substance use. The results concerning these types of prevention tactics are far from decisive.¹ Educational programs designed to deter individuals from using tobacco, alcohol, and drugs

¹For example, Hoek (1999) finds that tobacco advertising restrictions have little to no effect on smoking behavior, while Saffer and Chaloupka (2000) and Blecher (2008) conclude that comprehensive sets of advertising bans can reduce tobacco consumption. Dietz et al. (2008) show youth-oriented anti-tobacco media to have no influence on adult smoking behavior. Schneider et al. (1981) find no effect of advertising in the United States.

For alcohol advertising bans, results are also mixed. Using data from 17 countries, Saffer (1991) examines the effect of banning broadcast advertising of alcoholic beverages and concludes these bans significantly lower alcohol consumption. However, Young (1993) and Saffer (1993) disagree as to whether or not the results from Saffer (1991) are valid.

have also been a popular form of prevention. Results regarding the efficacy of these programs are mixed as well.²

This paper makes at least three important contributions to the literature. First, the effectiveness of the MMP has not been empirically scrutinized in a rigorous fashion. This study fills that gap by investigating the impact of the MMP campaign on teen meth use. Second, to the author's knowledge, this is the first paper to evaluate a demand-side intervention that specifically targets the market for methamphetamines.³ Third, and perhaps most notably, the findings in this paper have important implications for understanding policy efficacy in illegal drug markets. A demand-side intervention, such as the MMP, represents an extremely low cost program when compared to supply-side involvements that have been shown to have only temporary effects (see below). To the extent such a program works, the cost effectiveness is appealing from a policymaker's perspective. The annual operating budget of the MMP is approximately \$2.5 million, while the economic costs of methamphetamine in Montana have been estimated in the range of \$200 to \$300 million per year (Stanford GSB 2009; MT Department of Justice 2009).

The MMP has received significant praise since its inception in 2005. In 2006, the MMP campaign was cited by the White House as a model prevention program for the nation (montanameth.org 2009). Due to its apparent success, the campaign has been adopted by seven other states since 2007.⁴ Popular press accounts and legislators have attributed large decreases in teen meth use to the MMP (see, e.g., "The Antidrug Lord" 2008; "Graphic Ads" 2008; McCulloch 2009). A recent follow-up report on progress, prepared by the Montana Department of Justice, cites a decrease in meth use among teens of 44.6 percent since 2005 (McGrath 2008). However, Erceg-Hurn (2008) suggests the negative findings have been supported by poor methodology and misrepresented by the MMP. In particular, Erceg-Hurn (2008) cites the lack of an adequate control group from baseline and criticizes the MMP for ignoring preexisting downward trends when citing the success of their program. Yet, Erceg-Hurn (2008) omits any type of formal statistical analysis to support his criticisms.

To assess the impact of the MMP on teen meth use, this paper uses data from the 1999–2009 Youth Risk Behavior Surveys (YRBS).⁵ Initial results illustrate that rates of meth use were roughly 1.5 to 4 percentage points lower after the adoption of the MMP. However, when accounting for a preexisting downward trend in meth use, effects on meth use become small and statistically insignificant. These null findings are robust to using the related changes of meth use among individuals in states without exposure to the campaign as controls in a difference-in-difference empirical framework.⁶ A separate analysis of admission reports from the Treatment Episode Data Set (TEDS) confirms the MMP has had no discernable

²For example, the effects of the once widely popular Project Dare (Drug Abuse Resistance Education) have been documented extensively. Ennet et al. (1994) provide a meta-analysis of Project Dare outcome evaluations.

³Other anti-drug media campaigns have generally focused on less addictive substances such as marijuana. Hornik et al. (2008) show the National Youth Anti-Drug Media Campaign did not decrease marijuana use among youths.

⁴In chronological order: Arizona Meth Project launched in April 2007; Idaho Meth Project launched in January 2008; Illinois Meth Project launched in February 2008; Wyoming Meth Project launched in June 2008; Colorado Meth Project launched in May 2009; Hawaii Meth Project launched in June 2009; Georgia Meth Project launched in March 2010.

⁵It is important to note the MMP bases their conclusion that the MMP campaign has caused decreases in teen meth use on simple yearly means calculated from these data.

impact on meth use. These findings suggest that other factors, such as increased policing efforts that preceded the MMP, are more likely to have contributed to the decrease in the use of methamphetamines.

The remainder of this paper is organized as follows: Section II describes the background of the Montana Meth Project; Section III describes the YRBS data; Section IV lays out the empirical strategy; Section V discusses the results; Section VI analyzes treatment admissions data; Section VII concludes.

II. Methamphetamine Interventions and the Montana Meth Project

Methamphetamine is used in a variety of forms and can be smoked, snorted, injected, or ingested orally. As a powerful stimulant, immediate effects of use include increased wakefulness and physical activity and decreased appetite. Hyperthermia and convulsions can occur with an overdose and, if not treated promptly, can lead to death. Long-term effects may include addiction, memory loss, psychosis, violent behavior, mood disturbances, severe dental problems, and weight loss. Chronic abuse has also been linked to changes in brain structure that lead to reduced motor speed and impaired verbal learning (NIDA 2006).

The individual outcomes and economic consequences listed above have motivated multiple supply-side government interventions. Evaluations of these interventions generally conclude the programs have only temporary effects.⁷ Reuter and Caulkins (2003) emphasize the importance of quantifying the costs of these interventions. They stress that regulatory burdens and limits on the range of products available for therapeutic use need to be considered.

An alternative to supply-side interventions are programs that target consumers. The Montana Meth Project, a non-profit organization, introduced a large-scale, statewide antimethamphetamine campaign in 2005. The MMP set about approaching methamphetamines as a consumer product-marketing issue with the goal of providing Montana teens with information on the negative consequences of meth use. In particular, the MMP's objective was to:

- Increase the perceived risk and decrease the perceived benefit of trying meth so that perceptions reflected accurate information about the drug;
- Promote dialogue about the drug between parents and teens, as such dialogue has been shown to decrease illicit drug use; and

⁶A separate propensity score matching analysis also revealed the MMP campaign to have had no effect on youth meth use. These results are not included in this paper but are available from the author upon request.

⁷Cunningham and Liu (2003) illustrate that federal precursor chemical regulations aimed at limiting methamphetamine production and availability had temporary effects on methamphetamine-related hospital admissions in three western U.S. states. Cunningham and Liu (2005) show that precursor chemical regulations aimed at small-scale producers had no impact on methamphetamine-related arrests, while regulations that targeted large-scale producers had temporary effects. Dobkin and Nicosia (2009) analyze a DEA intervention in 1995 that shut down two large suppliers that were providing over 50 percent of the precursors used nationally to produce methamphetamine. The supply interruption resulted in immediate and large decreases in hospital and treatment admissions, meth use among arrestees, and felony methamphetamine arrests. Within 18 months, admissions and arrests returned to their original levels.

- Stigmatize use, making meth use socially unacceptable, just as cigarette smoking has become socially unacceptable in recent decades”

(Siebel and Mange 2009).

Focus group sessions held prior to the launching of the campaign indicated that a majority of teens believed meth to be a “party drug” without the addictive consequences associated with drugs like heroin (Siebel and Mange 2009). The MMP campaign aimed at changing these misperceptions.

The primary element of the MMP campaign has been the use of graphic advertisements.⁸ Users are depicted as “unhygienic, dangerous, untrustworthy, and exploitive” (Erceg-Hurn 2008). Ads rely on explicit images that include “illustrations of the decay of users’ bodies, young girls selling their bodies to older men for meth, violent criminal behavior committed by meth-hungry teens, and groups of meth users leaving their friends to die” (Siebel and Mange 2009). Individuals can be exposed to the campaign several different ways. First, statewide advertisements air as television commercials. Second, radio ads portray the risks of use with actual stories from Montana teens who disclose their personal experiences with meth. Lastly, print ads are featured in high school newspapers and on billboards across the state. Representing the largest advertiser in Montana, the MMP campaign consisted of 45,000 television ads, 35,000 radio ads, 10,000 print impressions, and 1,000 billboards statewide from September 2005 to September 2007.⁹ Evaluation of the campaign suggests the advertisements reach 70 to 90 percent of the state’s teenage population three times per week (methproject.org 2009).

The MMP was initially a privately funded campaign. Today, the campaign is financed through state and federal dollars and private contributions.¹⁰

III. Data

The data used in this paper come from the Montana and National Youth Risk Behavior Surveys (YRBS). For the analysis that considers Montana separately, the data cover the period 1999–2009. When individuals from the national sample are included as controls, the analysis is restricted to the period 1999–2007. This restriction is made because the 2009 national data are not yet available. Due to missing values, there is complete information for slightly over 13,800 individuals in the Montana YRBS and approximately 61,100 individuals in the National YRBS. Response rates for both surveys were very similar across the sample time frame. Below is a brief description of the YRBS data.

⁸Witte and Allen (2000) provide a meta-analysis of fear appeals and their implications for effective public health campaigns.

⁹Since 2007, these numbers have increased to 61,000 television ads, 50,000 radio ads, 139,000 print impressions, and 1,764 billboards (methproject.org 2009).

¹⁰From 2005 through 2007, the Thomas and Stacey Siebel Foundation invested over \$25 million in starting the program, market research and advertisement development (Siebel and Mange 2009). In 2007, the MMP campaign was allotted \$2 million from the Montana legislature. Later in the year, this amount was followed by nearly \$1.5 million of federal funding. Thomas Siebel, founder of the campaign, has advised the government to contribute \$40 million annually in federal funds to MMP-style prevention programs (Erceg-Hurn 2008).

National Youth Risk Behavior Surveys

The national surveys are conducted every other year by the Centers for Disease Control and Prevention (CDC) and provide data on U.S. high school students. The primary purpose of the YRBS is to gather information on youth activities that influence health. Each survey contains a battery of questions that gauge the use of alcohol, tobacco, and other drugs. Other survey questions address daily behaviors such as eating habits, physical exercise, and TV watching. The YRBS data have been used by economists to study a wide range of topics concerning policy evaluations and youth behavior.¹¹ Though intended to be nationally representative, not all 50 states are represented in any given year the survey has been conducted. For example, students from Montana have not been included in the national surveys. As a result, information from the state-specific Montana survey is augmented with the national data to analyze the difference between changes in Montana meth use and meth use in other states. The data provide student demographic characteristics and self-reported information on participation in risky activities. Restricted use state-identified versions of the National YRBS are used.

Montana Youth Risk Behavior Surveys

In addition to the National YRBS, state surveys are conducted by state education and health agencies. The questionnaires used at the state-level mirror the national surveys. More specifically, the questions used in the analysis below were worded exactly the same for the national and Montana surveys. Similar to the national surveys, the state surveys are conducted every other year and are aimed at collecting information on high school students. For Montana, the YRBS began including questions pertaining to meth use in 1999.

IV. Empirical Strategy

To estimate the effect of the MMP on meth use among Montana's youth, this paper employs two approaches. The first approach relies on within-Montana variation in meth use to identify the effect of the MMP. This evaluation focuses on meth use before and after the MMP was implemented in 2005. This first-difference approach is estimated by the following equation:

$$Y_{it} = \alpha + \mathbf{X}_{it}\beta_1 + \beta_2 \text{AfterMMP}_t + \varepsilon_{it} \quad (1)$$

where i indexes the individual and t indexes the year.

In equation (1), Y refers to the binary response of whether or not the individual reports having ever used meth. In particular, survey respondents were asked: "During your life, how many times have you used methamphetamines (also called speed, crystal, crank, or ice)?" \mathbf{X} is a vector of the individual characteristics described in Table 2. AfterMMP is a dummy variable for observations after the implementation of the MMP. The coefficient of interest, β_2 , measures the impact of the MMP campaign on the meth use of Montana's youth.

¹¹For other studies that use the YRBS data, see, e.g., Carpenter and Stehr (2008) on the effects of mandatory seatbelt laws on seatbelt use, motor vehicle fatalities, and crash-related injuries; Chatterji et al. (2004) on alcohol use and suicide attempts; Gruber and Zinman (2001) on trends in youth smoking.

Equation (1) is estimated with weighted least squares where age-by-race populations for the state of Montana are used as weights.¹²

Equation (1) does not account for unobserved Montana-specific changes that may have influenced meth use. One way to better control for unobserved variables is to include a control group that is plausibly uninfluenced by the MMP. The control group used in this paper consists of teens from states other than Montana and, thus, who are likely to be unaffected by the MMP.¹³ Identification in this framework relies on the assumption that meth use among individuals from other states tracks the trend of use among Montana's youth except the out-of-state individuals are not subject to the meth campaign. More specifically, the control group provides instructive counterfactuals for what would have happened to the rate of meth use among teens from Montana had they not been subjected to the MMP. This difference-in-difference (DD) approach is estimated by the following equation:

$$Y_{ist} = \alpha + \mathbf{X}_{ist}\beta_1 + \beta_2 MT_{st} + \beta_3 \text{AfterMMP}_t + \beta_4 (MT_{st} * \text{AfterMMP}_t) + \mathbf{S}_s\beta_5 + \varepsilon_{ist} \quad (2)$$

where i indexes the individual, s indexes the state, and t indexes the year. The variable MT is a dummy variable equal to one if the individual is from Montana. \mathbf{S}_s represents a vector of state fixed effects that control for differences in states that are common across years.¹⁴ The remaining variables are described as above. The interaction term coefficient, β_4 , represents the difference-in-difference estimate of the effects of the MMP on meth use among Montana's youth. If the MMP decreases meth use, then we expect β_4 to be negative.

All DD models are estimated by weighted least squares where state-specific age-by-race populations are used as weights.¹⁵ Models are estimated with least squares for ease of interpretation; however, the interpretation of the DD results is similar when probit models are used to explicitly model the dichotomous nature of the dependent variable. Following Bertrand et al. (2004), standard errors are clustered at the state-level.

V. Results from YRBS Data

Descriptive statistics

Table 1 presents descriptive statistics of the dependent variable used in the analysis. Rates of meth use from the North Dakota and Wyoming YRBS data are also reported in Table 1. In results discussed below, North Dakota and Wyoming are considered as alternative control states. For visual convenience, Figure 1a plots the means from Table 1 for Montana and the national sample. In Figure 1a, "meth use" is defined as having ever used meth during one's lifetime.¹⁶ It is immediately clear that self-reported meth use has been trending downward

¹²The weights were calculated using the National Cancer Institute, Surveillance Epidemiology and End Results, U.S. Population Data.

¹³It is certainly possible that youths from other states that have visited Montana since 2005 have been subjected to the Montana Meth Project. Though it seems unlikely that this would be a major concern in the analysis, one possible robustness check is to exclude individuals from bordering and nearby states from the control group. The results presented below are robust to these alternative control group specifications.

¹⁴It is important to note that an indicator for Montana is excluded from the \mathbf{S} vector. This is done so as to not preclude estimation of β_2 .

¹⁵To simply combine data from the Montana YRBS and national YRBS without weights would result in an overrepresentation of Montana youth.

throughout the sample time frame for Montana's youth. For the national sample, the downward trend holds for all years after 2001. For Figure 1a, it appears that meth use fell slightly more for individuals in Montana after the introduction of the MMP than for youths elsewhere. However, the downward trend for Montana meth use is fairly smooth throughout the sample period; this is contrary to what one would expect if the MMP has had a causal influence on meth use. Most importantly, these data illustrate the importance of controlling for preexisting trends. Figures 2a–2d illustrate trends in meth use for subsamples of the population on which one might expect the treatment effect to vary. Figures 2a and 2b separate the sample by sex, while Figures 2c and 2d consider differences by age. Each figure portrays similar trends to those shown in Figure 1a.

Table 2 presents descriptive statistics for the remainder of the variables used in the regression analysis. The YRBS data are limited in their content of individual characteristics in that only age, sex, race, and grade are incorporated in all years of the survey. Additional variables are included to control for individual preferences, personality, and risk preference. For example, whether or not an individual is a regular smoker or frequently wears a seat belt when riding in a vehicle proxy propensity towards risk. Sports participation is included to proxy attachment to school and community (Chatterji et al. 2004). Other variables included in the model describe the use of alcohol and other drugs, depression, whether the individual has been in a vehicle with a driver who was under the influence of alcohol, and whether the individual sees a resource teacher at school. Lastly, because MMP anti-meth ads air on Montana television channels, the amount of television the respondent reports watching on an average school day is included to proxy exposure to the campaign's television component.¹⁷ It is important to note these variables may be endogenous if they are a function of the same unobserved factors that influence meth use. However, as long as they are not correlated with the MMP campaign, their inclusion will not bias the MMP coefficients. Evidence from Table 4 suggests the use rates of other drugs were not influenced by the MMP campaign.

Further reference of Table 2 illustrates the Montana and national samples are similar along many dimensions. Yet, several characteristics are quite different. For example, Montana youth appear to be more physically active in that they spend less time watching TV and are more likely to participate in sports than individuals from the national sample. The primary difference between the two samples is the distribution of respondents by race.

First-difference results

Table 3 illustrates first-difference regression results for meth use. Here, the dependent variable indicates whether or not the respondent has ever used methamphetamines. Column 2 repeats the results from Column 1 with the exception that individual-specific controls are included. In Columns 1 and 2, the coefficient estimates on the AfterMMP variable are

¹⁶It should be noted the answer to the "meth use" survey question was interval coded. This allowed respondents to indicate the number of times they have used meth during their life. In results not reported in this paper, dependant variables incorporating information on the frequency of use were considered. The null findings were robust to alternative definitions of the dependent variable. These results are available from the author upon request. The decision to focus on a binary indicator of meth use was primarily made because of the risk of recall bias in past meth use.

¹⁷Unfortunately, due to confidentiality reasons, county- and school-level indicators for the Montana YRBS were not released to the author. These indicators could have been used to better control for exposure to the MMP campaign's billboard component.

negative and significant at the 1% level. The estimate in Column 2 suggests that meth use declined by 4.1 percentage points after the introduction of the MMP. For further perspective, this represents an approximate 38% reduction from the pre-MMP mean of self-reported meth use.

Column 3 of Table 3 explicitly takes into consideration the negative trend of meth use among Montana's youth. In particular, this regression includes an independent variable that takes on the value of one in 1999, three in 2001, five in 2003, and so forth. If the MMP has a causal impact on meth use, then one would expect to observe decreases in meth use relative to trend after the campaign was introduced in 2005. When controlling for a preexisting linear trend, the coefficient estimate on AfterMMP is no longer statistically significant at a conventional level. Furthermore, the magnitude of the estimate is substantively small. Again, this result should come at no surprise given the foreshadowing of Figure 1a.¹⁸ It is important to note the inclusion of individual-specific controls does not alter the main results of this analysis, further supporting the research design.¹⁹

Difference-in-difference results

Table 3 also presents the difference-in-difference results based on estimation of equation (2). The DD estimator is shown in the third row as the coefficient estimate on the interaction term MT*AfterMMP. The baseline specification in Column 4 illustrates a negative and significant coefficient estimate for MT*AfterMMP. A reduction of 1.5 percentage points represents roughly a 14% decrease in meth use among Montana's youth from the pre-MMP mean. The size of the decrease in meth use is considerably lower for the baseline DD estimate than the baseline first-difference estimates. Because the DD estimator compares the changes in meth use of Montana youths with the changes in use among individuals from other states, the large difference between the first-difference and DD estimates is clearly due to the fact the aforementioned negative trend was prevalent in the national sample as well as in Montana. Column 5 incorporates state-specific linear time trends. Here, the interaction term coefficient becomes positive and is nowhere near significant. Similar to the first-difference estimate that considers the downward trend, the magnitude of the coefficient is substantively small. Overall, the results from Table 3 provide little support for a decrease in meth use due to the MMP.²⁰

Other substances

Although the MMP campaign specifically targets the use of methamphetamines, it is possible users (or potential users) of other substances are influenced by the advertisements. To examine if the MMP has had an impact on the use of other drugs, Table 4 considers binary indicators as dependent variables for marijuana, household inhalants, cocaine, and

¹⁸It should be noted that the coefficient estimate for the linear trend variable was negative and significant at the 1% level. This emphasizes the importance of controlling for preexisting trends.

¹⁹Alternative specifications considered a shorter time frame before and after implementation of the MMP (i.e. 2003 to 2007). The shorter time window helps determine the stability of the simple first-difference estimator. Under these specifications, the AfterMMP coefficient estimates were smaller in magnitude than the baseline estimates, but remained negative and significant. The smaller size of the coefficients were not surprising given that Figure 1a displays the existence of a downward trend throughout the sample time period. When controlling for a linear trend, these results also became statistically insignificant.

²⁰Because Arizona began its own Meth Project in the spring of 2007, youths from this state do not serve as good "controls" for this year. However, it should be noted, the results are robust to excluding Arizona individuals from the sample.

heroin.²¹ For marijuana, the dummy variable represents whether or not the respondent reports having used the substance at least once during the past 30 days. For household inhalants, cocaine, and heroin, the dummy variable indicates whether or not the substance has ever been used during the respondent's lifetime. All difference-in-difference coefficient estimates provide strong evidence the MMP has had no influence on the rates of use of other substances.

Subsamples of youths and the selective recruitment hypothesis

Column 1 of Table 5 estimates equation (2) for subsamples of youths by demographic characteristics. Each cell represents a separate regression where the dependent variable indicates whether or not the respondent has ever used methamphetamines. Only the DD coefficient estimates are reported for each regression. All regressions control for state-specific trends. When considering the entire sample, it is possible that important effects on subgroups go undetected. Column 1 of Table 5 addresses this concern by estimating separate equations for whites, nonwhites, males, females, and youths by age. DD results for nonwhites and younger individuals actually indicate an increase in use after the adoption of the MMP campaign. The results in Column 1 provide little evidence that the MMP reduced use among subgroups of the general youth population in Montana.

Column 2 of Table 5 investigates the selective recruitment hypothesis.²² It is possible that youths who display relatively less risky behaviors are the most likely to be influenced by the MMP. Column 2 tests this hypothesis by estimating the effect of the MMP on meth use among subsamples who report not participating (or participating less) in certain risky behaviors. Column 2 follows the format of Column 1 where each cell represents a separate regression that includes state-specific linear trends. In particular, Column 2 considers samples of individuals who report having not binge drank in the last 30 days, never regularly smoked cigarettes, not driven under the influence of alcohol in the past month, not carried a weapon in the past month, and worn a seat belt often when riding in a vehicle.²³ All coefficient estimates are statistically insignificant. The results in Column 2 do not support the selective recruitment hypothesis.

Exposure to the campaign among MT youth

By the MMP's own estimates, the anti-meth advertisements reach over 70 percent of the state's teenage population three times per week (methproject.org 2009). Yet, it is likely some individuals are exposed to the campaign more than others.²⁴ Unfortunately, campaign exposure is unobserved in the data. County- and school-level identifiers would help control for exposure to certain elements of the campaign (e.g. exposure to billboards), but these indicators are not available due to confidentiality issues.

²¹To be more specific, the exact wording of the question referring to household inhalants is, "During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?"

²²The selective recruitment hypothesis has been studied in the literature on the effectiveness of seat belt laws. For example, see Carpenter and Stehr (2008).

²³"Binge" drinking refers to having had at least five drinks in one sitting during the past month. A "regular smoker" is one who has smoked at least one cigarette per day for a 30 day period in their life. An individual who "wears a seat belt often" is one who has self-reported wearing a seat belt "most of the time" or "always" when riding in a car driven by someone else.

²⁴Chou et al. (2008) show the bodyweight of children and adolescents to be sensitive to the amount of exposure to fast-food restaurant television advertising.

As an alternative measure of campaign exposure, Table 6 considers interactions between the AfterMMP indicator and the variables that describe the amount of TV the respondent reports watching on an average school day. Admittedly, the amount of TV watched by a MT teen is a very crude measure of exposure. There is no indication as to how many of the hours of TV watched are spent on MT-specific stations that air the meth ads. However, it seems reasonable to assume that youths who watch more TV are more likely to see the anti-meth commercials.

The equation estimated for Table 6 is identical to equation (1) except for the inclusion of the interactions between the AfterMMP variable and the TV dummies. Here, the interaction terms represent DD estimators that exploit the temporal variation of the MMP campaign and the within-MT variation of TV hours watched by the individual respondents. The interaction term coefficient estimates indicate that youths who watch one to three hours or four hours or more of TV per day were no less likely to try meth after the adoption of the campaign than were individuals who reported watching less than one hour of TV per day.

Robustness to comparison group

A potential issue with the DD results above is the use of the national sample as the control group. As previously noted, the Montana youth appear different from youth in the national sample along several dimensions. Most apparent is the difference in racial composition between the two groups.

To test the robustness of the results to the specification of the comparison group, data from the North Dakota and Wyoming Youth Risk Behavior Surveys are used. North Dakota and Wyoming border and have similar populations to that of Montana. Additionally, these two states have high levels of youth meth use that are more comparable to rates in Montana than are rates in the national sample (see Table 1). An added benefit to using the North Dakota and Wyoming YRBS is that data for 2009 is available.²⁵ This allows for examining a longer post-treatment period than is feasible with the national sample. Lastly, by utilizing Wyoming data for 2009, it is possible to observe youth meth use one year after Wyoming started its own Meth Project that was modeled to mimic the Montana campaign.

Because teens from two different states at two different times were exposed to a Meth Project, this analysis is based upon the following modification of equation (2):

$$Y_{ist} = \alpha + \mathbf{X}_{ist}\beta_1 + \beta_2 \text{Meth_Project}_{st} + \mathbf{S}_s\beta_3 + \mathbf{T}_t\beta_4 + \varepsilon_{ist} \quad (3)$$

where Meth_Project is equal to one if state s has a Meth Project campaign during year t and is equal to zero otherwise. \mathbf{X} is a vector of the individual characteristics described in Table 2 and \mathbf{S} and \mathbf{T} represent state and year fixed effects, respectively.²⁶ β_2 is the coefficient of interest and is analogous to the coefficient on the interaction term in equation (2).

²⁵The decision to use data from North Dakota and Wyoming was largely made due to the fact that these were the states that border Montana where data for 2009 was available. Data for Idaho and South Dakota (the remaining bordering states) were only available up through 2007.

²⁶In regards to \mathbf{X} , it was not possible to include the individual-level variables for other drug use and sports participation because the questions relevant to these variables were absent for several years of the North Dakota YRBS.

Figure 1b illustrates trends in meth use for Montana, North Dakota, and Wyoming. All three states exhibit downward trends in meth use during the sample time frame. In the main specification that includes state-specific linear trends, the coefficient estimate on Meth_Project is small in magnitude and statistically insignificant ($\beta_2 = -0.008$, s.e. = 0.009). For the sake of brevity, a table is not reported for these results but is available upon request. The estimates confirm the Meth Project has had no discernable impact on methamphetamine use.²⁷

VI. Analysis of the Treatment Episode Data Set

Methamphetamine treatment admissions data from the Treatment Episode Data Set (TEDS) are used to compliment the YRBS analysis. Drug treatment providers that receive federal funding are required to submit data to TEDS. For each admission, data on whether the patient tested positive for meth upon arrival is recorded. With the data from TEDS, it is possible to construct yearly, age- and sex-specific methamphetamine admission rates for each state. Existing research suggests treatment admissions data from TEDS serve as a useful proxy for the total number of methamphetamine users in the general population (Cunningham et al. 2010).

There are at least three benefits to using the TEDS data. First, they provide an objective measure of meth use as opposed to the self-reported data from the YRBS. Second, using annual data from 1995 to 2008, it is possible to observe a longer sample time frame than is feasible with the YRBS data. Moreover, the TEDS data are compiled annually, whereas the YRBS data are collected every other year. Lastly, it is possible to examine whether the MMP has had an impact on adult populations. Though the MMP specifically targets teenagers in their campaign, it is possible older individuals are influenced by the anti-meth ads.²⁸ This is of concern because the prison population and foster care caseloads are affected by meth use (Cunningham et al. 2010).

To estimate the effect of the MMP on methamphetamine admission rates, this paper estimates a model that mirrors the YRBS difference-in-difference research design presented above. Specifically, the following equation is estimated:

$$Y_{ast} = \alpha + \mathbf{X}_{ast}\beta_1 + \beta_2 MT_{st} + \beta_3 \text{AfterMMP}_t + \beta_4 (MT_{st} * \text{AfterMMP}_t) + \mathbf{S}_s\beta_5 + \mathbf{T}_t\beta_6 + \mathbf{Trend}_s + \varepsilon_{it} \quad (3)$$

where a indexes whether the observed admission rate is for males or females, s indexes the state, and t indexes the year.

In equation (3), the dependent variable is the natural logarithm of the sex-specific methamphetamine admissions rate per 100,000 of the relevant population.^{29, 30} \mathbf{X} is a

²⁷To focus solely on Montana's Meth Project, specifications were considered where observations from 2009 were dropped. The null findings were robust to this specification.

²⁸On a related note, Dietz et al. (2008) show that a youth-oriented anti-tobacco campaign, that supposedly decreased use among youths, had no effect on adult populations.

²⁹For example, the meth admissions rate for 18 to 20 year-old males in Montana is calculated based on the population of this age group in Montana for a given year.

³⁰To retain sample size, zero values were coded as 0.1 before taking the natural logarithm. Yet, the results were similar if admission rates equal to zero were excluded from observation.

vector of characteristics that includes a dummy indicating whether the observed admissions rate is for males or females, the state unemployment rate, the state average per capita income, and the state percentage of the population that is black. **MT** and **AfterMMP** are defined as above. **S** and **T** are state and year fixed effects, respectively. Lastly, **Trend** represents state-specific time trends. State populations are used as weights and standard errors are clustered at the state-level (Bertrand et al. 2004)

Table 7 presents descriptive statistics of the data used in the TEDS analysis. Because of the issues mentioned above that are associated with finding an appropriate control group, results were considered where MT was systematically compared to all other U.S. states, all other Western U.S. states, and all other Mountain states.³¹ As Table 7 makes clear, methamphetamine admission rates are very high in Montana relative to elsewhere. This is especially the case for the older age groups.

A problem with the TEDS data is the inability to observe whether the patient has had prior treatment episodes for meth use. This is of particular concern in light of extremely high recidivism rates among individuals seeking treatment for methamphetamine addiction (National Drug Intelligence Center 2006). The TEDS data does contain, however, information on the number of previous treatment episodes the patient has received in any drug or alcohol program.³² Table 7 also reports mean admission rates conditional on no previous treatment. Across all samples, conditional admission rates are significantly less than unconditional rates. This statistical artifact is consistent with the highly addictive nature of methamphetamines (Winslow et al. 2007). For conciseness, only regression results for unconditional admissions rates where all other U.S. states serve as controls are reported. The findings are robust to using conditional rates and the Western and Mountain U.S. states separately as controls. These results are available from the author upon request.

Table 8 presents the DD coefficient estimates of interest from the TEDS analysis.³³ Each column represents a separate regression. Column 1 illustrates results for 15 to 17 year-olds, those youths who are of an age most similar to the YRBS sample. Columns 2 and 3 represent estimates for 18 to 20 and 21 to 29 year-olds, respectively.³⁴

While two of estimates in Table 8 are negative in sign, none are statistically significant. For all estimates, the standard errors are quite large. The null findings for the 15–17 year-olds help confirm the results from the YRBS analysis. The Montana Meth Project appears to have had no influence on the meth use of high school aged individuals. The same holds for persons who are in transition from high school to adulthood (i.e. 18–20 year-olds) and for young adults (i.e. 21–29 year-olds).

³¹The Western states are Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The Mountain states are Arizona, Colorado, Idaho, Nevada, New Mexico, Utah, and Wyoming.

³²Unfortunately, the information on prior treatment episodes is fraught with missing data. For some years, over 15% of the entries for this variable are coded as missing.

³³The slight difference in sample size between Columns (1) and (2) is due to missing values.

³⁴The TEDS admissions data are available for the 21 to 24 year-old age group and the 25 to 29 year-old age group separately. For conciseness, these two groups are pooled together and a dummy variable is included to control for any time-invariant differences between the two groups. Given the format of the TEDS data, it was not possible to break down the admission rates for 15 to 17 year-olds and 18 to 20 year-olds any further by age.

VII. Conclusion

Methamphetamine use is widely prevalent across the United States and poses a considerable public health threat. Government supply-side interventions to the methamphetamine market have shown to have only temporary effects on meth-related behavior. Moreover, these programs have been criticized due to the regulatory burdens they impose and their potential for limiting the range of products available for legitimate therapeutic use. An alternative to supply-side interruptions, demand-side programs aim to prevent meth use by educating individuals on the adverse consequences associated with methamphetamines.

In 2005, the state of Montana adopted a graphic advertising campaign, the Montana Meth Project (MMP), with the intent of curbing meth use among Montana's youth. What initially began as a privately funded campaign, the MMP is currently financed through state and federal dollars and private contributions. With an annual operating budget of approximately \$2 to \$3 million, the MMP represents a potentially low cost alternative to supply-side interventions.

To evaluate the effectiveness of the MMP on teen meth use, this paper uses data from the 1999–2009 Youth Risk Behavior Surveys (YRBS). When accounting for a preexisting downward trend in meth use, effects on meth use become small and statistically insignificant. These results are robust to using the related changes of meth use among youths without exposure to the campaign as controls in a difference-in-difference specification. A complementary analysis of treatment admissions data confirms the MMP had no effect on meth use.

These results suggest the Montana Meth Project's campaign did not contribute to the decrease in meth use among Montana's youth. From a policy perspective, this research is important because it highlights the ineffectiveness of a campaign that is widely regarded as successful. It is vital for future research to determine whether or not other factors that preceded the MMP contributed to the decrease in teen meth use. For example, drug task forces were committed to seizing clandestine meth labs during the years prior to the introduction of the antimeth campaign (McGrath 2008). Subsequent studies may also benefit from focusing on trying to quantify trends in sentiment toward methamphetamine that pre-date the MMP. Lastly, this study calls for future research to focus on the determinants of youth meth use so as to better guide the allocation of resources towards effective policies.

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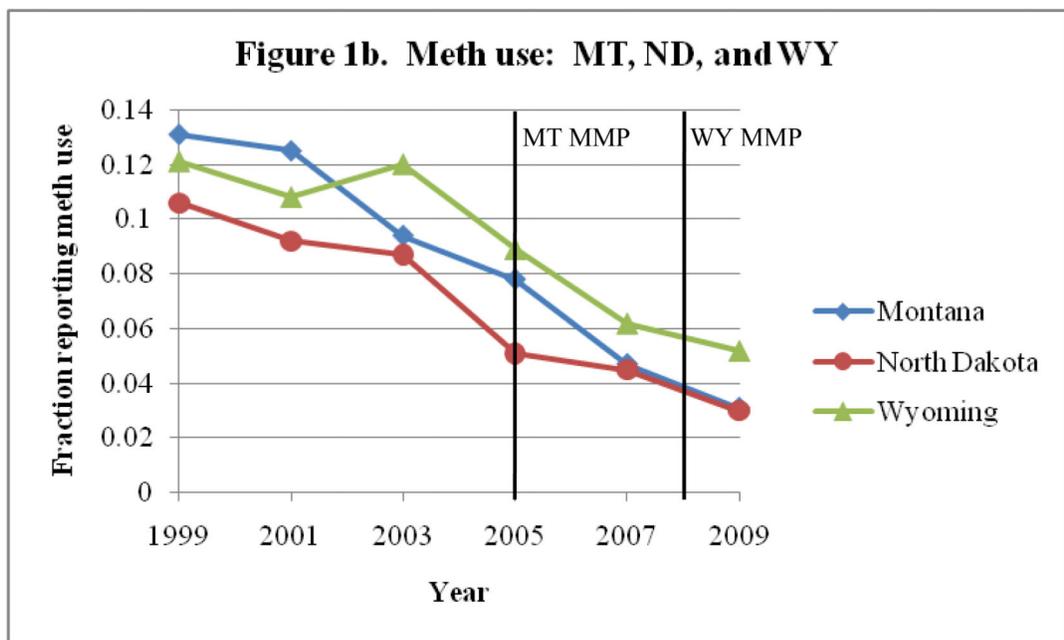
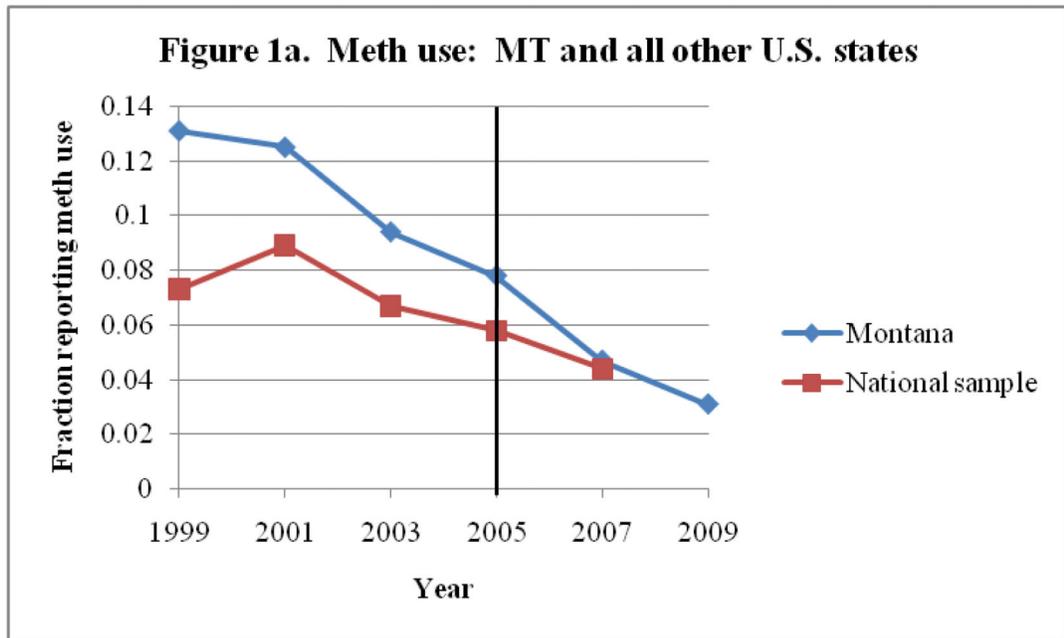


Figure 1.

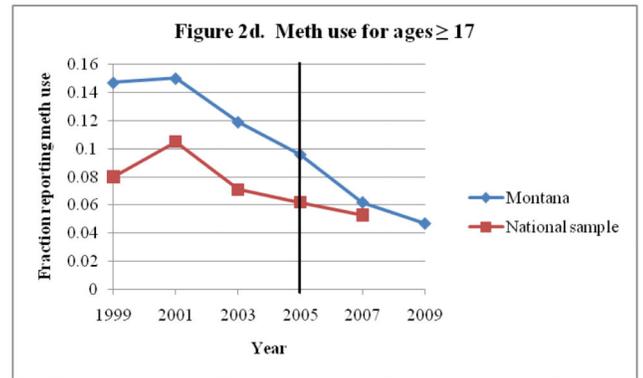
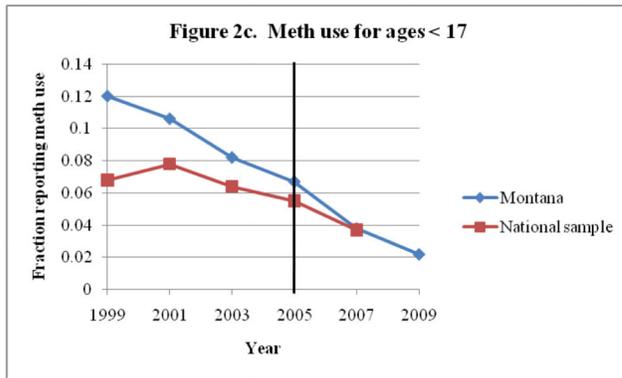
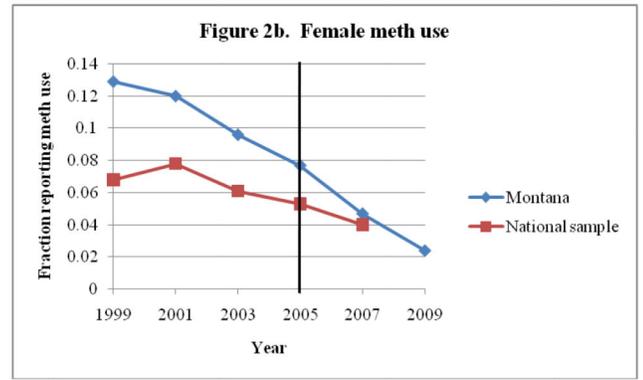
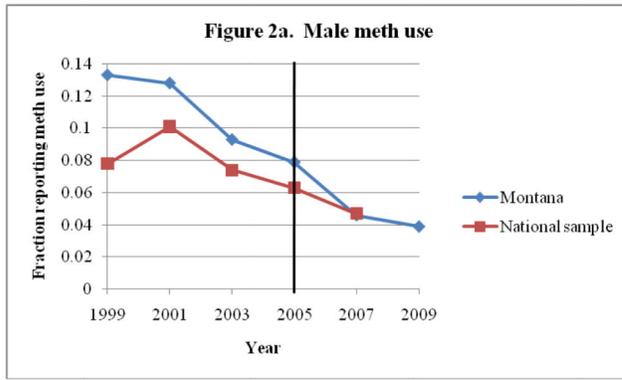


Figure 2.

Table 1

Descriptive statistics for MT, National, ND, and WY YRBS data: dependent variable

Variable	1999	2001	2003	2005	2007	2009
<i>Montana</i>						
Meth (ever)	0.131	0.125	0.094	0.078	0.047	0.031
SE	0.006	0.006	0.006	0.005	0.003	0.004
N	2881	2835	2706	2947	3864	1786
			<u>Pre-MMP (1999-2005)</u>	<u>Post-MMP (2007-2009)</u>		
Meth (ever)		0.107		0.042		
SE		0.003		0.003		
<i>National sample</i>						
Meth (ever)	0.073	0.089	0.067	0.058	0.044	...
SE	0.002	0.002	0.002	0.002	0.002	...
N	15076	13075	14947	13498	13568	...
			<u>Pre-MMP (1999-2005)</u>	<u>Post-MMP (2007)</u>		
Meth (ever)		0.072		0.044		
SE		0.002		0.002		
<i>North Dakota</i>						
Meth (ever)	0.106	0.092	0.087	0.051	0.045	0.030
SE	0.007	0.007	0.007	0.005	0.005	0.004
N	1795	1583	1648	1712	1693	1787
			<u>Pre-MMP (1999-2005)</u>	<u>Post-MMP (2007-2009)</u>		
Meth (ever)		0.084		0.037		
SE		0.003		0.003		
<i>Wyoming</i>						
Meth (ever)	0.121	0.108	0.120	0.089	0.062	0.052
SE	0.008	0.006	0.008	0.006	0.005	0.004
N	1625	2724	1522	2448	2145	2813
			<u>Pre-MMP (1999-2005)</u>	<u>Post-MMP (2007-2009)</u>		
Meth (ever)		0.107		0.056		
SE		0.003		0.003		

Note: The standard error of the mean is reported below each annual estimate of the average rate of having ever used methamphetamines.

Table 2

Descriptive statistics for MT and National YRBS data: independent variables

Variable	National YRBS means	Montana YRBS means
Age	16.189	16.069
Male	0.479	0.492
White	0.445	0.853
Black	0.221	0.008
Other race	0.334	0.139
Freshman	0.238	0.277
Sophomore	0.248	0.273
Junior	0.255	0.236
Senior	0.256	0.204
Ungraded	0.002	0.011
Depressed	0.294	0.255
Regular smoker	0.144	0.166
Drink often	0.139	0.174
Marijuana	0.426	0.407
Other drugs	0.089	0.080
TV less than 1 hr.	0.206	0.319
TV 1 to 3 hours	0.537	0.581
TV 4 hours plus	0.258	0.100
Seat belt often	0.600	0.663
Sports participation	0.542	0.620
Passenger of drinking driver	0.320	0.343
Resource	...	0.119

Notes: (1) N = 61,133 (national sample). N = 13,832 (Montana sample). (2) Sample period is 1999–2007 for national YRBS. Sample period is 1999–2009 for Montana YRBS. (3) The Depressed variable is equal to 1 if respondent felt so sad/hopeless that he/she stopped doing usual activities during the past 12 months, and equal to 0 otherwise. (4) The Regular smoker variable is equal to 1 if respondent has ever smoked at least one cigarette per day for 30 days, and equal to 0 otherwise. (5) The Drink often variable is equal to 1 if respondent has had at least one drink of alcohol on 6 or more days of the past month, and equal to 0 otherwise. (6) The two drug use variables are equal to 1 if respondent has ever used during his/her lifetime, and equal to 0 otherwise. (7) The TV variables describe the amount of TV watched on an average school day. (8) The Seat belt often variable is equal to 1 if respondent wears a seat belt "Most of the time" or "Always" when riding in a car driven by someone else, and equal to 0 otherwise. (9) The Sports participation variable is equal to 1 if respondent played on at least one sports team during the past 12 months, and equal to 0 otherwise. (10) The Passenger of drinking driver variable is equal to 1 if, during the past month, the respondent has ridden in a vehicle driven by someone who had been drinking alcohol, and equal to 0 otherwise. (11) The Resource variable is equal to 1 if respondent has received help from a resource teacher, speech therapist or other special education teacher, and equal to 0 otherwise. The information for the Resource variable was only available in the Montana YRBS. As a result, this variable was only included in the first-difference estimations.

Table 3

First-difference and difference-in-difference estimates for methamphetamine use.

	First-difference estimates			Difference-in-difference estimates	
	(1) Baseline Sample: 1999–2009	(2) Baseline Sample: 1999–2009	(3) Controlling for Preexisting Linear Trend: 1999–2009	(4) Baseline Sample: 1999–2007	(5) Controlling for Preexisting Linear Trend: 1999–2007
<i>Meth use</i>					
MT	---	---	---	-0.012*** (0.002)	0.103*** (0.027)
AfterMMP	-0.058*** (0.004)	-0.041*** (0.003)	-0.009 (0.006)	-0.026*** (0.005)	-0.015* (0.008)
MT* AfterMMP	---	---	---	-0.015*** (0.004)	0.005 (0.008)
Individual- specific controls	NO	YES	YES	YES	YES
Trends	NO	NO	YES	NO	YES
R ²	0.012	0.422	0.424	0.391	0.392
N	13832	13832	13832	73885	73885

Notes: (1) Sample is 1999–2009 Montana Youth Risk Behavior Surveys for first difference results. Sample is 1999–2007 National and Montana Youth Risk Behavior Surveys for DD results. (2) Each column is a separate regression. (3) Regression models in Columns 2–5 control for age, sex, race, grade, and include dummy variables describing depression, smoking, drinking, other drug use behavior, hours spent watching TV, seat belt use, sports participation, whether the individual sees a resource teacher at school, and whether the individual has been the passenger of a drunk driver. (4) For the first-difference estimates, "Trends" refers to a simple linear trend. For the DD estimates, "Trends" refers to state-specific linear trends. (5) Race- and age-specific populations are used as weights. (6) Standard errors are in parentheses and are clustered at the state-level for the DD results. (7)

* significant at 10% level;

** significant at 5% level;

*** significant at 1% level.

Table 4

Difference-in-difference estimates for use of other drugs.

	(1) Marijuana	(2) Inhalants	(3) Cocaine	(4) Heroin
MT	0.066* (0.033)	-0.204*** (0.008)	-0.197*** (0.012)	-0.013 (0.019)
AfterMMP	-0.014 (0.011)	0.015** (0.006)	-0.003 (0.007)	-0.009* (0.005)
MT*AfterMMP	-0.000 (0.010)	0.003 (0.006)	-0.007 (0.007)	0.000 (0.005)
State trends	YES	YES	YES	YES
R ²	0.297	0.149	0.225	0.075
N	74095	73726	74948	74218

Notes: (1) Sample is 1999–2007 National and Montana Youth Risk Behavior Surveys. (2) Each column represents a separate regression. (3) All regressions control for age, sex, race, grade, and include dummy variables describing depression, smoking, drinking, other drug use behavior, hours spent watching TV, seat belt use, sports participation, whether the individual has been the passenger of a drunk driver, state of residence, and state-specific linear trends. (4) State race- and age-specific populations are used as weights. (5) Standard errors are in parentheses and are clustered at the state-level. (6)

* significant at 10% level;

** significant at 5% level;

*** significant at 1% level.

Table 5

Difference-in-difference results for subsamples of youths and selective recruitment.

	(1) DD estimates (coefficient on MT* AfterMMP)		(2) DD estimates (coefficient on MT* AfterMMP)
<i>Subsamples of youths</i>		<i>Selective recruitment</i>	
Whites	0.008 (0.010) N=38069	No binge drinking past month	-0.002 (0.007) N=51998
Nonwhites	0.010 *** (0.003) N=35816	Not a regular cigarette smoker	0.002 (0.008) N=62849
Males	0.005 (0.009) N=35579	Have not driven under influence of alcohol in past month	0.007 (0.007) N=63847
Females	0.003 (0.008) N=38306	Have not carried a weapon in past month	0.005 (0.008) N=60182
Age < 17	0.011 ** (0.005) N=42820	Wear a seat belt often	-0.001 (0.007) N=44875
Age 17	-0.007 (0.014) N=31065		

Notes: (1) Sample is 1999–2007 National and Montana Youth Risk Behavior Surveys for DD results. (2) Each cell represents a separate regression. (3) All regressions control for age, sex, race, grade, and include dummy variables describing depression, smoking, drinking, other drug use behavior, hours spent watching TV, seat belt use, sports participation, whether the individual has been the passenger of a drunk driver, state of residence, and state-specific linear trends. (4) State race- and age-specific populations are used as weights. (5) Standard errors are in parentheses and are clustered at the state-level. (6)

* significant at 10% level;

** significant at 5% level;

*** significant at 1% level.

Table 6

Teen meth use and television exposure for Montana youth.

	Controlling for Preexisting Linear Trend: 1999–2009
<i>Meth use</i>	
AfterMMP	-0.013* (0.008)
TV_1to3hrs	-0.002 (0.005)
TV_4hrs_plus	-0.010 (0.008)
AfterMMP*TV_1to3hrs	0.004 (0.007)
AfterMMP*TV_4hrs_plus	0.012 (0.012)
Trend	-0.006*** (0.001)
R ²	0.424
N	13832

Notes: (1) Sample is 1999–2009 Montana Youth Risk Behavior Surveys. (2) Less than one hour of TV watching per day is the reference. (3) Each column is a separate regression. (4) All regression models control for age, sex, race, grade, and include dummy variables describing depression, smoking, drinking, other drug use behavior, hours spent watching TV, seat belt use, sports participation, whether the individual sees a resource teacher at school, and whether the individual has been the passenger of a drunk driver. (5) Race- and age-specific populations are used as weights. (6) Standard errors are in parentheses. (7)

* significant at 10% level;

** significant at 5% level;

*** significant at 1% level.

Table 7

Descriptive statistics: Treatment episode data, 1995–2008.

	Montana	All states (excl. MT)	Western U.S. states (excl. MT)	Mountain U.S. states (excl. MT)
Meth admission rate, age 15–17	225.74	62.05	179.02	128.27
Meth admission rate conditional on no prior treatment, age 15–17	102.60	35.73	116.02	85.77
Meth admission rate, age 18–20	481.00	94.39	252.05	216.35
Meth admission rate conditional on no prior treatment, age 18–20	217.08	50.71	150.64	120.93
Meth admission rate, age 21–29	705.70	136.03	377.04	285.82
Meth admission rate conditional on no prior treatment, age 21–29	238.38	66.17	201.90	137.99
Unemployment rate	4.569	5.101	5.688	4.642
Income per capita (2000 dollars)	24563.86	30035.63	30858.04	28124.07
Percent black	0.005	0.125	0.056	0.035

Notes: (1) Sample is 1995–2008 Treatment Episode Data Set (TEDS). (2) Sample means are state/year averages. (3) Admission rates are rates per 100,000 of the specified age group population. (4) Western U.S. states are Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Mountain U.S. states are Arizona, Colorado, Idaho, Nevada, New Mexico, Utah, and Wyoming.

Table 8

Meth admissions by age group. Treatment episode data analysis, 1995–2008.

	(1) 15 to 17 year-olds	(2) 18 to 20 year-olds	(3) 21 to 29 year-olds
MT [*] AfterMMP	0.040 (0.228)	-0.141 (0.235)	-0.102 (0.235)
State FE	YES	YES	YES
Year FE	YES	YES	YES
State trends	YES	YES	YES
R ²	0.878	0.895	0.913
N	1359	1368	2736

Notes: (1) Sample is 1995–2008 Treatment Episode Data Set (TEDS). (2) Each column is a separate regression. (3) Control group consists of all other U.S. states. (4) All regression models also control for sex, the state unemployment rate, state income per capita, and the percent of the state population that is black. (5) State populations are used as weights. (6) Standard errors are in parentheses and are clustered at the state-level. (7)

* significant at 10% level;

** significant at 5% level;

*** significant at 1% level.

The Meth Project and Teen Meth Use
New Estimates from the National and State Youth Risk Behavior Surveys

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Abstract

Anderson (2010) used data from the Youth Risk Behavior Surveys to estimate the effect of the Montana Meth Project, an anti-methamphetamine advertising campaign, on meth use among high school students. He found little evidence that the campaign actually curbed meth use. In this note, we use data from the national and state Youth Risk Behavior Surveys for the period 1999 through 2011 to build upon the work of Anderson (2010). During this period, a total of eight states adopted anti-meth advertising campaigns. While our results are typically consistent with those of Anderson (2010), we do find some evidence that the Meth Project may have reduced meth use among white high school students.

JEL Codes: H75, I18, K42, M37

Key Words: Meth Project, Methamphetamine Use, Youth Risky Behavior, Anti-Drug Campaign

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"We brought the Meth Project to Georgia to stem the growing methamphetamine epidemic in our state, and we are seeing impressive results."

--Johnny Isakson, Republican Senator of Georgia

1. INTRODUCTION

In 2005, Montana adopted an anti-methamphetamine advertising campaign known as the Meth Project. The goal of this campaign is to reduce methamphetamine (meth) use by increasing the perceived risk and decreasing the perceived benefit of trying meth, promoting dialogue about meth between parents and teens, and stigmatizing use (Siebel and Mange 2009). The campaign relies primarily on graphic print impressions, radio and television ads, and highway billboards. The ads consist of disturbing images such as addicts tearing off their own skin, young girls selling their bodies to older men for meth, and meth-crazed teens beating their parents for money.¹

Due to the apparent success of Montana's campaign, seven additional states have adopted their own Meth Projects (see Table 1).² In 2010, *Barron's* magazine listed the Meth Project as the third most effective philanthropy in the world (Siebel Scholars 2010). However, after accounting for preexisting downward trends in meth use, Anderson (2010) found little evidence of a relationship between the Montana Meth Project and meth use among high school students.³

Because of the focus on Montana, it is unclear whether the results from Anderson (2010) generalize. In an effort to examine whether the Meth Project was more successful elsewhere, we extend the Anderson (2010) analysis through 2011. Similar to Anderson (2010), after

¹ To view the Meth Project ads, visit <http://montana.methproject.org/Our-Work/view-ads.php>.

² The editorial board of the *Star-Tribune*, a major newspaper in Wyoming, was quoted as saying, "...the fact that Wyoming and six other states have launched programs similar to the Montana Meth Project shows plenty of people see it as something worth emulating (Star-Tribune Editorial Board 2010)."

³ See Anderson (2010) for a detailed description of the Montana Meth Project. See Dobkin and Nicosia (2009) and Cunningham and Finlay (2013) for research on supply-side meth shocks.

accounting for preexisting downward trends in meth use, we find little evidence of a relationship between the Meth Project and meth use within our full sample. However, we do find some evidence that the Meth Project may have decreased meth use among white high school students.

2. DATA AND EMPIRICAL MODEL

The data for this study come from the national and state YRBS and cover the period 1999 through 2011.⁴ The national YRBS is conducted biennially by the Centers for Disease Control and Prevention (CDC) and is representative of the population of U.S. high school students.⁵ The state surveys are also school-based and mirror the national surveys in terms of content. Although the state surveys are coordinated by the CDC, they are typically administered by state education and health agencies.

Our analysis uses both of these data sources so that identification comes from as many Meth Project adoptions as possible. While intended to be nationally representative, not all 50 states contribute data to the national YRBS in any given year.⁶ Between 1999 and 2011, 11 states contributed data to the national YRBS every year and six states contributed data before and after the adoption of their Meth Project (Arizona, Colorado, Georgia, Hawaii, Idaho, and Illinois). Appendix Table 1 illustrates the number of observations by year and state in the national YRBS analysis.

⁴ Anderson (2010) used national YRBS data through 2007 and Montana YRBS data through 2009. It is not possible to observe meth use prior to 1999 because this was the first year the YRBS asked respondents about meth use.

⁵ Federal agencies use the national YRBS data to follow trends in adolescent behaviors such as eating and exercise habits, violence, sexuality, and substance use. These data have also been used by researchers to evaluate the impacts of state-level policies. For examples, see Tremblay and Ling (2005), Carpenter and Cook (2008), Carpenter and Stehr (2008), Cawley et al. (2007), and Anderson (2014).

⁶ In order to link respondents to their state of residence, we obtained the restricted-use versions of the national YRBS.

Most states conducted their own version of the YRBS at some point between 1999 and 2011. We have obtained data from 45 states, seven of which conducted surveys before and after the adoption of their Meth Project (Arizona, Colorado, Georgia, Idaho, Illinois, Montana, and Wyoming).⁷ Appendix Table 2 illustrates the number of observations each state contributed to the state YRBS analysis. In combination, the national and state YRBS data cover all states and the District of Columbia. All eight states with Meth Projects contributed data before and after the adoption of their anti-meth campaign.⁸ Table 2 provides descriptive statistics for the national and state YRBS samples. Means are reported by whether a Meth Project was present in the respondent's state of residence during the year of the interview. On average, Meth Project states have lower rates of meth use, a lower percentage of black students enrolled in their high schools, and higher unemployment rates.

Figure 1 presents trends in meth use based on the combined national and state YRBS data. It is apparent that meth use has been trending smoothly downward in all states during the period under study. If the Meth Project had an effect, then we would expect to see an acceleration of this trend as states began adopting the campaign. Figure 1 provides no evidence to support this hypothesis. If anything, the decrease in meth use appears to have slowed among adopting states after 2005, the inaugural year of the Meth Project in Montana.

To examine the relationship between the Meth Project and meth use among youths in a more rigorous fashion, we exploit the temporal and spatial variation in the adoption of these

⁷ Roughly half of these states have given the CDC permission to release their data. To obtain the remaining data, direct requests were made to each state.

⁸ In the combined national and state YRBS sample, we have full coverage for 5 of the 8 Meth Project states. Idaho did not participate in the national or state YRBS in 1999 and Colorado did not participate in the national or state YRBS in 1999, 2003, and 2007. In addition, we only have data on Hawaii for 1999 and 2009 from the national YRBS. Hawaii conducted a state YRBS in 1999, 2005, 2007, 2009, and 2011. Unfortunately, our attempts at obtaining these data were rebuffed.

campaigns and estimate a standard difference-in-differences model. Specifically, our estimating equation is:

$$(1) \quad \text{Meth use}_{ist} = \beta_0 + \beta_1 \text{Meth Project}_{st} + \mathbf{X}_{ist} \boldsymbol{\beta}_2 + v_s + w_t + \Theta_s \cdot t + \varepsilon_{ist},$$

where i indexes individuals, s indexes states, and t indexes years. The dependent variable, Meth use_{ist} , is equal to 1 if respondent i reported having ever used meth, and is equal to 0 otherwise.

The vector \mathbf{X}_{ist} includes individual-level controls for age, sex, race and grade, and the unemployment rate in respondent i 's state.⁹ The vectors v_s and w_t represent state and year fixed effects, respectively, and state-specific linear time trends are represented by $\Theta_s \cdot t$. The variable of interest, Meth Project_{st} , is an indicator for whether a Meth Project had been implemented by state s by year t .¹⁰ All regressions are estimated as linear probability models and standard errors are corrected for clustering at the state level (Bertrand et al. 2004).¹¹

3. RESULTS

Table 3 presents estimates of equation (1) for the national, state, and combined YRBS samples. For each sample, results from specifications with and without state-specific linear time trends are presented. Figure 1 clearly illustrates the importance of controlling for preexisting trends in meth use.

⁹ The regressions based on the combined YRBS sample also include a dummy variable that indicates whether the respondent was sampled in the national YRBS or the state YRBS.

¹⁰ This variable takes on fractional values during the year in which a Meth Project was adopted.

¹¹ Logit and probit models yielded similar results.

Using the state YRBS data and a specification without state-specific linear time trends, the adoption of a Meth Project is associated with a 1.53 percentage point decrease in the probability of meth use. The same specification yields a similar estimate using the combined YRBS data.¹² However, when state-specific linear time trends are included, these estimates become much smaller in magnitude and lose statistical significance.¹³

The state-specific linear time trends are included to avoid confounding the treatment effect with pre-treatment trends. However, when there are insufficient observations in the pre-treatment period, empirically disentangling the trends and the treatment effect becomes difficult (Wolfers 2006). To address this issue, we consider a series of sensitivity analyses in Table 4. Here, we restrict focus to treatment states with relatively more pre-treatment years of data. For example, in panel A of Table 4, we drop treated states with only one year of pre-Meth Project data; in panel C, we drop treated states with three or fewer years of pre-Meth Project data. In general, these results support the findings from Table 3.¹⁴

In Table 5, we consider whether the relationship between the Meth Project depends on age, gender, or race.¹⁵ All estimates presented are based on specifications that include state-

¹² We also experimented with using the wild cluster bootstrap method suggested by Cameron et al. (2008) to produce t-statistics. Wild cluster bootstrap critical values provide an asymptotic refinement and may work better than other inference methods for OLS when the number of clusters is small. Both of the statistically significant effects shown in Table 3 became statistically insignificant at conventional levels when using the wild cluster bootstrap procedure.

¹³ For the national YRBS analysis, we considered weighted regressions using the sample weights provided by the CDC. These results were similar to those reported in Table 3. Because the national and state YRBS data were not specifically designed to be pooled, we also experimented with including the interaction term, *Meth Project*National YRBS*, on the right-hand-side of the estimating equation, where *National YRBS* is equal to one if the respondent was part of the national YRBS sample and equal to zero if the respondent was part of the state YRBS sample. This interaction term was never statistically distinguishable from zero, quelling some concerns about the viability of combining the two data sets.

¹⁴ It is also important to note that the national YRBS data set represents a highly unbalanced panel. We experimented with running our national YRBS analyses on a sample where only states with one or fewer missing years of data were included. These results were very similar to those shown in Table 3.

¹⁵ Appendix Table 3 shows mean rates of meth use by age, gender, and race.

specific linear time trends. The results in panel A compare estimates for YRBS respondents who were under the age of 17 at the time of the interview with estimates for respondents who were 17 years of age or older. For both groups, the relationship between the Meth Project and meth use is consistently statistically insignificant.

Panel B of Table 5 provides estimates by gender. The relationship between the Meth Project and meth use among males is negative and statistically significant when based on the national YRBS data. In the state and combined samples, however, this relationship becomes statistically indistinguishable from zero.¹⁶ There is no evidence that the Meth Project had an effect on female meth use.

Finally, the results in panel C of Table 5 provide estimates by race (i.e., white vs. non-white). The relationship between the Meth Project and meth use among white high school students is negative and statistically significant in the state YRBS sample.¹⁷ While this relationship becomes statistically insignificant in the combined sample, this may simply be due to the relatively small number of observations contributed by the treated states in the national YRBS data. Consequently, we leave open the possibility that the Meth Project had an effect on white students. There is no evidence that the Meth Project had an effect on meth use among non-white students.¹⁸

¹⁶ The statistically significant effect for males in the national YRBS sample became statistically insignificant when using the wild cluster bootstrap procedure described by Cameron et al. (2008). It is important to note that the coefficient estimates for males across the national and state YRBS samples are statistically indistinguishable from one another.

¹⁷ The statistically significant effect for whites in the state YRBS sample became statistically insignificant when using the wild cluster bootstrap procedure described by Cameron et al. (2008). It is important to note that the coefficient estimates for whites across the national and state YRBS samples are statistically indistinguishable from one another.

¹⁸ To further address issues with combining the national and state YRBS data sets, we collected population data from the National Cancer Institute's Surveillance Epidemiology and End Results Program (<http://seer.cancer.gov/popdata/>). We used these data to assign population weights to each respondent based on state of residence, age, gender, and race. The idea of weighting using these data is to better ensure representation at the

4. CONCLUSION

The Meth Project, an anti-methamphetamine advertising campaign, is intended to discourage meth use among young people. Since Montana established the first campaign in 2005, seven other states have adopted their own Meth Projects. Using data from the YRBS, Anderson (2010) found no evidence of a relationship between the Montana Meth Project and meth use among high school students.

We build upon the work of Anderson (2010) by using data from the national and state YRBS for the period 1999 through 2011 to examine the relationship between the Meth Project and meth use. During this period, eight states adopted anti-meth campaigns. While our results are typically consistent with those of Anderson (2010), we do find some evidence that the Meth Project may have reduced meth use among white high school students.

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Figure 1
Fraction Reporting Meth Use

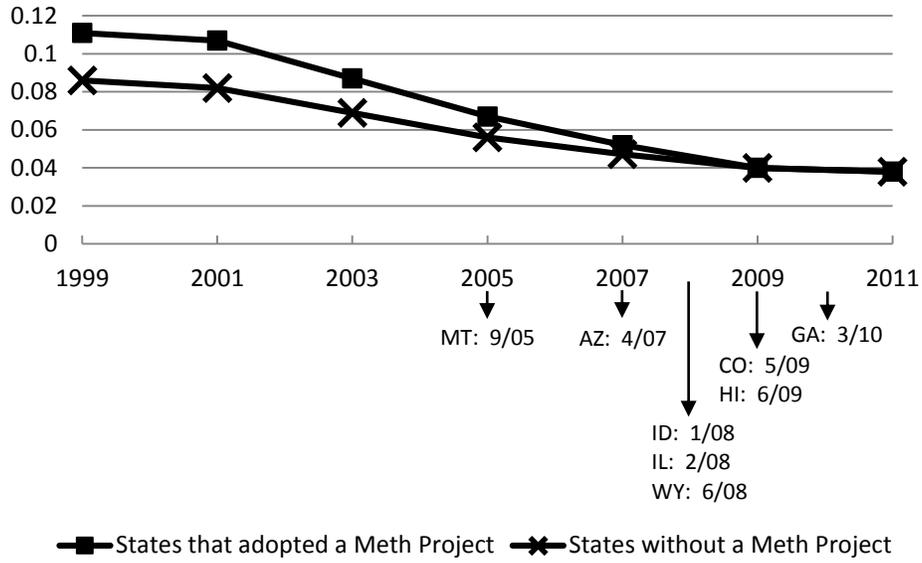


Table 1. Meth Projects, 1999-2011

	Effective Date
Arizona	April 2007
Colorado	May 2009
Georgia	March 2010
Hawaii	June 2009
Idaho	January 2008
Illinois	February 2008
Montana	September 2005
Wyoming	June 2008

Table 2. Descriptive Statistics: YRBS 1999-2011

	<u>National YRBS</u>		<u>State YRBS</u>		Description
	<i>Meth</i> Project = 1	<i>Meth</i> Project = 0	<i>Meth</i> Project = 1	<i>Meth</i> Project = 0	
Dependent Variable					
<i>Meth use</i> ^{a, b}	.0430	.0595	.0444	.0572	= 1 if respondent has ever used meth, = 0 otherwise
Independent Variable					
<i>Age under 15</i> ^{a, b}	.1030	.0944	.1104	.1328	= 1 if respondent is under 15, = 0 otherwise
<i>Age 15</i>	.2344	.2245	.2605	.2586	= 1 if respondent is 15, = 0 otherwise
<i>Age 16</i>	.2681	.2581	.2664	.2647	= 1 if respondent is 16, = 0 otherwise
<i>Age 17</i> ^{a, b}	.2433	.2620	.2333	.2233	= 1 if respondent is 17, = 0 otherwise
<i>Age 18 or older</i> ^b	.1512	.1610	.1294	.1205	= 1 if respondent is 18 or older, = 0 otherwise
<i>Male</i> ^{a, b}	.5030	.4892	.4927	.4865	= 1 if respondent is male, = 0 if respondent is female
<i>Grade 9</i>	.2483	.2449	.2804	.2819	= 1 if respondent is in grade 9, = 0 otherwise
<i>Grade 10</i>	.2515	.2463	.2674	.2684	= 1 if respondent is in grade 10, = 0 otherwise
<i>Grade 11</i> ^b	.2572	.2562	.2472	.2395	= 1 if respondent is in grade 11, = 0 otherwise
<i>Grade 12</i> ^b	.2410	.2514	.2023	.1931	= 1 if respondent is in grade 12, = 0 otherwise
<i>Ungraded</i> ^b	.0020	.0011	.0026	.0171	= 1 if grade is “ungraded”, = 0 otherwise
<i>Black</i> ^{a, b}	.1291	.2215	.0732	.1359	= 1 if respondent is black, = 0 otherwise
<i>White</i> ^{a, b}	.3594	.4293	.6345	.6273	= 1 if respondent is white, = 0 otherwise
<i>Other race</i> ^{a, b}	.5116	.3492	.2923	.2368	= 1 if respondent is of another race, = 0 otherwise
<i>Unemployment rate</i> ^{a, b}	8.831	6.176	7.120	5.811	State unemployment rate
N	5,610	95,136	37,426	497,233	

^a Statistically different at 5% level for national YRBS; ^b Statistically different at 5% level for state YRBS.

Notes: Means are based on unweighted data from the national and state YRBS

Table 3. Meth Projects and Youth Meth Use

	<u>National YRBS</u>		<u>State YRBS</u>		<u>Combined National and State</u>	
<i>Meth Project</i>	-.0105 (.0194)	-.0045 (.0081)	-.0153** (.0074)	-.0050 (.0064)	-.0162* (.0083)	-.0016 (.0059)
N	100,746	100,746	534,659	534,659	635,405	635,405
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State-specific trends	No	Yes	No	Yes	No	Yes

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents a separate OLS estimate based on data from the YRBS (1999-2011); the covariates are listed in Table 2. The combined national and state YRBS regressions include a dummy variable indicating whether the respondent was sampled in the national YRBS or the state YRBS. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 4. Sensitivity of Results to Sample Selection

	<u>National YRBS</u>		<u>State YRBS</u>		<u>Combined National and State</u>	
Panel A: Drop treated states with only one year of pre-Meth Project data						
<i>Meth Project</i>	-.0123 (.0212)	-.0086 (.0081)	-.0192** (.0082)	-.0072 (.0065)	-.0161* (.0083)	-.0016 (.0059)
N	98,927	98,927	514,752	514,752	634,863	634,863
Treated states in sample	AZ, GA, ID, IL		GA, ID, MT, WY		AZ, CO, GA, ID, IL, MT, WY	
Panel B: Drop treated states with two or fewer years of pre-Meth Project data						
<i>Meth Project</i>	-.0112 (.0225)	-.0066 (.0074)	-.0192** (.0082)	-.0072 (.0065)	-.0172** (.0085)	-.0032 (.0059)
N	98,271	98,271	514,752	514,752	629,457	629,457
Treated states in sample	AZ, GA, IL		GA, ID, MT, WY		AZ, GA, ID, IL, MT, WY	
Panel C: Drop treated states with three or fewer years of pre-Meth Project data						
<i>Meth Project</i>	-.0112 (.0225)	-.0066 (.0074)	-.0089 (.0060)	-.0047 (.0080)	-.0087 (.0073)	-.0006 (.0064)
N	98,271	98,271	494,124	494,124	608,645	608,645
Treated states in sample	AZ, GA, IL		GA, ID, WY		AZ, GA, ID, IL, WY	
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State-specific trends	No	Yes	No	Yes	No	Yes

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents a separate OLS estimate based on data from the YRBS (1999-2011); the covariates are listed in Table 2. The combined national and state YRBS regressions include a dummy variable indicating whether the respondent was sampled in the national YRBS or the state YRBS. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 5. Meth Projects and Youth Meth Use by Age, Gender, and Race

	<u>National YRBS</u>		<u>State YRBS</u>		<u>Combined National and State</u>	
Panel A: Meth Use by Age						
	Age < 17	Age ≥ 17	Age < 17	Age ≥ 17	Age < 17	Age ≥ 17
<i>Meth Project</i>	-.0008 (.0069)	-.0058 (.0155)	-.0056 (.0048)	-.0045 (.0093)	-.0032 (.0042)	-.0015 (.0085)
N	58,291	42,455	350,122	184,537	408,413	226,992
Panel B: Meth Use by Gender						
	Male	Female	Male	Female	Male	Female
<i>Meth Project</i>	-.0129** (.0063)	.0066 (.0143)	-.0039 (.0063)	-.0065 (.0072)	-.0003 (.0060)	-.0032 (.0068)
N	49,366	51,380	260,351	274,308	309,717	325,688
Panel C: Meth Use by Race						
	White	Non-white	White	Non-white	White	Non-white
<i>Meth Project</i>	-.0023 (.0122)	-.0012 (.0145)	-.0089** (.0041)	.0040 (.0099)	-.0065 (.0047)	.0071 (.0078)
N	42,855	57,891	335,649	199,010	378,504	256,901
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State-specific trends	Yes	Yes	Yes	Yes	Yes	Yes

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents a separate OLS estimate based on data from the YRBS (1999-2011); the covariates are listed in Table 2. The combined national and state YRBS regressions include a dummy variable indicating whether the respondent was sampled in the national YRBS or the state YRBS. Standard errors, corrected for clustering at the state level, are in parentheses.

Appendix Table 1. Number of Observations by State-Year: National YRBS

	1999	2001	2003	2005	2007	2009	2011	Total
Alabama	59	310	647	...	481	1,055	314	2,866
Arizona*	131	408	344	281	599	358	1,117	3,238
Arkansas	...	...	266	...	416	298	...	980
California	2,479	2,184	1,723	1,545	2,099	2,789	1,858	14,677
Colorado*	...	655	...	...	...	193	245	1,093
Connecticut	...	...	...	233	...	...	...	233
Delaware	...	...	364	...	...	...	225	589
D.C.	...	...	...	...	...	...	306	306
Florida	860	1,060	1,498	535	740	225	1,145	6,063
Georgia*	810	486	420	1,833	347	1,315	125	5,336
Hawaii*	308	...	...	...	...	234	...	542
Idaho*	...	156	...	240	...	...	260	656
Illinois*	228	438	316	490	585	1,489	990	4,536
Indiana	...	177	417	170	400	...	270	1,434
Iowa	...	...	...	238	246	...	...	484
Kansas	...	...	328	277	...	199	301	1,105
Kentucky	...	...	...	531	359	...	214	1,104
Louisiana	621	...	688	157	...	427	...	1,893
Maine	197	203	196	...	...	...	...	596
Maryland	...	...	259	...	...	...	...	259
Massachusetts	...	253	212	256	711	...	289	1,721
Michigan	522	338	398	295	297	320	625	2,795
Minnesota	...	...	...	95	...	188	...	283
Mississippi	637	339	...	...	359	...	94	1,429
Missouri	554	463	264	102	345	84	343	2,155
Montana*	...	184	...	...	...	...	...	184
Nevada	...	236	...	...	...	386	207	829
New Jersey	235	219	305	313	686	479	113	2,350
New Mexico	...	155	104	...	220	601	...	1,080
New York	726	308	910	461	909	1,191	643	5,148
North Carolina	509	666	...	644	580	...	1,103	3,502
Ohio	561	224	297	277	...	...	...	1,359
Oklahoma	...	395	...	235	280	...	...	910
Oregon	...	184	...	268	...	246	...	698
Pennsylvania	485	...	316	418	210	1,050	434	2,913
Rhode Island	75	...	...	...	...	...	...	75
South Carolina	798	...	884	285	...	...	...	1,967
South Dakota	...	...	297	...	...	...	...	297
Tennessee	265	607	...	394	163	...	290	1,719
Texas	2,707	2,042	2,617	1,717	1,463	1,321	1,775	13,642
Utah	...	...	178	273	197	...	...	648
Vermont	...	...	256	...	...	...	...	256

Appendix Table 1. Number of Observations by State-Year: National YRBS

	1999	2001	2003	2005	2007	2009	2011	Total
Virginia	742	...	243	348	436	98	202	2,069
Washington	...	52	...	101	...	245	167	565
West Virginia	...	262	...	230	244	465	257	1,458
Wisconsin	536	235	178	241	178	682	654	2,704

Notes: States that adopted a Meth Project are denoted with a star superscript and post-adoption observations are italicized.

Appendix Table 2. Number of Observations by State-Year: State YRBS

	1999	2001	2003	2005	2007	2009	2011	Total
Alabama	2,038	1,537	1,063	1,075	...	1,442	1,322	8,477
Alaska	...	...	1,445	...	1,265	1,213	1,259	5,182
Arizona*	...	...	...	1,904	1,655	1,483	1,899	6,941
Arkansas	1,457	1,670	...	1,505	1,540	1,596	1,310	9,078
Colorado*	...	...	...	1,464	...	1,445	1,404	4,313
Connecticut	...	...	...	2,167	1,980	2,304	1,977	8,428
Delaware	2,317	2,844	2,950	2,607	2,344	2,220	2,152	17,434
Florida	...	4,109	3,952	4,412	...	...	...	12,473
Georgia*	...	...	2,045	1,698	2,371	1,812	1,777	9,703
Idaho*	...	1,684	1,698	1,429	1,378	2,094	1,648	9,931
Illinois*	...	...	...	...	2,311	2,926	3,416	8,653
Indiana	...	...	1,631	1,508	2,248	1,467	2,726	9,580
Iowa	...	...	...	1,351	1,418	...	1,511	4,280
Kansas	...	...	...	1,636	1,685	1,982	1,811	7,114
Kentucky	...	...	1,574	...	3,428	1,723	1,650	8,375
Louisiana	...	...	...	...	...	984	1,107	2,091
Maine	...	1,308	1,626	1,326	1,259	...	...	5,519
Maryland	...	...	...	1,382	1,479	1,579	2,718	7,158
Massachusetts	...	...	3,528	3,301	3,020	2,608	2,623	15,080
Michigan	2,602	3,501	3,376	3,195	3,414	3,281	4,083	23,452
Mississippi	1,594	1,783	1,465	...	1,553	1,751	1,792	9,938
Missouri	1,613	1,631	1,530	1,857	1,515	1,592	...	9,738
Montana*	2,881	2,582	2,669	2,906	3,831	1,773	3,986	20,628
Nebraska	...	...	2,869	3,681	...	...	...	6,550
Nevada	1,669	1,428	1,942	1,518	1,714	2,019	...	10,290
New Hampshire	...	...	1,312	1,249	1,577	1,453	1,358	6,949
New Jersey	...	2,028	...	1,480	...	1,694	1,617	6,819
New Mexico	...	...	...	...	2,523	4,849	5,638	13,010
New York	3,314	...	9,004	9,225	12,564	13,625	12,300	60,032
North Carolina	...	2,517	2,518	3,804	3,389	5,530	2,205	19,963
North Dakota	1,790	1,573	1,642	1,711	1,689	1,783	...	10,188
Ohio	2,021	...	1,183	1,372	2,419	...	...	6,995
Oklahoma	...	...	1,366	1,686	2,561	1,386	1,133	8,132
Pennsylvania	...	...	...	...	...	2,025	...	2,025
Rhode Island	...	1,361	1,776	2,303	...	...	...	5,440
South Carolina	4,552	...	...	1,265	1,204	1,054	1,404	9,479
South Dakota	1,645	1,591	1,795	1,557	1,572	2,115	1,499	11,774
Tennessee	...	...	1,919	1,525	2,017	2,166	2,574	10,201
Texas	...	6,933	...	4,088	3,106	3,427	4,009	21,563
Utah	1,477	1,043	1,418	1,518	1,910	1,541	1,652	10,559
Vermont	...	9,012	7,903	9,072	7,309	9,928	8,240	51,464

Appendix Table 2. Number of Observations by State-Year: State YRBS

	1999	2001	2003	2005	2007	2009	2011	Total
Virginia	...	...	...	...	...	...	1,360	1,360
West Virginia	1,467	...	1,724	1,348	1,351	1,553	2,112	9,555
Wisconsin	1,314	2,088	...	2,345	2,046	2,386	2,949	13,128
Wyoming*	1,624	2,712	1,516	2,440	2,142	2,794	2,389	15,617

Notes: States that adopted a Meth Project are denoted with a star superscript and post-adoption observations are italicized.

Appendix Table 3. Descriptive Statistics for *Meth Use* by Age, Gender, and Race

	<u>National YRBS</u>		<u>State YRBS</u>	
Panel A: Meth Use by Age				
	<u>Age < 17</u>	<u>Age ≥ 17</u>	<u>Age < 17</u>	<u>Age ≥ 17</u>
<i>Meth use</i> ^{a, b}	.0536	.0655	.0502	.0679
Panel B: Meth Use by Gender				
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
<i>Meth use</i> ^{a, b}	.0658	.0517	.0640	.0490
Panel C: Meth Use by Race				
	<u>White</u>	<u>Non-white</u>	<u>White</u>	<u>Non-white</u>
<i>Meth use</i> ^a	.0687	.0511	.0562	.0565

^a Statistically different at 5% level for national YRBS; ^b Statistically different at 5% level for state YRBS.

Notes: Means are based on unweighted data from the national and state YRBS.

Appendix Table 4. Population Weighted Analysis for the Combined National and State YRBS

Panel A: Full Sample		
	Full Sample	
<i>Meth Project</i>	-.0030 (.0061)	-.0007 (.0053)
N	635,405	635,405
State-specific trends	No	Yes
Panel B: Meth Use by Age		
	Age < 17	Age ≥ 17
<i>Meth Project</i>	-.0066 (.0064)	.0063 (.0055)
N	408,413	226,992
State-specific trends	Yes	Yes
Panel C: Meth Use by Gender		
	Male	Female
<i>Meth Project</i>	-.0070 (.0103)	.0056 (.0061)
N	309,717	325,688
State-specific trends	Yes	Yes
Panel D: Meth Use by Race		
	White	Non-white
<i>Meth Project</i>	-.0028 (.0057)	.0107*** (.0037)
	378,504	256,901
State-specific trends	Yes	Yes

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents a separate OLS estimate based on data from the YRBS (1999-2011). All models control for the covariates listed in Table 2, a dummy variable indicating whether the respondent was sampled in the national YRBS or the state YRBS, year fixed effects, and state fixed effects. Standard errors, corrected for clustering at the state level, are in parentheses.



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Screening and Brief Intervention to Reduce Marijuana Use Among Youth and Young Adults in a Pediatric Emergency Department

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Keywords

emergency department; marijuana; screening; brief intervention; motivational interviewing; youth

INTRODUCTION

According to Drug Abuse Warning Network data for 2006, marijuana was involved in 209,563 emergency department (ED) visits and was the most frequently mentioned drug of abuse reported for adolescents.¹ Heavy marijuana use is a risk factor for injury and illness.² Regular use in early adolescence has been associated with greater likelihood of persistent and dependent daily use in adulthood and poor school, job and relationship outcomes.⁴ Children who are already using drugs by age 12 or 13 typically become involved with marijuana and then advance to other illegal drugs,⁵ and those who smoke marijuana before age 17 are from 1.6 to 6 times more likely to report abuse of or dependence on alcohol or an illicit drug later on in life.⁶ In a 10-year follow-up of 1,943 14–15 year olds in an Australian community cohort, weekly or more frequent cannabis use predicted a sevenfold increase in daily use at age 20, and heavy cannabis use in adolescence was associated with greater likelihood of cannabis dependence, cigarette smoking, illicit substance abuse, poor education and training outcomes, and less likelihood of being in a relationship in young adulthood.⁷

Motivational interventions for alcohol and injury among adolescents have been studied in the ED,^{8–10} and marijuana interventions have been shown to be effective in community settings,¹¹ but marijuana interventions for adolescents in the ED setting have not yet been reported. In this preliminary study, we test the effectiveness of a brief motivational intervention, conducted by peer educators during a pediatric ED visit (PED), to negotiate abstinence and/or reductions in marijuana use and related consequences among 14–21 year olds.

METHODS and MATERIALS

Study Design

This was a prospective randomized, controlled blinded trial of screening and brief intervention (SBI) for youth and young adults ages 14–21 presenting to the PED from January, 2005–March, 2007. Randomization was to three groups (intervention, standard assessed control and non-assessed control) in order to test the feasibility of identifying potential assessment reactivity effects. The study was approved by the BUMC Institutional Review Board and written informed consent was obtained on all subjects, and the study received a certificate of confidentiality at both federal and state levels. The study was monitored yearly by a Data Safety Monitoring Board.

Study Setting and Population

The study took place in the Pediatric Emergency Department (PED) of an inner-city, academic hospital. The PED is a component of a level I trauma and has a yearly census of approximately 29,000 patients from birth through the 21st birthday. Of these, 8,000 are between the ages of 18–21. The patient population is 60% female and ethnically and culturally diverse: 46% African American; 19% Hispanic, 12% white, 7% Cape Verdean and 5% Asian. Four-fifths speak English at home.

Screening

PED patients aged 14–21 years old who gave verbal consent were screened seven days per week from 8am–10pm in the privacy of either a room adjacent to the waiting room, the examining room, or at the bedside if admitted to the hospital. The screening was conducted as part of a larger randomized, controlled trial for an alcohol intervention study for youth and young adults. The screening instrument, “Youth and Young Adult Health and Safety Needs Survey,” included risk questions from the CDC Youth Behavioral Risk Factor Surveillance Survey (YBRFS). All patients presenting during the hours of screening were invited to participate in the study if they: 1) did not report “at risk alcohol use”; 2) smoked marijuana ≥ 3 times in the last 30 days; 3) or reported risky behavior temporally associated with marijuana use such as driving a car or riding in a car with someone who was smoking marijuana, getting in a fight, being injured, or having unplanned or unprotected sex after smoking marijuana. The cutoff of ‘3 to 5 days per month’ on the YBRFS question was selected because the goal of an SBIRT intervention is to address early use, in contrast to studies of youth in treatment, where 5 days a month is often used as the criterion for eligibility, and the goal is closer to tertiary prevention.

Patients were included in the study if they could communicate in English, Spanish, Haitian Creole or Cape Verdean Creole, were alert and oriented to person, time and place, and could give autonomous informed consent or assent if they were below the age of 18. Patients were excluded if they 1) could not be interviewed in privacy from accompanying family members; 2) planned to leave the area in the next three months; 3) could not provide reliable contact information to complete the follow-up procedures; 4) were currently in a residential substance abuse treatment facility; 5) were in custody or institutionalized; or 6) presented for a rape exam or psychiatric evaluation for suicide precautions. Eligible patients were asked to repeat and explain the key elements of the study prior to signing informed consent, and their responses were documented on a checklist.

Randomization

Enrollees were randomized to three conditions: Intervention (I), Assessed Control (AC) and Non-Accessed Control (NAC). Randomization was based on computer-generated random numbers in blocks of 100 stratified by age group (14–17 and 18–21). A double opaque

envelope system enabled blinding of the research assistants who performed the assessment to randomization status. The first envelope, with randomization to assessed (I, AC) or non-assessed (NAC) status, was opened immediately after enrollment. A second envelope indicating I or AC status was not opened until after assessment. Participants were cautioned not to reveal to the research assistants at the time of follow-up whether or not they had received any further testing after enrollment.

Procedures

The NAC group received only brief written information about risks associated with marijuana use along with a list of community resources and adolescent treatment facilities, and an appointment for follow-up in one year. The AC group received a battery of standard assessment instruments (see below), the written handout, and appointments to return at three months and one year. After assessment, the I group received a 20–30 minute structured conversation delivered by a peer educator in addition to the written materials, appointments for three months and one year, and a booster telephone call at 10 days post-enrollment.

Assessment Instruments

Measures designed to assess outcomes—The *Timeline FollowBack Calendar* (TLFB) was used to obtain reliable and valid self-report data on the number of days of marijuana use and days of getting high in the 30 days. The I and AC groups reported use prior to enrollment and again at three and 12 months; the NAC group reported use at 12 months only. The TLFB uses calendars, holidays and special events to trigger memory and is reported to reduce error in retrospective self-report; validity and reliability for recall of marijuana use have been well established.^{12, 13}

The *Adolescent Injury Checklist* (AIC), created for alcohol but adapted as a record of marijuana associated injury, was conducted at baseline for the I and AC group. The AIC has an internal consistency of $\alpha = .67$ for injury occurrence and $\alpha = .62$ for injury requiring medical care.¹⁴

Measures administered to assess comparability of randomization groups—Because this study was a pilot with a small sample, several instruments were used to measure variables that have been shown to moderate substance abuse associated risks, e.g. depression, global risk-taking personality propensity, and prior exposure to violence associated with PTSD symptoms.

The *Patient Health Questionnaire* (adolescent version) or PHQ-A Depression scale is a 15 item self-report questionnaire designed for the purpose of assessing mood disorders among adolescents seen in primary care clinic. This scale has good concurrent validity testing against DSM-IV diagnoses.¹⁵ The I and AC groups completed this questionnaire at baseline.

The Simpson and Joe *Risk-taking Scale*, conducted at baseline for I and AC groups, has been shown to be a strong predictor of self-reported drug use. This scale has an acceptable test-retest reliability and good psychometric properties (internal consistency of $\alpha = .77$ and GFI of $.97$).¹⁶

The *PTSD Checklist (PCL-C)* is a 17 item inventory that assesses the specific symptoms that make up the post-traumatic stress disorder diagnosis. Test-retest reliability is excellent at $.96$ and diagnostic efficiency is $.90$.¹⁷ The I and AC groups completed this questionnaire at baseline.

Intervention

Interventions were delivered by peer educators who were under 25 years of age and spoke Spanish, Haitian Creole and Cape Verdean as well as English; all except one had a bachelor's degree. The peer educators received one month of training consisting of slide presentations on human subjects protections, study protocol, adolescent development, rationale for intervention, and elements of motivational interviewing style. The intervention algorithm was taught using video demonstrations, role playing with simulated patients, and review of video and audio tapes of practice interviews.

The intervention format, successfully tested with adults in a cocaine and heroin study¹⁸, was adapted to incorporate both developmental and contextual aspects of young people's lives, and included an emphasis on assessing and enhancing sources of resilience. Content, based on research by Miller,¹⁹ Rollnick,²⁰ and Monti,⁸⁻¹⁰ consisted of the following components: 1) obtaining engagement and permission to raise subject; 2) establishing context ("What's a typical day in your life like?"); 3) offering brief feedback, information and norms, specific to age and gender, and exploring pros and cons of use: eliciting 'change talk' and using the *CRAFFT*²¹ questions and a *Readiness to Change* ruler to reinforce movement toward behavior change); 4) generating a menu of options; 5) calling up assets/instilling hope; 6) discussing the challenges of change; and ending in a 7) prescription for change, generated by the subject and referrals to community resources and specialty drug treatment services. Patients with *CRAFFT* scores of ≥ 2 (see figure 1) were advised that the score may indicate high risk and a possible need for further evaluation and treatment. All intervention patients received a five to ten minute booster phone call during which the interventionist reviewed the elements of the change plan, inquired about any progress towards change, and offered further referrals if those originally provided had not been possible to accomplish.

Adherence to the intervention algorithm was assessed weekly by the investigators and the project coordinator. The tapes were scored using an adherence check list of the key elements of the intervention (see Figure 2).

Follow-up Procedures

Follow-up occurred at three and twelve months for the I and AC groups and at 12 months only for the NAC group. Participants received \$10 at enrollment and \$35 at subsequent follow-up visits. To minimize attrition, participants received written and telephone reminders, including e-mail and text messages, at intervals prior to appointments, using standard methods for contacting friends, family members, caseworkers and agencies.^{22,23}

Definitions

Abstinence as defined as zero marijuana consumption (smoke in any form including passive smoke and tokes, or consumables) in the last 30 days, as recorded on the Timeline Followback. For this preliminary study, we did not attempt to quantify marijuana consumption. Use was therefore defined as any use, from tokes to blunts or quantities in baked goods, as distinguished from the cut-off of use at least three days out of the last thirty that was used as a criterion for enrollment.

Outcome Measures

Primary outcomes included: abstinence at 12 months and changes in patterns of marijuana use measured by TLFB; intention to stop using, cut back on use, or change the circumstances of use; and reduction of consequences and high risk behaviors related to marijuana use.

Data Analysis

Power considerations—Large differences between study groups would be needed for adequate power to show significance. However this is a pilot study. Planned enrollment samples of $n=70$ per group and an anticipated 25% loss to follow-up by 12 months yield expected analysis samples of $n=52$ per group at 12 months. Given an abstinence rate of 20% in the assessed control group, an abstinence rate of 45.5% in the intervention group (corresponding to an odds ratio of 3.30) would be needed for 80% power.

Primary outcomes—The I and AC groups were compared at 3 and 12 months to test the effects of brief intervention on abstinence and days of consumption, adjusting only for baseline levels of marijuana consumption. Because this was a pilot study with a small sample, it was not possible to control for other factors with the potential to play a role. Demographic and marijuana use variables for age, gender, race and language were analyzed to determine comparability of groups, using Chi square analysis for categorical variables, t-test for continuous variables, and Wilcoxon rank-sum for non-normal distributions. Two tailed t-test for means and Wilcoxon rank test for medians were used at the 3-month and 12-month follow-up to analyze differences from baseline in the number of days in the last 30 that marijuana was used. General estimating equation (GEE) methods were used to analyze the changes in marijuana consumption and risk behaviors in a pooled analysis using both 3 and 12 month data, controlling for baseline data. GEE methods also examined intention to change use at 3 and 12 months, without adjusting for baseline intentions.

Secondary outcome—To evaluate assessment reactivity, the AC and NAC groups were compared at 12 months. Preliminary analyses examined the feasibility of including a non-assessed control group by examining loss-to-follow-up across these two study groups. Differences in 12 month marijuana use, controlling for available screening data on level of baseline use, through multiple regression analysis explored potential assessment reactivity in the AC group.

RESULTS

Among 7,804 PED patients screened, 325 met eligibility criteria and 210 (65% of eligibles) were enrolled and randomized (I $n=68$, AC $n=71$, NAC $n=71$). Seventy percent completed the three month follow-up and 71% completed the 12-month follow-up (see Figure 3, Consort diagram).

The enrolled group included a greater proportion of patients under 17 years of age than did the group of eligibles (28% vs 23%), but there were no significant differences at baseline in gender, race, or language spoken at home. Among the three randomization groups, there were no significant differences at baseline in age, gender, race, language, or pattern of marijuana use. Among the I and AC groups, there were no significant differences in baseline scores for PTSD, depression, risk-taking, or marijuana-related injury. (Baseline characteristics of I and AC groups are reported in Table 1, where p values are presented to demonstrate equivalence of groups.)

Although there were no significant differences at baseline of risk behaviors, the I group used marijuana on more days per month (19 (sd 10.9)) than the AC group (15.3 (sd 10.1)) as measured by TLFB (see Table 2).

Intervention effects

All scored Adherence Checklists met the required cut-off of 80 out of 100 points.

Abstinence (see Table 3)—There was no significant difference in marijuana use in the past 30 days at the three-month follow-up between the I and the AC groups. At the 12 month follow-up, however, 45% of the intervention group were marijuana abstinent as measured by TLFB, compared to 22% of the assessed controls (OR 2.89, 95%CI 1.22, 6.84, $p<0.014$).

Although the I and the AC groups were similar in demographics and marijuana use at baseline, and similar in demographics at follow-up (see Table 4), there was a differential loss in numbers followed between the two groups at 12 months. For this reason we ran a sensitivity analysis, assuming the position that all subjects lost to follow-up were not abstinent (see Table 5). Although the results of this analysis only bordered on significance ($p=.053$, 95%CI 0.98, 4.92), the odds ratio did remain above 2 in this worst-case scenario.

Reductions in consumption (see Table 6)—On univariate analysis comparing TLFB mean use at baseline (BL) to data from the 12-month follow-up visit, the I group had four fewer days of use from BL at three months and six fewer days of use from BL at 12 months than ACs, with similar results from both t-test and Wilcoxon rank-sum analyses.

Consumption and risk factors adjusted for baseline levels (see Table 7)—A GEE analysis of those followed at three and at 12 months, controlling for baseline marijuana use, confirmed these results; at 12 months, those in the intervention group who smoked marijuana in the past 30 days reported fewer days high (OR 0.39, 95% CI 0.17, 0.89, $p<0.027$). There were no significant differences in risk behaviors.

Intentions to change behavior (see Table 7)—The intervention group was significantly more likely to report efforts to cut back or quit using marijuana, but groups were similar in reporting care taken with situations when using.

Referrals—The intervention group was more likely to report receiving a referral to community resources (OR: 3.36, 95% CI 1.09–10.40, $p<.05$). We were not able, in this small pilot study, to tie referrals to outcomes.

Assessment reactivity

There were no baseline differences in demographics between the NAC and AC groups or baseline differences in times per month of marijuana use. Preliminary analyses showed a difference in loss to follow-up between these two groups; loss to follow-up among light users (1 to 9 times per month) at baseline was 20% among the AC and 47% among the NAC group. We therefore controlled for baseline level of use (1–9 times vs. 10+ based on a screening question available for both groups) when comparing these two groups. There was no significant difference between groups in the average number of days of use at the 12 months follow-up visit ($p=.095$), with the NAC averaging 3.7 fewer days of use. These data suggest that the decline in use in the NAC group may be due to regression to the mean rather than to assessment reactivity.

Potential for PTSD to modify intervention results (see Table 8)

Participants in this study were assessed for PTSD positivity primarily to assure comparability of groups at baseline. Because prevalence was high and similar between the two groups, we performed a sub-analysis to evaluate potential differences in intervention effectiveness among those who were positive on the PCL-C scale.

This very exploratory analysis suggests that 1) rates of abstinence are in general lower among those with PTSD, 2) intervention has less of an effect for patients with PTSD, and 3) the observed effect of intervention is largely due to the effect in the group without PTSD.

DISCUSSION

It is important to note that standard statistical models for multivariable analysis and longitudinal analysis of dichotomous outcome variables are based on the odds ratio, and differences in abstinence and other categorical outcomes were described through odds ratios. Some of our outcomes had moderately high prevalence, and so these odds ratios will be further from the null than the corresponding relative risks. For example, Table 3 reports an odds ratio and 95% CI of 2.89 (1.22, 6.84) for abstinence in the intervention vs. assessed control group. The corresponding relative risk and 95% CI is 2.05 (1.13, 3.70).

Reducing marijuana use at the critical developmental stage of adolescence may interrupt a trajectory that would otherwise lead to injury, illness, dependence, and other negative health and social effects associated with heavy marijuana consumption. This preliminary PED study suggests that a 20 minute motivational interviewing style of conversation with a peer educator at the time of a clinical visit to the ED could reduce marijuana consumption, increase abstinence and decrease days of use. We are encouraged by the worst case analysis presented in Table 4, which sustains an odds ratio greater than 2. In other studies in which we were able to investigate reasons for refusal to keep a follow-up appointment, many patients stated that they did not come in because their use was behind them, they had changed their lives, and they did not want to be associated with the label of user or past-user.¹⁸ We therefore think it is unlikely that all non-followed patients in this sample were still using, as we presumed for this worst-case analysis.

Although the intervention group in this preliminary study was more likely to be marijuana abstinent at 12 months or to report reduce marijuana consumption if they were not abstinent, we detected no impact of either abstinence or reduced consumption on consequences and risk behavior. An earlier ED study among adult cocaine and heroin users receiving a peer intervention also increased abstinence rates and reductions in drug use based on hair analysis, but did not measure risk behaviors or consequences.¹⁸ Among adolescents and young adults who were high risk drinkers, intervention at time of the ED visit shows mixed results, with reductions in alcohol consequences in one study (n=94)⁸ and in consumption in a second, larger study (n=198).¹⁰ The current investigation differed from these alcohol intervention studies in three ways: 1) it focused on marijuana, not alcohol; 2) the motivational intervention was delivered by slightly older peers, rather than by experienced Masters' level counselors; and 3) it enrolled PED patients who presented for a range of medical conditions rather than only those who were admitted for intoxication or an alcohol-related injury.

In a community setting, researchers investigated the efficacy of a single session of motivational interviewing in reducing use of marijuana.¹¹ Those using marijuana who received the intervention were approximately 3.5 times as likely to decide to stop or cut down on the use of marijuana compared to those who received the non-intervention "educational as usual" control condition, even after adjusting for baseline and other potential confounders. The mean frequency of marijuana use declined by 66% in the intervention group; by contrast, the control showed a 27% *increase* of marijuana use. Notably, the intervention showed the most significant impact on those youth considered high risk: males, frequent cigarette smokers, recipients of government benefits, and those who were rated more psychosocially vulnerable. While the findings of our study are somewhat less dramatic, they do demonstrate a significant intervention effect, especially since the PED intervention was limited to 20 minutes compared to one hour in the McCambridge study cited above.

We believe that the PED presents a difficult environment in which to effect behavior change because of the challenges of working around time restraints, the primacy of patient flow, clinical staff priorities, and variations in acuity. Despite these barriers, the peer educators integrated well into the ED setting and were able to deliver a consistent intervention with excellent adherence to protocol. In the population that uses an inner-city PED, marijuana use is a norm and a difficult topic to broach, yet peers in this study were able to engage on this issue and negotiate successfully with accompanying parents to leave the room during interviewing so that the adolescent's privacy and confidentiality could be protected.

This preliminary study was not powered to capture relatively rare events or control for potential confounders. Follow-on studies are indicated to investigate impact on substance associated injury, identify the most effective context for screening questions (direct, drug-focused or embedded in a more comprehensive health survey), conduct sub-analyses to elaborate the role of predictors and moderators (demographics, mental health status, and operator differences), and determine which intervention components are most effective at what level of severity.

LIMITATIONS

This is a small pilot study. Although the sample size was adequate to show differences in marijuana consumption from baseline to 12-month follow-up, there was not sufficient power in this preliminary investigation to show differences in risk behaviors and consequences such as injuries that occur infrequently. Eligibility criteria for this study may also have been a factor, because low-end users were enrolled (3 or more days use per month or experience of consequences with fewer days of use). Randomization procedures stratified for severity of use may help to limit any 'noise' introduced by differences in severity.

The self-report measure used in this study (number of days of use on 30-day recall) did not attempt to quantify use (e.g. blunts, joints, tokes and time of day). Although formats such as Form-90 have been used for this purpose with adults, they have not been validated for accuracy in capturing dose, which can vary greatly with batch strength. Confirmation with a reliable chemical marker to quantify use over a 30-day window would have been helpful, and is certainly indicated for a follow-on study.

We also did not attempt to have participants recall use of the entire 12 months of the follow-up period, and may have missed efforts at abstinence that only lasted a few months but did not persist to the point of follow-up. We did obtain a 30 day snapshot at three months, but we did not believe that we could get accurate data retrospectively over a whole year's time with this population. Since there are a number of studies that have demonstrated the accuracy of a 30 day follow back report with adolescents who are not in treatment, we selected that shorter window. However it is the 12 month endpoint, not specific intervals within the 12 months, that is of the most interest. SBIRT in all the studies previously discussed has only a modest effect size, so it is particularly important to assure that the effects, when they occur, have real clinical impact and duration.

Exploratory analyses suggest that PTSD may play a role in intervention effectiveness, but this was a pilot study with very few participants. A follow-on study with a sample size large enough to permit appropriate sub-analyses should include subjects with PTSD in order to examine this question more fully.

It should also be noted that the participants in this study did not report significant alcohol use or polydrug use at baseline, and therefore results may have limited applicability to other populations. In the diverse patient population seen in urban pediatric emergency

departments, however, marijuana use commonly precedes alcohol use, and results may be particularly useful in those settings.

Finally, differential attrition in the important variable of severity of use at baseline occurred in the non-assessed group at follow-up. Because we had no information about the mental health characteristics, risk-taking attributes or injury history of those who we did not assess, we may also have had other important sources of differential attrition in the NAC group that we were unable to measure. We learned a valuable lesson: A no-assessment group still has to have high contact to avoid differential loss to follow-up.

CONCLUSION

A preliminary trial of SBI in the PED increased marijuana abstinence and reduced consumption among patients aged 14–21. These effects were strongest at 12 months, as reported by both 30 day recall and self-report of intention to change. However, there were no differences noted in risk behaviors or health consequences from baseline to final follow-up. This study demonstrated that a pediatric emergency department visit offers an opportunity to engage youth in a discussion of how drug use fits in with their lives and their goals.

We were not successful in measuring the impact of assessment on marijuana consumption and other behaviors after enrollment in a control group. A no-contact condition for the non-assessed group over the year after enrollment was insufficient to capture enrollees for follow-up across a range of baseline acuity.

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CRAFFT**(score = __ out of 6)**

Have you ever ridden in a **CAR** driven by someone (including yourself) who was “high” or had been using alcohol or drugs?

¹ yes² no

Do you ever use alcohol or drugs to **RELAX**, feel better about yourself, or fit in?

¹ yes² no

Do you ever use alcohol or drugs while you are by yourself, **ALONE**?

¹ yes² no

Do your family or **FRIENDS** ever tell you that you should cut down on your drinking or drug use?

¹ yes² no

Do you ever **FORGET** things you did while using alcohol or drugs?

¹ yes² no

Have you gotten into **TROUBLE** while you were using alcohol or drugs?

¹ yes² no

Figure 1.
The CRAFFT Questions²¹

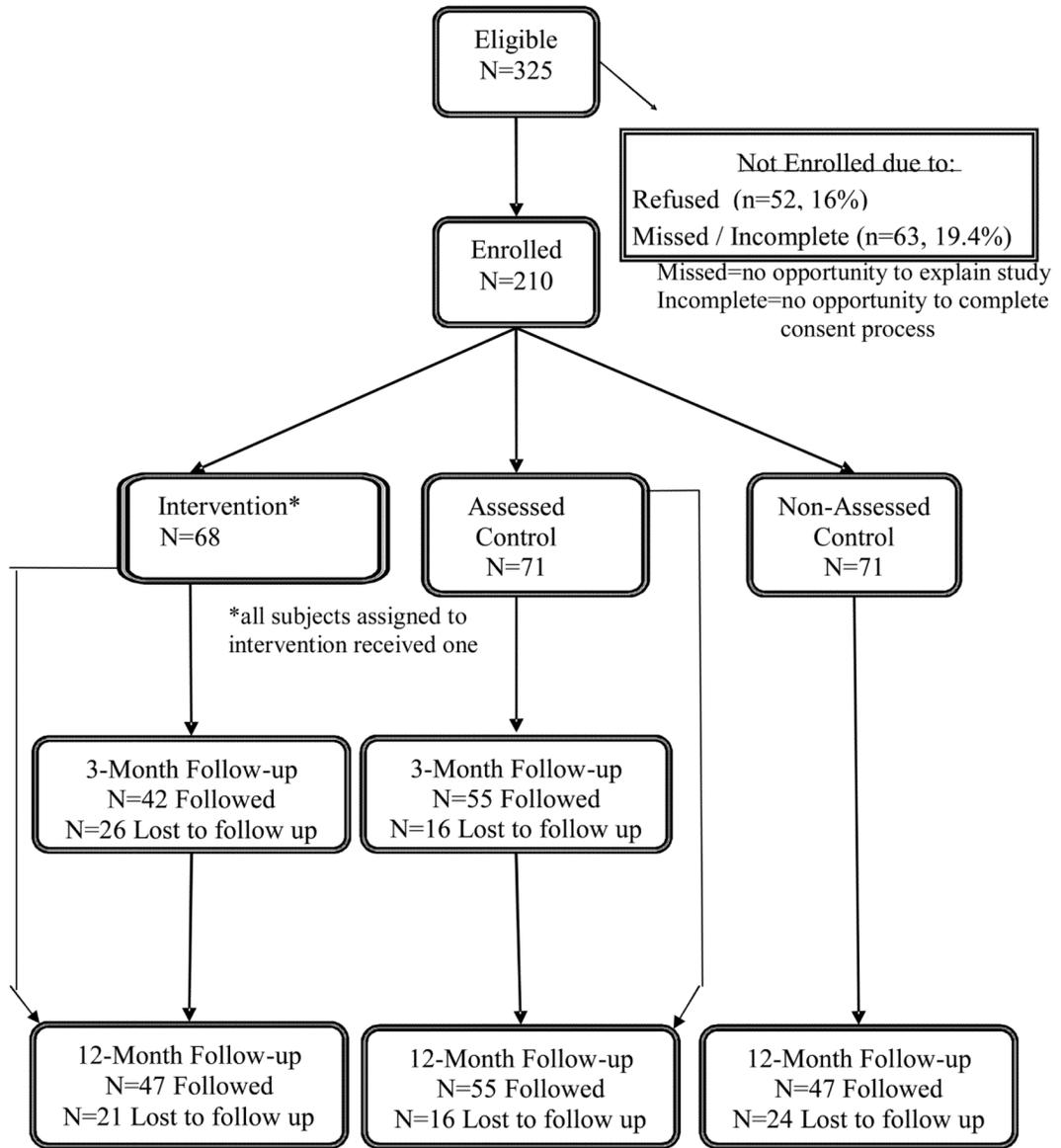


Figure 3.
CONSORT Diagram

Table 1

Baseline Demographic Characteristics: Intervention (I) and Assessed Control (AC) Groups.

	I (n=68)	AC (n=71)	p-value
	N (%)	N (%)	
Age			
≤ 17	20 (29.4)	21 (29.6)	0.983
≥ 18	48 (70.6)	50 (70.4)	
Sex			
Male	25 (36.8)	23 (32.4)	0.588
Female	43 (63.2)	48 (67.6)	
Race			
Black/African American	57 (83.8)	55 (77.5)	0.394*
Hispanic/Latino	7 (10.3)	11 (15.5)	
White	3 (4.4)	5 (7.0)	
Other	1 (1.5)	0	
Primary language			
English	62 (91.2)	62 (87.3)	0.796*
Other: Spanish, Haitian Creole, Cape Verdean	6 (8.8)	9 (12.7)	
Marijuana use in last 30 days			
1–9 times	26 (38.3)	30 (42.3)	0.629
10 or more times	42 (61.7)	41 (57.7)	
PTSD +	22 (32.4)	18 (25.4)	0.362
Depression +	10 (15.2)	6 (8.5)	0.222
Risk-taking +	10 (14.7)	13 (18.3)	0.568
Marijuana use prior to injury	8 (11.8)	9 (12.7)	0.870

P-values from chi-square tests or Fisher's exact tests (Fisher's exact test denoted by an asterisk).

Table 2

Baseline Risk Factors by Randomization Group: Intervention (I) and Assessed Control (AC) Groups.

	I (n=68)	AC (n=71)	
	Mean (SD)	Mean (SD)	p-value
Times per month using marijuana (TLFB)	19.0 (10.9)	15.3 (10.1)	0.039
In the last 30 days:	N (%)	N (%)	p-value
Got in fight after using marijuana	3 (4.4)	3 (4.3)	1.0*
Drove a car after using marijuana	9 (13.2)	10 (14.7)	0.804
Rode in a car with person who was drunk/high	16 (23.5)	12 (17.4)	0.373
Got injured after using marijuana	2 (2.9)	0	0.241*
Got arrested after using marijuana	1 (1.5)	1 (1.5)	1.0*
Had sex without a condom after using marijuana	9 (13.2)	9 (12.9)	0.980

For measurement variables, p-value from t-test. For categorical variables, p-values from chi-square tests or Fisher's exact tests (Fisher's exact test denoted by an asterisk).

Table 3

Comparison by randomization group of marijuana abstinence (among smokers) at 3 and 12 month follow-up by Timeline Followback 30 day recall.

	I	AC	Odds Ratio	95 % CI	p value
At 3 months	(n=42) (n=55)				
abstinent	6	7	1.15	0.36, 3.73	0.814
not abstinent	35	47			
At 12 months	(n=47) (n=55)				
abstinent	21	12	2.89	1.22, 6.84	0.014
not abstinent	26	43			

Table 4

Comparison of baseline factors between those followed and those lost to follow-up at 12 months.

	I (n=68)		p-value	AC (n=71)		p-value
	Followed n=47	Lost to f/u n=21		Followed n=55	Lost to f/u n=16	
Age						
≤17	31.9	23.8	0.498	34.6	12.5	0.123
≥18	68.1	76.2		65.5	87.5	
Sex						
Female	70.2	47.6	0.074	67.3	68.8	0.912
Male	29.8	52.4		32.7	31.3	
Race						
Black	85.1	81.0	0.727	76.4	81.2	1.0
Non-black	14.9	19.0		23.6	18.8	
Marijuana use past 30 days						
1-9 times	63.8	57.1		56.4	62.5	
≥10 times	36.2	42.9	0.600	43.6	37.5	0.662

P-values from chi-square tests.

Table 5

Sensitivity analysis assuming worst-case scenario that all subjects lost to follow-up were non-abstinent

At 12 months	I (n=68)	AC (n=71)	OR (95% CI)
Abstinent	21	12	2.2
Non-abstinent	47 (including 21 lost to f/u)	59 (including 16 lost to f/u)	0.98, 4.92 (p=.053)

Table 6
Outcomes by Randomization Group: Days per month using Marijuana using Timeline Follow-back.

	Intervention		Assessed Control		I vs AC p-value
	N	Mean (SD)	N	Mean (SD)	
Baseline	68	19.0 (10.9)	71	15.3 (10.1)	0.039
3-month follow up	41*	14.2 (10.8)	54*	13.7 (11.2)	0.837
Change baseline to 3-month	41	-5.0 (9.1)	54	-0.8 (9.9)	0.039
12-month follow up	47	11.0 (10.7)	55	13.2 (11.7)	0.352
Change baseline to 12-month	47	-7.1 (11.2)	55	-1.8 (11.9)	0.024
Baseline among those with 3-mo. f/u	41	19.1 (11.2)	54	14.5 (9.7)	0.035
3-month follow up	41	14.2 (10.8)	54	13.7 (11.2)	0.837
Change baseline to 3-month	41	-5.0 (9.1)	54	-0.8 (9.9)	0.039
Decline in marijuana use greater in the intervention group by -4.2 days/mo. (95% CI -8.1, -0.3)					
Baseline among those with 12-mo. f/u	47	18.1 (10.8)	55	15.0 (10.4)	0.142
12-month follow up	47	11.0 (10.7)	55	13.2 (11.7)	0.352
Change baseline to 12-month	47	-7.1 (11.2)	55	-1.8 (11.9)	0.024
Decline in marijuana use greater in the intervention group by -5.3 days/mo. (95% CI -10, -0.6)					

P-values from t-tests.

* one person in each group has 3 month follow-up form but no 3 month timeline follow-back

Table 7

GEE analyses, comparing I and AC Groups: Outcomes at 3 and 12 months

	BL, 3 Mo, 12 Mo.	I N=55 N=42 N=47	AC N=64 N=55 N=55	Adjusted Odds Ratio comparing I to AC	p-value for AOR	Main Effect p-value
Timeline Followback (TLFB) Smoked Marijuana 1+ days/month	BL 3 12	55 (100) 35 (85.4) 26 (55.3)	64 (100) 47 (87.0) 43 (78.2)	0.87 (0.27, 2.81) 0.35 (0.15, 0.82)	0.815 0.016	0.048 [†]
Felt unsafe past 30 days (composite safety variable)	BL 3 12	33 (64.7) 14 (34.2) 11 (23.4)	40 (63.5) 25 (45.5) 29 (52.7)	0.53 (0.21, 1.33) 0.20 (0.08, 0.55)	0.176 0.002	0.003
Carried weapon (gun, knife, club), past 30 days	BL 3 12	7 (13.0) 5 (11.9) 5 (10.6)	13 (20.3) 17 (30.9) 11 (20.0)	0.35 (0.11, 1.13) 0.57 (0.17, 1.88)	0.079 0.358	0.079
Physical fight past 12 months past 30 days past 30 days	BL 3 12	27 (50.0) 9 (21.4) 6 (12.8)	33 (51.6) 14 (25.5) 19 (34.6)	0.88 (0.32, 2.38) 0.26 (0.08, 0.81)	0.800 0.020	0.075
Drove a car after using marijuana , past 30 days	BL 3 12	8 (14.6) 6 (14.3) 8 (17.0)	9 (14.8) 10 (18.5) 13 (24.5)	0.82 (0.24, 2.76) 0.60 (0.21, 1.75)	0.745 0.352	0.383
Rode in a car with a person drunk/high after using marijuana , past 30 days	BL 3 12	12 (21.8) 11 (26.2) 10 (21.3)	11 (17.8) 13 (24.1) 13 (23.6)	1.01 (0.39, 2.62) 0.81 (0.31, 2.10)	0.985 0.668	0.800
Tried to cutback marijuana use ... in the last 3 months ...since you enrolled	3 12	29 (69.1) 34 (73.9)	28 (50.9) 33 (60.0)	2.15 (0.93, 4.99) 0.19 (0.81, 4.42)	0.074 0.143	0.029 [†]
Tried to stop using marijuana						

	BL, 3 Mo. 12 Mo.	I N=55 N=42 N=47	AC N=64 N=55 N=55	Adjusted Odds Ratio comparing I to AC	p-value for AOR	Main Effect p-value
... in the last 3 months	3	23 (54.8)	19 (34.6)	2.29 (1.01, 5.23)	0.048	0.020 [†]
...since you enrolled	12	25 (54.4)	21 (38.2)	1.93 (0.87, 4.27)	0.106	
Tried to be careful about situations you got into when using marijuana						
... in the last 3 months	3	32 (78.1)	38 (69.1)	1.59 (0.62, 4.05)	0.331	0.357 [†]
...since you enrolled	12	34 (73.9)	38 (70.4)	1.19 (0.49, 2.88)	0.694	
High on marijuana in 30 days (among those who smoked 1+ days in past 30 per TLFB)						
	3	55 (100)	64 (100)	1.41 (0.43, 4.57)	0.568	0.171 [†]
	12	36 (87.8)	46 (83.6)	0.39 (0.17, 0.89)	0.026	

[†] Denotes: did not adjust for a baseline measure

Table 8

Effect of intervention on marijuana use, stratified by PTSD

	PCL-C Positive (n=40)		OR (95% CI)	PCL-C Negative (n=99)		OR(95% CI)
	Intervention	AC		Intervention	AC	
At 3 Months:						
Abstinent	0	2	Cannot be computed	6	5	1.8 (0.5, 6.7)
Not abstinent	12	12		23	35	
At 12 Months:						
Abstinent	4	3	1.0 (0.2, 5.7)	17	9	4.8 (1.7, 3.5)
Not abstinent	13	10		13	33	

Communication Strategies

What Do Colorado Adults Know About Legal Use of Recreational Marijuana After a Media Campaign?

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Background. Colorado is among the first states to legalize the recreational sale of marijuana and therefore among the first to develop regulations outlining the purchase, possession, consumption, and enforcement, and penalties. Colorado legislators set aside funds for a statewide informational media campaign to educate Colorado residents on legal use of marijuana. **Method.** This study evaluated the effectiveness of the mass media campaign to increase awareness of the law through a prospective cohort surveyed before and 6 months after the launch of the campaign (n = 798). **Results.** A total of 28.0% reported recall of the Good to Know campaign. There was a significant positive change in accurate knowledge of marijuana laws from baseline to follow-up for each of the four primary indicators of knowledge of the marijuana laws. Among those who had inaccurate knowledge of the laws at baseline, those who reported seeing the campaign at least once or more were 2.53 (95% confidence interval = 1.29-4.95) times as likely to report accurate knowledge of the laws at follow-up compared with those who did not recall seeing the campaign, particularly among marijuana users. **Conclusions.** Those individuals who reported recall of the campaign were more likely to increase their accurate knowledge of marijuana laws.

Keywords: mass media campaign; marijuana; knowledge of laws

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In November of 2012, more than a decade after legalization of medical marijuana in Colorado, voters approved the retail sale of marijuana for non-medical use by those aged 21 years and older, referred to as recreational marijuana. Legalized marijuana raises public health concerns, including an increase in adolescent access and use and impaired driving (Asbridge, Hayden, & Cartwright, 2012; Hartman & Huestis, 2013; Lynskey & Hall, 2000; Pope et al., 2003). The effects of marijuana policy changes on public health consequences are undergoing scrutiny from researchers around the country (Hasin et al., 2015; Masten & Guenzburger, 2014; Pacula, Kilmer, Wagenaar, Chaloupka, & Caulkins, 2014; Pollini, Romano, Johnson, & Lacey, 2015; Salomonsen-Sautel, Min, Sakai, Thurstone, & Hopfer, 2014).

With the passage of recreational marijuana laws in Colorado came a host of regulations regarding the purchase, possession, and places where marijuana can be consumed. The regulations enacted in Colorado were designed to limit potential health consequences (Ghosh

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et al., 2015). For example, the legal purchase, use, and possession of marijuana is limited to adults aged 21 years and older (with the exception of medical use) in order to discourage adolescent use and associated effects on cognitive development. Driving under the influence of marijuana is illegal, and a driver with a blood level of 5 ng of Δ^9 -THC (tetrahydrocannabinol) per milliliter of whole blood is presumed to be impaired unless the driver can prove otherwise. Other provisions regulate marijuana in ways similar to alcohol, such as prohibiting public consumption, or to remain consistent with federal law (Cole, 2013), such as the prohibition of use on federal lands or the transport of marijuana to another state. The public's accurate knowledge of these new regulations is an important component to preventing illegal use and negative public health consequences (MacCoun, Pacula, Chiqui, Harris, & Reuter, 2009).

Few studies have examined the public's knowledge of marijuana laws. One recent study used the National Survey on Drug Use or Health to examine if respondents who live in decriminalized-marijuana states are more likely to have accurate knowledge of the penalty for possession of a small amount of marijuana than those living in nondecriminalized states (MacCoun et al., 2009). The authors found that nearly a third of respondents living in decriminalized state reported they "don't know" the penalty and in decriminalized states another 31% incorrectly reported jail time as the maximum penalty for marijuana possession (MacCoun et al., 2009). Past-year marijuana users in decriminalized states were more likely to have more accurate knowledge of the penalties (MacCoun et al., 2009), which may reflect a differential value between users and nonusers in knowledge of the laws.

The recent changes to the marijuana laws in Colorado address many spheres, including purchase, possession, consumption, enforcement, and penalties. Despite recent widespread media coverage of marijuana-related topics in Colorado and nationally, attention has not equally focused on all aspects of the new regulations, but the public is still expected to know the law after it is enacted. Recent changes to graduated driver's licensing laws or the use of mobile phones while driving can provide some insight into the public's understanding of new complex legislation. These new regulations are complex with distinctions based on age of the driver and rules (e.g., texting banned but talking allowed) that vary by state, and sometimes vary by city (Governors Highway Safety Association, 2016). Studies found incomplete knowledge of graduated driver licensing laws (Campbell, Chaudhary, Saleheen, Borrup, & Lapidus, 2009; Steenbergen et al., 2001) and cell phone restrictions while driving (Foss, Goodwin, McCartt, & Hellinga, 2009) in the absence of large educational efforts.

After passage of the Amendment 64 ballot measure to legalize recreational marijuana, Colorado legislators charged the Colorado Department of Public Health and Environment (CDPHE) to create statewide informational campaigns to educate Colorado residents and visitors on the parameters of safe, legal, and responsible use of recreational marijuana through prevention education and activities (Colorado Revised Statute, 2014). Funding for these public awareness activities was set aside from the tax revenue from the sale of recreational marijuana. The purpose of the current study is to evaluate the effectiveness of the first mass media campaign designed to increase accurate knowledge of recreational marijuana laws among adults in Colorado.

► MESSAGE DEVELOPMENT

CDPHE hired a local media agency to develop an informational media campaign with the goal of increasing accurate knowledge of recreational marijuana laws in order to promote safe and legal use and prevent underage access to marijuana. The message development was informed by prior work that has found that media campaigns that align community attitudes about use with the laws governing use and provide accurate information about the substances can be effective prevention strategies, especially among young people (Center for the Application of Prevention Technologies, 2014; Community Prevention Services Task Force, 2014). The local media agency developed creative concepts and a messaging strategy after conducting secondary research, in-depth interviews with 20 Colorado residents, and conducting a survey of 168 community members. The message was tested with 47 participants in online asynchronous focus groups who were asked to post written responses to open-ended questions on an online bulletin board. Another 400 individuals responded to an online survey where they ranked potential media concepts on a number of factors including the following: how educational, entertaining, or interesting the concepts were; their likelihood to visit the website promoted by the ad, and if they could recall the messages, or would share with others. Based on the results, a concept was selected for Colorado's marijuana education campaign. The message and tone were designed to resonate with a diverse, statewide audience regardless of their personal beliefs regarding the use of marijuana. The delivery was designed to be approachable and helpful by communicating the laws and deliberately lacked a persuasive message aimed at decreasing adult use of marijuana.

► MESSAGE DELIVERY

The campaign was launched in January of 2015 with radio, print, and public relations. The campaign

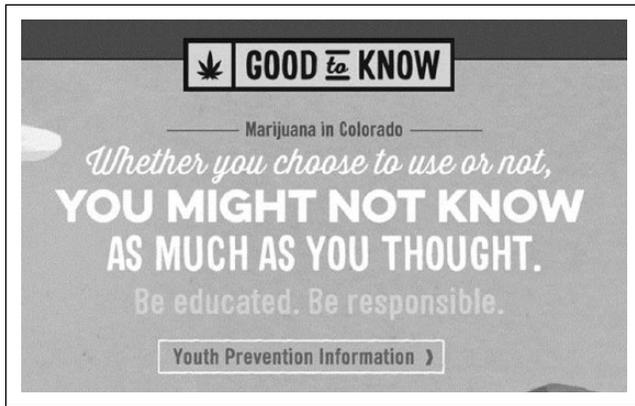


FIGURE 1. Example of *Good to Know* Campaign Material

concept of *Good to Know* (see Figure 1) represents four key law messages: (1) one must be 21 years old to use, buy, or possess recreational marijuana, and it is illegal to give or sell marijuana to anyone younger than 21 years; (2) one can be cited for driving under the influence of marijuana; (3) marijuana may not be consumed in a public place, including federal land and private vehicles; (4) marijuana may not be taken out of the state of Colorado. The campaign also advised against high-risk behaviors, such as overconsumption of edible marijuana products, unsafe storage of marijuana products around children, and use by youth. *Good to Know* was delivered in 60-, 30-, and 15-second television spots, radio advertisements, on billboards and public transit, and via digital advertising and social media channels. The *Good to Know* outdoor media ran from March 2, 2015 through April 24, 2015. TV media ran from February 23, 2015 through March 20, 2015 and digital media from February 23, 2015 through May 11, 2015. Twenty-one zip codes out of 662 in Colorado were exposed to outdoor media in various public locations, 65 zip codes had print media exposure in bars, and 5 zip codes had outdoor media exposure in public locations and in bars. Within the first 9 months of the campaign launch, *Good to Know* generated 170 million media impressions (CDPHE, 2015).

► METHOD

We used a prospective cohort design to examine changes in knowledge of the marijuana laws from baseline (before the launch of the campaign) to a follow-up 6 months later.

Sample

Participants were recruited from a survey-research registry that had been created by recruiting respondents

to a 2012 population-level survey of Colorado adults. All Colorado households with telephones were eligible for the 2012 survey, including cell-phone households, and were selected by sampling all Colorado telephone exchanges with at least one known residential telephone number. To complete the survey, the participant had to be at least 18 years old. After completing the initial survey, the respondents consented to be contacted for future studies, and 62% agreed ($n = 9,267$ of 14,998) and were enrolled in the survey-research registry. Registry volunteers and decliners were compared on a range of demographic and health behavior characteristics to examine the representativeness of registry participants as compared to the initial survey completers. There were no differences on a range of demographic and health behaviors (e.g., sex, smoking status) but also significant differences on other characteristics (e.g., registry members were more likely than decliners to be White, aged 45-64 years, and college graduates). Further details about the recruitment and maintenance of the registry and the implications for population inference have been published in a technical report (CDPHE, 2015).

Active registry members at the time of sampling were eligible to participate in the current study ($n = 8,670$). The selection process for the current study oversampled certain population groups to obtain more precise information about them (age <35 years, racial and ethnic minority groups, and then-current marijuana users). The final sample consisted of 1,523 registry members.

Data Collection Procedures

Participants were contacted first by mail and then by telephone to complete the survey. Participants with known mailing addresses ($n = 1,371$) were contacted first by mail in October 2014 prior to the launch of the media campaign. The mailing included a survey, cover letter, and an incentive of a \$2 bill. Anyone who had not responded within 10 days was sent a second mailing. Participants with a valid phone number who had not completed a survey by 1 week after the second mailed survey were contacted by telephone, which included 152 without a valid mailing address. Telephone interviews were conducted in English between November and December 2014, using a computer-assisted telephone interview system. Five interviewers attempted to contact participants during three calling periods (weekdays 9 a.m.-4 p.m., weekdays 4 p.m.-8 p.m., and weekends 11 a.m.-4 p.m.). Contact was attempted at least eight times before a participant was classified as a nonresponder. At least two attempts were made in each of the three calling periods, with the final two attempts occurring at any time. After

completing a phone interview, participants were mailed a \$10 gift card to one of two large local retailers, according to respondents' preference.

All those who participated between October and December 2014 were recontacted approximately 6 months later, after the launch of the media campaign. The follow-up survey used the same protocol as baseline, with two waves of mailing followed by phone calls to nonresponders to the mailing.

Measures

Knowledge of the Laws. At both baseline and follow-up participants were asked about six elements of the recreational marijuana laws including (1) legal age of recreational marijuana use (open-ended response), (2) legal locations for marijuana use (in a home, in a business, in an outdoor public place, don't know/not sure), (3) if marijuana can be mailed or carried out of state (yes, no, don't know/not sure), (4) if an individual who is driving after using marijuana be ticketed for driving under the influence (yes, no, don't know/not sure), (5) how many marijuana plants can Colorado residents legally grow in their home for personal recreational use (open-ended response), and (6) how much recreational marijuana can a Colorado resident legally possess (open-ended response in ounces). For analysis, each response was collapsed into a binary response, where 1 = *correct knowledge of the law* and 0 = *incorrect or lack of knowledge of the law*. Correct knowledge was defined as reporting age 21 years to buy, marijuana can be used in a home but not in a business or outdoor public place, marijuana cannot be taken out of state, an individual using marijuana can be ticketed for driving under the influence, a resident can grow six plants and possess 1 ounce.

We created a composite score of the four items that were most central to the campaign's messaging by summing the number of correct responses to the following indicators of knowledge of the marijuana laws: (1) legal age of recreational marijuana use, (2) legal to use marijuana use in a public place, (3) if marijuana can be mailed or carried out of state, and (4) if an individual who is driving after using marijuana be ticketed for driving under the influence. Those who answered all four items correctly were given a score of 1, and those who answered less than all four correctly were given a score of 0. This composite score was calculated at baseline and follow-up.

Media Awareness. At follow-up, awareness of the campaign was assessed with an item prompting recall of the campaign slogan *Good to Know*. The instructions stated, "Here is a list of slogans that have been promoted in some Colorado communities. For each slogan, please

mark how many times you saw or heard it in the past six months" with the response options, none, once or twice, more than twice, don't know/not sure. The campaign of interest was third in a list with nine other slogans, which included two fake slogans. The other slogans were recently active marijuana education campaigns in Colorado, funded either by marijuana industry groups or with state funding such as "Drive High, Get a DUI," "Don't be a lab rat," and "Consume Responsibly." The two fake slogans were "Home Ok, in the park no way," and "Marijuana and you."

Demographic Characteristics and Marijuana Use.

Demographic characteristics were obtained for participants from the registry: gender (male/female), age, and race/ethnicity (categorized as non-Hispanic White, non-Hispanic African American, Hispanic or Latino, and all other races). Participants were asked at baseline and follow-up, "During the past 30 days, on how many days did you use marijuana?" (open-ended responses). Participants who responded one or more at either baseline or follow-up were categorized as current users.

Analysis

All analyses were limited to participants who completed both baseline and follow-up surveys. We used McNemar's test to evaluate changes in knowledge of the law from baseline to follow-up. We used multivariate logistic regression models to test for the association between recalling the *Good to Know* campaign slogan and increased accurate knowledge of the recreational marijuana laws from baseline to follow-up. We present findings from logistic regression models from those who had inaccurate knowledge of the laws at baseline.

► RESULTS

From the sample of 1,523 registry members, a total of 993 participants completed the baseline survey for a response rate of 70% calculated using American Association for Public Opinion Research (2008) guidelines. The follow-up survey was completed by 798 individuals (82%) response from baseline participants (Table 1).

A total of 28.0% reported recall of the *Good to Know* campaign at follow-up; 13.5% reported seeing it once or twice and 14.5% reported hearing or seeing it twice or more. Campaign recall did not differ by gender, race/ethnicity, or current marijuana use status. Younger adults (20-34 years) were significantly more likely to recall the campaign than those 55 years and older (34.8% vs. 24.5%, respectively; data not shown).

TABLE 1
Demographic Characteristics of Respondents to Baseline and Follow-Up Survey (n = 798)

<i>Individual Characteristics</i>	<i>Total % [95% CI]</i>	<i>Gender</i>	
		<i>Male % [95% CI]</i>	<i>Female % [95% CI]</i>
Total		42.0 [38.5, 45.4]	58.0 [54.6, 61.5]
Age (years)			
20-34	14.2 [11.7, 16.6]	14.3 [10.6, 18.1]	14.0 [10.9, 17.2]
35-54	25.4 [22.4, 28.5]	24.2 [19.6, 28.8]	26.3 [22.3, 30.4]
55+	60.4 [57.0, 63.8]	61.5 [56.3, 66.7]	59.6 [55.1, 64.1]
Race/ethnicity			
White	68.4 [65.2, 71.7]	72.8 [68.1, 77.6]	65.2 [60.9, 69.6]
Hispanic	13.7 [11.3, 16.0]	11.9 [8.45, 15.4]	14.9 [11.7, 18.2]
African American	15.0 [12.6, 17.5]	12.2 [8.7, 15.8]	17.1 [13.6, 20.5]
Other	2.9 [1.7, 4.0]	3.0 [1.2, 4.8]	2.8 [1.3, 4.3]
Current marijuana use			
Yes	26.7 [23.6, 29.8]	33.4 [28.4, 38.5]	21.8 [18.0, 25.6]
No	73.3 [70.2, 76.4]	66.6 [61.5, 71.6]	78.2 [74.4, 82.0]

NOTE: 95% CI = 95% confidence interval.

Accurate knowledge of marijuana laws increased significantly from baseline to follow-up for the four components of the composite score (Table 2). When considering the composite index of these four laws, almost every demographic category saw a significant increase in knowledge of the law (males/females, marijuana users and nonusers, 35- to 54-year-olds, 55 years and older, Whites, Hispanics, and those reporting another race). The two exceptions were African Americans and 20- to 34-year-olds did not have a significant increase in knowledge of these laws (data not shown). When considering other marijuana laws that were not a focus of the campaign, there was a significant increase in knowledge that one can use in a private home and may purchase 1 ounce, and no significant change in knowledge that one cannot use in a business and may grow six plants (Table 2).

Nonusers had more increases in accurate knowledge of the laws from baseline to follow-up as compared to current marijuana users. Nonusers had significant increases in accurate knowledge of the four primary indicators of knowledge of the marijuana laws and that one may use marijuana in a private home. Current marijuana users had significant increase in accurate knowledge that marijuana cannot be used outdoors, as well as in the composite index (Table 2).

Among those who had inaccurate knowledge of the laws at baseline, those who reported seeing the campaign at least once or more were 2.53 (95% CI = 1.29-4.95) times as likely to report accurate knowledge of

the laws at follow-up compared to those that did not recall seeing the campaign, after controlling for gender, race/ethnicity, age, and current marijuana use status (Table 3). The results were similar when recall of the campaign was separated into once or twice versus more than twice. Current marijuana users were significantly more likely to increase their accurate knowledge of the laws from baseline to follow-up (odds ratio [OR = 3.60, 95% CI = 1.53-8.49]).

► DISCUSSION

In a state that legalized recreational marijuana, a cohort study of adults found that a mass media campaign to promote knowledge of legal permissions and restrictions reached all demographic segments, with highest message awareness among younger adults, although this group did not have a significant increase in knowledge. Overall, knowledge of the new laws increased significantly among marijuana nonusers but less so among users. This is primarily due to the higher accurate knowledge levels among marijuana users before the campaign was launched. This suggests that those individuals who needed to know certain aspects of the law (e.g., those who intended to purchase or use marijuana) may have proactively sought out the needed information even before the campaign was launched. This distinction between individuals who are motivated to know the laws and those who are not may also explain the relatively low level of knowledge of the

TABLE 2
Comparison of Knowledge of Marijuana Laws Before and After the Marijuana Media Campaign Among an Evaluation Panel of English-Speaking Colorado Adults

Correct Response	Overall (n = 798)		Current Marijuana Users (n = 188)		Nonusers (n = 610)	
	Baseline % [95% CI]	Follow-up % [95% CI]	Baseline % [95% CI]	Follow-up % [95% CI]	Baseline % [95% CI]	Follow-up % [95% CI]
Composite score						
Age 21 years, can get DUI, cannot take out of state, cannot use in public place	62.0 [58.6, 65.4]	73.1 [69.9, 76.3]	81.1 [75.9, 86.4]	89.3 [85.0, 93.5]	54.8 [50.7, 58.9]	67.0 [63.1, 71.0]
Components of composite score						
Must be at least 21 years to buy	72.7 [69.6, 75.8]	78.7 [75.8, 81.6]	89.2 [85.0, 93.4]	91.5 [87.7, 95.2]	66.6 [62.7, 70.5]	73.9 [70.3, 77.6]
Can get cited for DUI	90.5 [88.5, 92.6]	93.7 [92.0, 95.4]	95.8 [93.1, 98.5]	96.7 [94.3, 99.1]	88.6 [86.0, 91.2]	92.6 [90.4, 94.7]
May not take out of state	91.2 [89.2, 93.2]	94.2 [92.6, 95.8]	96.2 [93.7, 98.8]	99.1 [97.8, 100.0]	89.3 [86.8, 91.8]	92.4 [90.2, 94.6]
May not use in outdoor place	94.6 [93.0, 96.2]	97.8 [96.7, 98.8]	96.2 [93.7, 98.8]	99.5 [98.6, 100.0]	94.0 [92.1, 96.0]	97.1 [95.7, 98.5]
Other law knowledge items						
May use in a private home	89.0 [86.8, 91.2]	92.8 [90.9, 94.6]	98.1 [96.3, 99.9]	97.1 [94.8, 99.4]	85.6 [82.7, 88.5]	91.2 [88.8, 93.5]
May not use in a business	81.0 [78.3, 83.8]	83.2 [80.5, 85.8]	78.3 [72.7, 83.9]	82.6 [77.4, 87.8]	82.1 [78.9, 85.2]	83.4 [80.3, 86.5]
May purchase 1 ounce	31.0 [27.7, 34.2]	34.1 [30.7, 37.4]	49.8 [43.0, 56.5]	52.2 [45.4, 58.9]	24.0 [20.6, 27.5]	27.5 [23.9, 31.2]
May grow six plants	25.5 [22.5, 28.6]	26.6 [23.5, 29.7]	51.2 [44.4, 57.9]	51.9 [45.1, 58.6]	16.1 [13.1, 19.1]	17.2 [14.1, 20.3]

NOTE: 95% CI = 95% confidence interval; DUI = driving under influence. Entries in boldface indicate a significant change from baseline to follow-up ($p < .05$).

TABLE 3
Multivariate Results of a Logistic Regression Predicting Increase in Knowledge of Marijuana Laws at Follow-Up
(n = 295)

<i>Demographic Characteristic</i>	<i>Model 1</i>		<i>Model 2</i>	
	<i>aOR</i>	<i>95% CI</i>	<i>aOR</i>	<i>95% CI</i>
Gender				
Male	0.95	[0.56, 1.63]	0.96	[0.55, 1.69]
Female (ref)	1.0	—	1.0	—
Race				
White (ref)	1.0	—	1.0	—
Hispanic	0.95	[0.44, 2.03]	1.04	[0.48, 2.24]
African American	0.92	[0.46, 1.80]	1.18	[0.57, 2.44]
Other	2.02	[0.50, 8.18]	2.02	[0.44, 9.30]
Age (years)				
20-34	0.84	[0.35, 2.03]	0.80	[0.32, 1.98]
35-54	1.69	[0.93, 3.05]	1.67	[0.90, 3.10]
55+ (ref)	1.0	—	1.0	—
Marijuana use status				
Current user	3.19	[1.45, 6.99]	3.60	[1.53, 8.49]
Noncurrent user (ref)	1.0	—	1.0	—
Recall of <i>Good to Know</i> slogan				
Saw campaign one or more times			2.53	[1.29, 4.95]
Did not recall seeing campaign (ref)			1.0	—

NOTE: aOR = adjusted odds ratio; 95% CI = 95% confidence interval; ref = reference. Entries in boldface indicate significance ($p < .05$).

amount of marijuana once can purchase and the number of plants one can grow. These details of the laws are most applicable to those individuals intending to purchase or grow marijuana (a minority of the population), and those individuals may have sought out the information well in advance of the campaign. Furthermore, the campaign content did not include specific information about the number of plants one can grow or the amount that can be legally purchased.

In our multivariate analysis of only those with inaccurate knowledge of the laws at baseline, marijuana use status was strongly associated with an increase in accurate knowledge of the laws. This finding suggests that the content of the media campaign was more salient among marijuana users. Taken together these findings demonstrate an important distinction between marijuana users and nonusers. Health practitioners designing marijuana-related education campaigns may find it valuable to consider different communication approaches for marijuana users and nonusers. Those aged 20 to 34 years, who have a higher rate of marijuana use, had no significant increase in knowledge of the laws. This may be attributed to a higher level of knowledge of the laws at baseline. The confounding

of age and marijuana use status is worth further exploration to understand if there are important differences within the population of marijuana users.

In addition to age, there may be other important distinctions among the marijuana using population. Our measure of marijuana use status was a question assessing past 30-day use of marijuana but there may be differences among those who have regularly used marijuana for years, those that have only recently begun or increased their frequency of use, and nonusers who are contemplating trying marijuana in the near future. Another alternative media strategy would be to design messages for particular subpopulations, or focused on particular regulations, in contrast to a broad population approach used in Colorado. In fact, the *Good to Know* media campaign will be followed by smaller, more focused campaigns that are in various stages of development and dissemination including campaigns focused on marijuana users, tourists, Spanish-speaking adults, parents, adolescents, pregnant and breastfeeding women, and health care providers.

The *Good to Know* campaign content was developed at the same time, rather than after, we administered the baseline survey. The campaign was launched within

several months of funding being available to the state health department. The timeline for the campaign development and roll-out was determined by state legislative priorities, not by the state health department that funded the campaign, and thus was subject to political and budgetary constraints outside of the control of the state health department. Public health practitioners are often faced with a rapid onset of a new or emerging health concern, which limits the amount of resources that are given to a needs assessment before taking action. As states enact changes in marijuana regulations a lesson can be learned from Colorado on the benefits of measuring baseline awareness of regulations in advance of designing public health education campaigns.

Strengths and Limitations

This study used a large prospective cohort, drawn from a representative sample, with relatively high response rates at both time points. The absence of a control group and lack of randomization does not allow examination of potential historical or external effects such as media coverage that would occur regardless of the evaluated campaign and ongoing campaigns with overlapping messages. Another limitation is that there is not a comparison to accurate knowledge of other laws, such as regulations regarding alcohol or tobacco use, which could serve as a benchmark for what level of accurate knowledge would be acceptable. Participants were not asked where they saw or heard advertising, which would have distinguished between those who gained knowledge from unpaid media or news coverage versus paid advertising.

Conclusions

This study demonstrates success of the *Good to Know* campaign to educate Colorado residents on recreational marijuana regulations in reaching a broad population. Those individuals who reported recall of the campaign were more likely to increase their accurate knowledge of marijuana laws.

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Efficacy of a Universal Brief Intervention for Violence Among Urban Emergency Department Youth

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Abstract

Background—Violent injury is the leading cause of death among urban youth. Emergency department (ED) visits represent an opportunity to deliver a brief intervention (BI) to reduce violence among youth seeking medical care in high-risk communities.

Objective—To determine the efficacy of a universally applied Brief Intervention (BI) addressing violence behaviors among youth presenting to an urban ED.

Methods—ED youth (14-to-20 years-old) seeking medical or injury-related care in a Level-1 ED (October 2011–March 2015) and screening positive for a home address within the intervention or comparison neighborhood of a larger youth violence project were enrolled in this quasi-experimental study. Based on home address, participants were assigned to receive either the 30-min therapist-delivered BI (Project Sync) or a resource brochure (enhanced usual care [EUC] condition). The Project Sync BI combined motivational interviewing and cognitive skills training,

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including a review of participant goals, tailored feedback, decisional balance exercises, role-playing exercises, and linkage to community resources. Participants completed validated survey measures at baseline and a 2-month follow-up assessment. Main outcome measures included self-report of physical victimization, aggression, and self-efficacy to avoid fighting. Poisson and Zero-inflated Poisson regression analyses analyzed the effects of the BI, as compared to the EUC condition on primary outcomes.

Results—409 eligible youth (82% participation) were enrolled and assigned to either receive the BI (n=263) or the EUC condition (n=146). Two-month follow-up was 91% (n=373). There were no significant baseline differences between study conditions. Among the entire sample, mean age was 17.7 y/o (SD 1.9), 60% were female, 93% were African-American, and 79% reported receipt of public assistance. Of participants, 9% presented for a violent injury, 9% reported recent firearm carriage, 20% reported recent alcohol use, and 39% reported recent marijuana use. Compared with the EUC group, participants in the therapist BI group showed self-reported reductions in frequency of violent aggression (therapist, -46.8%; EUC, -36.9%; Incident rate ratio [IRR], 0.87; 95% confidence interval [CI], [0.76–0.99]) and increased self-efficacy for avoiding fighting (therapist, +7.2%; EUC, -1.3%; IRR, 1.09; 95% CI, 1.02–1.15). No significant changes were noted for victimization.

Conclusions—Among youth seeking ED care in a high-risk community, a brief, universally applied BI shows promise in increased self-efficacy for avoiding fighting and a decrease in the frequency of violent aggression.

Trial Registration—Clinicaltrials.gov identifier – NCT02586766

Keywords

Youth Violence; Universal Injury Prevention; Emergency Medicine; Brief Intervention; Motivational Interviewing

Introduction

Youth violence is a significant public health problem. Homicide rates among U.S. youth are fourteen times higher than those among youth in other high-income countries.¹ Violent injury is the leading cause of death for urban minority youth and responsible for more than 600,000 adolescent ED visits annually.² Nationwide, 25% of high school age students report fighting in the past 12-months and 18% report carrying a weapon in the past month.³ Societal costs associated with this violence are substantial, estimated at more than \$4 billion for acute medical care and \$32 billion for lost wages/productivity annually.⁴ Developing effective prevention programs for at-risk youth is a significant focus of public health efforts,^{5–11} especially given data demonstrating that adolescent violence involvement is linked with negative long-term health and psychosocial outcomes, including substance abuse/dependence, anxiety/depression, post-traumatic stress disorder, incarceration, violent injury, and death.^{5,12–22}

Urban EDs are an important, but underutilized setting for violence prevention.⁵ Prior data highlight that youth seeking ED care within urban settings have elevated rates of violence, as well as associated risk behaviors, including substance use, firearm possession, and weapon

carriage.^{23–26} Urban EDs also provide an opportunity to access traditionally hard-to-reach adolescents, including uninsured/underinsured youth, as well as those without a primary care physician and those not regularly attending school.^{27,28} Prior studies have demonstrated the effectiveness of brief interventions (BI) for the prevention of a range of injury-related risk behaviors, most commonly alcohol use.^{29–35} More recently, ED-based BIs have been expanded to incorporate violence prevention.^{36,37} Findings from the SafERteens study, a randomized control trial (RCT) conducted among ED adolescents screening positive for alcohol and peer violence demonstrated that a therapist-delivered BI significantly reduced peer aggression, peer victimization, dating victimization, and alcohol-related consequences.^{36–38} While such selective interventions conducted among an at-risk population (i.e., youth with a history of alcohol use and prior violence) have been shown to be effective, researchers have not previously evaluated a BI to reduce violence behaviors among a universal population of ED youth living in neighborhoods with elevated levels of community violence. Such a universal prevention-based approach (i.e., addressing violence risk among all youth who are seeking ED care from a high-risk neighborhood) has the potential to substantially effect the public health of urban communities, especially if the BI is designed to be delivered seamlessly during an ED visit.

Similar to other urban communities with elevated rates of crime, violence and poverty, youth violence is a significant problem in Flint, MI.³⁹ Since 2011, the Michigan Youth Violence Prevention Center has been working with community partners to implement a comprehensive youth violence prevention program.⁴⁰ The present study evaluates the ED-based component of this program focused on an individual level intervention addressing youth populations. Specifically, this article examines the efficacy of a therapist-delivered universal BI (Project Sync) as compared to an enhanced usual care (EUC) condition in reducing violence behaviors among adolescents seeking ED care at a Level-1 trauma center within discrete geographical regions of Flint. It was hypothesized that youth receiving the BI would decrease self-reported violence behaviors (aggression, victimization) and increase self-efficacy for avoiding fighting compared to youth in the EUC group who did not receive the BI.

Methods

Study Design and Setting—Project Sync is a 5-year quasi-experimental trial testing the efficacy of a BI as compared to an EUC condition for a universal population of youth seeking medical or injury-related care in the Hurley Medical Center (HMC) ED in Flint, Michigan. The study was one component of a multi-faceted youth violence prevention program⁴⁰ testing six interventions within a focused intervention neighborhood as compared to a comparison neighborhood. Interventions were designed so as not to overlap. The current study was the only intervention to focus on individual counseling of youth in an ED regarding their involvement in violence. Other interventions focused on improving social interactions (e.g., parent/adult mentoring relationships) or environmental factors (e.g., community policing, clean & green initiatives); only one other intervention was focused at the individual level, but utilized a school-based curriculum to focus on positive youth development among a younger adolescent population. Both neighborhoods were matched on

multiple socio-demographic characteristics, including the percentages of African-American/Hispanic residents, owner-occupied housing, high-school graduates, and residents below the poverty level. The neighborhoods were also matched on adolescent population counts, median household income, and violent crime rates. The UM and HMC IRBs approved all study procedures; a CDC Certificate of Confidentiality was also obtained.

Recruitment—Recruitment (October 2011-March 2015) occurred within the HMC ED between 2:30-pm and 10:00-pm, 7-days a week, excluding holidays, with additional morning (8:30-am-4:00-pm) and mid-day (11:30-am-7pm) shifts as scheduling allowed. Of note, the intervention neighborhood was purposefully oversampled to meet the aims of the larger YVPC project (i.e., to interact with as many youth from the intervention neighborhood as possible).

Eligibility—ED patients (14–20 years-old) were identified using electronic medical records and approached in waiting rooms/treatment spaces. Participants screening positive for a home address within the intervention or comparison neighborhood were eligible for inclusion. Patients were excluded if they were unable to provide informed consent due to medical (e.g., altered mental status) or psychiatric reasons (e.g., cognitive impairment), or if they were presenting for a sexual assault and/or suicidal ideation/attempt. Patients were also excluded if they were <18 years-old and seeking care without a parent/guardian present (or they were unavailable for phone consent), in police custody, or if they were unable to self-administer the survey or participate in the BI (e.g., non-English speaking).

Study Protocol—Following written consent (or assent with parent/guardian consent), participants self-administered a ~25-minute computerized baseline survey (\$20 remuneration) via touchscreen tablet. Participants were assigned to a study condition based on home address; those residing in the intervention neighborhood received the ~30-minute BI, while those in the comparison neighborhood received a resource brochure (i.e., EUC condition). Participants self-administered a computerized follow-up assessment at 2-months (\$25 remuneration). Follow-up visits, which were arranged at the time of the baseline visit, were primarily conducted in-person (n=357; 95.7%) in a convenient location (e.g., ED/hospital, home visit, community location). Of in-person follow-ups, 77% occurred at the study hospital. Participants were sent a combination of reminders for follow-up appointments, including post-cards, phone calls, and texts to enhance attendance.

Measures

Socio-Demographics—Demographic and socio-economic characteristics (e.g., age, gender, race/ethnicity, marital status, living situation, public assistance) were assessed using items from the Add-Health Study,^{41,42} the NIH Guidelines on race/ethnicity,⁴³ and the Drug Abuse Treatment Outcome Studies.⁴⁴ Three items from the Flint Adolescent Survey⁴⁵ assessed school completion (“Are you currently in school?”; “What is the highest grade you have completed?”) and average grades (“What kind of grades do you usually/did you usually get in school?”). Participants who reported that they were not currently in school and who indicated that the highest grade completed was less than a high school diploma were coded

as dropouts. Education measures were collapsed to indicate whether the participant had failing grades or had dropped out of school.

Past 2-month Background Characteristics—Firearm Carriage was assessed using a single item (“How often have you carried a gun with you when you were outside your home?”) from the Tulane Youth Study.^{46,47} The response scale (never, 1 time, 2-times, 3–5 times, 6–10 times; 11–20 times, >20 times) was dichotomized (yes/no for firearm carriage) for analysis. This measure excludes firearm carriage for hunting/sporting activities. Gang involvement was assessed with a single item (Do you consider yourself a member of a gang?; Yes/No).^{26,48} Community violence exposure was assessed with the 5-item community violence scale from the “Things I Have Seen and Heard Survey”.^{49,50} This scale assesses the frequency of five behaviors (“heard gun shots”; “seen drug deals”; “my house has been broken into”; “seen someone get stabbed or shot”; “seen gangs in my neighborhood”) on a Likert scale ranging from 0 (“never”) to 3 (“many times”). For analysis, a summary score was created [range 0–15; $\alpha=0.72$], with higher scores indicative of higher perceived levels of community violence exposure.

Alcohol (“In the past 2 months, have you had a drink of beer, wine, or liquor more than 2–3 times”; Yes/No) and marijuana use (“During the past 2 months, how many days did you use marijuana?”) were assessed using measures from the Add-Health Survey.⁴² For analysis, any response other than never to the marijuana item (Response scale: Never, <1 time a month, 2–3 days/month; 1–2 days/week; 3–5 days/week, Everyday) was coded as positive for recent marijuana use (Yes/No). Finally, participants were asked to indicate whether this ED visit resulted from a violent injury (Yes/No).

Primary Outcomes—The main outcomes for the study were physical aggression, victimization, and self-efficacy for non-fighting. The adapted 12-item revised conflict tactics scale (CTS-2)^{51,52} and the 4-item conflict in adolescent dating relationships inventory (CADRI)⁵³ were used to measure prevalence and frequency of physical aggression and victimization for peers (e.g., friends, strangers, acquaintances, relatives, etc.) and partners (e.g., girlfriend/boyfriend, fiancée, husband/wife), respectively. Each scale measures the frequency [response scale ranging from 0 (never) to 6 (>20 times)] of moderate (e.g., pushed, shoved) and severe (e.g., hit, punched, used a knife/gun) violence behaviors and are measured separately for victimization (i.e., someone did to you) and aggression (i.e., you did to someone). Peer and partner scores were summed for a total measure of physical aggression ($\alpha=0.90$) and physical victimization ($\alpha=0.92$). Self-efficacy for avoiding fighting was assessed using a five item scale [How sure are you that you can “stay out of fights?”; “Understand another person’s point of view?”; “Calm down when you are mad?”; “talk out a disagreement?”; “Learn to say out of fights?”] from the Teen Conflict Survey;^{54,55} responses ranged from 0 (not at all) to 4 (extremely) and were summed for a total self-efficacy score (range 0–20; $\alpha=0.80$).

Study Conditions

Brief Intervention: Youth in the intervention group received the ~30-min therapist-delivered BI within the ED prior to hospital admission/discharge. The study therapist was

aided by a tablet computer to provide both tailored feedback to the participant and to standardize the delivery of intervention content. The BI was paused and restarted as necessary to avoid interfering with medical care. The Project SYNC BI integrated elements of motivational interviewing (MI) to enhance problem recognition (i.e., why behaviors negatively influence goals) with cognitive behavioral strategies for skill development (i.e. how to change current behaviors). MI is a person-centered counseling technique emphasizing a non-judgmental and non-confrontational approach.^{56,57} MI focuses on establishing a discrepancy between current behaviors and future goals to resolve ambivalence, enhance intrinsic motivation, and increase self-efficacy for change. The intervention proceeded through 5 sections: 1) reviewing personalized goals; 2) delivering tailored feedback on violence (including normative re-setting and how substance use contributes to behaviors); 3) decisional balance exercises to establish the potential benefits of avoiding fighting (e.g., preventing injury); 4) five role playing scenarios to develop cognitive skills in anger management, conflict resolution, refusal skills for substance use/ weapon carriage, and skills for avoiding violent situations; and, 5) summary of goals, skills discussed, and linkage to community resources. A detailed community resource brochure was also provided.

The Project Sync BI was adapted from the previously described SaFERteens BI,^{36–38} which was designed specifically for teens with prior alcohol use and fighting. Modifications included adapting the role-playing scenarios and intervention content to be applicable to youth regardless of their history of prior violence or prior alcohol use (i.e., relevant for a universal ED sample). If youth had not experienced fighting, the therapist focused on the prevention of future aggression and victimization and/or discussed situations that the participant’s friends, family or neighbors had experienced. In addition, intervention scenarios were updated to be reflective of more current teen issues than those used in the SaFERteens study (e.g., “someone stole your cellphone” rather than “someone stole your sneakers”). As with SaFERteens, intervention content was developed to be culturally relevant for urban youth.

The Project SYNC BI was delivered by study therapists trained in behavioral health fields (e.g., social work, clinical psychology). They completed a 5-day training at the beginning of the study, including training in MI techniques and intervention delivery. Prior to study initiation, therapists completed mock patient scenarios and were required to demonstrate appropriate proficiency with MI and all components of intervention delivery. In addition, study therapists were carefully monitored throughout the trial in four ways. First, they received close clinical supervision and review of audiotaped therapy sessions by a licensed therapist during the initial weeks of the study as a quality assurance check. Second, study therapists were required to complete individual regular clinical supervision twice a month and group clinical supervision once a month with a licensed therapist throughout the study to ensure adherence to all aspects of the study protocol. Third, study therapists received booster trainings throughout the study (twice/year) to maintain clinical skills and prevent drift from the study protocol. Finally, a random 5% of all therapy sessions were audiotaped and coded using the Motivational Interviewing Treatment Integrity Global Scale (MITI-3),⁵⁸ a standardized instrument for measuring and ensuring that the therapist is adhering to the principles of MI and the therapy protocol in clinical trials that involve MI-based behavioral

counseling. For this study, therapy sessions demonstrated acceptable fidelity (mean global spirit rating: 4.8 [SD 0.3; range: 3.7–5.0]), exceeding the recognized competency level of 4.

Enhanced Usual Care (EUC): Participants in the EUC condition received a basic brochure listing available community resources (e.g., substance use, leisure activities).

Data Analysis—Descriptive statistics were computed for the entire sample and by assigned treatment condition. Frequencies of risk behaviors (e.g., violent victimization, aggression, self-efficacy) were computed for descriptive purposes and percent change at 2-months following the ED visit are presented. Regression analyses (i.e., Poisson based on distribution) were conducted examining the effects of the BI (compared to EUC) on the occurrence (binary variable) and frequency (continuous) of primary outcomes [i.e., aggression, victimization, self-efficacy]. For victimization and aggression, Zero-inflated Poisson (ZIP) models were utilized to account for the large proportion of zeros. Follow-up rates were high (91.2%) and attrition analyses demonstrated that baseline characteristics (i.e., age, race, gender, assigned group) were not significantly related to follow-up, suggesting missing outcome data was likely missing at random. Cohen effect sizes⁵⁹ were calculated to indicate the strength of the relationship between the BI and observed outcomes to allow for future comparison. Prior prevention literature suggests that effect sizes >0.10 are clinically meaningful.⁶⁰ Data were analyzed using SAS 9.4 (SAS Institute Inc.; Cary, NC).

Results

Enrollment—A total of 1,188 patients aged 14–20 years old with a home address within the intervention or comparison neighborhood presented during recruitment (Figure 1). Of 619 youth eligible for inclusion, 80.5% (n=498) were approached, with 82.1% (409; BI=263; EUC=146) enrolling in the study and 17.9% (n=89) refusing participation. Those refusing participation were more likely from the intervention rather than the comparison neighborhood (21.7%-vs.-9.9%, $\chi^2=10.46$; $p<0.05$) and were less likely to identify as African American when compared with other racial/ethnic categories (16.6%-vs.-32.5%, $\chi^2=6.34$; $p<0.05$). No differences were noted with regards to age or sex. Compliance with assigned condition and follow-up rates exceeded 91.2%, with no differential follow-up by condition. Of note, only five participants (1.9%) in the intervention group reported exposure to one of the other youth violence initiatives, with four of the five reporting their exposure was to a community-level clean and greening initiative. The remaining 98% reported no direct exposure to the other YVPC community interventions.

Participant Characteristics—Table 1 characterizes the sample by study condition. No differences between groups were noted by condition with regards to background characteristics, substance use, and/or violence involvement. Among the entire sample, 59.9% of participants were female, 93.4% were African-American, and mean age was 17.7 (SD=1.9). Most participants in both groups reported receipt of some public assistance (79.0%) and 75.3% reported living with a parent/guardian. Overall, 20.1% of youth reported recent alcohol use and 38.6% reported recent marijuana use. Recent violence involvement was similar between conditions, with two-thirds of youth reporting a recent violent event;

48.2% reported being the aggressor and 58.7% reported being victimized. Among all participants, only 8.8% were seeking care for a violent injury.

Primary Outcomes—Overall, 85.7% (n=209) of participants receiving the intervention rated the BI as very or extremely helpful (mean score=3.3; SD=0.8). Regression models computed for violence outcomes (aggression, victimization and self-efficacy for avoiding fighting) at 2-months (Table 2: Descriptive data; Table 3: Poisson/ZIP models) demonstrated that the BI significantly decreased the frequency of violent aggression (BI, -46.8%; EUC, -36.9%; IRR, 0.87; 95% CI, 0.76–0.99) and increased self-efficacy for avoiding fighting (BI, +7.2%; EUC, -1.3%; IRR, 1.09; 95% CI, 1.02–1.15) when compared to EUC. No significant changes were noted for frequency of victimization or for the prevalence of victimization or aggression. Cohen’s d effect sizes for the BI were as follows: violent aggression, 0.16; and self-efficacy, 0.24.

Discussion

Results demonstrate that a 30-minute BI was effective reducing violent aggression and increasing self-efficacy for avoiding fighting among a universal sample of youth seeking ED care in a high-risk community. Although effect sizes were modest, findings are similar to other ED-based behavioral^{35,61} and school-based universal violence interventions.⁶² Further, effect sizes are clinically significant given that violent injury is the leading cause of death among urban youth, surpassing death due to cancer, asthma, HIV/AIDS, and motor vehicle crash injury.⁶³ In addition, these findings further validate the findings of the SaFERteens study, demonstrating that a BI delivered during an ED visit can be efficacious reducing adolescent violent behaviors.^{37,61} Our study adds to the literature by demonstrating that components of the SaFERteens BI can be successfully adapted for application among a universal sample that is not being screened for alcohol use or prior violence. We found that the universal intervention was well received by participants, with low refusal rates (<20%) and with 86% of youth rating the intervention as very or extremely helpful, reinforcing that youth in high-risk neighborhoods, even those youth without prior violence history, are willing to discuss ways to reduce their future violence risk. Taken together, these findings have important public health implications for communities with elevated levels of violence, as the ED is a critical site for reaching youth who do not attend school (22% in our sample) or receive regular primary care, and may represent a promising primary prevention tool for reducing violence in such communities.

Improved violence outcomes may have resulted from a combined focus on increasing motivation for behavior change and increasing their skills for avoiding violent situations, non-violent conflict resolution, and anger management. Alternatively, intervention effects may have resulted from the focus on social promotive factors, including linkage to available psychosocial or substance use resources and to positive community activities. Further study is needed to identify which intervention components were critical to the effectiveness of the BI among this universal sample. Understanding which components were the most effective will aid in the design and implementation of future violence interventions. It should be noted that aggression behaviors included moderate and severe behaviors (e.g., knife/firearm use). Due to the limited sample size, it is unknown whether youth with higher severity violence

profiles were more motivated to change their behavior. More study with a larger adolescent sample is needed to understand the mediating and moderating factors that may have influenced outcomes.

Although additional study is needed to assess the generalizability of our findings, the combined approach of focusing on individual-level therapist-delivered behavioral counseling and cognitive skill development among a universal population of at-risk adolescents has the potential to be effective in other clinical and non-clinical settings. Universal school-based violence interventions have shown efficacy addressing a range of violence-related behaviors among school-aged populations.⁶⁴ Yet, most studies to date have focused on positive youth development among younger elementary and middle school aged children. Further, among studies focused on high-school aged adolescents, most are limited to educational programs or peer-based mentoring for bullying and/or dating violence behaviors.⁶⁴ Within pediatric primary care settings, several screening tools for violence risk have been developed,^{65–67} but few researchers have examined the best methods of intervening with adolescents who screen positive for violence risk and/or those who are at-risk as a result of living in high-risk communities.⁶⁸ In addition, few researchers have examined a therapist-delivered BI to address a broader range of violence behaviors in school- or primary care settings. Such an approach may be an effective universal prevention tool for addressing violence risk among adolescent populations in these settings, although further study is needed.

We did not observe a decrease in victimization during follow-up. This finding, which differs from the SafERteens study, may have resulted from our focus on a universal sample. Less than 65% of our youth reported violent experiences (aggression or victimization) in the two months preceding their ED visit. In contrast, recent fighting and alcohol use were inclusion criteria for the SafERteens study, and more than 80% of that sample reported experiencing consequences (e.g., trouble at school) due to their violence involvement.⁶¹ Prior violence may serve to differentially enhance the salience of intervention components related to victimization, including such cognitive elements as developing skills for avoiding violence. Alternatively, the shorter follow-up period for our study may have limited participant exposure to violence situations, reducing the opportunity to observe changes in victimization. Further study and a longer follow-up period are needed to fully understand the effects of the Project Sync BI on victimization.

While a computerized workbook was used to guide the BI and increase fidelity, it is important to note that an on-site, in-person therapist was required. This approach has implications for translating and disseminating the Project Sync BI into busy, understaffed urban EDs, as well as for the cost-effectiveness of this BI as a universal prevention tool. Prior evaluations testing a fully computerized version of the SafERteens BI did not demonstrate efficacy for violence, but did reduce alcohol-related consequences.^{61,69} Similarly, a recent study demonstrated that a fully automated stand-alone computer BI was effective in reducing alcohol consumption and alcohol related consequences (e.g., DUI) among underage risky drinkers.³⁵ It may be that key components of violence BIs, including empathy or complex therapist reflections concerning youth involvement in violence, may not be easily transferred to a computerized platform. Alternatively, recently tested BIs with efficacy reducing substance use may have benefited from advancements in automated

tailoring technology. In addition, the marked increase in adolescent utilization of interactive technologies such as social media may serve to enhance the effectiveness of newer technology-based therapeutic interventions. Regardless, further study is needed to develop the most seamless and cost-effective delivery method for a universal violence BI. One potential alternative is the use of centralized call centers with access to remote therapists that can deliver the intervention, especially among low-resource urban EDs. This approach has recently gained acceptance in medical and research communities, as well as among large insurance agencies for other disease management and behavioral interventions^{70–74} and may offer a more cost-efficient delivery method for underserved low resource settings.

Limitations

Study limitations should be acknowledged; including the quasi-experimental rather than RCT design. This concern is partly mitigated by the absence of baseline differences among study conditions and the focus of the study on replicating the positive SafERteens effects among a universal sample. However, it must be acknowledged that we cannot fully account for the full range of potential unmeasured confounding variables with this design. Findings may not generalize to youth not included in the study, including those in Flint who do not reside in the intervention or comparison neighborhoods, as well as those who were excluded (e.g., youth seeking care for suicidal ideation/sexual assault). While the sample reflected the racial and ethnic composition of the study site, further testing among youth with other racial and ethnic characteristics (e.g., Hispanic) is required. The use of self-report data is a potential limitation; however prior studies confirm the reliability and validity of self-report data when privacy and confidentiality are assured.⁷⁵ Although attrition is a potential limitation, follow-up rates exceeded 90%. Further study with a longer follow-up period is required to assess the effects of the BI on long-term outcomes. Finally, as this was one component of a larger youth violence prevention program, there may have been spill over effects from the other interventions; however, less than 2% of the intervention group reported exposure to one of the other youth violence initiatives.

Conclusion

Our evaluation suggests that a universal BI for violence, delivered by a therapist in the ED setting, can be effective in reducing aggression and increasing self-efficacy for avoiding fighting among a universal sample of youth in a high-risk community. These findings have important implications for community-based violence prevention programs addressing this complex public health problem. Future research should focus on investigating alternative cost-efficient delivery mechanisms that can improve the likelihood of translating this universal BI into the routine clinical care that is provided to ED youth in high-risk communities to decrease the leading cause of morbidity and mortality among urban youth.

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Abbreviations

BI	Brief Intervention
ED	Emergency Department
US	United States
RCT	Randomized Control Trial
HMC	Hurley Medical Center
UM	University of Michigan
IRB	Institutional Review Board
CDC	Centers for Disease Control
CTS	Conflicts tactics scale
CADRI	Conflict in adolescent dating relationships inventory
MI	Motivational Interviewing
DUI	Driving under the Influence
IRR	Incident Rate Ratio
CI	Confidence Interval
YVPC	Youth Violence Prevention Center
SD	standard deviation
NIH	National Institutes of Health

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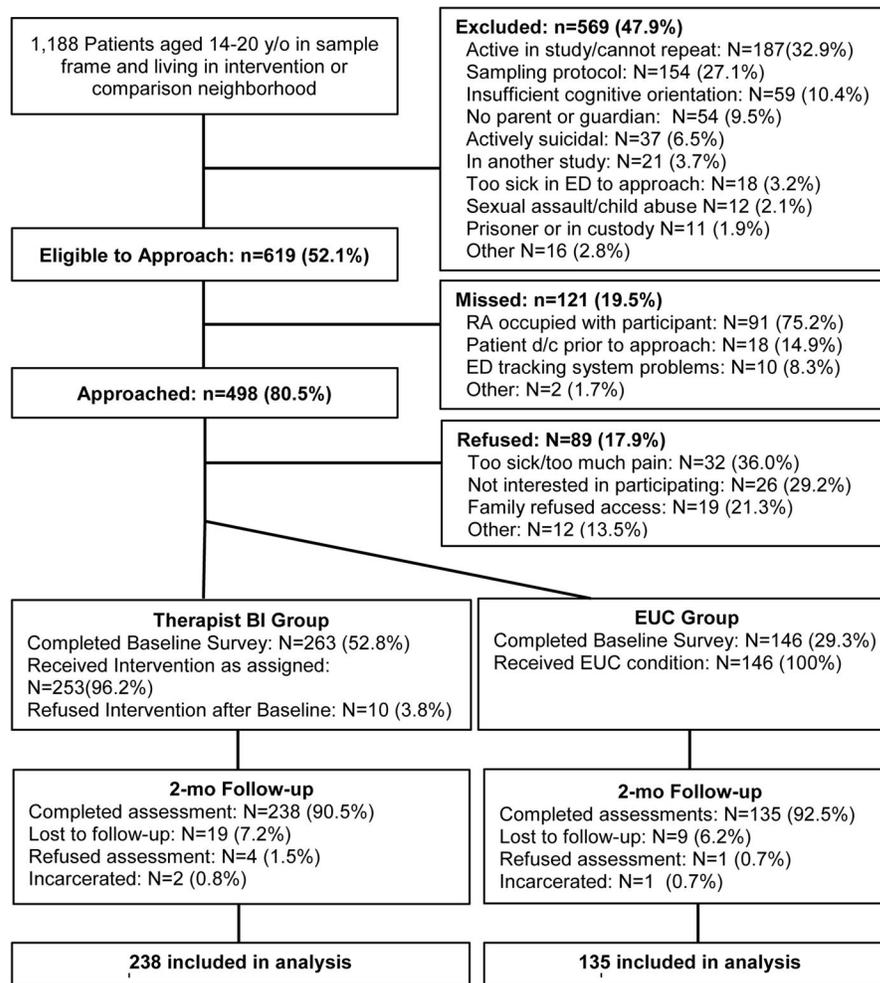


Figure 1. Project Sync flowchart for recruitment and study enrollment from Hurley Medical Center in Flint, Michigan (October 4th 2011-March 30th 2015).

Table 1

Baseline background, violence and substance use characteristics by study condition

	Therapist BI Group (n=263)	EUC Group (n=146)	Total (n=409)
Background Characteristics			
Age (mean, SD)	17.7 (1.9)	17.5 (2.0)	17.7 (1.9)
Female (n, %)	161 (61.2%)	84 (57.5%)	245 (59.9%)
African American	243 (92.4%)	139 (95.2%)	382 (93.4%)
Married/Living with Partner	43 (16.4%)	26 (17.8%)	69 (16.9%)
Live with Parent/Guardian	191 (72.6%)	117 (80.1%)	308 (75.3%)
Public Assistance (Parent or Participant)	209 (79.5%)	114 (78.1%)	323 (79.0%)
Failing Grades/Dropped out of school	60 (22.8%)	30 (20.6%)	90 (22.0%)
Gang Involvement	17 (6.5%)	6 (4.1%)	23 (5.6%)
Firearm Carriage	23 (8.7%)	12 (8.2%)	35 (8.6%)
Community Violence	5.2 (3.4)	5.4 (3.4)	5.3 (3.4)
ED Visit/Presentation			
Violent Injury	19 (7.2%)	17 (11.6%)	36 (8.8%)
Past 2-month Substance Use			
Any Alcohol Use	51 (19.4%)	31 (21.2%)	82 (20.1%)
Any Marijuana Use	100 (38.0%)	58 (39.7%)	158 (38.6%)
Past 2-month Violence Experiences			
Any Experiences of Violence (n, %)	173 (65.8%)	90 (61.6%)	263 (64.3%)
Any Violent Aggression (n, %)	128 (48.7%)	69 (47.3%)	197 (48.2%)
Any Violent Victimization (n, %)	162 (61.6%)	78 (53.4%)	240 (58.7%)
Self-Efficacy for avoiding fights	12.9 (4.4)	13.1 (4.6)	13.0 (4.5)

Note: Significance Levels

*
< 0.05,**
<0.01,***
<0.001

Table 2

Within-condition (therapist BI group; EUC group) self-report of changes in violent victimization, aggression and self-efficacy for non-violence at baseline to the 2-month follow-up.

	Baseline Mean (SD)	2-Month Follow-Up Mean (SD)	Change from Baseline to 2- months % Change
Any Violent Victimization			
Therapist BI Group	6.07 (11.55)	2.93 (6.60)	-51.7% ***
EUC Group	4.37 (7.20)	2.50 (5.64)	-42.8%
Any Violent Aggression			
Therapist BI Group	4.81 (9.05)	2.56 (6.06)	-46.8% ***
EUC Group	3.96 (6.88)	2.50 (6.04)	-36.9% ***
Self-Efficacy for Avoiding fighting			
Therapist BI Group	12.87 (4.39)	13.79 (4.64)	+7.2% ***
EUC Group	13.10 (4.60)	12.93 (5.22)	-1.3%

Note: Significance Levels

* < 0.05,

** <0.01,

*** <0.001

Table 3

Zero Inflated Poisson (ZIP) regression analyses examining the efficacy of the therapist brief intervention (versus the EUC group) on the extent of violence victimization, aggression and self-efficacy at the 2-month follow-up

	IRR [#] (95% CI) Frequency	AOR ^{##} (95% CI) Prevalence
Any Violent Victimization		
Baseline victimization	1.02 (1.02, 1.03) ***	0.87 (0.83, 0.91) ***
Therapist BI	1.02 (0.89, 1.16)	1.06 (0.66, 1.70)
Any Violent Aggression		
Baseline aggression	1.04 (1.03, 1.04) ***	0.91 (0.88, 0.94) ***
Therapist BI	0.87 (0.76, 0.99) *	0.78 (0.49, 1.24)
Self-Efficacy for Avoiding fighting^{###}		
Baseline self-efficacy	1.05 (1.04, 1.05) ***	----
Therapist BI	1.09 (1.02, 1.15) **	----

[#]IRR = Incident Rate Ratio; IRR values >1 indicate variables associated positively with the outcome of interest and values <1.0 indicate variables associated negatively with the outcome of interest.

^{##}AOR: adjusted odds ratio.

^{###}Self-efficacy for avoiding fighting was a Poisson regression model Significance levels:

* < 0.05,

** <0.01,

*** <0.001



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Effects of Ads from a Drug and Alcohol Prevention Campaign on Willingness to Engage in Alcohol-Related Risky Behaviors

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Abstract

Behavioral willingness is conceptualized as a pathway to behavior that is non-deliberative, yet traditional measures require thoughtful deliberation to complete. This study explored non-deliberative measures of alcohol-related willingness to complement recent work on marijuana-related willingness. The study also examined whether ads from a field-tested drug-and-alcohol prevention campaign may have operated by influencing alcohol-related willingness. Participants viewed campaign ads or consumer ads (control). Outcomes were reaction times to make speeded judgments about whether one would engage in risky alcohol-related behaviors. Results showed that campaign ads lowered willingness to play drinking games and (for males) to drive while intoxicated.

Introduction

A key task in the evaluation of health campaigns is the testing of psychological mechanisms via which messages may have effects (Cappella, 2006; Slater, 2006). Such efforts are diagnostic in that they can confirm the extent to which message strategies had the intended impact on psychological variables that are hypothesized to lead to behavior. Further, for campaigns targeting multiple behavioral objectives, the exploration of psychological mechanisms may help explain varying degrees of success in achieving behavioral change.

The present study addresses these concerns for a multipurpose drug and alcohol prevention campaign aimed at middle school youth that was tested in a randomized community trial (Slater et al., 2006). The campaign was developed to prevent uptake of multiple substances (marijuana, alcohol, and other drugs). To complement work already done on the psychological impact of the campaign on marijuana-related outcomes (Comello & Slater, 2011), the present study examined impact with respect to alcohol-related constructs.

We focus on non-deliberative processing of messages, which occurs when there is little motivation or opportunity to process (Fazio, 2001). Because non-deliberative processing of messages is difficult to assess in the field, we conducted this study to probe the psychological impact of the campaign in ways that are not feasible in the field but are nonetheless important to understanding campaign effects. The key non-deliberative measure employed in this study was designed to assess behavioral willingness (Gibbons, Gerrard, Blanton, & Russell, 1998), an antecedent to risky behavior that is reactive rather than reasoned. In contrast to previous studies that have measured behavioral willingness using deliberative items (i.e., requiring thoughtful deliberation to answer), we utilize a non-deliberative measure based on speeded judgment tasks that, in our view, is more conceptually congruent with the cue-sensitive reactivity that is fundamental to behavioral willingness.

The campaign that served as the source of stimuli for this experiment is the “Be Under Your Own Influence” campaign, a general purpose drug and alcohol prevention campaign aimed at middle-school youth that was tested in a randomized community trial involving eight treatment and eight control communities throughout the U.S. (Slater et al., 2006). Results from the randomized community trial showed fewer users at final post-test for marijuana, alcohol, and cigarettes in intervention communities; growth trajectory results demonstrating reduction in uptake were significant for marijuana, marginally significant for alcohol, and non-significant for cigarettes.

A lab experiment (Comello & Slater, 2011) examining the effects of exposure to ads from the campaign showed that treatment ads were more effective (relative to comparison and control ads) at lowering behavioral willingness to use marijuana at a party with friends. Although these results point to plausible mechanisms for reduction in marijuana use, alcohol-related outcomes deserve consideration given that the results of the randomized community trial also had measurable impact on alcohol use. Exploration of alcohol outcomes is further warranted by public health concerns over alcohol use among young people, given recent increases in the proportions of college students who reported heavy episodic drinking (Hingson, Zha, & Weitzman, 2009).

Although other mass media prevention campaigns have been studied in terms of psychological mechanisms (Flynn et al., 2006; Komro et al., 2001; Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001; Evans, Price, & Blahut, 2005; Zhao et al., 2006), one issue that remains largely unexplored is the non-deliberative processing of messages, which may occur when there is little motivation or opportunity to carefully consider the consequences of a behavior. In these situations, automatically activated attitudes can guide behavior without an individual’s active consideration of the situation or even awareness that an attitude has been activated (Fazio, 2001). This may well be the case for youth exposed to a health campaign in a school environment.

Once a construct is made accessible, accessibility may influence behavior in a number of ways. Accessibility moderates the link between a construct and behavior relevant to that construct, with greater accessibility associated with greater correspondence between construct and behavior (Fazio, Powell, & Williams, 1989). Further, accessibility of beliefs about an object influences formation of attitudes about the object (Roskos-Ewoldsen & Fazio, 1997). Thus, even ads that are processed in a non-deliberative manner may have effects on future actions through the route of accessibility.

Operationally, how should researchers examine the impacts of non-deliberative processing? One method is through the use of measures that do not rely on conscious self-assessment. Although there are many such measures, what they have in common “is that they all seek to provide an estimate of the construct of interest without having to directly ask the participant for a verbal report” (Fazio & Olson, 2003). A primary benefit is that such measures minimize the pressure some participants may feel to provide socially desirable answers, which is a nontrivial issue when assessing outcomes related to risky or illegal behaviors. The measures we are introducing here in an alcohol-related context (and that have already been used in a drug-prevention context [Comello, 2011; Comello & Slater, 2011]) are non-deliberative in that the primary indicator of interest is quickness to respond to a yes/no question. Although the manifest content of the response is important as well, the speed with which the answer is given is considerably more revealing, because it reflects the degree to which the construct represented by the response is available to guide behavior – and it is precisely this aspect of responding that is beyond the conscious control of most participants.

The key non-deliberative outcome we examine in this study is behavioral willingness, which has been described as an openness to engage in risky behaviors that is related to but different from intention (Gibbons et al., 1998; Gibbons, Gerrard, & Lane, 2003). Whereas intention is a product of deliberative thought, willingness can be characterized as reactivity to behavioral cues that may be present in risk-conducive situations. Such a construct makes intuitive sense, because it is easy to imagine that most respondents would report intentions to avoid risky behaviors but may nevertheless be willing to engage in the behaviors if they found themselves in an environment that made the behavior attractive, easy, and expected. Gibbons and colleagues (1998) demonstrate that while willingness is correlated with intention, willingness predicts behavior independent of intention.

The conceptualization of behavioral willingness as a non-deliberative vs. deliberative pathway to behavior would imply an operationalization using non-deliberative measures. However, the original measures of willingness are deliberative in that participants are asked to estimate the probability of engaging in acts at varying levels of risk. A non-deliberative measure of behavioral willingness, however, was recently introduced in the context of evaluating the “Be Under Your Own Influence” ads for impact on marijuana related risk behaviors (Comello & Slater, 2011); the measure proved sensitive to the effects of condition, with lower willingness to use marijuana after exposure to campaign vs. comparison and control ads. In the same study, a deliberative measure of intention was not sensitive to the effect of condition, demonstrating greater sensitivity of the non-deliberative measure of willingness. Other recent work (Goodall, 2009) showed the effects of alcohol advertisements on a non-deliberative measure of willingness but not on a traditional deliberative measure of alcohol attitude. Although it is acknowledged that the ideal comparison would be between deliberative vs. non-deliberative versions of behavioral willingness in the same study, measuring both in the same study would likely sensitize participants to the construct and would thus reduce measurement quality. However, the studies cited above provide reason to think that non-deliberative measures of willingness may have advantages over deliberative measures as outcomes in studies of substance-related message effects (see also Czyzewska & Ginsburg, 2007).

The findings suggest that we might expect effects on willingness to engage in alcohol-related risky behaviors in the current study. Such a prediction is further indicated by the impact of the “Be Under Your Own Influence” ads on reducing alcohol use in the field and the possibility that the effects may be explained by reductions in willingness. Thus, it was hypothesized that exposure to the treatment (vs. control) ads will be associated with lower willingness to engage in a variety of risky behaviors involving alcohol.

Method

Participants

The sample was composed of 105 undergraduates at a large Midwestern university. The mean age was 20.12 (SD = 1.97), and 61% were female. The breakdown by ethnicity was White (88%), Black (4%), Asian (6%), and other (2%). The data for the present study were gathered at the same time as the data used in the previously described study on marijuana-related outcomes. The protocol and materials were approved by the Institutional Review Board at the university where data collection took place. To recruit participants, announcements were made in large classes about the opportunity to participate in a lab experiment for a small amount of course credit. Participants provided informed consent by signing a consent form before beginning the experiment.

Design and Stimuli

The study used a post-test-only experimental design with random assignment to treatment or control conditions. Stimuli for the treatment condition featured all four ads from the first year of the two-year campaign. These ads conveyed the desirability of making the right choices and of working toward future goals, and that drug and alcohol use would undermine such efforts. An example of copy from one of the print ads demonstrates the autonomy theme: “Tougher. Smarter. I want to get there now. Not later. I’m living out loud. In the fast lane. And I’m doing it without drugs and alcohol. I’m under my own influence. How about you?” This particular copy was accompanied by young athletes involved in a competition, along with the tagline “Be Under Your Own Influence.” The other ads conveyed a similar message and depicted youth engaged in other fun activities. In both conditions, the advertisements were presented in random order.

The control condition featured four informational ads for consumer products such as mattresses and air travel that appeared in national publications. The treatment and control conditions were comparable in that both contained print ads of sufficient production quality to be used for national dissemination. Additionally, the stimulus materials were comparable in overall levels of arousal produced. Previous research has shown that higher levels of arousal are associated with slower reaction times (Lang, Bolls, Potter, & Kawahara, 1999). Thus, if the conditions differed in arousal capacity, one would expect to see differences in baseline reaction speed in the practice task that was administered immediately after exposure. However, there were no group differences on this task, $F(1,103) = .97, p = .33$. (Additional information on the baseline measure is provided in the following sections.)

Measures

Dependent variables—Our general approach in measuring constructs was to use response latency in speeded categorization tasks. For this study, participants had to respond to a single word or phrase (described in more detail for each outcome below) on a computer screen by pressing one of two buttons on the keyboard to indicate “yes” or “no.” Thus, the outputs of the task are response (yes/no) as well as reaction time (measured in milliseconds), with quicker reaction times indicating greater accessibility.

Alcohol-related behavioral willingness was operationalized using speeded dichotomous judgments of whether one would participate in a risky behavior, consistent with the conceptualization of willingness as reactive rather than reasoned (Gibbons et al., 1998), and consistent with recent operationalizations of willingness in the context of marijuana use (Comello, 2011; Comello & Slater, 2011). Participants were asked to imagine themselves at a party with friends and to decide how they would act in three potentially risky situations that might arise in such a context. The situations involved opportunities to get drunk by playing shots, to get drunk by playing beer pong, and to drive while intoxicated. After reading each scenario (which was not a timed task), participants viewed another screen that contained a single risky action, and participants had to decide quickly whether or not they would act as described by pressing “yes” or “no.”

The situation involving shots asked “Suppose you are with friends who start playing a drinking game involving repeated shots of hard liquor. What would you do?” The single behavioral choice was “I would play until I was very drunk,” and the choices were “yes” and “no.” For willingness to play beer pong, participants were asked “Suppose you are with friends who start playing beer pong. This game includes two teams, and members of each team try to throw ping pong balls across a table into full cups of beer. If a ball lands in a person's cup, that person must quickly drink the entire contents. What would you do?” The risky action choice was the same as for willingness to play shots. Finally, to assess

willingness to drink and drive, participants were asked “Suppose you have been drinking with friends at a party several miles from campus. You and your friends are ready to go home, and you are the one who drove. You are buzzed, but not as much as your friends. What would you do?” The choice was “I would drive my friends home.” The order of presentation of items was randomized.

Other variables taken into account—Given the reaction-time measures of the present study, it was critical to account for individual differences in ability to respond quickly to prompts (Fazio, 1990). The measure of baseline reaction speed was participants’ mean reaction time in a practice categorization task that preceded all other tasks in the study. Because the correlations between average quickness and all outcomes were significant and moderate in strength, it was included as a covariate. Condition had no effect on baseline reaction speed, thus fulfilling the requirement of independence between the covariate and independent variable.

Gender was examined for potential interactions with condition in light of the gender differences that have emerged in alcohol-related research among young adults (Wechsler, Dowdall, Davenport, & Rimm, 1995) and in advertising information processing (Wolin, 2003).

Procedure

The study used DirectRT (Jarvis, 2008a) and MediaLab (Jarvis, 2008b) software programs for presenting stimuli and recording responses. After signing consent forms, participants were randomly assigned to condition and were seated at individual computer stations. In each condition, participants viewed four print ads for 20 seconds each. After each ad, participants were asked to give a one-sentence description of the ad as a check that participants had viewed it. After viewing all of the ads, participants received onscreen instructions and went through a practice run to gain familiarity with the reaction-time task. (As previously noted, condition had no effect on mean baseline reaction speed from the practice run.) The practice run was followed by the reaction-time tasks assessing behavioral willingness to use alcohol, followed by deliberative questions measuring demographics. After answering these items, participants were debriefed and dismissed with thanks.

Data Cleaning and Analysis Plan

Reaction-time data, which tend to have a strong positive skew, were handled based on guidelines from Fazio (1990). Data were transformed using a negative reciprocal transformation ($-1000/x$). The transformed data correspond to the raw data, in that lower transformed scores indicate lower raw scores; in other words, more negative scores indicate faster reaction times. These data were used in subsequent analyses, although Table 1 reports untransformed data for easier interpretation.

The plan was to conduct preliminary analysis to examine the distribution of “yes” and “no” responses for each outcome. The distribution of “yes” and “no” outcomes across conditions was assessed with chi-square tests to determine whether condition had an effect on valence of response. Such an outcome may be quite unlikely, if it is indeed the case that traditional deliberative measures of willingness are not sufficiently sensitive to non-deliberative message processing effects, as has already been argued. A key objective, however, for inspecting distribution equivalence across conditions would be to establish the independence of the variables, which would indicate that it would be permissible to use valence as a blocking variable in analysis.

Analysis of covariance (ANCOVA) was used for all analyses. Condition, gender, and valence of response were entered as factors. Average reaction-time in the practice task was transformed with a negative reciprocal transformation and then entered as the covariate. For analyses including response valence as a factor, it is important to note that hypothesis support would not be indicated by a significant main effect of condition, which would collapse across “yes” and “no” responses, but rather by a significant interaction of condition with valence, followed up by decomposition of the interaction to examine the effect of condition separately for “yes” and “no” responses. An effect in the hypothesized direction at this level could then be taken for hypothesis support.

Results

Table 1 reports adjusted raw mean reaction times for each dependent variable by condition, valence, and gender, as well as numbers of participants by condition and valence.

Preliminary analysis

Inspection of percentages of “yes” and “no” responses for each outcome indicated that half or more of the responses were consistent with non-risky behaviors. For the outcome of getting drunk by playing shots, 57% of participants indicated unwillingness (responded “no” to “I would play until I was very drunk”). With respect to the two other outcomes, 50% indicated unwillingness to get drunk playing beer games, and 76% indicated unwillingness to drive friends home while intoxicated. To see if these distributions were different across conditions, chi-square tests were conducted. The results showed no effect of condition on valence across outcomes: beer games ($\chi^2 = .01$, $df = 1$, $p = .96$), pong ($\chi^2 = .11$, $df = 1$, $p = .75$), and driving while intoxicated ($\chi^2 = 1.05$, $df = 1$, $p = .31$). Given no differences, valence was used as a blocking variable for subsequent analysis, per the analysis plan.

Main results

It was predicted that exposure to treatment (vs. control) ads would result in lower willingness to engage in risky behaviors involving alcohol, which was operationalized in this study as unwillingness to get drunk playing beer games at a party, to get drunk playing shots at a party, and to drive while intoxicated. The hypothesis was supported for all but one scenario.

For the outcome of playing beer games, responses were first collapsed across gender because preliminary analyses showed no differences by gender. ANCOVA results showed a significant interaction between condition and valence of response, $F(1,100) = 4.93$, $p = .03$, partial $\eta^2 = .05$. Among those who indicated unwillingness (“no” response to “I would play until I was very drunk”), responses were faster among those who were exposed to treatment vs. control. However, among those who indicated willingness (“yes” response to “I would play until I was very drunk”), the opposite pattern was observed, with faster responses among those who were exposed to control. Further probing showed that the difference in treatment vs. control was significant for those who indicated unwillingness [$F(1,44) = 4.18$, $p = .05$, partial $\eta^2 = .08$], but not among those who indicated willingness, $F(1,55) = 1.14$, $p = .29$.

For the outcome of playing shots, responses were also collapsed across gender because preliminary analyses showed no differences by gender. However, subsequent analysis showed no significant interaction between condition and valence, $F(1,100) = .06$, $p = .81$.

For the outcome of driving friends home while intoxicated, there was a significant three-way interaction among condition, valence, and gender, $F(1,96) = 7.32$, $p = .008$, partial $\eta^2 = .07$. The pattern of results was such that for males, exposure to the treatment condition vs.

control seemed to quicken “no” responses and delay “yes” responses, with the opposite pattern observed among females. Separate analyses by gender showed that the interaction of condition and valence was significant only for males [$F(1,36) = 9.01, p = .005$, partial $\eta^2 = .2$] but not for females [$F(1,59) = 1.03, p = .32$]. Further decomposition of the interaction for males revealed a significant effect of condition only for those who indicated unwillingness to drive while intoxicated [$F(1,26) = 5.53, p = .03$, partial $\eta^2 = .18$], with greatly lowered willingness associated with treatment. However, the difference was not significant for males who were willing, $F(1,9) = 3.07, p = .11$.

Discussion

The purpose of this study was to evaluate the cross-context applicability of a non-deliberative approach to measuring behavioral willingness, as well as to explore the psychological impact of a general purpose substance-abuse prevention campaign (“Be Under Your Own Influence”) on alcohol-related outcomes. The most striking pattern that emerged was the effect of condition on those who indicated unwillingness, with lower willingness among those exposed to campaign ads to play beer drinking games and (for males) to drive while intoxicated. These effects were in the predicted direction, consistent with the effects of the field-tested campaign on behavior in the field. Taken together with previous experimental findings relative to marijuana use, the present study demonstrates the cross-substance effectiveness of the campaign at the psychological level.

In addition, the results underscore the utility of non-deliberative behavioral willingness measures as outcomes in risk-prevention contexts. Most decisions to engage in risky behavior are often made impulsively in social situations, when there might be pressure to respond quickly to social demands in ways that are perceived as socially desirable (Gibbons et al., 1998; Gibbons et al., 2003). In our view, the non-deliberative measure provides the closest epistemic association to this situation than does the traditional deliberative measure, which is inherently a reasoned and cognitively reflective response. Although it is acknowledged that the traditional measure provides more manifest response options than does the dichotomous non-deliberative measure, we suggest that the sensitivity of the non-deliberative measure lies in the reaction-time component rather than in the valence. This paper therefore contributes to the literature by demonstrating the sensitivity of these measures to media effects, as well as applicability in an alcohol prevention context.

For the three alcohol-related scenarios that were used as behavioral willingness outcomes, there were effects on unwillingness to drive while intoxicated and to play beer games, but not on unwillingness to play shots. It is unclear why this should have been the case. However, it is possible that because hard liquor is involved, drinking shots may be perceived as a more “hard core” behavior than playing beer pong or driving while under the influence. If this is the case, then there may be less ambiguity surrounding decisions to avoid participating and therefore less opportunity for persuasive messages to facilitate quickness of response.

This study has limitations. The convenience sample of college students limits the generalizability of findings. However, it should be noted that the campaign messages tested here were aimed at middle-school students, so this was a conservative test with respect to effects on the intended audience. Although a middle-school sample would have been ideal, the reaction-time measures required computer-administered data collection, and it was not feasible to bring middle-school students to campus or to arrange for equipment and software to be brought to schools. We used a purposive sample of ads (given the campaign-evaluation objective of the study), but doing so limits the generalizability of findings to other campaigns. To increase generalizability, future study should employ random sampling from

predefined populations of ads. In terms of measurement, the reaction-time measures represent a new approach to assessing willingness and have yet to undergo formal reliability and validity testing. Research is planned that will develop multiple-item measures of willingness with high reliability, as well as help establish correspondence of the reaction-time measures with behavior. Another limitation is that there are potential moderators of message effects on alcohol-related willingness that our study was not able to explore. These variables include attitudes, perceived norms, and outcome expectancies related to alcohol, as well as general orientation toward risk (i.e., sensation seeking; Zuckerman, 1979). Future work should examine how these variables may qualify message effects on willingness in order to enhance understanding of the persuasive process.

In summary, this study fulfilled campaign-evaluation objectives of exploring mechanisms underlying behavioral effects and of assessing outcomes pertinent to a campaign goal (alcohol prevention) that have not been studied to date. The results suggest that the campaign had an effect by lowering behavioral willingness to engage in some types of risky alcohol use, such as playing beer pong and (among males) willingness to drive while intoxicated. The study also demonstrated the utility of measuring campaign effects using non-deliberative measures to best capture the automatic processing of messages that may take place, as well as the nature of pressured decision-making in social situations. It is suggested that such measures can be a valuable tool for planning or evaluating campaigns because they can illuminate the psychological processes underlying behavior change.

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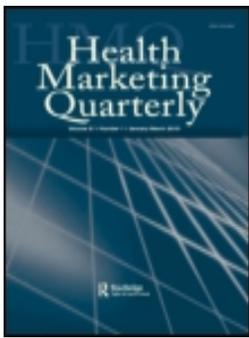
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Table 1

Adjusted Raw Mean Reaction Times in Milliseconds by Condition, Valence, and Gender

<i>Dependent variable</i>	<i>Treatment (n = 54)</i>		<i>Control (n = 51)</i>	
	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Females</i>
Get drunk playing shots				
Unwilling (n = 60)	2134 (328)	1971 (241)	1555 (332)	1911 (263)
Willing (n = 45)	1717 (311)	1995 (325)	1668 (407)	1714 (278)
Get drunk playing beer pong				
Unwilling (n = 47)	2719 (493)	1317 (334)	2116 (464)	2024 (381)
Willing (n = 58)	1729 (354)	2418 (368)	1380 (458)	1784 (314)
Drive while intoxicated				
Unwilling (n = 82)	1544 (237)	1321 (180)	2041 (244)	1199 (173)
Willing (n = 23)	1282 (320)	1559 (368)	854 (452)	2192 (406)

Note. Reaction times are in milliseconds. Standard errors are in parentheses. Means were adjusted for baseline reaction speed. Raw data are reported in table but were transformed prior to analyses.



Comparing Effects of “My Anti-Drug” and “Above the Influence” On Campaign Evaluations and Marijuana-Related Perceptions

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Comparing Effects of “My Anti-Drug” and “Above the Influence” On Campaign Evaluations and Marijuana-Related Perceptions

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Two national campaigns—My Anti-Drug and Above the Influence—have been implemented to prevent youth substance use. Although Above the Influence was conceptualized as a major shift in messaging from My Anti-Drug, no studies have reported head-to-head tests of message effects on behavior-relevant outcomes. An experiment was conducted in which participants viewed ads from one of the campaigns and answered questions about ad appeal and emotional tone; campaign appeal; and marijuana-related beliefs. Compared to My Anti-Drug ads, Above the Influence ads were associated with more positive emotional tone and with lower perceptions of marijuana risk. Implications for message design and evaluation are discussed.

KEYWORDS *media campaign, drug prevention*

Although billions of taxpayer dollars have funded televised national campaigns to prevent youth substance use, most of these efforts have had null or even adverse effects (Hornik, Jacobsohn, Orwin, Piesse, & Kalton, 2008). However, because the most recent national campaign has shown

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promise in the field (Carpenter & Pechmann, 2011; Slater, Kelly, Lawrence, Stanley, & Comello, 2011), it is important for public health marketers and researchers to understand how this campaign differs from earlier efforts in terms of ability to influence antecedents to behavior. Such knowledge has potential to guide the design and pretesting of future campaigns to maximize effectiveness and to make best use of public funds.

The present study is the first to pit the two most recent national antidrug media campaigns in tests of effectiveness in a lab experiment. The process of copy-testing ads in the laboratory is common in advertising to increase the likelihood that ads have intended effects when they are deployed in the field (see Pechmann & Andrews, 2011). Although the current study examines ads that have already been released, testing at this stage offers a chance to reassess strategy and presumed mechanisms underlying change. In line with other studies of advertising effectiveness, the outcomes of interest are well-known antecedents to behavior such as attitudes toward ad, campaign, and product category (i.e., marijuana), as well as perceived emotional tone of ads. In addition to individual ad ratings, the study considers ratings of the campaign as a whole based on exposure to multiple ads. The results shed light on differences between the campaigns that should help inform future prevention efforts.

Background

The prevention of marijuana use among young people continues to be an important focus of national public-health efforts. Rates of use among teens appear to be on the rise, coupled with declining levels of perceived risk (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Heavy use is linked to cognitive and psychomotor impairment (O'Shea, McGregor, & Mallett, 2006), and driving under the influence of marijuana is a direct contributor to motor-vehicle accidents (Ramaekers, Berghaus, van Laar, & Drummer, 2004).

To create a media environment supportive of nonuse, U.S. Office of National Drug Control Policy (ONDCP) has worked with major advertising agencies and behavior-change experts to develop national media campaigns aimed at preventing marijuana and other substance use. As the first major branded effort, the My Anti-Drug campaign focused primarily on the negative consequences of marijuana use, consistent with behavioral prediction models that emphasized the role of beliefs about consequences. (The campaign name was modified slightly in each ad, with "Your" and "My" sometimes used in place of "The." For simplicity, the campaign is referred to here as My Anti-Drug, or MAD.) Before being launched, ads were submitted to a rigorous quantitative copy test, and only the ads that were successful in increasing perceived marijuana risks and in moving other targeted beliefs were allowed to air (Foley & Pechmann, 2004; Pechmann & Andrews, 2011).

A more detailed description of campaign development is provided by Worden and Slater (2004).

Despite these efforts, an evaluation of the campaign that covered the period from 1999 to 2004 concluded that the campaign “was unlikely to have had favorable effects on youths and may have had delayed unfavorable effects” (Hornik et al., 2008, p. 2229; see also Ginsburg & Czyzewska, 2005). Given the disappointing performance, the campaign was submitted to a major overhaul in 2005. Whereas earlier ads had emphasized negative consequences, subsequent ads focused on increased personal autonomy and other positive consequences of avoiding substances, such as being able to pursue career goals or exciting activities. These ads carry the brand Above the Influence (ATI), and according to a recent field evaluation (Slater et al., 2011), self-reported exposure to the campaign predicted reduced marijuana use and uptake trajectory.

Although it is easy to differentiate MAD and ATI based on brand names and stated platforms, public health communicators should seek to understand how the campaigns differ in terms of impact on psychological constructs that are proposed to influence behavior. Because it is often not feasible to pretest effects on behavior, inclusion of appropriate antecedents to behavior in pre-testing can provide a wider range of outcomes to examine. From a theoretical perspective, researchers can assess whether mechanisms via which ads are presumed to work in the field are actually in operation. Also, a focus on psychological impact can help researchers identify other potential mediators of campaign effects that could be used in future copy-testing and evaluation.

The present study is the first to pit ads from the campaigns in an experimental setting. Not only does this provide an assessment of the latest campaign (ATI) for which no copy-test data have yet been reported; the study also compares effects to those of the earlier, less successful campaign (MAD). In so doing, it may be possible to pinpoint which outcomes are most promising to target in future efforts.

Three key outcomes examined in this experiment include attitude toward ad, attitude toward campaign, and attitude toward product category. Attitude toward ad is a well-known construct in consumer behavior that encompasses feelings of favorability toward the ad itself and that has been shown to mediate consumer choice (Shimp, 1981). Thus, a person who likes an ad for a product will be moved by those feelings of favorability to choose the product. In a prevention context, liking for a prevention ad can lead to greater intention to avoid the unhealthy behavior (Nan & Zhao, 2010). Similar to attitude toward ad, attitude toward campaign is a measure of favorability, except that the object of evaluation is the entire campaign rather than a specific ad (Kelly, Slater, & Karan, 2002).

Whereas attitudes toward ad and campaign refer to advertising, attitude toward product category refers to evaluations of the product itself. In the case of ads against an unhealthy product, the desired effect would be unfavorable

evaluations of the product; previous work has shown that attitude toward product category is an important antecedent of purchase intentions and behavior (Kelly et al., 2002). Attitudes toward marijuana use encompass beliefs about the negative consequences of behavior, which leading models of behavior influence such as Theory of Reasoned Action (Ajzen & Fishbein, 1980) and health belief model (Becker, 1974) indicate is a key determinant of behavior. Although the ads from the MAD campaign were extensively copy-tested to ensure that they increased perceptions of marijuana-use risk (Foley & Pechmann, 2004), similar testing on ATI ads has not been reported.

Finally, this study examines perceived emotional tone of ads, which refers to pleasant and unpleasant emotional states that are evoked. The literature on fear appeals suggests that messages evoking high levels of fear in conjunction with high levels of perceived efficacy may be effective (Witte & Allen, 2000). However, other researchers have noted that fear-based appeals may have weaker desirable effects than expected and potentially harmful unintended effects (Hastings, Stead, & Webb, 2004); this observation seems consistent with the lack of effectiveness of MAD, which included a number of fear-based ads.

Thus, the primary research questions are whether exposure to MAD and ATI ads will result in different ratings of attitude toward ads, emotional tone of ads, attitude toward campaign, and perceptions about marijuana relevant to risk and desirability. Further, with respect to marijuana perceptions, an additional question is whether exposure to either campaign will result in ratings different from baseline measures.

METHOD

Data were collected as a pretest for a larger study utilizing ONDCP ads as stimuli. Institutional Review Board approval was obtained before beginning recruitment and data collection.

Participants

The sample was composed of 96 undergraduate students. The mean age was 21.4 ($SD=2.2$), and 71% were female. The breakdown by ethnicity was White (76%), Black (9%), Hispanic (8%), Asian (2%), and other (5%).

Design

The overall design was a posttest-only, between-subjects design with random assignment to condition. For outcomes presuming exposure to a campaign, the design was a two-group comparison (MAD and ATI). Participants were randomly assigned to view all the ads from one of the campaigns. There

were 48 participants in each group, and eight ads from each campaign. For outcomes relevant to marijuana perceptions, the design was a three-group comparison (MAD, ATI, and control). Participants were assigned to one of three groups: (a) exposure to MAD ads prior to completing attitude toward marijuana-related measures, (b) exposure to ATI ads prior to completing these measures, and (c) no exposure to ads prior to completing these measures. Thus, the marijuana-related responses from participants in the third group served as a baseline against which responses from the other two groups could be compared. For these outcomes, there were 32 participants in each condition.

Procedurally, the goals of this study were combined by assigning participants in the third condition to view either MAD or ATI ads after they had completed the attitude toward marijuana measures. Thus, all participants evaluated all the ads from one of the two campaigns and completed individual ad and overall campaign evaluation measures. However, a third of participants completed the attitude toward marijuana measures prior to exposure.

Stimuli

This study focused on video PSAs produced by the ONDCP for national dissemination. Prior to the experiment, a review was conducted of the population of ONDCP anti-marijuana youth-aimed ads from 2002 through 2007. These ads ($n = 43$) were received as an electronic video collection from ONDCP; in addition, several antimarijuana ads were also reviewed that had been produced since 2007 and that were posted on the Above the Influence website (<http://www.abovetheinfluence.com/the-ads/>).

The review was intended to cull out ads that would obviously not be suited for the present study and the college-aged sample that was anticipated. Ads were first excluded if they contained animated characters ($n = 7$) or if they contained no human characters at all ($n = 1$). Next, ads were reviewed for age appropriateness to a college audience. Because the ONDCP ads were developed for audiences younger than college age, there was a concern that some ads would too strongly evoke a high-school or middle-school environment and might be considered irrelevant. To identify potentially problematic ads, the author and a research assistant viewed all ads and flagged those that contained scenes of high school or middle school (e.g., lockers in hallway, etc.); statements from characters that college is still far in the future; clear evidence that main characters are living at home on a permanent basis; and obviously very young looking characters. After this process, 16 ads remained, evenly split between MAD and ATI (Table 1). Participants viewed all eight ads from one of the conditions. Exposure to multiple ads allowed participants to get a sense of the campaign as a whole to enable measurement of attitude toward campaign.

TABLE 1 Descriptions of Ads by Campaign

	Description	Attitude toward ad	Emotional tone
My Anti-Drug			
Concert	Boys at concert get busted for smoking pot in the restroom.	3.51 (1.70)	-0.85 (1.92)
Drive-thru	Boys going through drive-thru in car are high; driver accidentally hits child on bike.	2.69 (1.31)	-3.60 (2.23)
Couple	Girl who is high at party is unable to ward off advances of male.	3.18 (1.76)	-3.44 (1.98)
4-cigarettes	Boy rolls contents of four cigarettes into a large joint.	3.40 (1.18)	-1.53 (2.01)
Memorial	Boy remembers younger brother, whom he killed in auto accident while he was driving under influence.	2.25 (1.24)	-3.29 (1.87)
Wallet	Boy talks disparagingly about older brother who smokes pot and hasn't accomplished much in life.	2.89 (1.36)	-1.38 (2.23)
Championship	Boy gets kicked off basketball team for smoking pot and blows team's chance at championship.	3.27 (1.73)	-1.18 (1.77)
Shacoya	Girl talks about her aspirations and how she refuses to succumb to friends' influence to smoke pot.	2.88 (1.50)	1.63 (2.00)
Above the Influence			
Transformation	Boy stands in middle of room while people do various things to him. He finally tells them to stop and he walks away.	2.49 (1.21)	-0.67 (1.42)
Smushed	Girl who appears flattened talks about how she got that way by giving in to pressure.	3.77 (1.53)	-1.07 (1.75)
Whatever	Boy driving car talks about how he lives life for his friends, who are always high.	2.73 (1.38)	0.24 (2.02)
Pete's couch	Boy describes smoking pot as the most boring and safe activity in the world and says he prefers to take his chances.	2.38 (1.36)	1.02 (2.08)
Conversation	Boy feels regret for getting high at party and not taking someone home as promised.	2.69 (1.13)	-1.78 (1.60)
Shadows	Boy shooting hoops goes off to accept a joint, leaving his shadow sitting dejected on the court.	3.71 (1.06)	-0.76 (1.44)
Shoulders	Boy gets offered joint at party. He hears voices with arguments for and against accepting, but realizes his voice is only one that matters.	3.02 (1.49)	0.69 (1.69)
T-shirts	Boy wearing many T-shirts removes them until he is left with one that reads "Above the Influence."	3.52 (1.50)	0.53 (1.75)

Note. Ad ratings represent means with standard deviations in parentheses.

Measures

Attitude toward ad (MacKenzie & Lutz, 1989; Mitchell & Olson, 1981; Shimp, 1981) consisted of five semantic-differential items (good/bad, appealing/not appealing, not irritating/irritating, effective/not effective, and powerful/weak) on a 1–7 scale ($\alpha = .86$). These items were averaged for each ad; then the mean score across all ads for each campaign was calculated to serve as an overall measure of ad evaluations in tests of campaign effects.

Emotional tone (Pechmann & Reibling, 2006) was assessed by asking whether the ad made the participant feel angry, sad, and disgusted ($\alpha = .79$), and amused, happy, and upbeat ($\alpha = .76$), with responses on a 1–7 scale anchored by *not at all* and *a lot*. As with attitude toward ad, emotional tone served as an individual ad evaluation but was also averaged across ads. Furthermore, net affect was calculated by subtracting the mean of negative evaluations from positive evaluations in order to characterize the overall balance of emotion elicited by the set of ads in each campaign. Lower (i.e., more negative) scores therefore denote a greater amount of negative affect relative to positive.

Attitude toward campaign (adapted from Kelly et al., 2002) asked participants to consider the campaign as a whole and to evaluate the extent to which they found the campaign cool, appealing, effective, and likeable ($\alpha = .86$). Responses were on a 1–7 scale anchored by *not at all* and *a lot*.

Finally, attitude toward product category items asked participants to indicate the extent to which they thought marijuana use was dangerous, risky, cool, and enjoyable (Kelly et al., 2002). Responses were on a 1–7 scale anchored by *not at all* and *a lot*. The items about whether marijuana is dangerous and risky were combined into an index of perceived risk ($r = .58$, $p < .0005$). The items about whether marijuana is cool and enjoyable were likewise combined into an index of perceived desirability ($r = .66$, $p < .0005$). These indexes were treated as related outcomes in MANCOVA.

COVARIATES

Age, gender, television affinity (Rubin, 1981), and sensation seeking (Zuckerman, 1979) were measured as potential covariates. Groups were not different with respect to any of the variables, thus indicating that random assignment to group was successful. Only sensation seeking was included as a covariate because it was the only variable that was significantly related to all outcomes; further, it did not interact with the independent variable in predicting any of the outcomes, thus indicating acceptability for use as a covariate. A four-item sensation seeking scale ($\alpha = .78$) was used (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002; Stephenson Hoyle, Palmgreen, & Slater, 2003).

Procedures

The study used MediaLab (Jarvis, 2008) for presenting stimuli and recording responses. Participants signed consent forms and were seated at computer stations in private rooms. Participants then answered questions on demographics and covariates. For one third of the participants, attitude toward marijuana use items appeared at this time. Next, participants viewed all eight ads (appearing in random order) from either MAD or ATI and completed ad evaluation measures after each one. After seeing all the ads, participants completed attitude toward campaign measures. For the two-thirds of participants who had not yet completed attitude toward marijuana measures, those items appeared next. Finally, all participants were debriefed and thanked.

RESULTS

Table 1 provides a description of ads by campaign, as well as mean scores for attitude toward ads and net emotional tone. Interestingly, although the set of MAD ads includes the three most negative ads, it also contains the ad with the most positive emotional tone. It should be noted that this particular ad was developed toward the end of the MAD campaign; at this point, the campaign had already received substantial criticism and was beginning to make changes in message strategy.

Table 2 shows overall and group means of all key outcomes.

The primary objective of the study was to conduct tests of campaign effects. Campaigns did not differ in terms of mean attitude toward ad, $F(1,93) = .04$, $p = .85$, nor in attitude toward campaign, $F(1,93) = .18$, $p = .67$. However, there was a significant difference in emotional tone, $F(1,93) = 40.45$, $p < .0005$, partial $\eta^2 = .30$. The net emotional tone of MAD ads ($M = -1.71$, $SE = .17$) was more negative than that of ATI ads ($M = -0.22$, $SE = .17$).

Whereas the individual-ad evaluation measures were taken after campaign exposure for all participants, attitudes toward product category (marijuana) were measured before exposure for a third of participants to serve as baseline, thus creating three levels of exposure. MANCOVA was

TABLE 2 Overall and Group Means for Ad, Campaign, and Marijuana Evaluations

Dependent variable	Overall	MAD	ATI	Control
Attitude toward ad	3.02 (.10)	3.01 (.14)	3.04 (.14)	N/A
Attitude toward campaign	4.80 (.12)	4.75 (.18)	4.86 (.18)	N/A
Net emotional tone	-0.97 (.12)	-1.71 (.17)	-0.22 (.17)	N/A
Perceived risk	4.27 (.17)	4.87 (.30)	3.84 (.29)	4.10 (.29)
Perceived desirability	2.89 (.16)	2.59 (.27)	2.82 (.27)	3.26 (.27)

Note. Means adjusted for sensation seeking; standard errors in parentheses. MAD = My Anti-Drug; ATI = Above the Influence.

conducted to see if the perceived risk index (risky and dangerous) and the perceived desirability index (cool and enjoyable) would as a pair discriminate among levels. Results were significant at the multivariate level, Wilks' $\lambda = .89$, $F(4,182) = 2.84$, $p = .03$, partial $\eta^2 = .06$.

At the univariate level, there were no group differences on the perceived desirability index, $F(2,92) = 1.54$, $p = .22$. However, results were significant for the perceived risk index, $F(2,92) = 3.29$, $p = .04$, partial $\eta^2 = .07$. Pairwise contrasts showed that MAD exposure was associated with significantly higher risk perceptions ($M = 4.87$, $SE = .30$) compared to ATI exposure ($M = 3.84$, $SE = .29$; M difference = 1.03, $p = .02$), and marginally higher compared to baseline ($M = 4.10$, $SE = .29$; M difference = .77, $p = .07$). Risk perceptions were lower among those exposed to ATI compared to baseline, but the difference was not significant (M difference = $-.26$, $p = .53$).

DISCUSSION

The purpose of this study was to shed light on the success of the revamped national media campaign (ATI) by comparing it to a previous effort (MAD) in terms of psychological impact. The data suggest that MAD and ATI differ in terms of impacts on perceived risk and emotional tone, based on evaluations of the ads included in this study.

Higher levels of perceived marijuana risk associated with MAD might be expected, given that MAD ads were designed and extensively copy-tested to ensure impact on key beliefs about marijuana dangers (Foley & Pechmann, 2004), whereas ATI ads were not. Nonetheless, if risk perceptions were the primary mechanism via which prevention ads influence behavior (as suggested by rational models of behavior change such as the Health Belief Model), it would seem reasonable to expect higher levels of risk perceptions associated with the more successful ATI campaign; however, that was not the case in this experiment. A theoretical implication is that public health marketers should look beyond conventional models of behavioral influence and consider more recent models that have emphasized non-rational processes underlying behavioral choices (e.g., Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008).

Based on the results, a more promising mechanism seems to be the emotional tone of the campaign. ATI ads included in this study evoked more positive net affect overall compared to MAD. It is interesting to note that the mean net emotional tone of the ATI ads was still slightly more negative than positive ($M = -0.22$, $SE = .17$), which could reflect the mixed emotions evoked by some scenarios or across ads. This may be expected because depictions of choices regarding substance use can sometimes reflect uncomfortable situations, even if the choice results in a positive outcome. However, the study provides some evidence that the ATI campaign was more successful in incorporating positive messaging throughout the campaign, relative to

previous efforts. An implication for future research is to determine what types of narratives evoke the optimal balance between negative and positive emotions with respect to drug prevention issues.

Although differences emerged for emotional tone and perceived risk, there were no differences observed for attitude toward campaign or mean attitude toward ad. What might account for the lack of sensitivity of these established measures? A possibility is that production values might heavily influence attitudes. Given that well-known firms developed both campaigns, the production values were uniformly high; hence, the ads may have elicited similar ratings across campaigns. As with findings related to perceived risk, an implication for practice is that these measures should not be relied on solely in formative evaluations of campaigns as measures of effectiveness. Rather, they should be used in conjunction with outcomes that tap other potential mediating states, such as emotional response. Another possibility for the lack of effects observed in attitudinal outcomes is that deliberative measures (i.e., measures that require thoughtful deliberation to complete) of attitudes may not be ideal for sensitive topics, given the possibility that some participants may provide socially desirable responses. Thus, pretests and evaluations of campaign materials may wish to employ nondeliberative measures (for example, see Comello & Slater, 2011), which may display greater sensitivity to exposure effects.

This study has several limitations. Because undergraduates served as participants in the experiment, generalizations to the target population of ONDCP's efforts (middle- and high-school youth) cannot be made. It should be noted, however, that a college audience would have provided a more conservative test of ad and campaign effects, relative to a younger audience. Additionally, college students may wield influence over the intended audience as older siblings and peers; thus, knowledge of effects among this group has public-health value because of the potential for older students to model attitudes toward prevention efforts and substance use. In terms of stimuli, ads were presented as straightforward stimuli and were not embedded in other content. Future research should examine effects when ads are embedded among filler ads or in original programming. In terms of measures, certainly other variables could have been included as measures of media effects. These include perceived efficacy to avoid drugs, perceived norms, intentions, and behavior. Still, it is noteworthy that some of the measures included here (such as attitude toward ad) are common ad-pretest measures; the current study contributes by revealing the limits of their usefulness in developing drug prevention advertising.

As a step toward further research that links strategies to behavior, the current study identified psychological constructs that were differentially affected by the campaigns, and then considered these effects in light of behavior-based evaluations of the campaigns. It is clear that targeting marijuana risk perceptions alone is not effective, because the more-successful ATI ads did not increase these from baseline or to a level above that associated with

MAD exposure. Nor is it adequate to rely solely on attitudes toward the ads and the campaigns, because these did not substantially differ across campaigns despite the different levels of effectiveness on behavior. On the other hand, broadening theoretical frameworks beyond those that depend on rational processes and, correspondingly, expanding ad pretest measures beyond traditional items may be more effective approaches to designing ads for large-scale media-based prevention efforts.

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Therapist and computer-based brief interventions for drug use within a randomized controlled trial: effects on parallel trajectories of alcohol use, cannabis use and anxiety symptoms

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ABSTRACT

Background and Aims Despite their high comorbidity, the effects of brief interventions (BI) to reduce cannabis use, alcohol use and anxiety symptoms have received little empirical attention. The aims of this study were to examine whether a therapist-delivered BI (TBI) or computer-guided BI (CBI) to address drug use, alcohol consumption (when relevant) and HIV risk behaviors, relative to enhanced usual care (EUC), was associated with reductions in parallel trajectories of alcohol use, cannabis use and anxiety symptoms, and whether demographic characteristics moderated reductions over time. **Design** Latent growth curve modeling was used to examine joint trajectories of alcohol use, cannabis use and anxiety symptoms assessed at 3, 6 and 12 months after baseline enrollment. **Setting** Hurley Medical Center Emergency Department (ED) in Flint, MI, USA. **Participants** The sample was 780 drug-using adults (aged 18–60 years; 44% male; 52% black) randomly assigned to receive either a TBI, CBI or EUC through the *HealthiER You* study. **Interventions and comparator** ED-delivered TBI and CBIs involved touchscreen-delivered and audio-assisted content. The TBI was administered by a Master's-level therapist, whereas the CBI was self-administered using a virtual health counselor. EUC included a review of health resources brochures in the ED. **Measurements** Assessments of alcohol use (10-item Alcohol Use Disorders Identification Test), cannabis use (past 30-day frequency) and anxiety symptoms (Brief Symptom Inventory-18) occurred at baseline and 3-, 6- and 12-month follow-up. **Findings** TBI, relative to EUC, was associated with significant reductions in cannabis use [$B = -0.49$, standard error (SE) = 0.20, $P < 0.05$] and anxiety ($B = -0.04$, SE = 0.02, $P < 0.05$), but no main effect for alcohol use. Two of 18 moderation tests were significant: TBI significantly reduced alcohol use among males ($B = -0.60$, SE = 0.19, $P < 0.01$) and patients aged 18–25 years in the TBI condition showed significantly greater reductions in cannabis use relative to older patients ($B = -0.78$, SE = 0.31, $P < 0.05$). Results for CBI were non-significant. **Conclusions** Emergency department-based therapist-delivered brief interventions to address drug use, alcohol consumption (when relevant) and HIV risk behaviors may also reduce alcohol use, cannabis use and anxiety over time, accounting for the overlap of these processes.

Keywords Alcohol, anxiety, brief intervention, cannabis, emergency department, latent growth curve modeling.

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INTRODUCTION

Alcohol and drug misuse quadruple the risk of emergency department (ED) injury-related admissions world-wide [1,2]. Thus, the ED provides an invaluable setting for

screening, brief intervention and referral to treatment (SBIRT) for substance use. The efficacy of SBIRT in health-care settings, including the ED, however, has been mixed. Prior studies have supported the efficacy of alcohol brief interventions (BI) [3–5], although BIs targeting drug

use have yielded inconsistent results [6–11] and the inclusion of boosters has shown no effect [12,13]. Further, the impact of alcohol and drug BIs on comorbid mental health problems (e.g. anxiety) is largely unknown.

More recently, *HealthiER You* [14] tested the efficacy of a computer-guided BI (CBI) and a therapist-delivered BI (TBI) relative to enhanced usual care (EUC) for drug-using adults presenting to an ED in a predominately low-income, urban community. The BIs were based on motivational interviewing (MI) and focused on reducing drug use, with HIV risk behaviors as a secondary behavioral target [15]. At 3-month follow-up, participants were re-randomized to receive either an adapted motivational enhancement therapy (AMET) booster or EUC. At 12-month follow-up, the therapist-delivered BI was associated with reduced number of days using any drug and reduced weighted drug days (the number of days using any drug, weighted by the number of drugs used each day). Both TBI and CBI contributed to fewer cannabis use days compared with EUC. The effects of boosters were non-significant [14].

Despite the promising findings of *HealthiER You*, the effectiveness of BIs for reducing substance use [8,16] in diverse health-care settings remains equivocal. Most previous drug-focused BIs were delivered in primary care settings where the severity of substance use problems tends to be low [17], which may account for a failure to detect significant intervention effects in some studies. One notable exception is Project QUIT [6], which was effective in reducing drug use. By contrast, utilizing an urban ED provided *HealthiER You* opportunities to reach at-risk populations [18] that may be more likely to benefit from brief interventions [8]. To address these inconsistencies, studies are needed to explore potential moderators of BI effectiveness to establish for whom BIs might be most effective, including critical demographic factors such as age, race and sex. For example, alcohol and cannabis use both typically peak during the early to mid-20s and are most common in males and white individuals [19]. Within urban, under-resourced communities, however, cannabis is highly prevalent [20].

In addition to alcohol and cannabis use being highly comorbid [21], anxiety symptoms also commonly co-occur with both alcohol and cannabis use and are associated with greater impairment than substance use alone [21]; as such, it is important to disentangle the processes that are shared versus unique among these co-occurring problems. Competing perspectives have been used to account for the comorbidity between anxiety and substance use disorders (SUD): (1) anxiety symptomatology promotes SUDs, (2) SUDs promote anxiety problems, (3) a third common factor promotes both anxiety and problematic substance use and (4) there are bidirectional effects of anxiety and substance use on one another [22]. Given these complexities, longitudinal studies are necessary to clarify how these processes ‘travel together’ over time. While there is some

evidence that anxiety can moderate the effectiveness of cannabis treatment [22], no studies have tested whether BIs designed to reduce drug use can have positive collateral effects by simultaneously reducing parallel trajectories of alcohol use and symptoms of anxiety. This information would shed light on the extent to which efficacious drug-focused BIs contribute to positive mental health outcomes broadly or have specific effects only on drug use, which would imply the need for tailoring of BIs towards alcohol versus cannabis use versus mental health coping skills more specifically.

To address these gaps in the literature, we used data from *HealthiER You* [14] to examine trajectories of alcohol use, cannabis use and anxiety during a 12-month period among drug-using adults presenting to an ED located in a predominately low-income, urban community who were randomly assigned to receive CBI, TBI or EUC. Next, we investigated whether TBI or CBI (relative to EUC) was related to greater reductions in alcohol use, cannabis use or anxiety symptoms within a parallel process latent growth curve modeling (LGCM) framework that accounted for overlap of these outcomes. The use of LGCM enabled us to explore the unique variation in rates of alcohol use, cannabis use and anxiety symptoms over three follow-up periods (baseline, and 3-, 6- and 12-month) while simultaneously accounting for overlap of these processes [23]. Finally, we tested whether the effectiveness of TBI or CBI (relative to EUC) was moderated by sex, race or age. While prior work using data from *HealthiER You* [14] reported main outcomes, it did not account for the overlap in cannabis use, alcohol use and anxiety symptoms and did not explore moderators of treatment effectiveness. We hypothesized that both BIs (i.e. TBI and CBI) relative to EUC would be related to greater rates of reduction in all three processes—alcohol use, cannabis use and anxiety symptoms, given previous findings that *HealthiER You* BIs reduced cannabis use [14] and that cannabis use, alcohol use and anxiety tend to co-occur, such that improvements in one outcome may contribute to improvements in the others. Because no prior studies have explored potential moderation of parallel trajectories of these processes, we did not have a priori hypotheses about how sex, age or race might moderate the effectiveness of TBI and CBI on intervention outcomes.

METHODS

Study design

The design, procedures, sample and primary and secondary outcomes of the *HealthiER You* trial have been described in detail in prior publications [14,15,24]. Briefly, the trial involved a 3×2 factorial design where participants were initially randomized to one of three conditions delivered at the baseline ED visit: (1) 30-minute CBI, (2) 30-minute TBI or (3) EUC (review of health resources brochures in

the ED, exceeding the standard of care) (see Bonar *et al.* [24], Table 1, for detailed description of the interventions). After a 3-month follow-up assessment, participants were then randomized to receive an adapted motivational enhancement therapy (AMET) booster or EUC-B (B: Booster review of health brochures) (see Blow *et al.*, [14] for further description of AMET procedures). Follow-up staff and 3-month therapists were blinded to baseline condition assignment. Outcomes were measured at 3, 6 and 12 months after baseline enrollment. Procedures were approved by the University of Michigan and Hurley Medical Center Institutional Review Boards and a Certificate of Confidentiality was provided by the National Institutes Health.

Study setting and recruitment

Recruitment and baseline intervention delivery took place at the Hurley Medical Center Emergency Department (ED) in urban, Flint, Michigan from February 2011 to August 2012. Research assistants screened patients aged 18–60 years who were identified through the electronic medical record in the ED. After providing informed consent, patients completed screening measures to determine randomized controlled trial (RCT) eligibility (exclusions included psychosis, medical instability, in police custody, seeking care for suicidal ideation or acute sexual assault, non-English-speaking or illiterate, severe hearing or visual impairment). Compensation for the 15-minute screening survey was a \$1.00 gift (e.g. puzzle books, lotion). To be eligible for inclusion in the study, participants were required to have a Specific Substance Involvement score ≥ 4 for any illicit or misused prescription drug (i.e. stimulants,

sedatives, narcotics) within the past 3 months on the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST [25]). Those agreeing to participate provided a second-stage informed consent and completed additional baseline survey measures and a time-line follow-back [26] interview plus a urine drug test (see [14,24] for more details).

Interventions

The interventions and EUC have been previously described in detail [14,15,24]. Briefly, the interventions were grounded in motivational interviewing [27], with parallel content in the CBI and TBI. Interventions used MI strategies to address participants' drug use, as well as alcohol consumption when relevant, and HIV risk behaviors. The interventions included identifying participants' strengths and goals while addressing drug use via tailored exercises and feedback. After each baseline BI, participants received a summary 'change plan' that was based on elements selected during the intervention (e.g. strengths, tools for change, etc.), as well as resource pamphlets (e.g. housing, food, etc.).

In the CBI, participants used a touchscreen tablet with audio via headphones that included still and moving images and interactive vignettes and exercises led by a virtual counselor, using tailored reflections. The TBI was delivered by Master's-level therapists, trained in MI by study investigators, using a touchscreen tablet to guide the session and maintain intervention fidelity in the chaotic ED environment where interruptions for medical care are common. The TBI covered similar content as the CBI, including focusing on goals, benefits of change, etc.

Table 1 Descriptive statistics for main outcome variables of cannabis use, alcohol use and anxiety symptoms in the whole sample and across each of the intervention conditions.

	Whole sample			Therapist-delivered brief intervention			Computer-guided brief intervention			Control		
	N	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Alcohol use (baseline)	780	5.08	7.22	266	4.94	7.04	257	4.75	6.62	257	5.56	7.94
Alcohol use (3-month follow-up)	628	5.49	7.69	223	5.35	6.96	199	5.21	8.01	206	5.92	8.13
Alcohol use (6 month follow-up)	659	4.25	6.13	234	4.63	6.24	208	3.95	5.99	217	4.14	6.14
Alcohol use (12-month follow-up)	679	4.12	6.43	233	4.46	6.53	221	3.61	6.15	225	4.27	6.57
Cannabis use (baseline)	780	13.06	11.70	266	13.69	11.76	257	11.94	11.65	257	13.53	11.65
Cannabis use (3-month follow-up)	628	13.25	12.06	223	14.39	12.14	199	11.63	11.73	206	13.57	12.16
Cannabis use (6-month follow-up)	659	12.28	12.17	234	13.80	12.53	208	10.44	11.73	217	12.40	12.02
Cannabis use (12-month follow-up)	679	12.46	12.32	233	14.06	12.54	221	9.98	11.42	225	13.23	12.61
Anxiety symptoms (baseline)	778	0.93	1.03	264	0.88	1.01	257	0.95	1.02	257	0.95	1.07
Anxiety symptoms (3-month follow-up)	628	1.00	1.05	223	1.03	1.02	199	0.98	1.10	206	0.99	1.04
Anxiety symptoms (6-month follow-up)	659	0.86	0.96	234	0.92	0.97	208	0.83	1.04	217	0.81	0.88
Anxiety symptoms (12-month follow-up)	679	0.81	0.95	233	0.85	0.97	221	0.82	0.97	225	0.75	0.91

SD = standard deviation.

At 3 months, a 40-minute AMET session was also delivered by Master's-level therapists. This session involved a review of participants' substance use from the past 3 months, which assisted with tailoring the session that was also computer-guided to support therapists in moving through the intervention components. Therapists delivering the TBI and AMET passed proficiency thresholds determined using the Motivational Interviewing Treatment Integrity Code (MITI Moyers *et al.*, unpublished; Motivational Interview Adherent summary score of 99 and 97% for AMET [14]).

At both time-points, the EUC condition involved reviewing a local health resource brochure and HIV prevention information. This information was also given to participants in the other conditions at both baseline and follow-up visits to control for information receipt. Response rates were greater than 80% for all follow-up periods (3 months: 81%, 6 months: 85%, 12 months: 87%) and

were similar in all three intervention groups (CBI, TBI, EUC) [14,24].

Measures

Outcome measures included (a) past 3-month alcohol use severity as measured by the 10-item Alcohol Use Disorders Identification Test (AUDIT [28]), which includes frequency of use, average consumption and binge drinking along with seven consequence items (baseline $\alpha = 0.89$, 3-month $\alpha = 0.90$, 6-month $\alpha = 0.87$, 12-month $\alpha = 0.88$), (b) past 30-day cannabis use frequency as measured by the National Survey on Drug Use and Health (NSDUH) CAI Specifications for Programming [29] and (c) past-week anxiety symptoms as measured by a three-item anxiety subscale of the Brief Symptom Inventory-18 (BSI-18 [30]) (baseline $\alpha = 0.79$, 3-month $\alpha = 0.83$, 6-month $\alpha = 0.82$, 12-month

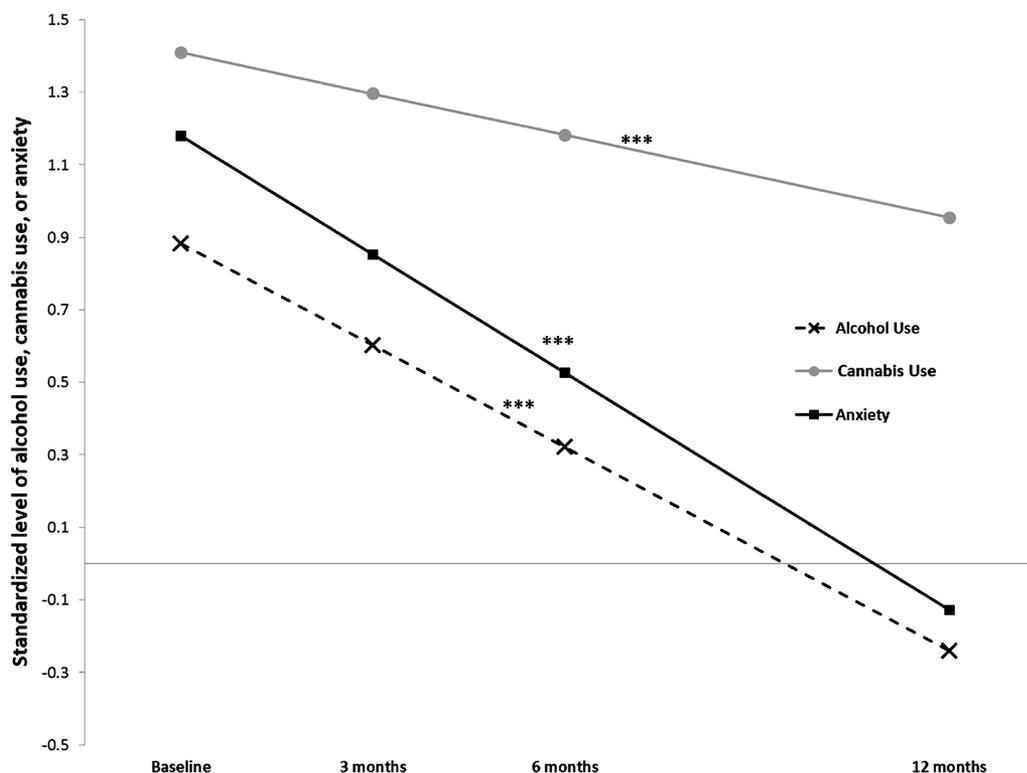


Figure 1 Joint process model showing that alcohol use, cannabis use and anxiety levels decreased significantly across the whole sample from baseline to 12-month follow-up. *** $P < 0.001$. Model fit statistics: comparative fit index (CFI) = 0.94; Taylor–Lewis Index (TLI) = 0.92, root mean square error of approximation (RMSEA) = 0.06, standardized root mean square residual (SRMR) = 0.05. Standardized values reflect Z-scores. Overall, throughout the whole sample, there was a reduction in alcohol use across the four time-points, with significant variance in both starting levels (intercept) and linear change (slope): means: slope, $B = -0.04$, standard error (SE) = 0.01, $P < 0.001$, intercept, $B = 0.96$, SE = 0.04, $P < 0.001$; variances: slope, $B = 0.01$, SE = 0.006, $P < 0.05$. Intercept, $B = 0.66$, SE = 0.06, $P < 0.001$. There was also a reduction in cannabis use across time, with significant variance in both starting levels (intercept) and linear change (slope): means: slope, $B = -0.18$, SE = 0.11, $P = 0.11$, intercept, $B = 13.08$, SE = 0.40, $P < 0.001$; variances: slope, $B = 2.63$, SE = 0.93, $P < 0.01$. Intercept, $B = 86.07$, SE = 5.20, $P < 0.001$. There was a significant correlation between the starting levels of anxiety and alcohol use ($r = 0.31$, $P < 0.001$), but not between anxiety and cannabis use or between alcohol and cannabis use. Finally, there were correlations between slope factors (i.e. correlation in linear change): alcohol and cannabis use, $r = 0.35$, $P < 0.05$; alcohol use and anxiety: $r = 0.47$, $P < 0.05$; cannabis and anxiety: $r = 0.42$, $P < 0.05$.

$\alpha = 0.81$). These measures have well-established validity [31–33].

Analytical plan

Aim 1: Explore trajectories of alcohol use, cannabis use and anxiety during a 12-month period

We used parallel process latent growth curve modeling (LGCM) in Mplus version 7.2 with full information maximum likelihood estimation with robust standard errors based on a covariance matrix generated from multiple covariates (i.e. age, sex, race) to account for any missing data [34]. Scores for alcohol use, cannabis use and anxiety symptoms at baseline, 3-, 6- and 12-month assessments were used as indicators for the intercept (starting values) and slope (linear change) factors for each process, with baseline set as the intercept. The slope and intercept factors for each process (i.e. alcohol use, cannabis use and anxiety) were allowed to covary, to take into account the ‘parallel’ or ‘joint’ nature of the processes unfolding over time at

the latent level (but not at the observed indicator level), and each slope factor was regressed onto each of the three intercept factors. All models also accounted for subsequent AMET randomization [14]. Comparative fit index (CFI: cut-off value 0.95) and root mean square error of approximation (RMSEA: cut-off value 0.06) were used to assess model fit [35].

Aim 2: Impact of intervention on reductions in alcohol use, cannabis use and anxiety and potential moderation by sex, age and race

To explore the main effects of the interventions and potential moderation by sex, age and race, we tested a single path model in Mplus where we regressed slope and intercept factors onto intervention conditions (TBI relative to EUD and CBI relative to EUD) and interaction terms between intervention condition (i.e. TBI or CBI relative to EUD) with sex, race and age. An intent-to-treat approach was used to include all available data for all participants who were randomized. We probed significant interactions

Table 2 Main and moderating effects of intervention condition and sex, age, and race on linear reduction in concomitant cannabis use, alcohol use and anxiety.

	Slope factors								
	Cannabis			Alcohol			Anxiety		
	B (SE)	β	P	B (SE)	β	P	B (SE)	β	P
Main effects									
Male	0.07 (0.40)	0.02	0.871	0.34 (0.19)	0.16	0.070	-0.06 (0.03)	-0.20*	0.023
Age	0.001 (0.02)	0.001	0.998	0.01 (0.01)	0.15	0.065	0.003 (0.001)	0.18*	0.023
White	-0.01 (0.38)	-0.003	0.981	-0.17 (0.17)	-0.08	0.307	-0.03 (0.03)	-0.10	0.233
TBI	-1.01 (0.38)	-0.29*	0.007	0.02 (0.19)	0.01	0.929	-0.06 (0.03)	-0.17*	0.039
CBI	-0.38 (0.37)	-0.11	0.304	-0.10 (0.18)	-0.05	0.569	-0.04 (0.03)	-0.13	0.157
Effects of starting levels									
Cannabis intercept	-0.03 (0.02)	-0.16	0.164	0.004 (0.007)	0.03	0.586	-0.001 (0.001)	-0.09	0.203
Alcohol intercept	-0.004 (0.03)	-0.01	0.883	-0.09 (0.03)	-0.47***	0.001	0.001 (0.002)	0.05	0.564
Anxiety intercept	-0.68 (0.35)	-0.35	0.052	-0.49 (0.18)	-0.39**	0.006	-0.03 (0.04)	-0.14	0.518
Interaction effects									
TBI × male	-0.13 (0.52)	-0.03	0.808	-0.66 (0.26)	-0.22*	0.010	0.05 (0.04)	0.10	0.217
CBI × male	0.37 (0.53)	0.08	0.485	-0.02 (0.27)	-0.01	0.947	0.04 (0.04)	0.09	0.272
TBI × age	0.04 (0.02)	0.16*	0.039	0.02 (0.01)	0.09	0.202	0.001 (0.002)	0.01	0.947
CBI × age	0.001 (0.02)	-0.002	0.985	-0.02 (0.01)	-0.12	0.084	0.001 (0.002)	0.91	0.928
TBI × white	0.45 (0.51)	0.13	0.268	0.24 (0.14)	0.08	0.326	0.07 (0.04)	0.16	0.069
CBI × white	-0.27 (0.43)	-0.06	0.606	-0.05 (0.25)	-0.02	0.842	0.003 (0.04)	0.01	0.937
R ²		0.15**			0.33***			0.29***	

*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$. TBI = therapist-based intervention; CBI = computer-based intervention; SE = standard error. Model fit statistics: comparative fit index (CFI) = 0.93, Taylor–Lewis Index (TLI) = 0.91, root mean square error of approximation (RMSEA) = 0.04, standardized root mean square residual (SRMR) = 0.03. Effects of interventions are relative to a no-intervention control group within a randomized controlled trial (RCT) design. Income was not a significant predictor in the model and its inclusion did not change the findings presented. Thus, consistent with the original publication using this intervention sample, it was not included in the final model (Blow *et al.* [14]). All models also accounted for subsequent AMET randomization (Blow *et al.* [14]). Because depression and anxiety are often comorbid, we controlled for the effects of depression symptoms at baseline on all intercept and slope factors. Higher levels of depression were related to higher starting levels (i.e. intercept factor scores) of anxiety and alcohol use and significant increases (i.e. slope factor) in alcohol use over time (results available on request). Finally, each intercept factor was also simultaneously regressed onto sex, age and race. Starting levels of cannabis use and alcohol use were higher in males, starting levels of alcohol use were lower in white participants, starting levels of cannabis were higher in younger participants and starting levels of anxiety were higher in older participants (results available on request).

by separately exploring slopes for males versus females, white versus non-white participants, and different ages.

RESULTS

Descriptives

Participants were aged 31 years on average [range = 18–60; standard deviation (SD) = 10.9]; 44% ($n = 347$) were male and 52% ($n = 407$) were black (see [14] for further details). At baseline, 66% of the sample ($n = 513$) reported cannabis use problems (ASSIST score ≥ 4), 23% ($n = 179$) displayed harmful alcohol use (AUDIT score ≥ 8) and 25% ($n = 196$) displayed significant symptoms of anxiety (BSI anxiety score > 1.33 , equivalent to a T-score > 63 among both men and women). There were no statistical differences in baseline demographic, drug use or anxiety characteristics across intervention groups (CBI, TBI, EUC). Table 1

presents descriptive statistics for alcohol use, cannabis use and anxiety symptoms across all four assessment points.

Aim 1: Trajectories of alcohol use, cannabis use and anxiety during a 12-month period

Figure 1 displays the longitudinal trajectories of alcohol use, cannabis use and anxiety after accounting for their shared overlap across the whole sample from baseline to 12-month follow-up [CFI = 0.94; Taylor–Lewis Index (TLI) = 0.92, RMSEA = 0.06, standardized root mean square residual (SRMR) = 0.05]. Alcohol use, cannabis use and anxiety symptoms all showed significant reductions over the 1-year follow-up. In support of these processes as being overlapping or ‘joint processes’, higher starting levels (i.e. intercept factors) of anxiety and alcohol use were correlated, and there were significant correlations between slope factors (i.e. correlation in

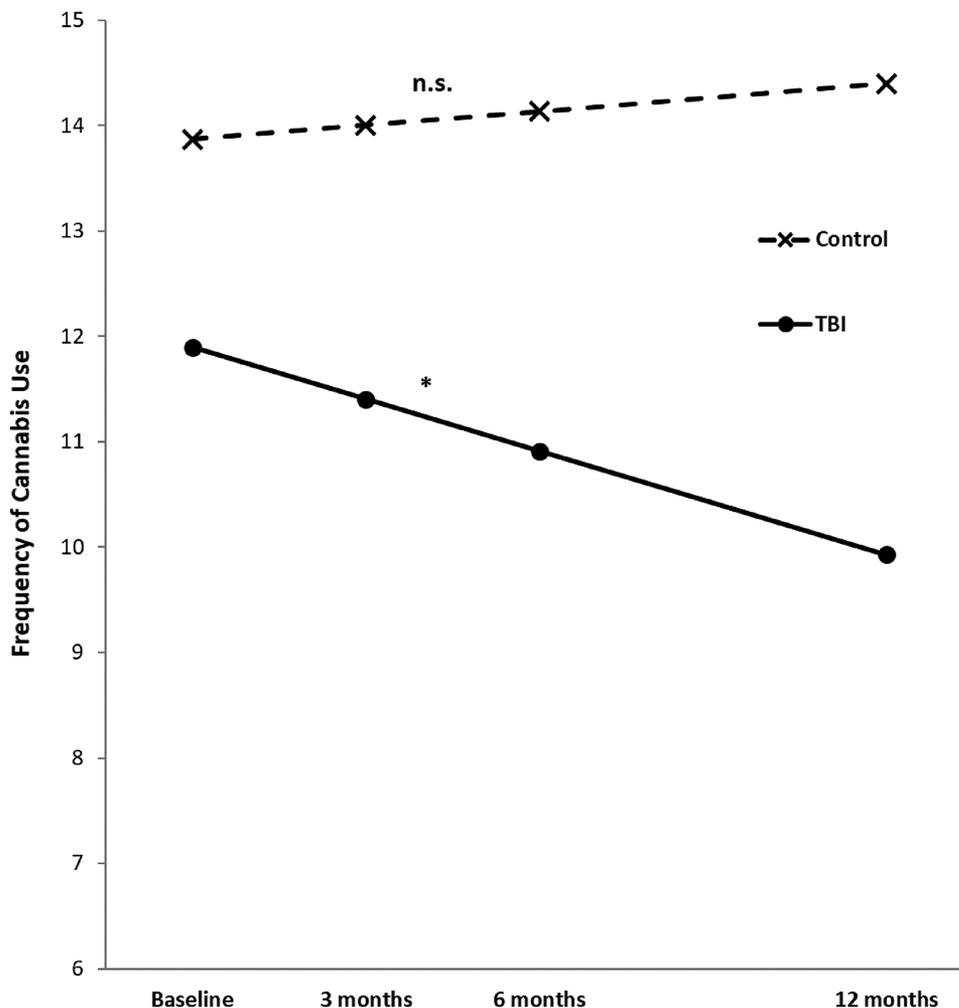


Figure 2 Cannabis use showed a significant reduction over time from baseline to 12 months in the therapist-based intervention (TBI) group. $*P < 0.05$, NS = non-significant. There was a significant linear reduction in cannabis use over time in the TBI group [$B = -0.49$, standard error (SE) = 0.20, $P < 0.05$] but not the control group ($B = 0.13$, SE = 0.20, $P = 0.50$)

rates of linear change) for all three variables. That is, the rate of reduction for all three processes was correlated (see Fig. 1).

Aim 2: Impact of intervention on reductions in alcohol use, cannabis use and anxiety symptoms and potential moderation

Table 2 presents results from the single model regressing slope factors from the parallel process growth model onto the main and moderating effects of intervention condition (TBI or CBI relative to EUC), sex, age and race on linear change. The model also controlled for main effects of sex, age and race on starting levels of substance use and anxiety (i.e. intercept factors) (CFI = 0.93, TLI = 0.91, RMSEA = 0.04, SRMR = 0.03). First, we found a main effect of TBI on cannabis use slope. Specifically, there was a significant reduction in cannabis use over time in the TBI group, but not the EUC group (Fig. 2). Similarly, there was a main effect of TBI relative to EUC on reduction in anxiety levels from baseline to 12-months (Table 2; Fig. 3).

There were no unique main effects of CBI relative to EUC on the rate of change in any of the three parallel processes of alcohol use, cannabis use and anxiety symptoms, taking into account the overlap of these processes.

In the same model, we included interaction terms between intervention condition and sex, age and race. First, we found that sex moderated the effectiveness of TBI on the rate of reduction in alcohol use (Table 2). We probed this interaction by exploring rates in reduction in alcohol use among males and females separately. Relative to the EUC condition, we found a significant linear reduction in the rate of alcohol use over time among males, but not females, in the TBI group (see Fig. 4). Secondly, the effect of TBI on the slope of cannabis use was moderated by age. We explored this interaction among four different age groups. We found that only participants aged 18–25 years who received TBI, but not aged 26–35, 36–46 or 46 and older, showed significant reductions in cannabis use relative to EUC. We

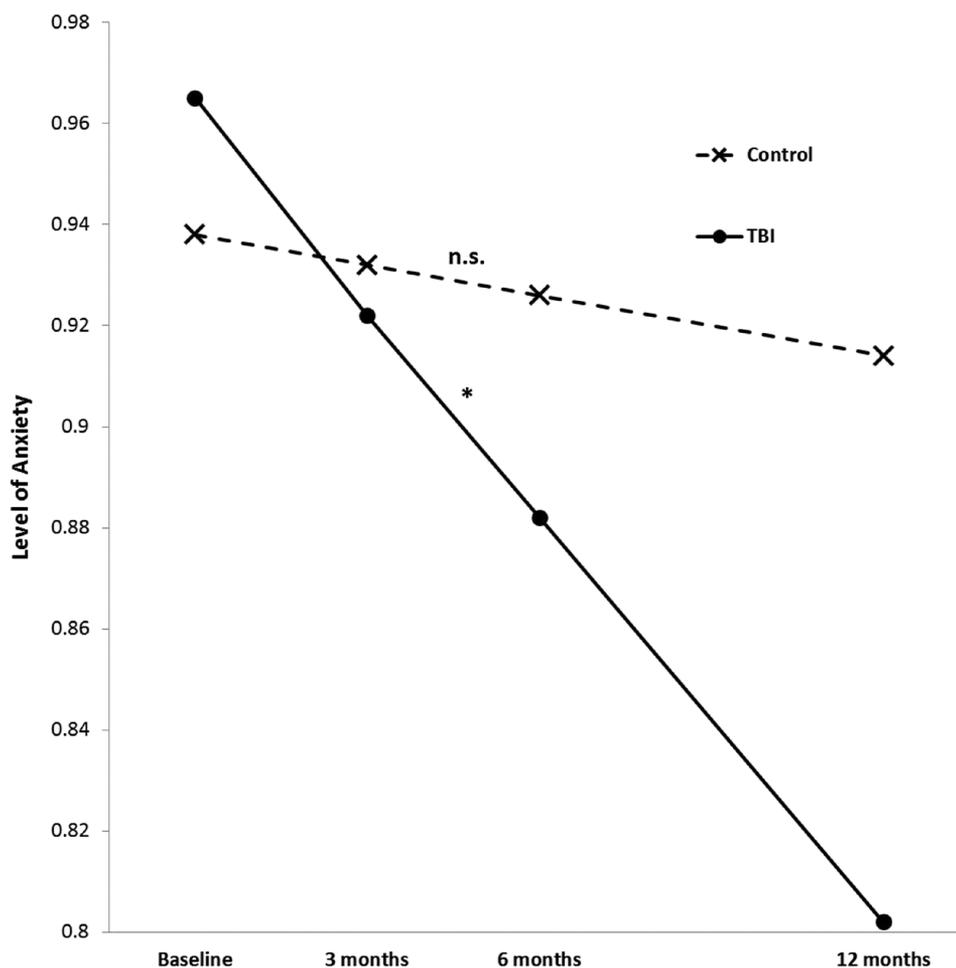


Figure 3 Anxiety level showed a significant reduction over time from baseline to 12 months in the therapist-based intervention (TBI). * $P < 0.05$, NS = non-significant. There was a significant linear reduction in level of anxiety over time in the TBI group [$B = -0.04$, standard error (SE) = 0.02, $P < 0.05$] but not the control group ($B = -0.006$, SE = 0.02, $P = 0.74$)

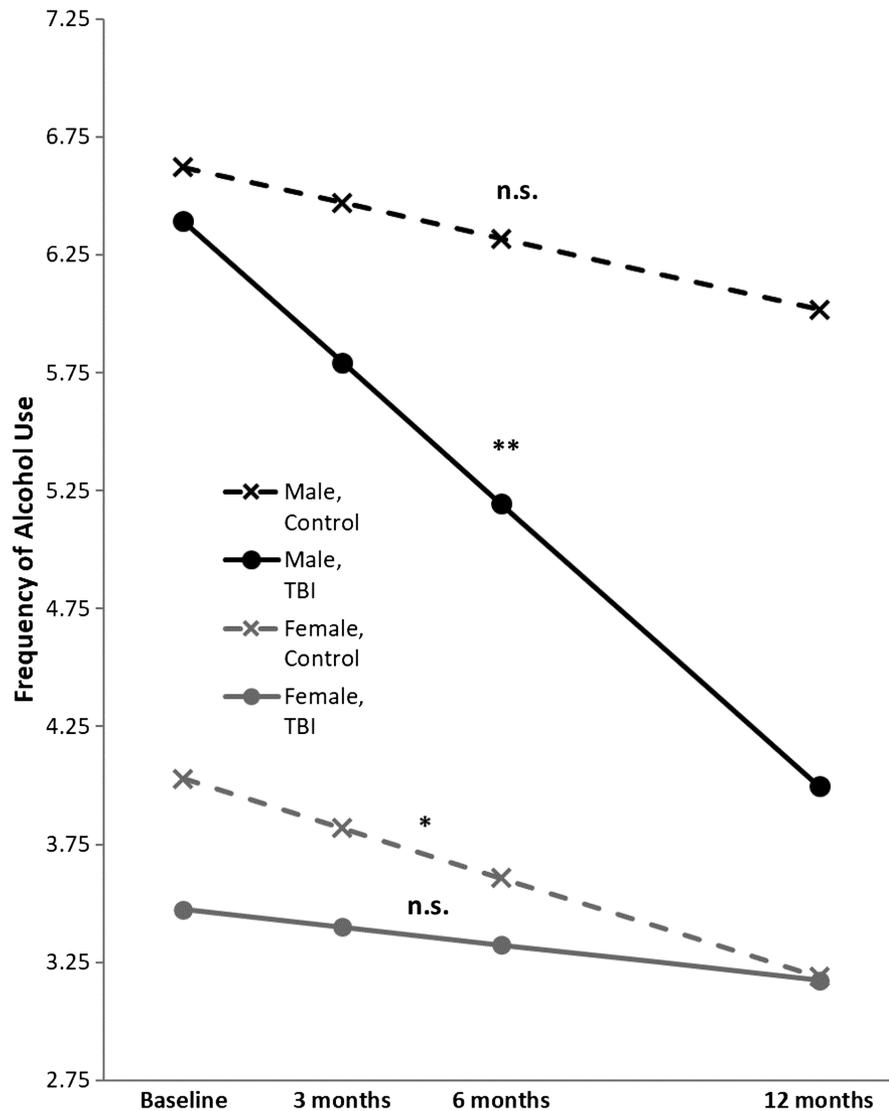


Figure 4 Alcohol use showed a significant reduction over time from baseline to 12 months among males in the therapist-based intervention (TBI). $***P < 0.01$, $*P < 0.05$, NS = non-significant. There was a significant linear reduction in level of alcohol use over time among males in the TBI group [$B = -0.60$, standard error (SE) = 0.19, $P < 0.01$] but not the control group ($B = -0.15$, SE = 0.18, $P = 0.40$). Among females, there was a slight decrease in alcohol use in the control group ($B = -0.21$, SE = 0.11, $P < 0.05$), but the rate of alcohol use among females in the TBI group did not change significantly ($B = -0.08$, SE = 0.12, $P = 0.52$)

found no significant moderation of the effects for the CBI, or of either TBI or CBI by race (Fig. 5).

DISCUSSION

Alcohol use, cannabis use and anxiety symptoms often co-occur and it is critical to study how they 'travel together' and the extent to which BIs aimed at reducing drug use that can be implemented with high fidelity and accessibility might exert collateral effects on alcohol use and anxiety. In this novel study that incorporated sophisticated quantitative modeling techniques using data from a large sample of low-income, urban adults who presented to an ED, we examined 12-month trajectories of alcohol use, cannabis

use and anxiety following completion of drug-focused TBI or CBI intervention modalities compared to EUC. We showed that TBI was effective in reducing cannabis use and anxiety symptomatology. Moreover, we found that TBI was effective in reducing alcohol use specifically among males and that younger participants benefited the most from the effects of TBI in reducing cannabis use. We highlight three main implications from these findings.

First, we found that TBI was an effective intervention for reducing harmful drug and alcohol use, as well as co-occurring anxiety symptoms, among ED patients. These results indicate that successfully intervening on drug use can positively impact comorbid alcohol use and anxiety symptoms, suggesting that concurrent or integrated treatments

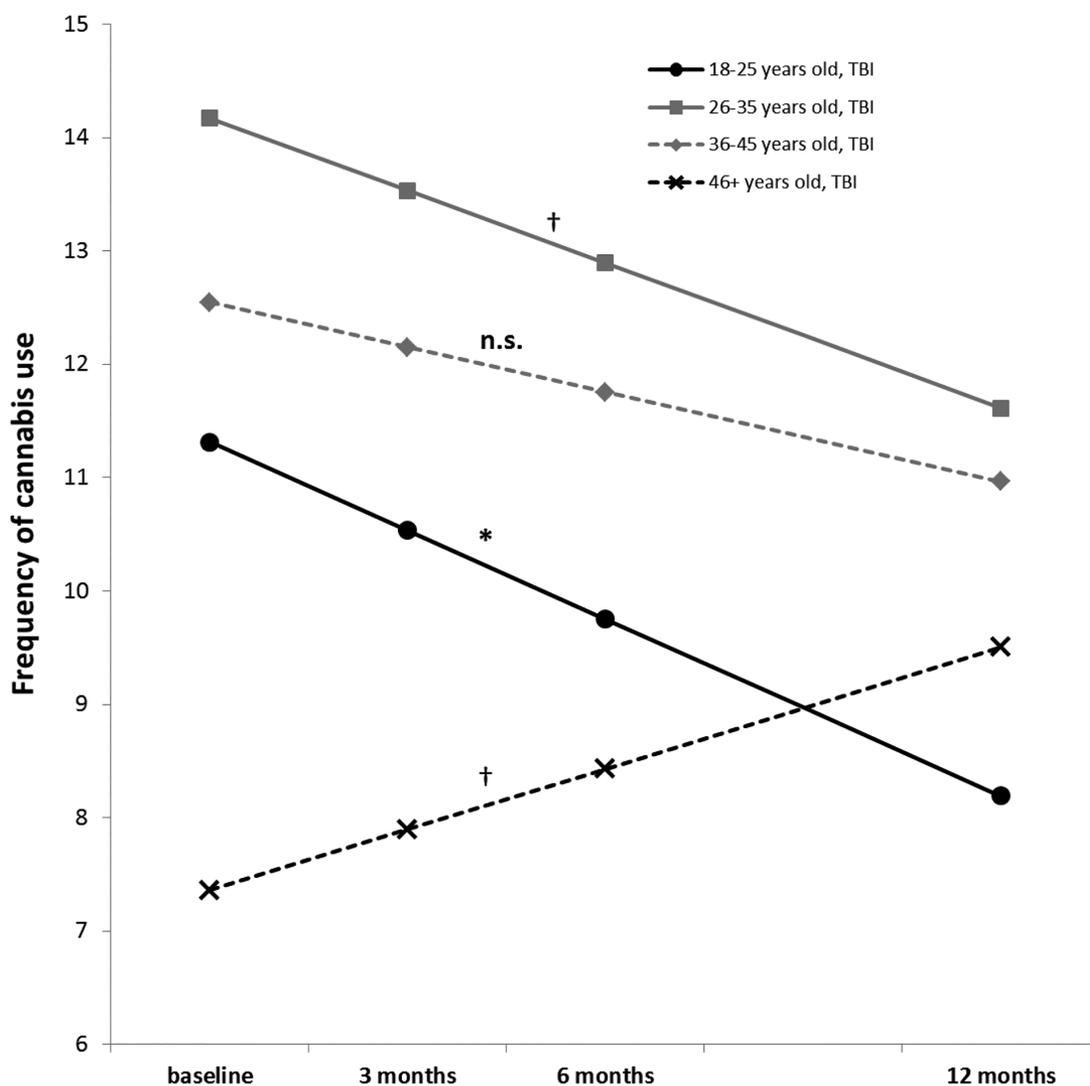


Figure 5 Participants aged 18–25 years benefited most from the therapist-based intervention (TBI) relative to other age groups. * $P < 0.05$, † $P < 0.10$. The figure shows linear change in cannabis usage among individuals within the TBI group divided into four age categories: 18–25 ($n = 101$), 25–35 ($n = 76$), 36–45 ($n = 45$) and 46 years and older ($n = 35$). Individuals aged 18–25 years who received TBI showed a significant reduction in cannabis usage [$B = -0.78$, standard error (SE) = 0.31, $P < 0.05$]; individuals aged 26–35 within the TBI group also showed a modest reduction in cannabis use, but was not significant ($B = -0.64$, SE = 0.38, $P = 0.09$); individuals aged 36–45 years within the TBI group did not show a significant change in usage ($B = -0.40$, SE = 0.50, $P = 0.43$); finally, individuals aged 46 years or older within the TBI group actually showed a slight increase in cannabis use but was not significant ($B = 0.54$, SE = 0.31, $P = 0.09$)

for anxiety-related problems may not be necessary for some individuals [36]. Although CBI reduced cannabis use days when examined as a sole outcome [14], CBI relative to EUC did not result in significant reductions in severity of alcohol use, cannabis use and anxiety when examined as simultaneous outcomes. While CBI offers many advantages, such as convenience and low costs, aspects of communicating in-person with a therapist during a single session may facilitate enhanced change processes in multiple co-occurring outcomes beyond the scope of a self-directed, single session computer program. Additional research is needed to compare effectiveness of therapist

versus computer-based BIs directly and among more representative samples.

Secondly, reductions in alcohol use after TBI were found among men, but not women. Although females showed decreasing alcohol use during the 12 months following TBI, the extent of their declines in alcohol use were much smaller than males. By the 12-month follow-up, frequency of alcohol use remained higher among males compared to females, but the sex gap significantly narrowed as a result of TBI. This is consistent with findings from a systematic review of brief alcohol interventions in primary care settings [37], which reported evidence for clear reductions in

alcohol use following BI for men, but not women. The mechanism driving this sex difference is probably lower rates of consumption resulting in floor effects; however, more research is needed to examine ways to enhance interventions for women (e.g. greater inclusion of sex-specific consequences) [38]. In contrast to sex differences in intervention effects, race did not impact linear reductions in cannabis use, alcohol use or anxiety. This is notable, given the racial diversity of the present sample. Many previous BI RCTs have utilized primarily white samples (however, see [39]), which has limited the ability to examine systematic differences in intervention effectiveness as a function of race or ethnicity [37].

Thirdly, significant reductions in cannabis use in the TBI condition were specifically found among young adults between the ages of 18 and 25 years. This finding is critical from a developmental perspective, because substance use tends to peak during the transition to adulthood (i.e. aged 18–25 years [19]). This developmental period also coincides with the typical onset of symptoms of substance use disorder (SUD [20]). Approximately 5.3 million—or one in seven—young adults in the United States aged 18–25 years have a SUD, which represents the largest proportion of individuals with problematic substance use [2,40]. Thus, findings from the present study highlight the potential impact of the *HealthiER You* TBI on reducing cannabis use among young adults at a critical juncture in development. The ED may be an especially important venue for SBIRT with drug-using emerging adults who may not otherwise receive interventions, because the ED is a frequent source of care to uninsured and under-insured populations [41,42], and emerging adults often lack connection to health-care providers when transitioning out of pediatric medicine [42–45].

Strengths and limitations

A major strength of the present study is its methodological approach. Given the high co-occurrence of alcohol use, cannabis use and anxiety, examining their parallel trajectories provides valuable information pertaining to the utility of TBI and CBI for drug use in impacting not only substance use, but also mental health outcomes. We also were able to examine potential moderators of the effectiveness of BIs, providing more information about which interventions are effective in reducing alcohol use, cannabis use and anxiety, and for whom. Although a strength of the study is the ED sample of racially diverse, low-income adults the findings, including moderation effects, require replication prior to generalization to other populations. Further, this study was conducted among adults screening positive for drug use (primarily cannabis), and findings may not generalize to samples screening positive for alcohol use or other mental health concerns. In addition, dismantling studies may

provide insights into which components of BIs contribute to improvements across mental health outcomes, including anxiety and substance use, versus those that are specific to reducing drug and alcohol use.

CONCLUSIONS

In summary, findings from the present study not only highlight the potential utility of a motivational interviewing-based TBI focused on reducing drug use for also reducing alcohol use, cannabis use and anxiety symptoms up to 12 months following the intervention, but also demonstrate the importance of examining subgroup differences, such as sex and age, in relation to intervention outcomes. TBIs implemented through the *HealthiER You* study offer a relatively time-efficient way to reduce substance use and improve anxiety symptoms.

Clinical trial registration

Name of trial: HealthiER You: Optimizing Screening, Brief Interventions, and Referral to Treatment (SBIRT) in the Emergency Department. Registration number: NCT01113190. Registration date: 20 April 2010. Recruitment initiation date: 2 February 2011. Link: <https://clinicaltrials.gov/ct2/show/NCT01113190?term=healthier+you&rank=2>.

Declaration of interests

None.

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Original Paper

The Living the Example Social Media Substance Use Prevention Program: A Pilot Evaluation

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Abstract

Background: Adolescent substance use rates in rural areas of the United States, such as upstate New York, have risen substantially in recent years, calling for new intervention approaches in response to this trend. The Mentor Foundation USA conducts the Living the Example (LTE) campaign to engage youth in prevention using an experiential approach. As part of LTE, youth create their own prevention messages following a training curriculum in techniques for effective messaging and then share them via social media. This paper reports on a pilot evaluation of the LTE program.

Objective: To conduct a pilot test of LTE in two rural high schools in upstate New York. We hypothesized that positive antidrug brand representations could be promoted using social media strategies to complement the Shattering the Myths (STM) in-person, event-based approach (hypothesis 1, H1), and that youth would respond positively and engage with prevention messages disseminated by their peers. We also hypothesized that exposure to the social media prevention messages would be associated with more positive substance use avoidance attitudes and beliefs, reductions in future use intentions, and decreased substance use at posttest (hypothesis 2, H2).

Methods: We adapted a previously published curriculum created by the authors that focuses on branding, messaging, and social media for prevention. The curriculum consisted of five, one-hour sessions. It was delivered to participating youth in five sequential weeks after school at the two high schools in late October and early November 2016. We designed a pre- and posttest pilot implementation study to evaluate the effects of LTE on student uptake of the intervention and short-term substance use and related outcomes. Working at two high schools in upstate New York, we conducted a pilot feasibility evaluation of LTE with 9th-grade students (ie, freshmen) at these high schools. We administered a 125-item questionnaire online to capture data on media use; attitudes toward social media; next 30-day personal drug use intentions; personal reasons to use drugs; reasons participants believe their peers would use drugs; self-reported exposure to the LTE program; and receptivity to the LTE program, among those reporting exposure. We constructed multivariable logistic regression models to analyze the relationship between program receptivity and outcomes. First, in a cross-sectional logistic regression model, we regressed self-reported LTE message receipt on drug use intent and actions related to LTE messaging. Then, for analysis of participants with matched pre- and posttest responses, we used multilevel generalized estimating equation (GEE) techniques to model changes in behavior from baseline to follow-up.

Results: Youth reported increased intentions to use marijuana (odds ratio [OR] 2.134, $P=.02$) between pre- and posttest. However, youth who reported exposure and receptivity to LTE reported a significant decrease in intentions (OR 0.239, $P=.008$). We observed a similar pattern for sedatives/sleeping pills—an increase in intentions overall (OR 1.886, $P=.07$), but a decrease among youth who reported exposure and receptivity to LTE (OR 0.210, $P=.02$). We saw the same pattern for use of any drug—an increase in

reported intentions overall (OR 2.141, $P=.02$), but a decrease among youth who reported exposure and receptivity to LTE (OR 0.111, $P=.004$).

Conclusions: We observed some evidence of significant LTE program effects. Social media may be an effective strategy for peer-to-peer substance use prevention in the future. These findings point both to the potential of LTE and the social media diffusion model and to the need for more research on a larger scale with an expanded youth population in the future.

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KEYWORDS

substance use prevention; peer-to-peer education; social media; adolescence

Introduction

Background

Adolescent substance use rates in rural areas of the United States, such as upstate New York, have risen substantially in recent years [1], calling for new intervention approaches in response to this trend. There is growing evidence that substance use, including marijuana and other drug use, has negative health consequences for adolescents, especially when use begins early and when multiple substances are used [2]. Recent studies suggest adolescent marijuana use may be linked to altered longer-term neurodevelopmental trajectories, compromised neural health, impaired frontal lobe function, and psychosocial effects [3-8]. Additionally, early-onset adolescent marijuana use combined with alcohol and other substance use has been linked to numerous cognitive impairments and neural health effects [9,10]. Social norms favoring many forms of substance use are increasing [11,12] and may be associated with medicalization and legalization of marijuana in some states [13,14]. According to the 2016 survey *Monitoring the Future*—a long-term study of the behaviors, attitudes, and values of American adolescents, college students, and young adults—38% of high school seniors living in states with medical marijuana laws reported past-year use, compared with 33% in states without these laws. Furthermore, perceptions regarding the dangers of marijuana are at the lowest point ever, with only 31% of high school seniors perceiving smoking marijuana regularly as a “great risk.” Increased adolescent substance use due to changing norms and relaxed laws is a substantial public health threat.

The Mentor Foundation USA conducts the Living the Example (LTE) campaign [15], which includes an interactive youth rally event, *Shattering the Myths (STM)*, designed to dispel myths surrounding drug abuse and engage youth in prevention messages using an experiential learning approach. LTE is a branded program that creates new mental associations with the positive attributes of avoiding substance use that may modify adolescent social norms and reduce drug use intentions [16]. The rally is a catalyst for youth to become advocates for prevention; however, the rally was originally conceived to be conducted in person, thus limiting potential reach of prevention messages. In response to the growing popularity and use of social media, we adapted LTE to include a social media component. We trained youth advocates to create LTE-branded prevention messages, disseminate them via social media platforms, and engage peers in their social networks, with the intention of increasing peer interaction around the brand’s core

messaging. We conducted a pilot study in Columbia County, New York, to evaluate the efficacy of LTE with the added social media component. We also assessed the utility of this novel approach using social media strategies and branding principles to reach at-risk youth with prevention messages, engage youth in the program’s brand, and monitor exposure to specific social media channels.

Potential of Social Media for Prevention

New technologies, including the Internet, social media, and mobile phones, offer tremendous potential to expand the reach and effectiveness of public health programs [17,18]. As noted, some prevention programs have used social media as delivery channels, such as *Above the Influence* with its large Facebook presence and efforts to create a social community of youth sharing narratives related to the avoidance of marijuana [18-20]. However, relatively little has been published demonstrating the effectiveness of social media as substance use prevention channels. The Substance Abuse and Mental Health Services Administration (SAMHSA) has funded a number of statewide media campaigns for prevention, some of which have used social media activities, including Colorado’s *SpeakNow!* Campaign focused on teen drinking prevention [21]. However, these efforts are in their infancy, and LTE is a novel effort to design and test a systematic intervention for prevention driven by social media.

Theoretical Basis for Living the Example: Branding and Social Media

Schools are a common context for interventions, given their almost universal access to youth. School-based interventions have an established history with an emerging array of successful interventions documented on SAMHSA’s National Registry of Evidence-based Programs and Practices [20]. Reviews report an average effect size for youth in school substance use prevention programs in the range of Cohen $d=0.10$ to 0.16 [22-27]. However, in a prevention environment in which marijuana use—and potentially other substance use—is normalized, a more comprehensive approach using other channels to deliver prevention messages is needed. Given its near ubiquity, one promising channel is social media.

Previous research provides a basis for adding media to school interventions. In the conceptual framework behind Slater and colleagues’ intervention that combined in-school activities and community-level media, *Be Under Your Own Influence*, adolescent experience was embedded in school, community, and the larger social world experiences [28]. Other prevention efforts have been conducted in rural communities and school

settings, similar to LTE, and have demonstrated effectiveness [29-31].

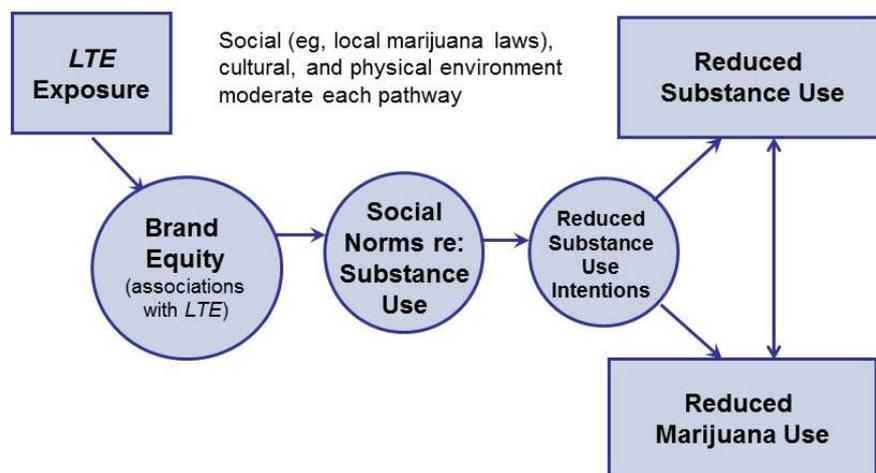
LTE provides an even broader community reach by offering a strong presence on social media platforms widely used by adolescents. This approach complements and extends the reach of the existing Mentor Foundation USA's in-person STM youth rally. Social media provides access to a larger social world that is inaccessible via direct experience [32]. Social media messages echo branded STM rally messages beyond school walls, reinforcing and amplifying antiuse norms [33].

Health branding represents an evolution in behavioral theory, building on social cognitive theory (SCT) and the theory of planned behavior (TPB) (see Figure 1) [34,35]. Health branding specifies the modeling component of SCT by proposing a testable process by which the benefits of healthy behaviors may be depicted through positive social role models, such as teens who remain drug-free and thereby achieve social status and respect. It also specifies the attitude component of TPB, namely that a change in attitudes targeted by health messages is

mediated by the novel theoretical construct of brand equity (see Figure 1). Health branding extends research on the mediation of health beliefs targeted in behavior change campaigns [36]. Previous research on prevention programs such as Above the Influence demonstrates that higher brand equity is associated with improved antiuse attitudes and norms [18]. This study extends that research.

Using social media strategies and branding principles, we conducted a pilot test of LTE in two rural high schools in upstate New York. We hypothesized that positive antidrug brand representations could be promoted using social media strategies to complement the STM in-person, event-based approach (hypothesis 1, H1), and that youth would respond positively and engage with prevention messages disseminated by their peers. We also hypothesized that exposure to the social media prevention messages would be associated with more positive substance use avoidance attitudes and beliefs, reductions in future use intentions, and decreased substance use at posttest (hypothesis 2, H2).

Figure 1. Living the Example (LTE) conceptual model.



Methods

Intervention

In late September and early October 2016, we conducted a weeklong, in-person STM rally at each school based on the idea of Living the Example (ie, living drug-free as a positive alternative to drug use) at two high schools in Columbia County, New York. Following the weeklong rally, we engaged a group of youth ambassadors (n=12 per high school) in a 5-week, after-school social media and prevention-branding training activity. As part of the training, the ambassadors learned how to develop and disseminate their own prevention messages. They were trained to create social media content and share their drug use avoidance experiences, thus forming positive antidrug social norms with their friends and social networks. The training was based on a previous activity developed by the two lead authors (WE and EA) under National Institutes of Health funding. For 5 weeks after the weeklong STM rally, ambassadors at both high schools disseminated prevention messages through their social networks with the

#livingtheexample hashtag to identify posts as representing the LTE program.

Living the Example Social Media Training

The social media training consisted of five, one-hour sessions. The training was conducted five sequential weeks after school at the two high schools in late October and early November 2016. The curriculum comprised the following:

1. Session 1: What is a Brand? This session described the idea of branding; how it is used to market products, services, and companies; and how it can be applied to social causes and behavior change. The idea of branding substance use prevention was introduced.
2. Session 2: Introduction to Social Media. This session introduced youth to the basics of social media, how it can influence message recipients, and how to begin thinking about creating their own influential messages. The session included a social media message creation exercise.

3. Session 3: Boosting Online Engagement. This session covered how to connect and build engagement with social networks. It also covered the idea of social media as a conversation, knowing one's audience, techniques to create engaging posts, and how to communicate about prevention topics with peers.

4. Session 4: Using Your Voice—Introduction to Advocacy. This session focused on how youth can share their opinions about an issue in their community that they would like to change. It examined examples of how advocacy has made a difference in social causes and how to create advocacy messages.

5. Session 5: Advocacy in Action. This session focused on applying concepts from the preceding sessions to advocate for substance use prevention with peers. It included an exercise in creating a persuasive social media prevention message and post.

Once the training was completed, youth were encouraged to continue creating their own prevention messages and disseminating them to peers through their preferred social media channel for the rest of the fall 2016 semester.

Evaluation Methods

We designed a pretest-posttest pilot implementation study to evaluate the effects of LTE on student uptake of the intervention and short-term substance use and related outcomes. Working at two high schools in upstate New York, we conducted a pilot feasibility evaluation of LTE with 9th-grade students (ie, freshmen) at these high schools. The rationale for testing the program with freshmen was that they had not yet been enrolled in any previous high school-level prevention programs, including Mentor Foundation USA programs. Due to challenges in collecting posttest data at one high school, the following presentation of data and results focuses on one school for which we successfully completed both pre- and posttesting. We sought to evaluate whether branded prevention messages disseminated via social media increased intervention effects of the adolescent substance use prevention program.

Measures and Instrument

We developed a questionnaire using validated scales from previous work by the authors [37,38], as well as from other validated scales from both the SAMHSA 2014 Communities that Care survey instrument and the 2012 Monitoring the Future survey [39,40]. The 125-item instrument was programmed into SurveyMonkey software for computer-administered completion during a required freshman English class at both high schools. In addition to demographic information and last grade completed in school, other scales used included the following: Traditional and Digital Media Use (9 items); Attitudes Toward Social Media (18 items); Drug Use Risk Perceptions (12 items); Personal and Perceived Peer Reasons to Use Drugs (6 items); Drug Use Social Norms (18 items); Perceived Peer Drug Use (18 items); Reported Peer Drug Use (14 items); Self-Reported Past 30-Day Drug Use (14 items); Next 30-Day Drug Use Intentions (8 items); Drug Use/Refusal Influences (8 items); and Self-Reported Exposure to the LTE Program and Receptivity to the LTE Program (7 items), which was administered among those reporting exposure.

Data Collection

We recruited participants from the 9th-grade student bodies at the two high schools and attempted to obtain full participation from all freshmen. Active parental consent had been previously obtained for youth ambassadors to participate in the social media training activity and we sought passive parental consent for all potential freshmen participants in the questionnaire. Youth informed assent was also obtained prior to questionnaire administration. No personal contact or other identifying information was stored with the questionnaire data and a unique identifier was created and used to match pre- and postquestionnaire responses by participant. All study instruments and the protocol were approved by the George Washington University Institutional Review Board and the principals of each high school.

Pretest questionnaires were administered before the intervention launched in late September 2016 and posttest questionnaires were administered in December 2016. Students were asked to log into a password-protected site and complete the pretest and posttest questionnaires online using SurveyMonkey. A total of 129 participants were recruited at the high school included in the pre-post analysis, representing the entire eligible freshman student body at that school. The questionnaire was anonymous and confidential; no student was obligated to complete the questionnaire or penalized for nonparticipation. Students were enrolled in a contest for retail gift card prizes as an incentive upon completion.

Data Analysis

We conducted all data analysis in Stata release 14 (StataCorp LLC). For each wave of the study, we matched respondents and were able to identify matching records for 80 of the 129 (62.0%) total study participants; 49 students out of 129 (38.0%) completed the posttest only. We compared drug use intent; personal reasons why they, or general reasons why their peers, might use drugs; and agreement with actions related to LTE messaging for baseline and follow-up questionnaires. We also examined respondent exposure to both traditional and new media, social media use attitudes, and how students interacted with LTE social media posts. We created dummy variables that represented students' likelihood of using a specific or any drug in the next 30 days. We also created a dummy variable to represent whether the respondent self-reported receipt of LTE social media posts.

We then constructed multivariable logistic regression models to analyze the relationship between program receptivity and outcomes. First, in a cross-sectional logistic regression model, we regressed self-reported LTE message receipt on drug use intent and actions related to LTE messaging. Then, for analysis of participants with matched pre- and posttest responses, we used multilevel generalized estimating equation (GEE) techniques to model changes in behavior from baseline to follow-up. We estimated the odds of reductions in drug use intent from baseline to follow-up in those who interacted with LTE compared to those who did not. All models included age and gender as covariates.

Table 1. Descriptive statistics of participants (n=80).

Characteristics	n (%)
Gender	
Female	39 (49)
Male	40 (50)
Other/transgender	1 (1)
Total	80 (100)
Age at baseline (years)	
13	9 (11)
14	64 (80)
15	6 (8)
16	1 (1)
Total	80 (100)

Results

Table 1 summarizes the sample demographics of freshmen successfully surveyed at follow-up.

Figure 2 summarizes results on reasons why participants believed their peers used drugs. Nearly all of the categories of reasons scored above 50%, indicating that youth had many reasons why they believed their peers would use drugs. Peer pressure showed up as the most commonly reported reason (36/49, 73%) among participants who only responded to the

wave 2 questionnaire. Among those who responded to both waves, family stress was the most common reason (67/80, 84%). The most common overall reason for drug use among all respondents was family stress (105/129, 81.4%).

Figure 2 also summarizes reasons why participants said that they personally used drugs. As personal reports of drug use are generally lower, the results for this scale were lower than perceptions of peer use. Among those who responded to both waves, boredom and academic stress were the most common reasons (32/80, 40%). The same two categories were most common among all respondents (43/129, 33.3%).

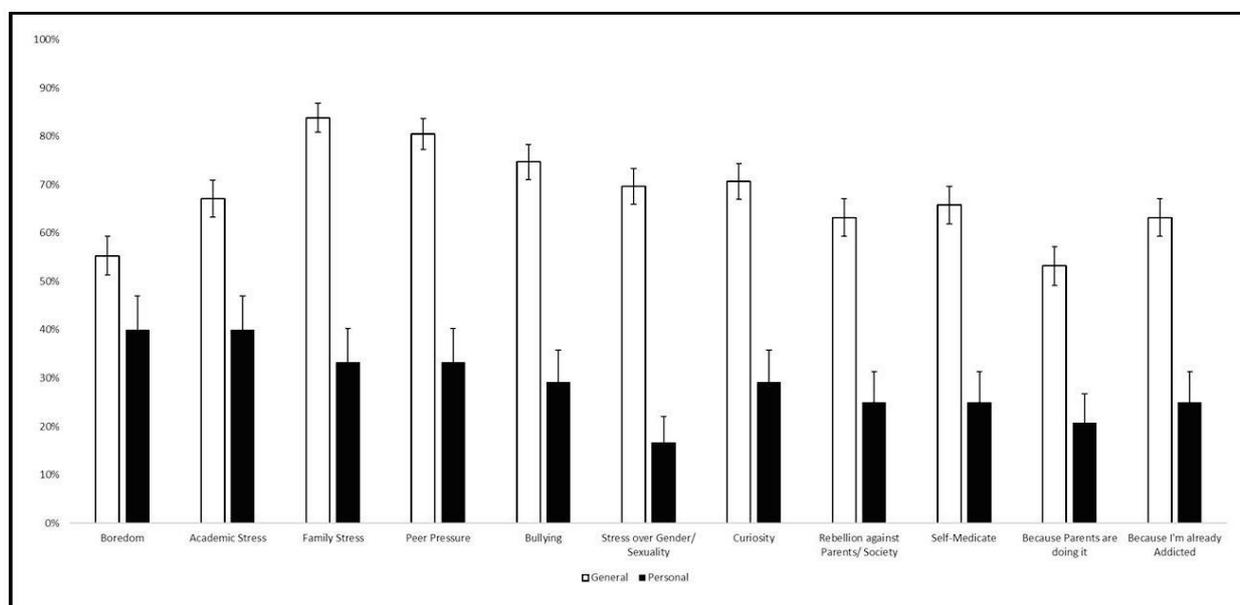
Figure 2. Reasons for peer and personal drug use among matched respondents.

Table 2. Multivariate regressions comparing self-reported drug use intent at pre- and posttest and Living the Example receptivity (matched participants, n=80).

	Self-reported drug use intent, exponentiated coefficient (P)													
	1 ^a	2 ^b	3 ^c	4 ^d	5 ^e	6 ^f	7 ^g	8 ^h	9 ⁱ	10 ^j	11 ^k	12 ^l	13 ^m	14 ⁿ
Any LTE ^o exposure	0.918 (.94)	0.565 (.61)	2.445 (.18)	0.678 (.74)	1.491 (.61)	0.972 (.96)	1.217 (.86)	2.097 (.45)	2.097 (.45)	2.097 (.45)	2.364 (.38)	2.097 (.45)	2.360 (.24)	2.121 (.19)
Change from baseline to follow-up	1.672 (.35)	1.892 (.06)	1.886 (.07)	2.261 (.08)	1.848 (.17)	2.134 (.02)	1.681 (.15)	1.066 (.90)	1.066 (.90)	1.066 (.90)	0.855 (.76)	1.066 (.90)	0.676 (.45)	2.141 (.02)
Change from baseline to follow-up among those with LTE receptivity	1.820 (.54)	1.495 (.62)	0.210 (.02)	1.409 (.72)	0.432 (.33)	0.239 (.008)	1.809 (.35)	1.000 (>.99)	1.000 (>.99)	1.000 (>.99)	1.000 (>.99)	1.000 (>.99)	0.736 (.73)	0.111 (.004)
Gender ^p	0.663 (.63)	3.027 (.12)	1.343 (.60)	0.845 (.81)	1.197 (.76)	1.698 (.40)	1.279 (.77)	1.108 (.91)	1.108 (.90)	1.108 (.91)	1.699 (.54)	1.108 (.91)	1.691 (.43)	2.006 (.12)
Age	0.467 (.28)	0.560 (.24)	0.614 (.29)	0.428 (.17)	0.508 (.22)	0.834 (.70)	0.462 (.12)	0.782 (.74)	0.782 (.74)	0.782 (.74)	0.581 (.44)	0.782 (.74)	0.740 (.60)	0.673 (.33)

^aWill smoke cigarettes.

^bWill use electronic cigarettes (ie, vaping).

^cWill use sedatives such as sleeping pills.

^dWill use tranquilizers or antianxiety drugs.

^eWill use painkillers such as OxyContin or similar.

^fWill use marijuana.

^gWill use synthetic marijuana or K2/Spice.

^hWill use cocaine.

ⁱWill use crack.

^jWill use hallucinogens.

^kWill use any inhalant for kicks or to get high.

^lWill use heroin.

^mWill use any other medicines or substances.

ⁿWill use at least one drug.

^oLTE: Living the Example.

^pFemale is the reference for gender.

Table 2 summarizes results of the GEE models we developed to compare pre- and posttest results and the effect of self-reported exposure and receptivity to LTE social media messages. Youth reported increased intentions to use marijuana (odds ratio [OR] 2.134, $P=.02$) between pre- and posttest, which may be expected given the age range of 14-15 years and concomitant increase in drug use intentions observed in other research for this age group [41,42]. However, among youth who reported exposure and receptivity to LTE, they reported a significant decrease in marijuana use intentions (OR 0.239, $P=.008$). We observed a similar pattern for sedatives/sleeping pills—an increase, although only marginally significant, in intentions overall (OR 1.886, $P=.07$), but a decrease among youth who reported exposure and receptivity to LTE (OR 0.210, $P=.02$). We saw the same pattern for use of any drug—an increase in reported intentions overall (OR 2.141, $P=.02$), but a decrease among youth who reported exposure and receptivity to LTE (OR 0.111, $P=.004$). No other statistically significant results were observed, although a marginally significant increase in e-cigarette (ie, vaping) use was observed among all respondents (OR 1.892, $P=.06$) and a nonsignificant increase

was observed among those exposed and receptive to LTE (OR 1.495, $P=.62$).

Discussion

Principal Findings

With respect to H1, we found that, overall, youth responded positively and engaged with LTE messages when they were exposed to them by their peers. As shown in **Table 2**, message receptivity was generally high among those who self-reported exposure to LTE social media. Respondents found LTE to be engaging and convincing, and they generally liked the posts. In terms of immediate response from the target audience, the LTE peer-to-peer approach appears to be a promising way to deliver prevention messages.

We also confirmed H2 in that positive receptivity to LTE messages was associated with some evidence of reduced self-reported drug use intentions, specifically for marijuana and use of sedatives/sleeping pills, and reports of intent to use any drug. As shown in **Table 2**, the overall sample showed a significant increase in intent to use both marijuana,

sedatives/sleeping pills, and any drug, but there was a significant reduction in intent among those who were receptive to LTE messages. While this result could be due to other factors not measured in the study, given the pilot nature of this work and intent to establish preliminary evidence of efficacy and feasibility, these findings suggest that LTE is promising.

Additionally, we identified a number of key reasons why youth believe their peers use drugs and why they personally would use drugs. The most frequently cited reasons why youth believe their peers use drugs and why they themselves would use drugs were academic stress, family stress, and peer pressure. In an overall social environment where marijuana use laws are relaxing, perceived risk and social unacceptability of marijuana use may be decreasing [43]. These changing perceptions and risk factors should be investigated in future studies.

We observed no significant effects for a number of other drugs measured, including cigarettes, e-cigarettes, prescription drugs, inhalants, cocaine, and others. However, the LTE curriculum did not specifically focus on these drugs and in conversations with youth (see sections below), we found that youth did not post about them specifically. Thus, message recipients' attitudes toward these drugs may not have been affected.

Overall, study findings suggest that peer-to-peer substance use prevention via social media is a promising strategy. Given the low cost and low burden of social media as an intervention channel, schools, communities, and prevention programs can use this approach even in low-resource settings. However, more research is needed on how best to structure such programs. LTE used a model that combined a curriculum, training of peer leaders, and sharing of prevention messages in a social network by those trained peer leaders. The advantages, disadvantages, and alternatives to this model should be explored in future studies.

Intervention Challenges and Opportunities

In terms of the process of implementing the LTE intervention and the social media training, we observed many positive aspects of the intervention, as well as some challenges. Youth ambassadors who received the social media and peer leadership training liked the experience, were receptive to LTE overall, and reported enjoying the program. Based on our survey data, we have evidence that they participated and did indeed share sufficient social media posts with their peers to generate high LTE awareness in their social networks and produce the observed effects on substance use intentions. Additionally, we also gathered valuable information on how best to use social media platforms. Students indicated that they frequently used Snapchat Geofilters to stay connected to peers. LTE and similar programs may benefit from using this tool, including at events and within social media training/school programming. Furthermore, Instagram and Snapchat now have 24-hour *Story* features that youth encouraged us to use. These features allow more people to see the posts for a longer period of time, thus potentially facilitating diffusion of messages, enhancing reach, and increasing exposure to program messages.

We experienced some challenges with the LTE social media training. One was that our social media examples were often based on Facebook, which is a platform that many youth participants were no longer using. Alternatively, we found that Snapchat and Instagram were the most widely used platforms, with Snapchat typically being used for person-to-person contact (ie, one individual at a time, similar to texting) and Instagram being used for *posts*. Almost none of the participants used Facebook and very few had a Twitter account. Use of Snapchat and Instagram presented challenges for the program, since they were less conducive to detailed posts that tend to be best for prevention advocacy. We recognize that future versions of LTE and programs using similar engagement strategies need to be responsive to rapidly changing social media use patterns among adolescents.

In addition to the social media platform used, youth participants indicated that the intention of the social media message should match the purpose for which they usually used a particular platform. In other words, youth participants primarily used Instagram to demonstrate personal involvement or creativity, and not necessarily to send messages, including prevention messages.

However, participants were more willing to put out *motivational messages* that might deter a peer from using drugs. These messages were intended to be positive and could show "who they were." The research team faced some challenges communicating and reminding the youth ambassadors to post on social media. We attempted to use direct messaging through Instagram, but some students reacted negatively, indicating a preference for not receiving contact from school or adults through the platform, which they considered as an extension of their "personal space" reserved for socializing with peers.

Limitations

Finally, it should be noted that this was a pilot study and had the limited objective of demonstrating the potential of social media as a peer-to-peer education tool for prevention. As such, we had a relatively small sample size and, thus, limited statistical power. Therefore, our results should be interpreted with caution. The sample was limited to freshmen; while we achieved a near census of full participation among the freshman class, this did not represent the school as a whole. Additionally, results are not generalizable beyond this population or the individual school setting.

Despite these limitations, LTE did demonstrate a significant program effect. Social media may be an effective strategy for peer-to-peer substance use prevention in the future. Anecdotal information gathered during implementation revealed a number of ways the program and use of social media may be optimized in the future. These findings point both to the potential of LTE and the social media diffusion model and to the need for more research on a larger scale with an expanded youth population in the future.

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Conflicts of Interest

None declared.

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Abbreviations

GEE: generalized estimating equation

H1: hypothesis 1

H2: hypothesis 2

LTE: Living the Example

OR: odds ratio

SAMHSA: Substance Abuse and Mental Health Services Administration

SCT: social cognitive theory

STM: Shattering the Myths

TPB: theory of planned behavior

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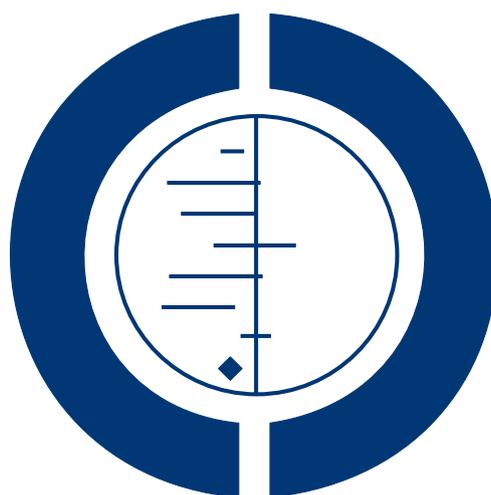
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Media campaigns for the prevention of illicit drug use in young people (Review)

Ferri M, Allara E, Bo A, Gasparrini A, Faggiano F



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[Intervention Review]

Media campaigns for the prevention of illicit drug use in young people

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ABSTRACT

Background

Substance-specific mass media campaigns which address young people are widely used to prevent illicit drug use. They aim to reduce use and raise awareness of the problem.

Objectives

To assess the effectiveness of mass media campaigns in preventing or reducing the use of or intention to use illicit drugs amongst young people.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library* 2013, Issue 1), including the Cochrane Drugs and Alcohol Group's Specialised Register; MEDLINE through PubMed (from 1966 to 29 January 2013); EMBASE (from 1974 to 30 January 2013) and ProQuest Dissertations & Theses A&I (from 1861 to 3 February 2013).

Selection criteria

Cluster-randomised controlled trials, prospective and retrospective cohort studies, interrupted time series and controlled before and after studies evaluating the effectiveness of mass media campaigns in influencing drug use, intention to use or the attitude of young people under the age of 26 towards illicit drugs.

Data collection and analysis

We used the standard methodological procedures of The Cochrane Collaboration.

Main results

We included 23 studies involving 188,934 young people, conducted in the USA, Canada and Australia between 1991 and 2012. Twelve studies were randomised controlled trials (RCT), two were prospective cohort studies (PCS), one study was both a RCT and a PCS, six were interrupted time series and two were controlled before and after (CBA) studies. The RCTs had an overall low risk of bias, along

Media campaigns for the prevention of illicit drug use in young people (Review)

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with the ITS (apart from the dimension 'formal test of trend'), and the PCS had overall good quality, apart from the description of loss to follow-up by exposure.

Self reported or biomarker-assessed illicit drug use was measured with an array of published and unpublished scales making comparisons difficult. Pooled results of five RCTs (N = 5470) show no effect of media campaign intervention (standardised mean difference (SMD) -0.02; 95% confidence interval (CI) -0.15 to 0.12).

We also pooled five ITS studies (N = 26,405) focusing specifically on methamphetamine use. Out of four pooled estimates (two endpoints measured in two age groups), there was evidence of a reduction only in past-year prevalence of methamphetamine use among 12 to 17 years old.

A further five studies (designs = one RCT with PCS, two PCS, two ITS, one CBA, N = 151,508), which could not be included in meta-analyses, reported a drug use outcome with varied results including a clear iatrogenic effect in one case and reduction of use in another.

Authors' conclusions

Overall the available evidence does not allow conclusions about the effect of media campaigns on illicit drug use among young people. We conclude that further studies are needed.

PLAIN LANGUAGE SUMMARY

Do media campaigns prevent young people from using illicit drugs?

Media campaigns to prevent illicit drug use are a widespread intervention. We reviewed 23 studies of different designs involving 188,934 young people and conducted in the United States, Canada and Australia. The studies tested different interventions and used several questionnaires to interview the young people about the effects of having participated in the studies brought to them. As a result it was very difficult to reach conclusions and for this reason we are highlighting the need for further studies.

BACKGROUND

Health promotion, mass media campaigns are initiatives typically undertaken by national authorities which use communication media to disseminate information about, for example, health or threats to it and to persuade people to adopt behavioural changes. Mass media campaigns are implemented via television and radio broadcasts, newspaper or magazine advertisements, billboards and road posters. They can also use colourful advertisements and brochures available for travellers on buses and the metro and, more recently, a broad range of available technology including the Internet, mobile phone short messages and email lists. Media campaigns can be of short or longer duration and sometimes they encompass several consequent rounds of delivery. They can be standalone interventions or be integrated into complex social marketing programmes.

Mass media campaigns for the prevention of illicit drug use are very common worldwide but only few campaigns have been formally evaluated (Wammes 2007). Furthermore, most of those evalua-

tions (Rossi 2003) assessed only the process (in terms of understanding, retention and appeal of the messages) and the very few that assessed outcomes (in terms of behaviours of use) often found weak or counterproductive effects.

Description of the condition

Initiation of use of all substances typically occurs during the teens or early years of adulthood (ESPAD 2011; UNODC 2012). Since the neurological or psychological factors that may influence how and whether addiction develops are unknown, "even occasional drug use can inadvertently lead to addiction" (Leshner 1997; Leshner 1999). Indeed, research has found that drug use leading to dependence usually starts in adolescence (Camf 2003; McLelland 2000; Swendsen 2009).

Since the neurological and social mechanisms of dependence are similar for all addictive substances, a common view, therefore, is that prevention should focus on an age group (teenagers) rather

than specific substances (Ashton 2003; Leshner 1997; Nestler 1997; Wise 1998).

Description of the intervention

The mass media (TV, Internet, radio, newspapers, billboards) have increasingly been used as a way of delivering preventive health messages. They have the potential to modify the knowledge or attitudes of a large proportion of the community (Redman 1990). They also have the potential to reach large populations of suscepti-

ble individuals and groups that may be difficult to access through more traditional approaches. In addition, in terms of the per capita cost of prevention messages, they are relatively inexpensive (Brinn 2010).

This review is limited to mass media campaigns that aim to prevent the uptake of illicit drug use (both in general or that of specific substances) or to reduce or stop the use of illicit drugs. It excludes mass media campaigns that aim to promote safer or less harmful use of drugs.

The following table summarises the main characteristics of most mass media campaign.

Category	Objective	Target audience	Details
Information campaign	Warning	General or youth population	Information about the dangers and risks of a range of illicit substances
	Empowerment	General population, especially parents	Information about how to contribute to drug prevention through your own behaviour
			Information about where and how to seek support, counselling and treatment regarding illicit drug use, especially for your children
		Youth population	Information about where and how to seek support, counselling and treatment regarding illicit drug use
	Support	General population	Information about existing prevention interventions or programmes in communities, in schools or for families in order to strengthen community involvement and support for them
Social marketing campaign	Correct erroneous normative beliefs	General or youth population	Declared purpose is to correct erroneous normative beliefs about the extent and acceptance of drug use in peer populations (“you’re not weird if you don’t use because 80% of your peers don’t either”)
	Setting or clarifying social and legal norms	General or youth population	Declared purpose is to deglamorise and demystify drug use and related behaviour (e.g. drug driv-

(Continued)

			ing) and to explain the rationale of community norms and control measures
	Setting positive role models or social norms	General or youth population	Declared purpose is to promote non-drug-use-related prototypes of lifestyles, behaviour and personality

How the intervention might work

Most campaigns are based on a limited number of theoretical models, such as the health belief model (lack of knowledge about health harms may lead to drug use), the theory of planned behaviour (drug use is a rational decision due to attitude toward drugs, perceived social norms and perceived control over drugs) and the social norms theory (overrated perception of prevalence among peers may lead to drug use). In summary, the theories most frequently used as base for anti-drugs mass media campaigns are:

- **Health belief model.** This model (Glanz 2002) is based on the concept that the perceived susceptibility to and the severity of the disease and the perceived benefits of action to avoid disease are the key factors in motivating a positive health action. So, based on some elements of the model, the provision of factual information about the negative effects and dangers of drugs should deter use or prevent substance abuse by creating negative attitudes towards drug use.

Intervention based on this theory: information campaign

- **Theory of reasoned action/theory of planned behavior.** The theory of reasoned action/theory of planned behaviour (Ajzen 1991) proposes that an individual's behavioural intentions have three constituent parts: the individual's attitude towards the behaviour, the social norms as perceived by the individual and the perceived control over the behaviour. Individuals may weight these differently in assessing their behavioural intentions. According to this model, drug use is a consequence of a rational decision (intention), which is based on the belief about drug use, the social norms towards drug use and the belief about control over the behaviour.

Intervention based on this theory: social marketing campaigns with the objective of setting or clarifying social and legal norms as well as information campaigns

- **Social norms theory.** This theory (Perkins 1986) states that "our behaviour is influenced by incorrect perceptions of how other members of our social groups think and act" (Berkowitz 2004, p. 5). Campaigns based on this theory, which are also referred to as 'normative education', challenge the

misconception that many adults and most adolescents use drugs. For example, students are provided with information on the prevalence - from either national or local surveys - of drug use among their peers so that they can compare their own estimates of drug use with the actual prevalence.

- Related to this is the **Super-Peer Theory** (Strasburger 2008). The Super-Peer Theory postulates that media portrayal of drug use (or casual sex or violence) influences the susceptible teens.

Intervention based on this theory: social marketing campaigns that aim to correct erroneous normative beliefs

- **Social learning theory.** The social learning theory (Bandura 1977) postulates that personality is an interaction between environment, behaviours and the psychological processes of an individual. Also referred to as observational learning, the theory of social learning places an emphasis on observing and modelling other people's behaviours, attitudes and emotional reaction.

Intervention based on this theory: social marketing campaigns setting positive role models or social norms

Why it is important to do this review

Bühler and Kröger (Bühler 2006) conclude their review of reviews with the recommendation to use media campaigns only as supporting measures and not as a single strategy alone, whereas Hawks 2002, in line with the review of reviews by the Health Development Agency (HDA) (McGrath 2006), concludes that "the use of the mass media on its own, particularly in the presence of other countervailing influences, has not been found to be an effective way of reducing different types of psychoactive substance use. It has however been found to raise information levels and to lend support to policy initiatives".

Despite concerns in reviews about poor effectiveness and possible harm of anti-drug prevention activities (Faggiano 2008), media campaigns are still very popular worldwide and in European Union member states (EMCDDA 2009).

An assessment of both positive and negative (iatrogenic) effects is important for ethical reasons as well, because mass media campaigns - unlike other social or health interventions - are imposed on populations that have neither asked for nor explicitly consented to the intervention (Sumnall 2007). A systematic review of all the studies assessing media campaign interventions aimed at preventing illicit drug use in young people is therefore necessary in order to inform future strategies and to help design campaigns that avoid harm. Such a review will also contribute to the identification of further areas for research.

OBJECTIVES

To assess the effectiveness of mass media campaigns in preventing or reducing the use of or intention to use illicit drugs amongst young people.

METHODS

Criteria for considering studies for this review

Types of studies

Any study that evaluates the effectiveness of mass media campaigns in influencing drug use, intention to use or the attitude of young people towards illicit drugs.

1. Randomised controlled trials in which the unit of randomisation is an individual or a cluster (the school, community or geographical region)
2. Controlled trials without randomisation allocating schools, communities or geographical regions
3. Prospective and retrospective cohort studies
4. Interrupted time series
5. Controlled before and after studies

Types of participants

Young people under the age of 26.

Types of interventions

Experimental intervention

The following definition was adopted by a similar Cochrane review (Brinn 2010): "Mass media is defined here as channels of communication such as television, radio, newspapers, billboards, posters, leaflets or booklets intended to reach large numbers of

people and which are not dependent on person to person contact". To be included in the review, a study needs to assess a mass media campaign explicitly aimed at influencing people's drug use, intention to use or attitude towards illicit drugs use.

Control intervention

- 1) No intervention; 2) other types of communication interventions such as school-based drug abuse prevention programmes (Faggiano 2008); 3) community-based prevention programmes; 4) lower exposure to intervention; 5) time before exposure to intervention.

Types of outcome measures

Primary outcomes

1. Self reported or biomarker-assessed illicit drug use

Secondary outcomes

1. Intentions not to use/to reduce use/to stop use
2. Attitudes towards illicit drug use
3. Knowledge about the effects of illicit drugs on health
4. Understanding of intended message and objectives
5. Perceptions (including perceptions of peer norms and perceptions about illicit drug use)
6. Adverse effects induced by the campaign (reactance, i.e. a reaction to contradict the prevailing norms of rules and positive descriptive norms, i.e. increased perception that drug use in peer population is common, normal or acceptable)

Search methods for identification of studies

Electronic searches

We obtained relevant trials from the following sources:

1. Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library* 2013, Issue 1) which includes the Cochrane Drugs and Alcohol Group's Specialised Register;
2. MEDLINE through PubMed (freely accessible at <http://www.ncbi.nlm.nih.gov/pubmed/>) (from 1966 to 29 January 2013);
3. EMBASE (from 1974 to 30 January 2013);
4. ProQuest Dissertations & Theses A&I (from 1861 to 3 February 2013).

We compiled detailed search strategies for each database searched. These were based on the search strategy developed for PubMed but revised appropriately for each database to take account of differences in controlled vocabulary and syntax rules.

The search strategy for:

1. CENTRAL is shown in [Appendix 1](#);
2. PubMed is shown in [Appendix 2](#);
3. EMBASE is shown in [Appendix 3](#);
4. ProQuest Dissertations & Theses A&I was: (*media campaigns OR mass media*) AND *illicit drug** AND *preventi**.

We searched for ongoing clinical trials and unpublished studies on the following Internet sites:

1. <http://www.controlled-trials.com>;
2. <http://apps.who.int/trialsearch/>;
3. <http://clinicaltrials.gov/>;
4. <https://eudract.emea.europa.eu/>.

Searching other resources

We also searched other sources to identify relevant studies. We assessed conference proceedings that were likely to contain relevant material and contacted the authors. We contacted investigators or experts in the field to seek information on unpublished or incomplete trials. We also reviewed EMCDDA National Focal Points Annual National Reports for any description of relevant studies conducted in Europe.

We used the first studies identified as fulfilling the inclusion criteria to inspect the MeSH terms and to integrate the search strategies. Moreover, we used the “related articles” function of PubMed in a “capture-recapture method” to validate the inclusiveness of the search strategy.

We did not apply any language restriction.

Data collection and analysis

Selection of studies

Two review authors (EA and MF) inspected the search hits by reading the titles and the abstracts. We obtained each potentially relevant study identified in the search in full text and at least two review authors assessed studies for inclusion independently. In case of doubts as to whether a study should have been included, this was resolved by discussion between the review authors. We collated and assessed multiple publications as one study.

Data extraction and management

Two review authors (EA and AB) independently extracted data and input relevant information into Review Manager ([Review Manager 2012](#)) for meta-analysis. Two review authors (MF and FF) assessed the theoretical background of the campaigns. We discussed and solved every step by consensus. We produced a narrative synthesis of the key findings along with a meta-analysis of studies which used appropriate measures.

Assessment of risk of bias in included studies

Four review authors (EA, AB, MF and FF) performed quality assessments independently. We discussed and solved any disagreement by consensus. We uploaded final assessments into Review Manager. In order to obtain more information on the criteria for reducing risk of bias, we contacted the authors of most of the studies.

To assess RCTs we followed the criteria recommended by the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)). The recommended approach for assessing risk of bias in studies included in Cochrane Reviews is a two-part tool, addressing seven specific domains, namely sequence generation and allocation concealment (selection bias), blinding of participants and providers (performance bias) blinding of outcome assessor (detection bias), incomplete outcome data (attrition bias) selective outcome reporting (reporting bias) and other source of bias. The first part of the tool involves describing what was reported to have happened in the study. The second part of the tool involves assigning a judgement relating to the risk of bias for that entry, in terms of low, high or unclear risk. The domains of sequence generation and allocation concealment (avoidance of selection bias) were addressed in the tool by a single entry for each study. Blinding of participants might not be applicable for this type of intervention, and we therefore considered blinding of personnel and outcome assessors (avoidance of performance bias and detection bias). We considered a study to have low risk of bias if the data were obtained with an anonymous questionnaire or administered by computer. We considered incomplete outcome data (avoidance of attrition bias) for all outcomes.

For ITS studies we used the tools developed by the Effective Practice and Organization of Care (EPOC) Group ([Appendix 4](#)). For cohort studies we used the SIGN Quality Criteria described in [Appendix 5](#).

Measures of treatment effect

We intended to analyse dichotomous outcomes (such as intention to use or actual use of illicit substances) by calculating the risk ratio (RR) or odds ratio (OR) for each trial and express the uncertainty in each result with their 95% confidence intervals. We only found continuous outcome measures which we analysed by calculating the standardised mean difference (SMD) with its corresponding 95% confidence intervals.

Unit of analysis issues

In the case of cluster-randomised trials the unit of analysis is either the school or the town. We stated at protocol level that in this case we would have taken into account the criteria for assessing bias in cluster-randomised trials as described in the *Cochrane Handbook*. We inflated each arm's standard deviation for two studies ([Slater 2006](#); [Newton 2010](#)) by multiplying it by the study design effect,

a coefficient which takes into account the average cluster size and the study intra-class correlation.

Dealing with missing data

Where needed, we contacted the authors of the studies for integration of any possible missing data.

Assessment of heterogeneity

The presence of heterogeneity between the trials was tested using the I^2 statistic and the Chi^2 test. A P value of the I^2 statistic higher than 0.50 and a P value of the Chi^2 test lower than 0.10 suggests that there is some evidence of heterogeneity.

Assessment of reporting biases

We intended to use funnel plots (plots of the effect estimate from each study against the standard error) to assess the potential for bias related to the size of the trials, which could indicate possible publication bias. In fact we did not reach the minimum number of (10) studies included in the meta-analysis which is suggested as sufficient for conducting a funnel plot ([Higgins 2011](#)).

Data synthesis

We intended to carry out a meta-analysis by combining RR/OR or the SMD where possible. We performed a meta-analysis of the RCTs using a random-effect model in order to take into consideration the heterogeneity among studies.

For the studies evaluating the Meth Project ([Colorado Meth 2011](#); [Georgia Meth 2011](#); [Hawaii Meth 2011](#); [Idaho Meth 2010](#); [Wyoming Meth 2011](#)) we performed a separate meta-analysis. An interrupted time series (ITS) design was applied for estimating the differences in prevalence of methamphetamine use before and after the Meth Project intervention, adjusting for any underlying temporal trend. Statistical models were based on multilevel mixed effects logistic regression, with State as a random intercept modelling baseline log odds of methamphetamine use to vary randomly across states. The relatively few data points did not allow exploring of more complex models, e.g. the temporal trend could not be assumed to vary randomly across states. The fixed part of the final model assumes (i) a different baseline by age group, but similar among states; (ii) a linear temporal trend homogeneous across states; (iii) an effect of the intervention differing by age group but constant across time and occurring immediately after the intervention. The model may be written as $\text{logit}(\text{use}_{ij}) = \beta_0 + u_{0j} + \beta_1 \text{time}_i + \beta_2 \text{interv}_i + \beta_3 \text{age}_i + \beta_4 \text{age} \times \text{interv}_i + \epsilon_{ij}$, with use

as prevalence of methamphetamine use, time as a continuous variable, intervention and age as two-level categorical variables and J indicating state. The exponentiated coefficient β_2 is interpretable as the ratio between the odds of using methamphetamine after (numerator) and before (denominator) the intervention ([Gilmour 2006](#)). The model was fitted separately for past-month and past-year use of methamphetamine. Data points regarding lifetime use of methamphetamine were not analysed.

Subgroup analysis and investigation of heterogeneity

We intended to perform stratified meta-analysis in order to assess the differential effect of the campaigns based on different theoretical approaches. However the impact of media campaigns may be mediated by the sub-cultural environment and, in particular, by the attitude towards substance use in a given culture. Therefore, at protocol level it was anticipated that subsets of studies were to be analysed by characteristics of target participants (regional location, users versus non-users etc.) whenever possible. Studies could also be compared by type of campaign, based on different theoretical approaches. We did not reach the number of studies sufficient to perform any type of sub-set analysis.

Sensitivity analysis

To incorporate the assessment of risk of bias in the review process we first plotted the intervention effect estimates against the assessment of risk of bias. We subsequently inspected the results stratified for risk of bias and we did not find significant associations between measure of effect and risk of bias. We therefore decided to not include the 'Risk of bias' assessment in the meta-analysis and to discuss it narratively in the results section. The items considered in the sensitivity analysis were the random sequence, blinding of personnel and outcome assessors, and selective reporting.

RESULTS

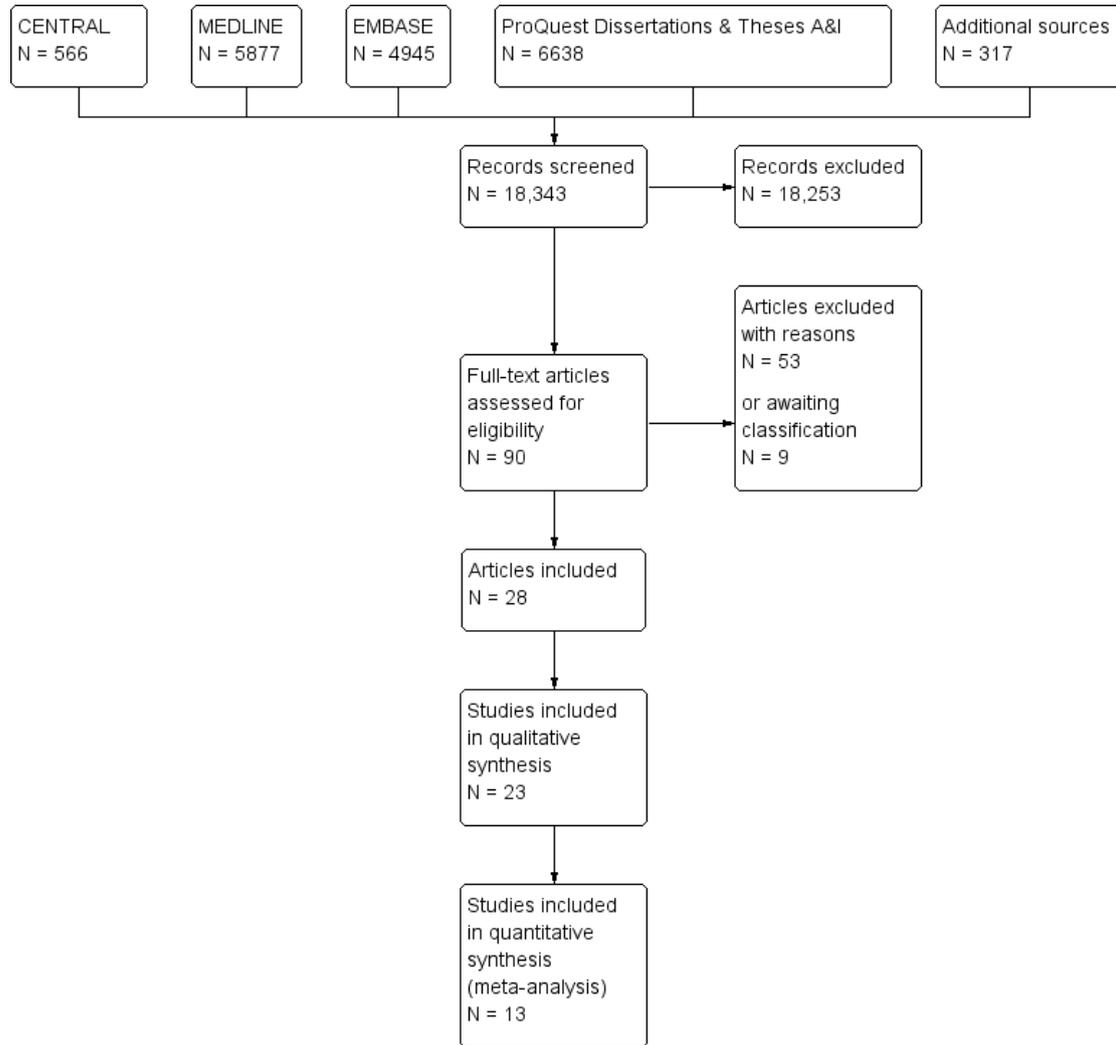
Description of studies

See: [Characteristics of included studies](#), [Characteristics of excluded studies](#) and [Characteristics of studies awaiting classification](#).

Results of the search

The study flow chart is presented in [Figure 1](#).

Figure 1. Study flow diagram. Please note that some studies include more than one article. This explains why there are 23 included studies out of 28 included articles.



Search sources

On 29 January 2013 we performed a PubMed (MEDLINE) search as described in [Appendix 2](#), which identified 5877 records. On 30 January 2013 we searched CENTRAL which returned 566 results and EMBASE which gave 4945 records. On 3 February 2013 we also performed a ProQuest 'Dissertations & Theses A&I' search which returned 6638 records.

We also obtained additional records (N = 317) from one single paper ([Hornik 2006](#)) using PubMed's 'Similar articles' feature, and from papers extracted from 10 reviews ([Battjes 1985](#); [Berberian 1976](#); [Hailey 2008](#); [Kumpfer 2008](#); [Romer 1994](#); [Romer 1995](#); [Schilling 1990](#); [Stephenson 2003b](#); [Wakefield 2010](#); [Werb 2011](#)),

three reports ([EMCDDA 2010](#); [Know the Score 2007](#); [NCI 2008](#)) and three book chapters ([Crano 2001](#); [Flay 1983](#); [Moskowitz 1983](#)).

Screening

We independently screened records from each source search, i.e. no automatic removal of duplicates was used because of the risk of false-positive duplicates. Therefore, we screened 18,343 titles and abstracts. Of them, we excluded 18,253 records (99.5%) as obviously irrelevant.

Full-text analysis

We examined the full-text articles of the remaining 90 records. Of them, 62 records were either excluded (N = 53) due to ineligibility of intervention type, participant age and reported outcome, or set in a pending status (N = 9) due to missing information. We contacted authors whenever possible.

Twenty-eight records corresponded to 23 unique studies which were included in this review. A subset of 13 studies (eight RCTs and five ITS) could also be included in meta-analyses, mostly thanks to personal communication with some authors who provided us with unpublished data and additional reports.

Included studies

Study design

Out of 23 unique studies, 12 were randomised controlled trials (RCT) (Czyzewska 2007; Fang 2010; Fishbein 2002; Kelly 1992; Lee 2010; Newton 2010; Palmgreen 1991; Polansky 1999; Schwinn 2010; Slater 2011; Yzer 2003; Zhao 2006), two were prospective cohort studies (PCS) (Hornik 2006; Scheier 2010), one study was both a RCT and a PCS (Slater 2011), six were ITS (Carpenter 2011; Colorado Meth 2011; Hawaii Meth 2011; Idaho Meth 2010; Palmgreen 2001; Wyoming Meth 2011) and two were before and after (CBA) studies (Georgia Meth 2011; Miller 2000).

Population

No study enrolled subjects younger than 10 years old. Twenty-one studies included subjects older than 10 and younger than 20 years old. Two studies included subjects older than 20 years old and younger than this review's limit of 26 years old; one of them included only people older than 20 (Miller 2000) and one people aged 18 to 22 (Palmgreen 1991).

Three studies included only girls (Fang 2010; Kelly 1992; Schwinn 2010). The others did not specify any sex-related selection criteria. Two studies focused on specific ethnic or racial groups: one on Mexican-American boys and girls (Polansky 1999) and one on Asian-American girls (Fang 2010). The remaining studies did not use ethnicity, racial or socioeconomic characteristics to define the selection criteria.

Intervention

Mass media components

Eight studies evaluated standalone TV/radio commercials (Czyzewska 2007; Fishbein 2002; Kelly 1992; Palmgreen 1991; Palmgreen 2001; Polansky 1999; Yzer 2003; Zhao 2006) and four studies evaluated standalone Internet-based interventions (Fang 2010; Lee 2010; Newton 2010; Schwinn 2010). Eleven studies evaluated multi-component interventions, three regarding TV/radio and printed advertising (Miller 2000; Slater 2006; Slater 2011) and eight regarding TV/radio commercials, printed advertisements and Internet advertising (Carpenter 2011; Hornik 2006; Scheier 2010 and the five Meth Projects). No study evaluated interventions using standalone printed advertising.

Three studies added a school-based drug prevention curriculum (Slater 2006; Slater 2011) or a combination of peer education, computer resources, campus policy and campus-wide events (Miller 2000) to the mass media component(s).

Setting

Eleven studies were conducted in only one setting: eight studies in a school/college setting (Czyzewska 2007; Fishbein 2002; Kelly 1992; Lee 2010; Miller 2000; Newton 2010; Polansky 1999; Yzer 2003), two in a community setting (Fang 2010; Schwinn 2010) and one in a national/statewide setting (Palmgreen 2001).

Twelve studies were conducted in multiple settings: three in school and community settings (Palmgreen 1991; Slater 2006; Zhao 2006), eight in community and national settings (Carpenter 2011; Hornik 2006; Scheier 2010 and the five Meth Projects), while one (Slater 2011) reported evaluations of two similar but distinct interventions - one implemented in a school and community setting and one aired to the whole nation.

Comparison group

Fourteen studies compared one or more mass media interventions with no intervention (Fang 2010; Fishbein 2002; Lee 2010; Miller 2000; Palmgreen 2001; Schwinn 2010; Slater 2006; Yzer 2003; Zhao 2006 and the five Meth projects). Four studies compared higher to lower exposure to a mass media intervention (Carpenter 2011; Hornik 2006; Scheier 2010; Slater 2011). Five studies compared anti-drug advertisements with another intervention (Czyzewska 2007; Kelly 1992; Newton 2010; Palmgreen 1991; Polansky 1999). Two studies (Palmgreen 1991; Yzer 2003) had different intervention arms comparing either another intervention or no intervention. For details of control interventions see the table [Characteristics of included studies](#).

The following table summarises the interventions evaluated and the exposure of the comparison groups, as well as the theories underlying the interventions.

Studies	Ex- plicit under- pinning the- ory	Intervention			Comparison group		
		Inter- net-based in- tervention	PSA (public service - TV/ radio) adver- tisements	Printed ad- vertisement	No interven- tion	Lower expo- sure to inter- vention	Other inter- vention/dif- ferent combi- nation of same inter- vention
Palmgreen 1991	In- fluence of sen- sation-seeking on drug use		X				X
Kelly 1992	Role of discus- sion on atti- tudes and opinions		X				X
Polansky 1999	Decision the- ory		X				X
Miller 2000	Self regulation theory		X	X	X		
Palmgreen 2001	In- fluence of sen- sation-seeking on drug use		X		X		
Fishbein 2002	Beliefs, norms or self efficacy		X		X		
Yzer 2003	The- ories of behav- ioral change: persuasion ef- fects		X		X		X
Slater 2006	Social-eco- logical frame- work (norms and expect- ations influ- ence drug use)		X	X	X		
Zhao 2006	Normative be- liefs		X		X		

(Continued)

Czyzewska 2007	Reactance theory		X				X
Hornik 2006	Unclear	X	X	X		X	
Scheier 2010	Social marketing	X	X	X		X	
Schwinn 2010	Social learning theory	X				X	
Lee 2010	Readiness to change	X				X	
Fang 2010	Family-oriented	X				X	
Newton 2010	Social influence approach	X					X
Idaho Meth 2010	Perception of risk and perception of social disapproval are correlated with drug consumption	X	X	X	X		
Colorado Meth 2011							
Georgia Meth 2011							
Hawaii Meth 2011							
Wyoming Meth 2011							
Slater 2011	Autonomy and aspiration perceptions as mediators marijuana use		X	X		X	
Carpenter 2011	Unclear; evaluated many heterogeneous mass media campaigns	X	X	X		X	

Outcome

The sum of studies described in this paragraph exceeds the number of included studies because many studies measured more than one outcome.

Sixteen studies measured the effect of mass media campaigns on illicit drug use. Thirty-six studies reported the following secondary outcomes (seven were without primary outcomes):

- seven studies: intentions not to use/to reduce use/to stop use;
- 15 studies: attitudes towards illicit drug use;
- two studies: knowledge about the effects of illicit drugs on health;
- one study: understanding of intended message and objectives;
- 11 studies: perceptions (including perceptions of peer norms and perceptions about illicit drug use).

Country

Twenty-one studies were conducted in the USA, one in the USA and Canada (Schwinn 2010), and one in Australia (Newton 2010).

Duration

No follow-up was described, or was applicable, for seven studies (Carpenter 2011; Czyzewska 2007; Fishbein 2002; Palmgreen

1991; Polansky 1999; Yzer 2003; Zhao 2006). Follow-up was shorter than 12 months for four studies (Fang 2010; Kelly 1992; Lee 2010; Schwinn 2010), and longer than or equal to 12 months for the remaining 12 studies.

Excluded studies

Several thousand studies were excluded after screening their title and abstract because they did not meet the inclusion criteria. Fifty-three studies required closer scrutiny and are listed in the [Characteristics of excluded studies](#) table.

Four were excluded because the population studied did not meet the inclusion criteria; nine studies included interventions different from our inclusion criteria. The remainder were excluded because the study design did not meet the inclusion criteria.

Risk of bias in included studies

Randomised controlled trials (RCTs)

Approximately half of the included studies are randomised and quasi-randomised controlled trials. One of them is a mixed RCT-cohort study (Slater 2011). The results of their 'Risk of bias' assessments are presented in [Figure 2](#) and [Figure 3](#) and described in detail in [Table 1](#).

Figure 2. Randomised controlled trial 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

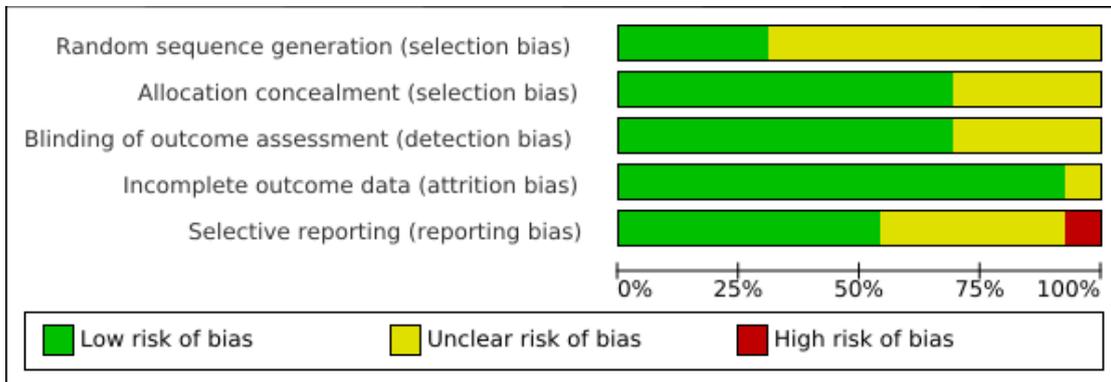


Figure 3. Randomised controlled trial 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Czyzewska 2007	?	+	+	+	?
Fang 2010	?	+	+	+	?
Fishbein 2002	?	?	+	+	+
Kelly 1992	?	?	?	+	+
Lee 2010	+	+	+	+	?
Newton 2010	+	+	+	+	?
Palmgreen 1991	?	?	?	+	+
Polansky 1999	?	?	+	?	+
Schwinn 2010	?	+	+	+	-
Slater 2006	?	+	?	+	+
Slater 2011	+	+	?	+	+
Yzer 2003	+	+	+	+	+
Zhao 2006	?	+	+	+	?

Overall the quality of the included RCTs is acceptable: the stronger dimension is the consideration of risk of attrition bias (incomplete data addressed in the discussion) and the weaker dimension the risk of selection bias (unclear description of method for randomisation). More than half of the studies were clearly free of selective outcome reporting. In one case (Schwinn 2010) there was a clear indication of potential high risk of reporting bias.

Other potential sources of bias

Ecological factors are likely to interfere with the effect of a me-

dia campaign. These factors can include exposures to other media campaigns (advertisements), films or mass media debates directly addressing illicit drugs or other factors acting indirectly (for example, a popular singer who dies from an overdose).

Interrupted time series (ITS) and before and after studies (CBA)

Six studies are ITS and two studies are CBA. The results of their 'Risk of bias' assessments are presented in Figure 4 and Figure 5.

Figure 4. Interrupted time series 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

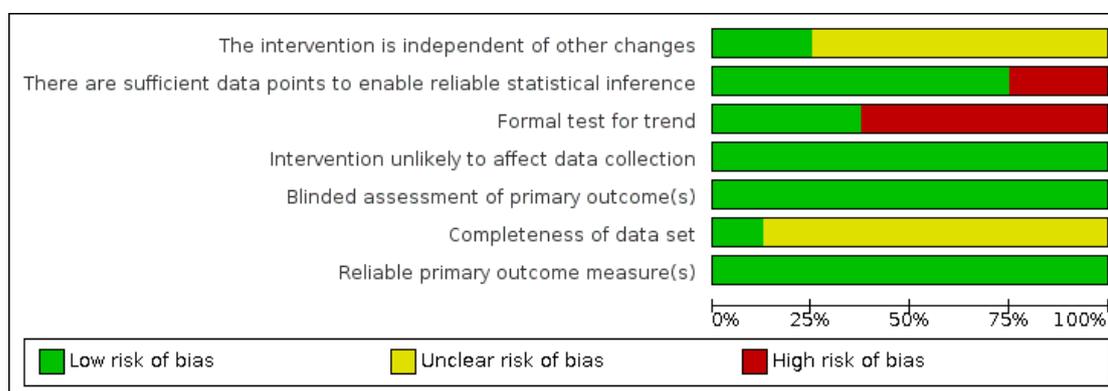


Figure 5. Interrupted time series 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

	The intervention is independent of other changes	There are sufficient data points to enable reliable statistical inference	Formal test for trend	Intervention unlikely to affect data collection	Blinded assessment of primary outcome(s)	Completeness of data set	Reliable primary outcome measure(s)
Carpenter 2011	+	-	+	+	+	?	+
Colorado Meth 2011	?	+	-	+	+	?	+
Georgia Meth 2011	?	+	-	+	+	?	+
Hawaii Meth 2011	?	+	-	+	+	?	+
Idaho Meth 2010	?	+	-	+	+	?	+
Miller 2000	+	-	+	+	+	+	+
Palmgreen 2001	?	+	+	+	+	?	+
Wyoming Meth 2011	?	+	-	+	+	?	+

Overall the studies reported sufficient data points to enable reliable statistical inferences; they also had good strategies to ensure anonymous or computer-administered questionnaires and to ensure that interventions did not affect data collection. The reliability of primary outcome measures was also satisfactory for all the studies. The weaker points were the lack of a formal test for trends and the unclear completeness of the data sets for many studies.

Prospective cohort studies (PCS)

Three studies are cohort studies and one of them is a mixed RCT-cohort study (Slater 2011). The results of their 'Risk of bias' assessments are presented in Table 2, Figure 6 and Figure 7.

Figure 6. Prospective cohort studies 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies

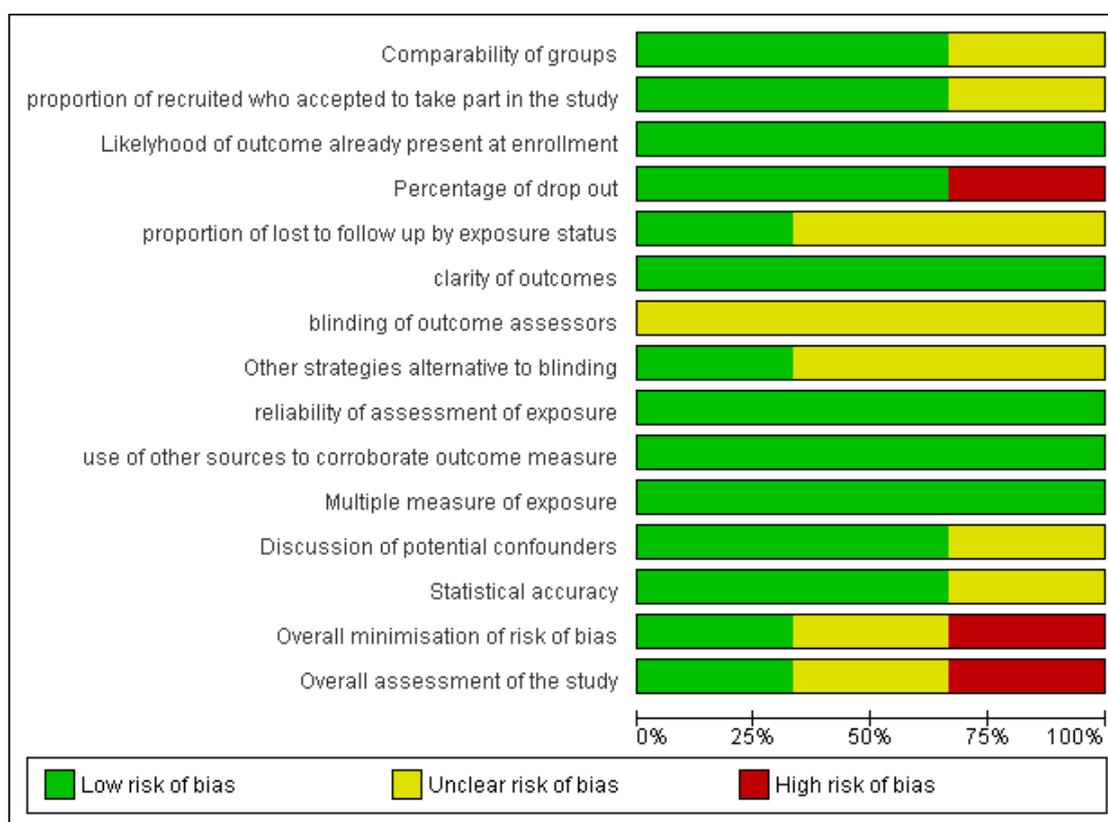


Figure 7. Prospective cohort studies 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

	Comparability of groups	proportion of recruited who accepted to take part in the study	Likelihood of outcome already present at enrollment	Percentage of drop out	proportion of lost to follow up by exposure status	clarity of outcomes	blinding of outcome assessors	Other strategies alternative to blinding	reliability of assessment of exposure	use of other sources to corroborate outcome measure	Multiple measure of exposure	Discussion of potential confounders	Statistical accuracy	Overall minimisation of risk of bias	Overall assessment of the study
Hornik 2006	+	+	+	+	?	+	?	+	+	+	+	+	+	+	+
Scheier 2010	+	+	+	+	+	+	?	?	+	+	+	?	?	-	-
Slater 2011	?	?	+	-	?	+	?	?	+	+	+	+	+	?	?

Overall, all PCS addressed an appropriate and clearly focused question. In two studies subjects were selected with proper procedures in order to make them comparable in all respects. The same two studies indicated how many of the people asked to take part actually participated in the study. One study (Slater 2011) failed to address these issues. Attrition was 35% in two studies and 42.9% in Slater 2011. Comparison between participants and those lost to follow-up was made only in Scheier 2010.

Assessment

The outcomes were clearly defined in all studies. Blinding to exposure status was not applicable for any of the studies. In one study (Hornik 2006) there was some recognition that knowledge of exposure status could have influenced the assessment of the outcomes. In all studies the measure of assessment of exposure was reliable: evidence from other sources was used to demonstrate that the method of outcome assessment was valid and reliable, and exposure level or prognostic factor was assessed more than once.

Confounding

The main potential confounders were adequately identified and taken into account in two studies (Hornik 2006; Slater 2011).

Statistical analysis

Confidence intervals were provided in two studies. One study reported only P values (Scheier 2010).

Overall assessment of the study

One study did very well in addressing the risk of bias or confounding (Hornik 2006), one did quite well (Slater 2011) and one did not adjust for potential confounders (Scheier 2010).

Effects of interventions

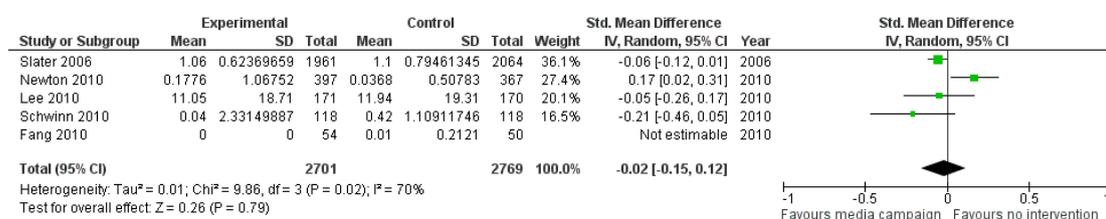
Primary outcomes

Self reported or biomarker-assessed illicit drug use

This primary outcome is measured in 15 studies: five randomised controlled trials (RCT) + one RCT and prospective cohort study; two prospective cohort studies; six interrupted time series (ITS) and one controlled before and after (CBA) study.

The five RCTs (Fang 2010; Lee 2010; Newton 2010; Schwinn 2010; Slater 2006) enrolled 5470 young people and were included in a meta-analysis (see Figure 8). Their pooled results show no effect of media campaign intervention (standardised mean difference (SMD) - 0.02; 95% confidence interval (CI) -0.15 to 0.12, heterogeneity $P = 0.02$) (Analysis 1.1). Youngsters exposed to a media campaign tend to use, on average, fewer illicit substances measured through an array of published and unpublished scales including the American Drug and Alcohol Survey (Centers for Disease Control and Prevention), Youth Risk Behavior Survey, Australian National Drug Strategy Household Survey and Global Appraisal of Individual Needs-I (see Table 3).

Figure 8. Forest plot of comparison: I Mass media versus no mass media intervention (RCT), outcome: I.1 Drug use.



Several time points of use were available in the different studies, but we chose the six-month follow-up as a standard comparable across studies. To do this we have used both published and unpublished data kindly provided by the authors. Among the six-month assessments, Slater 2006 and Schwinn 2010 measured use in the past 30 days, Lee 2010 measured use in the past three months and Newton 2010 frequency of use in the past 12 months.

The pooled result shows no effect of the intervention, with overall significant heterogeneity among studies ($P < 0.05$); this can be partially explained by the results of Newton 2010 which showed a reduction of use in the control group.

The theoretical background for the five studies was varied, with two studies based on the social learning theory (Schwinn 2010) and the social ecological framework (Slater 2006) providing the better results, whereas the study based on the social influence ap-

proach (Newton 2010) favoured the control group.

Five ITS (Colorado Meth 2011; Georgia Meth 2011; Hawaii Meth 2011; Idaho Meth 2010; Wyoming Meth 2011, $N = 26,405$) evaluated the Meth Project intervention in five US states. In every study the first year reports pre-campaign figures. Observed and predicted overall and state-specific probabilities were plotted against time for both past-month (Figure 9) and past-year (Figure 10) use of methamphetamine. Among study participants aged 12 to 17 years old there was no evidence of an effect on past-month prevalence of methamphetamine (odds ratio (OR) 1.16, 95% CI 0.63 to 2.13) and evidence of a reduction in past-year prevalence (OR 0.59; 95% CI 0.42 to 0.84). Among participants aged between 18 and 24 years old there was no evidence of an effect for past-month (OR 0.72; 95% CI 0.16 to 3.20) or past-year (OR 0.91; 95% CI 0.43 to 1.94) prevalence of methamphetamine.

Figure 9. Observed and predicted probabilities of past-month methamphetamine use in the Meth Project studies

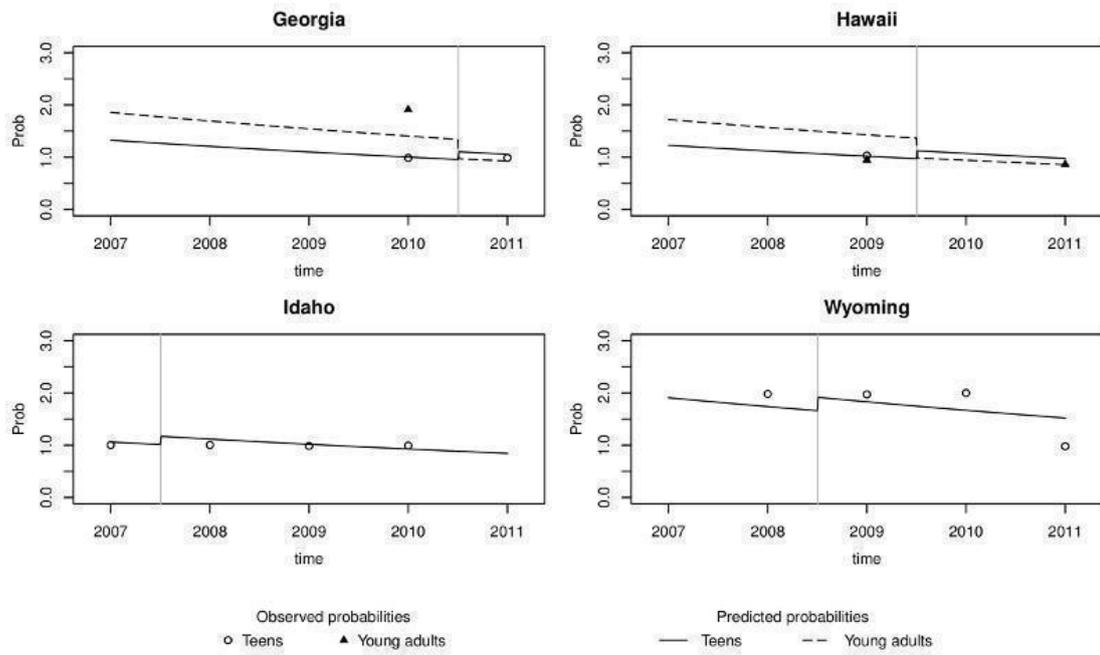
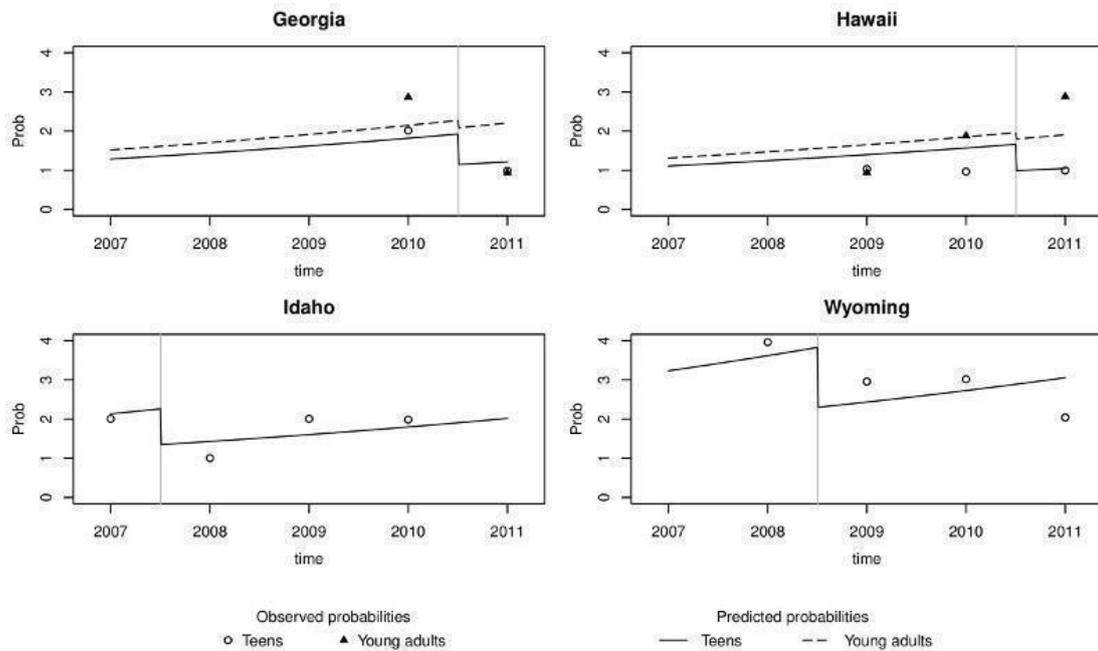


Figure 10. Observed and predicted probabilities of past-year methamphetamine use in the Meth Project studies



Due to the intrinsic methodological limitations of ITS studies and the impossibility of conducting more sophisticated analyses (e.g. by adjusting for potential confounders), these findings should be considered with caution.

Slater 2011, the only RCT that included a prospective cohort study (the reason why it was not included in the meta-analysis) found evidence that a community-level campaign, adjusted for the effect of a school-level campaign, reduced marijuana uptake compared to no intervention (estimate -0.511; $P = 0.026$).

Two prospective cohort studies ($N = 10,632$) found results ranging from non-significantly effective to a significant iatrogenic effect. Namely, Scheier 2010 found that over time young participants in the experimental arms reported increasingly more awareness and recalled increasingly more campaign messages, and also a concomitant but not statistically significant decrease in their reported levels of marijuana use. Hornik 2006 measured past-year marijuana use after exposure to a national media campaign as a function of exposure to a specific advertisement at a prior round and found an increase in use (odds ratio (OR) 1.21; 95% CI 1.19 to 1.65), controlled for considered confounders.

One ITS (Palmgreen 2001) was included in the meta-analysis because the author we contacted for this review suggested presenting the data as in the original papers. In this 32-month study, high sensation-seekers exhibited a significant upward trend in 30-day

marijuana use before exposure to the campaign and a significant downward trend after exposure. This finding was reported in both the communities involved in the study (Knox County Time Series ($P = 0.001$) and the Fayette County Time Series ($P = 0.003$ and $P = 0.001$ after campaign 1 and 2, respectively)).

One ITS (Carpenter 2011) analysed the relationship between exposure to the 'Above the Influence' campaign in 210 US media markets and adolescent marijuana use from 2006 to 2008. The study showed lower rates of past-month (adjusted odds ratio (AOR) 0.67; 95% CI 0.52 to 0.87) and lifetime (AOR 0.76; 95% CI 0.62 to 0.93) marijuana use among girls in grade eight. For boys in grade eight and both girls and boys in grades 10 and 12 there was no evidence of an association between the campaign and a reduction in marijuana use.

The only controlled before and after (CBA) study (Miller 2000) found a modest increase in drug use in the control campus, paralleled by a modest decrease in drug use in the experimental campus, without statistical significance.

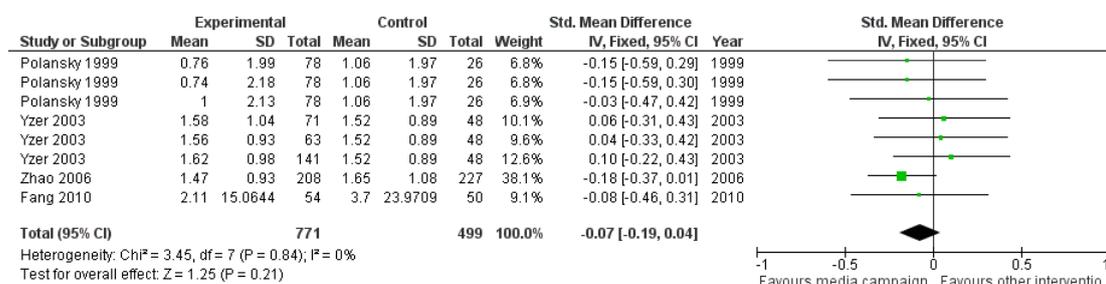
Secondary outcomes

Intentions not to use/to reduce use/to stop use

This outcome was measured by four RCTs, which found a non-statistically significant effect in favour of media campaigns, and one prospective cohort study which, on the other hand, found a possible iatrogenic effect.

Four RCTs (Fang 2010; Polansky 1999; Yzer 2003; Zhao 2006) involving 1270 students were included in the meta-analysis (see Figure 11) and the pooled analysis shows that there is no effect (SMD -0.07; 95% CI -0.19 to 0.04) (Analysis 1.2). Intentions to use drugs were measured with several unpublished scales and the Drug Attitude Scale (see Table 3 for a brief description of the scales used).

Figure 11. Forest plot of comparison: 1 Mass media versus no mass media intervention (RCT), outcome: 1.2 Intention to use drugs.



Hornik 2008 was not included in the meta-analysis because its study design (prospective cohort study) was not comparable with that adopted by the others (randomised controlled trial). The study found that at one round a higher level of exposition was associated with more intention to use marijuana (expressed as less intention to avoid marijuana use ($y = -0.07$; 95% CI -0.13 to -0.01).

Attitudes towards illicit drug use

Fourteen studies including 37,172 youngsters considered this outcome which was measured specifically by eight RCTs, one prospective cohort study and five ITS. No meta-analysis was possible and results have been described narratively. Overall, no conclusions can be drawn on the basis of the available studies.

Eight RCTs showed mixed results with four studies giving positive results and four uncertain results. For example, Palmgreen 1991 found that media campaign messages specifically targeting high sensation-seekers were more effective than controls in increasing negative attitude towards drug use. In Kelly 1992 the exposed group showed a change in attitude towards drugs. In Polansky 1999 ninth-grade students exposed to media advertisement showed more ability to resist peer pressure to use drugs than

the control group. In Czyzewska 2007 the anti-marijuana advertisements group showed a tendency to more negative implicit attitudes to marijuana than the control whereas Newton 2010 showed that at the 12-month follow-up no differences between groups persisted for alcohol expectancies, cannabis attitudes or alcohol- and cannabis-related harms. The advertisements studied by Yzer 2003 targeted the belief that marijuana is a gateway to use of stronger drugs. Nevertheless results did not support this as no clear persuasion was found for any of the ad sequences. In comparison to the control condition, adolescents in the explicit gateway condition tended to agree less with the gateway message and displayed weaker correlations between anti-marijuana beliefs and their attitude towards marijuana use. Schwinn 2010 measured drug resistance/refusal skills; however they did not report results. Zhao 2006 did not find any significant effect on individual measures of attitude change.

Hornik 2006 found a small but significant increase in anti-marijuana beliefs and attitudes in students exposed to media campaigns even though this was not accompanied by significant parallel gains in intentions not to use, social norms or self efficacy.

Heterogeneous results were reported in the five included Meth

Project studies. In [Wyoming Meth 2011](#) more teens disapproved of experimental meth use (i.e. trying meth once or twice) in 2008 than 2011, and both experimental and regular use of heroin, marijuana and cocaine. In [Colorado Meth 2011](#) disapproval of experimental use of marijuana decreased but disapproval of regular use increased from 2009 to 2011. In [Georgia Meth 2011](#) most 12 to 17-year-olds disapproved of experimental use of meth, heroin and cocaine in 2011 than in 2010. In [Hawaii Meth 2011](#) more 12 to 17-year-olds disapproved experimental use of meth in 2009 than in 2011. Most 18 to 24-year-olds disapproved of experimental and regular use of meth and experimental use of heroin and cocaine. In [Idaho Meth 2010](#) more teens disapproved of experimental and regular use of meth, heroin and cocaine in 2007 than in 2010.

Knowledge about the effects of illicit drugs on health

One RCT measured this outcome, finding a possible association between the effectiveness of the campaign and message on individual characteristics. One study shows significant improvement in knowledge about the target substance in the experimental group. [Lee 2010](#) found an association between contemplation for change and marijuana use at three-month follow-up. Intervention participants who were higher in contemplation for change showed a significant decrease in marijuana use. Nevertheless, this result was not confirmed at six months follow-up. [Newton 2010](#) showed that at the 12-month follow-up, significant improvements in alcohol and cannabis knowledge in students in the intervention group compared to the control group were present.

Understanding of intended message and objectives

Only one RCT addressed this outcome: [Fishbein 2002](#) which adopted a measure of perceived effectiveness of a media campaign.

Perceptions (including perception of peer norms and perception of risks of use of illicit drugs)

This outcome was measured by 11 studies (N = 40,243): four RCTs, one prospective cohort study, one CBA and five ITS.

Only one of the four included RCTs found a significant effect in favour of media campaigns in changing towards a negative perception of marijuana use ([Zhao 2006](#)). The remainder found weaker results apparently in favour of interventions.

[Fishbein 2002](#) adopted a measure of perceived effectiveness of media campaign based on realism, learning and emotional responses, all considered highly correlated with effective messages. [Zhao 2006](#) found that students exposed to media campaign messages showed changes towards a negative perception about the consequences of marijuana use. [Schwinn 2010](#) measured the normative belief among participants and found a change in the experimental group which was not maintained at six months follow-up. As already mentioned [Yzer 2003](#) targeted the belief that marijuana is a gateway to stronger drugs. Results did not support this and no clear

persuasion was found for any of the ad sequences. In comparison to the control condition, adolescents in the explicit gateway condition tended to agree less with the gateway message and displayed weaker correlations between anti-marijuana beliefs and their attitude toward marijuana use.

[Hornik 2006](#), the only prospective cohort study investigating this outcome, found a small but significant increase in anti-marijuana beliefs and attitudes in students exposed to media campaigns yet this was not accompanied by significant parallel gains in intentions not to use, social norms or self efficacy

The only CBA ([Miller 2000](#)) found that the students enrolled in the experimental arm showed significantly higher perceived risks from substance use

Results differed considerably across the five included Meth Project studies. In [Wyoming Meth 2011](#) perception of ease to acquire any of the examined drugs (meth, heroin, marijuana and cocaine) decreased from 2008 to 2011. More teens agreed with all of the 14 perceived risks attributed to meth and more teens disagreed with six out of the nine perceived benefits attributed to meth. In [Colorado Meth 2011](#) more teens in 2011 than in 2009 agreed with nine of the 14 items concerning risks attributed to meth. In [Georgia Meth 2011](#) perception of ease to acquire cocaine and heroin decreased from 2010 to 2011 among 12 to 17-year-olds. More teens agreed with all of the 14 perceived risks attributed to meth, and fewer teens agreed with five of the nine perceived benefits attributed to meth. Among 18 to 24-year olds, more young adults agreed with seven of the 14 perceived risks attributed to meth, and fewer young adults agreed with six of the nine perceived benefits attributed to meth. In [Hawaii Meth 2011](#) perception of ease to acquire heroin decreased from 2009 to 2011 among 12 to 17-year-olds. The percentage of those who see a “great risk” in taking meth, heroin and cocaine decreased by around 10 points. More teens agree with 13 of the 14 perceived risks attributed to meth. Among 18 to 24-year-olds a reduction of perceived ease to acquire marijuana and cocaine was also described. In such an age group the percentage of those who see a “great risk” in taking meth, heroin and cocaine decreased by around 15 points. More young adults agreed with all of the 14 perceived risks attributed to meth and fewer young adults agreed with five of nine perceived benefits of meth. In [Idaho Meth 2010](#) perception of risk in trying meth, heroin and cocaine once or twice increased from 2007 to 2010. More teens agreed with all of the 14 perceived risks attributed to meth and fewer teens agreed with all of the nine perceived benefits attributed to meth.

Adverse effects

- Reactance (i.e. a reaction to contradict the prevailing norms of rules)

[Fishbein 2002](#) found that six out of 16 studied Public Service Advertisements (PSA) were judged by the young participants as not effective. In other words, adolescents viewing these six PSAs

reported that they and their friends would be more likely to try or to use drugs, and would feel less confident about how to deal with situations involving drugs. Specifically negative correlations were found for the advertisement tackling marijuana ($r = -0.52$), those not specifying a drug or talking about drugs in general, also tended to be judged as ineffective, although this relationship was not significant ($r = -0.23$). PSAs describing the “just say no” message tended to be judged as less effective ($r = -0.29$). [Yzer 2003](#) found that adolescents exposed to the “Gateway” message (explicitly saying that marijuana use led to use of hard drugs) considered this message less effective and were (although not statistically significantly) more positive towards marijuana use, while [Hornik 2006](#) found a possible presence of pro-marijuana effects in at least two analyses out of 10 in terms of intention to use and initiation.

- Positive descriptive norms (i.e. increased perception that drug use in peer population is common, normal or acceptable)

[Palmgreen 2001](#) found a reinforcing effect of the media campaign on pro-marijuana beliefs (particularly for occasional use).

DISCUSSION

Summary of main results

The studies included in this review tested an array of different interventions including national campaigns, public service advertisements, television messages, video tapes and Internet-based campaigns and the effects were measured by means of unpublished and published scales administered to the participating adolescents. Hence the first issue is the comparability of results.

Overall 15 studies measured the effects on the use of drugs of nine campaigns of which four used the Internet, one was performed in school setting and four were TV broadcasting campaigns (the Meth Project was assessed by five studies and the National Youth Anti-Drug Media Campaign (NYADMC) was assessed at different stages by five studies).

The outcomes on the use of drugs of five randomised controlled trials (RCTs) (four on Internet-based interventions and one on TV/radio broadcasting) have been pooled, resulting in no effect of mass media campaigns (standardised mean difference (SMD) -0.02; 95% confidence interval (CI) -0.15 to 0.12), with statistically significant heterogeneity ($P = 0.02$). The four studies including Internet-based interventions gave contrasting results about drug use (some showed that the intervention reduced the use of drugs and some showed that the intervention could favour use), whereas the study on the national campaigns found a reduction in use in the experimental group.

The study evaluating the school media campaign found a non-significant reduction in drug use in the experimental group.

The studies evaluating the Meth Project on methamphetamine were included in a separate meta-analysis, the pooled results of

which showed a significant reduction in the past-year use of methamphetamine.

Five studies evaluated different phases of the NYADMC. The preliminary study showed positive results in favour of the campaign, the two studies evaluating the 1st phase showed an opposite effect, with a significant increase in drug use in the more robust study, and the two studies evaluating the 2nd phase showed positive results in favour of the campaign.

There are a series of observational studies, generally cohort studies or interrupted time series (ITS), which can be classified as field trials and evaluate the effectiveness of the multimedia-TV campaigns intervention in its context. They show contrasting results, from weakly effective, as for the Meth Project campaign, to clearly harmful, as one form ([Hornik 2006](#)) reported statistically significant results in favour of the control group, showing an increase in marijuana use of 20% in those more exposed to the campaign compared to those less exposed. The multistage evaluation of the NYADMC campaign conducted to positive results.

Looking at the secondary outcomes, the RCTs included in the meta-analysis showed non-significant results in favour of the groups exposed to the campaign for intention to use, an outcome considered a proxy for future behavior ([Litchfield 2006](#); [Olds 2005](#)). One observational study ([Hornik 2006](#)) found a possible reinforcing effect of media campaign exposure on intention to use, especially cannabis.

Summing up the available evidence from RCTs shows that media campaigns based on the Internet are not effective in reducing the use of drugs, whereas the evidence from observational studies shows that there are some positive effects in reducing last-year prevalence in younger people. A study based on independent data collection gave overall positive results for girls and showed no effectiveness in boys in terms of marijuana use.

Overall completeness and applicability of evidence

The objective of this review was to measure the effect of media campaigns on influencing drug use among young people. The studies we included only partially answer the question and they are hardly comparable. In fact the studies focused on a variety of interventions and used several different scales to measure the outcomes. It was therefore not possible to have results on all the typologies of campaign listed in the introduction section, and any attempt to compare effects is limited.

A second threat to the applicability of results is the nature of the studies: the RCTs are always carried out in an experimental context such as, for example, schools in which the students randomised to the intervention arm are exposed to the media message, or the trials enrolling volunteers on the Internet, a very selected population. This appears to measure efficacy and not effectiveness of the intervention, given that subjects are out of the context in which they would be exposed in the real world. The other studies, called

field studies, measure the effect in a real context, but are limited in numbers, overall methodological quality and are actually focused on two campaigns.

Furthermore, all the studies were conducted in the USA, apart from two in Canada and Australia, and as a consequence the generalisability to other geographical and social contexts, such as Europe, remains unclear.

Quality of the evidence

We included 23 studies on very different interventions, the effects of which were measured with several scales. The methodological quality of the included studies was hard to assess as many dimensions were unclear in the relevant publications. Nevertheless, when the dimensions were reported the quality of the studies was acceptable. In many cases further information was obtained by contacting the study authors. The main limitation of the evidence available is the lack of comparability of some measures of outcomes and, more importantly, the unclear causal relationship between the campaign size and its effect. This lack of clarity reduces the generalisability of results, i.e. it is still unclear which part of a campaign should be reproduced to achieve which results.

Potential biases in the review process

The inclusion of studies which are different from randomised controlled trials complicates the identification and retrieval of the studies, due to a less structured indexing of studies in different databases, and lack of devoted registries and unique identification of studies. We therefore acknowledge that we might have missed some studies. Nevertheless, an accurate cross-check of all the reference lists and contacts with the principal investigators in the field may have reduced this risk.

The assessment of study quality relied on study design-specific checklists, yet for many publications the majority of the information we used to assess and score the quality criteria was unclear. We therefore contacted many authors to ask for clarification, but in the case of the older studies it was not possible to retrieve additional information.

Agreements and disagreements with other studies or reviews

Werb and colleagues (Werb 2011) performed a systematic review of all the studies assessing public service announcements (eight studies) including meta-analyses for two outcomes: intention to use and mean use of illicit drugs. In spite of different inclusion criteria (as we also included non-PSA interventions) and criteria for analysis, we reached similar conclusions. Furthermore, Wakefield 2010, in their broader analysis of media campaigns aiming to change health behaviour, address the media campaign effect

on illicit drugs use with five studies, concluding that the relevant evidence is inconclusive.

AUTHORS' CONCLUSIONS

Implications for practice

The effectiveness of media campaigns to prevent illicit drug use among young people is not clearly supported, with some evidence of iatrogenic effects. Therefore it is recommended that such campaigns should only be provided in the context of rigorous, well-designed and well-powered evaluation studies.

Implications for research

The great majority of the studies are conducted in the United States, thus more worldwide studies should be carried out. Moreover, validated and standardised tools to measure the outcome are recommended to allow comparability and generalisability of results. As the actual evidence suggests some effectiveness in specific populations (younger and female, for example) we need to focus better on investigation of the components of media campaigns which are effective in specific populations.

For this reason, beyond the general methodological recommendations, we suggest a strategy to make the best use of available resources and study designs. Our suggestions initially consider general improvement of methods:

- field evaluation studies should adopt, whenever possible, a cohort design;
- studies should be conducted in different countries and contexts;
- validated, comparable and standard tools should be used for the measurement of effects;
- the separate testing of specific media campaign components for their efficacy should be carried out by pilot randomised controlled trials in specific populations;
- future studies should ensure consistency among hypothesis testing, study design and measures of outcomes.

In general, whenever possible, interrupted time series studies, using independent and current data collection (such as the one by Carpenter 2011), should be conducted to assess the overall effects of any anti-drug media campaign.

Until the development of this research is ensured, we should not exclude the possibility of a campaign having iatrogenic effects.

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Werb D, Mills EJ, Debeck K, Kerr T, Montaner JS, Wood E. The effectiveness of anti-illicit-drug public-service announcements: a systematic review and meta-analysis. *Journal of Epidemiology and Community Health* 2011;**65** (10):834–40. [PUBMED: 21558482]
- Wise 1998**
Wise RA. Drug-activation of brain reward pathways. *Drug and Alcohol Dependence* 1998;**51**:13–22.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Carpenter 2011

Methods	Study design: interrupted time series study Sampling: systematic sampling (schools are selected within geographic areas that are determined by the sampling section of the University of Michigan Survey Research Center, page 949) Comparison group(s): pre-intervention surveys Follow-up duration: n/a Study time span: 2006 to 2008 (approximately 36 months)	
Participants	130,245 youths from 8th to 12th grade (13- to 18-year-old)	
Interventions	All media for 210 media markets for 2006 to 2008, after the introduction of the Above the Influence campaign	
Outcomes	<ul style="list-style-type: none"> • Past 30-day marijuana use • Lifetime marijuana use • Past-month alcohol consumption 	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Colorado Meth 2011

Methods	Study design: interrupted time series study Sampling: n/a Comparison group(s): pre-intervention survey Follow-up duration: n/a Study time span: March 2009 to April 2011 (26 months)	
Participants	1803 youths (600 + 601 + 602)	
Interventions	Meth Project (USA), a “messaging campaign, supported by community outreach, and public policy initiatives”. The campaign comprises “television, radio, print, billboard, and Internet advertising”	
Outcomes	<ul style="list-style-type: none"> • Past-month use of methamphetamine • Attitudes on methamphetamine and other drugs • Perceptions concerning methamphetamine and other drugs • Information sources and advertising awareness • Statewide Meth Project awareness and perceptions 	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaires
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Methods	Study design: randomised controlled trial Sampling: not specified Comparison group(s): 4 = 2 anti-tobacco advertisements x 2 orders of advertisements (i. e. explicit attitudes towards tobacco or marijuana) Follow-up duration: not applicable Study time span: not specified
Participants	229 college students aged 18 to 19 years
Interventions	15 advertisement embedded in a 15-minute science programme (USA). 10 advertisements were youth directed, 5 were non-youth directed. Each programme comprised of 90-second science film segments, 30-second youth-directed ad, 30-second non-youth-directed ad, then again another 30-second youth-directed ad. There were 4 versions of recorded programme corresponding to 4 experimental conditions: 2 types of advertisements (i.e. anti-tobacco or anti-marijuana) x 2 orders of advertisements (i.e. explicit attitudes towards tobacco or marijuana)
Outcomes	<ul style="list-style-type: none"> • Implicit and explicit attitude towards tobacco • Implicit and explicit attitude towards marijuana
Notes	Implicit attitudes were assessed through the Implicit Association Test (IAT)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	p. 117 "They were randomly assigned to experimental conditions", but randomisation details are not reported
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 117: "Two groups of 18- to 19-year-old college students were exposed to either anti-tobacco or anti-marijuana advertisements followed by implicit and explicit tests of attitudes to both, marijuana and tobacco"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 119 "Next to a computer, each person had a survey with a pre-recorded ID number on it"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants completed the test (being a post-only design); p. 117 "Two groups of 18- to 19-year-old college students were

Czyżewska 2007 (Continued)

		exposed to either anti-tobacco or anti-marijuana advertisements followed by implicit and explicit tests of attitudes to both, marijuana and tobacco”
Selective reporting (reporting bias)	Unclear risk	No study protocol was mentioned

Fang 2010

Methods	Study design: randomised controlled trial Sampling: random sampling (through online advertisement and community service agencies) Comparison group(s): no intervention Follow-up duration: 6.25 months Study time span: September 2007 to ~December 2008 (~16 months)	
Participants	108 Asian-American girls aged 10 to 14 with private access to a computer, and their mothers	
Interventions	Internet-based prevention programme (USA) guided by family interaction theory and aiming to prevent girls’ substance use through enhancing mother-daughter interactions. 9 sessions: mother-daughter relationship, conflict management, substance use opportunities, body image, mood management, stress management, problem solving, social influences, self efficacy. The programme was not designed expressly for Asian-Americans	
Outcomes	<ul style="list-style-type: none"> ● Past 30-day use of <ul style="list-style-type: none"> ○ alcohol ○ cigarettes ○ marijuana ○ prescription drugs ● Intention to use any of the above in the future ● Depression ● Other variables <ul style="list-style-type: none"> ○ Self efficacy ○ Refusal skills ○ Mother-daughter closeness ○ Mother-daughter communication ○ Maternal monitoring ○ Family rules against substance use 	
Notes	Only 1 post-test survey. Unclear whether the intervention focused on a single substance or many	
<i>Risk of bias</i>		
Bias	Authors’ judgement	Support for judgement

Fang 2010 (Continued)

Random sequence generation (selection bias)	Unclear risk	p. 530 “Mother-daughter dyads were randomly assigned to intervention (n = 56) and control arms (n = 52)”, but randomisation details are not reported
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 530: “Delivered by voice-over narration, animated graphics, and games, session content involved skill demonstrations and interactive exercises that required the joint participation of mothers and daughters.”
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Online questionnaire p. 530 “Girls and mothers had separate and unique log-in names and passwords, and each completed a pretest and posttest survey online”
Incomplete outcome data (attrition bias) All outcomes	Low risk	Low number of missing outcome data; missing data balanced in numbers across study groups p. 530 “Mother-daughter dyads were randomly assigned to intervention (n = 56) and control arms (n = 52)” “Two mother-daughter dyads attrited from each arm, and 104 dyads (54 intervention and 50 control) successfully completed both pretest and posttest measures”
Selective reporting (reporting bias)	Unclear risk	p. 530 “The study protocol was approved by Columbia University’s Institutional Review Board”

Fishbein 2002

Methods	Study design: randomised controlled trial Sampling: systematic random sampling (letters from each included middle/high school) Comparison group(s): 5 experimental (6 advertisements each, embedded in a 24-minute documentary) + versus no intervention (documentary only) condition Follow-up duration: not applicable Study time span: not specified
Participants	3608 youths aged 11 to 18 years (grades 4 to 12), median age 15 years

Fishbein 2002 (Continued)

Interventions	30 public service announcements produced by the Partnership for a Drug Free America (USA)	
Outcomes	<ul style="list-style-type: none"> ● 30 dependent variables (5 scores for each of the 6 PSAs) <ul style="list-style-type: none"> ○ Perceived PSA effectiveness and realism ○ Negative and positive emotional response ○ Amount learned (understanding of intended message and on) ● 5 scores resulting from mean of the 6 PSA scores <ul style="list-style-type: none"> ○ Total perceived PSA effectiveness and realism ○ Total negative and positive emotional response ○ Total amount learned (understanding of intended message and on) ● Perceptions: <ul style="list-style-type: none"> ○ Perceived danger of engaging in risky behaviours ○ Perceived harmfulness of engaging in risky behaviours ○ Social norms 	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No mention of the sequence generation in the article (methods section p. 239)
Allocation concealment (selection bias)	Unclear risk	No mention of the sequence generation in the article (methods section p. 239)
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 240 "Confidentiality and anonymity were emphasized in the instructions, both in written and audio-video form"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Apparently almost all the sample exposed to interventions were included in the final analysis (and filled out the questionnaires) . But no mention of the number originally enrolled, mention of some drop-outs apparently unlinked to outcomes but no absolute numbers reported
Selective reporting (reporting bias)	Low risk	Protocol not available but we do not suspect selective reporting

Georgia Meth 2011

Methods	Study design: before and after study Sampling: 4-stage probability sampling Comparison group(s): pre-intervention survey Follow-up duration: n/a Study time span: November 2009 to April 2011 (18 months)
Participants	4454 youths (2432 + 2022)
Interventions	Meth Project (USA), a “messaging campaign, supported by community outreach, and public policy initiatives”. The campaign comprises “television, radio, print, billboard, and Internet advertising”
Outcomes	<ul style="list-style-type: none"> • Past-month use of methamphetamine • Attitudes towards methamphetamine and other drugs • Perceptions concerning methamphetamine and other drugs • Information sources and advertising awareness • Statewide Meth Project awareness and perceptions
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaires
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Hawaii Meth 2011

Methods	Study design: interrupted time series study Sampling: 4-stage probability sampling Comparison group(s): pre-intervention survey Follow-up duration: n/a Study time span: March 2009 to March 2011 (25 months)
Participants	3305 youths (1065 + 1035 + 1205)

Hawaii Meth 2011 (Continued)

Interventions	Meth Project (USA), a “messaging campaign, supported by community outreach, and public policy initiatives”. The campaign comprises “television, radio, print, billboard, and Internet advertising”	
Outcomes	<ul style="list-style-type: none"> • Past-month use of methamphetamine • Attitudes on methamphetamine and other drugs • Perceptions concerning methamphetamine and other drugs • Information sources and advertising awareness • Statewide Meth Project awareness and perceptions 	
Notes		
Risk of bias		
Bias	Authors’ judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaires
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Hornik 2006

Methods	Study design: prospective cohort study Sampling: systematic sampling (4-stage, geographic) Comparison group(s): lower exposure to intervention Follow-up duration: November 1999 to June 2004 (56 months) Study time span: September 1999 to June 2004 (58 months). Up to 4 observations per each of the 3 cohorts. Interviews were carried out at home
Participants	8117 youths aged 12.5 to 18 years in the first round
Interventions	The National Youth Anti-Drug Media Campaign (USA) was a comprehensive social marketing campaign aimed at youths aged 9 to 18 years and disseminated through television, radio, websites, magazines, movie theatres and others. The campaign established partnership with civic, professional and community groups and outreach programs with the media, entertainment and sport industries

Hornik 2006 (Continued)

Outcomes	<ul style="list-style-type: none"> • Lifetime, past-year and past 30-day use of marijuana • Intention to use marijuana • Attitudes towards marijuana and self efficacy to resist use of marijuana • Perceptions and social norms about marijuana 	
Notes	<p>NIDA report 'Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings. June 2006', on which this article is based, was also used to retrieve information for this meta-analysis</p>	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous and administered via computer p. 2230 (Hornik 2008) "NSPY questionnaires were administered on laptop computers brought into the respondents' homes. The interviewer recorded answers for the opening sections, but for most of the interview, to protect privacy, respondents heard pre-recorded categories of questions and answer through headphones and responded via touch screen selection on the computer. Interviews could be conducted in English or Spanish"
Incomplete outcome data (attrition bias) All outcomes	Low risk	"The overall response rate among youths for the first round was 65%, with 86% to 93% of still eligible youths interviewed in subsequent rounds", page 2230 in Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, page 2-12, table 2-A "Completed interviews by wave"
Selective reporting (reporting bias)	Low risk	No protocol available but the we do not suspect selective reporting bias

Idaho Meth 2010

Methods	Study design: interrupted time series study Sampling: 4-stage probability sampling Comparison group(s): pre-intervention survey Follow-up duration: n/a Study time span: September 2007 to December 2010 (40 months)	
Participants	11,143 youths (3091 + 2590 + 2641 + 2821)	
Interventions	Meth Project (USA), a “messaging campaign, supported by community outreach, and public policy initiatives”. The campaign comprises “television, radio, print, billboard, and Internet advertising”	
Outcomes	<ul style="list-style-type: none"> • Past-month use of methamphetamine • Attitudes towards methamphetamine and other drugs • Perceptions concerning methamphetamine and other drugs • Informations sources and advertising awareness • Statewide Meth Project awareness and perceptions 	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaires
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Kelly 1992

Methods	<p>Study design: randomised controlled trial. Sampling: not specified. Comparison group(s):</p> <ul style="list-style-type: none"> • control group (no anti-drug PSA and no group discussion). • experimental group 1 (anti-drug PSA without group discussion) • experimental group 2 (anti-drug PSA with group discussion) <p>Follow-up duration: 1.5 months (6 weeks). Study time span: not specified, at least 1.5 months.</p>
Participants	79 female college students, primarily 18 to 19 years old
Interventions	Anti-drug messages (USA) selected from the library of the Media Advertising Partnership for a Drug-Free America and centred on drugs and alcohol
Outcomes	<ul style="list-style-type: none"> • Attitudes towards marijuana • Attitudes towards cocaine • Attitudes towards crack • Attitude towards getting drunk
Notes	Pre-test, post-test and 6-week follow-up means are provided. Standard deviations are not provided

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported p.80 "Subjects were randomly divided into a total of 9 discussion groups."
Allocation concealment (selection bias)	Unclear risk	Not reported Baseline comparisons reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding of outcome assessors not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data and clear reporting of sample size both of the intervention and control group
Selective reporting (reporting bias)	Low risk	No study protocol available but clear reporting of main study hypothesis and direct correlation between main topics investigated in the experiment and reported outcomes TOPICAL EXPERIMENTAL AREAS: p. 79 "two topical areas chosen for the study were (1) the age at which parents

		<p>should talk to their children about dangers of drugs, (2) how much responsibility one has, if any, for another's drug use"</p> <p>OUTCOMES:</p> <p>p. 80 "three questions asking at what age children should be spoken to about marijuana, cocaine and crack"</p> <p>p. 81 "one question asked subjects to rate their agreement on a 5 point Likert scale with the statement "whether or not I get drunk is nobody's business". Similar question were asked regarding use of marijuana, cocaine and crack"</p>
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Lee 2010

Methods	<p>Study design: randomised controlled trial</p> <p>Sampling: random sampling (letters and email sent to ~4000 college students at a "large public university in the Northwest United States")</p> <p>Comparison group(s): no intervention (no feedback or information, students were asked to complete web-based assessments)</p> <p>Follow-up duration: 6 months</p> <p>Study time span: June 2005 to not specified (at least 6 months because a 6-month follow-up was performed)</p>
Participants	341 college students aged 17 to 19 with any use of marijuana in the 3 months before study
Interventions	Internet-based personalised feedback intervention (USA). Participants were presented with feedback about their marijuana use, perceived and actual descriptive norms about marijuana use, and perceived pros and cons of using marijuana. Skills and training tips for avoiding marijuana and making changes in use were provided, as well as limited alcohol feedback. Perceived high-risk contexts and alternative activities around campus and in the communities were provided
Outcomes	<ul style="list-style-type: none"> • Past 90-day use of marijuana • Contemplation to change marijuana use (intention) • Consequences of marijuana use (knowledge) • Family history of drug problem
Notes	Baseline survey, then 3- and 6-month follow-ups

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-based p. 267, "Students were randomly assigned

		to a personalized feedback intervention (PFI) or control condition based on their screening responses (prior to baseline), using a stratified randomization procedure to produce groups with equivalent use rates at randomization”
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 268: “Students in the intervention group received individual personalized feedback based on baseline information. On completion of the baseline survey, PFI participants could immediately view feedback online and could choose to print feedback to their own printer. Participants could return to view feedback on the web for 3 months”
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Computer-administered questionnaire (p. 266-7)
Incomplete outcome data (attrition bias) All outcomes	Low risk	p. 268 “All analyses are based on intent-to-treat, regardless of whether participants viewed their feedback”
Selective reporting (reporting bias)	Unclear risk	p. 267 “All study procedures were approved by the university IRB and a federal Certificate of Confidentiality was obtained from the National Institutes of Health”

Miller 2000

Methods	Study design: before and after study Sampling: random sampling Comparison group(s): no intervention (other campus with no intervention) Follow-up duration: 1 year Study time span: 1988-9, for 1.5 years
Participants	1024 college students at baseline (median age 25 in the intervention group, 22 in the control group), 865 at 1-year follow-up
Interventions	The Campuswide Alcohol and Drug Abuse Prevention Program (CADAPP; USA), based on self regulation theory. The campaign made use of printed materials, videotapes, speakers, peer-education, computer resources, campus policy, campus wide events. Other components of CADAPP targeted particular at-risk segments: free and confiden-

Miller 2000 (Continued)

	tial psychological 'drinker's checkup', list of drug/alcohol referral services available in the community, free psychological help for concerned family members and friends, alcohol self control training for on-campus fraternities	
Outcomes	<ul style="list-style-type: none"> • Frequency of use of 10 types of drugs including cannabis and cocaine • Past 30-day alcohol consumption • Perception of risk related to alcohol and other drugs use • Problems related to alcohol and other drug use 	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 746 "Impact of CADAPP was measured through anonymous surveys of students on each campus [..]"
Incomplete outcome data (attrition bias) All outcomes	Low risk	p. 751 "At baseline (fall) assessment, 1,400 surveys were distributed to enrolled UNM students, a sample of approximately 6% selected randomly by the university's computerized mailing list program. Of these, 567 surveys were returned and usable (41%). At the control campus, 1,080 surveys were distributed to a random sample of students, 457 of whom returned them (42.3%). [...] The return rates were 431 (31%) at UNM and 434 (34%) at NMSU"
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Newton 2010

Methods	Study design: randomised controlled trial Sampling: cluster sampling Comparison group(s): other type of communication interventions (usual health classes) Follow-up duration: 12 months Study time span: March 2007 to November 2008 (21 months)
Participants	764 13-year-old students from 10 Australian independent secondary schools (intervention branch: N = 397, 5 schools; control branch: N = 367, 5 schools). Students who enrol in independent schools come predominantly from high socioeconomic backgrounds
Interventions	Climate Schools course (Australia) is an Internet-based intervention founded on the social influence approach, derived from Bandura's social learning theory. The course delivered 2 sets of 6 40-minute lessons, each including 15 to 20-minute Internet-based lesson completed individually and 20 to 25-minute teacher-delivered activities. During the Internet-based part, students followed a cartoon storyline of teenagers experiencing real-life situations and problems with alcohol and cannabis
Outcomes	<ul style="list-style-type: none"> • Use of alcohol (number of drinks per week) and cannabis (times per week) • Alcohol and cannabis knowledge • Alcohol and cannabis attitudes • Alcohol- and cannabis-related harms
Notes	Assessment: baseline, immediately post, and 6 and 12 months following completion of the intervention Hybrid intervention: both school- and Internet-based

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	p. 750 "The 10 participating schools were assigned randomly using an online randomization system (www.randomizer.org) to either the control condition (usual drug education) or the intervention condition (the Climate Schools: Alcohol and Cannabis course)"
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 750 "The Climate Schools: Alcohol and Cannabis course comprised the delivery of two sets of six 40-minute lessons. The Climate Schools: Alcohol module was delivered immediately after the baseline assessment, and the Climate Schools: Alco-

		hol and Cannabis module was delivered 6 months later in the same school year. Each lesson included a 15-20-minute Internet-based lesson completed individually, where students followed a cartoon storyline of teenagers experiencing real-life situations and problems with alcohol and cannabis. The second part of each lesson was a predetermined activity delivered by the teacher to reinforce the information taught in the cartoons. Intervention group teachers were provided with a programme manual but no additional training.”
Blinding of outcome assessment (detection bias) All outcomes	Low risk	p. 751 “A self-report questionnaire was completed online by all students in a classroom setting, where anonymity and confidentiality were assured”
Incomplete outcome data (attrition bias) All outcomes	Low risk	Similar attrition % over the 2 study groups (figure 1, page 754) p. 754 “Compared to students who were present at baseline and any follow-up occasion, students present only at baseline had significantly higher alcohol-related knowledge [7.66 versus 7.48 (of 16); F(1, 758) = 4.88, P < 0.05]. There were no significant differences on any other alcohol or cannabis outcome measures, nor was there evidence of differential attrition”
Selective reporting (reporting bias)	Unclear risk	No study protocol was mentioned

Palmgreen 1991

Methods	<p>Study design: randomised controlled trial.</p> <p>Sampling: random sampling (students were recruited from a variety of sources, including driver’s licence listings, recruitment advertisements in local newspapers and shopper weekly, etc)</p> <p>Comparison group(s): 2 experimental viewing conditions</p> <ul style="list-style-type: none"> ● one public service announcements (PSA) aimed at high sensation-seekers (HSSs) ● one PSA aimed at low sensation-seekers (LSSs) <p>Follow-up duration: not applicable</p> <p>Study time span: not specified, at least 1 day</p>
Participants	207 18- to 22-year-old youths

Palmgreen 1991 (Continued)

Interventions	2 national-quality 30-second embedded PSAs, one aimed at HSS and the other at LSS (USA)	
Outcomes	<ul style="list-style-type: none"> • Attitude toward drug use • Intention to call a support hotline 	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not clearly reported p. 221 "LSSs and HSSs were randomly assigned to one of the experimental conditions or the control group"
Allocation concealment (selection bias)	Unclear risk	Not reported No baseline comparisons reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding of outcome assessors not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data and clear reporting of sample size both of the intervention and control group
Selective reporting (reporting bias)	Low risk	No study protocol available but clear reporting of main study hypothesis (p. 219) and outcomes measures

Palmgreen 2001

Methods	Study design: interrupted time series study Sampling: systematic sampling (geographical and grade stratification from enrolment lists of 7th to 10th graders in spring 1996) Comparison group(s): pre-intervention surveys Follow-up duration: n/a Study time span: March 1996 to December 1998 (34 months)
Participants	6371 youths from 7th to 10th grade (12- to 17-year-olds), 3174 from Fayette County and 3197 youths from Knox County
Interventions	3 anti-marijuana public service announcements televised from January through April 1997 and from January through April 1998 in Fayette and Knox Counties (USA). These advertisements were based on the SENTAR (sensation-seeking targeting) prevention approach

Palmgreen 2001 (Continued)

Outcomes	<ul style="list-style-type: none"> • Past 30-day use of marijuana 	
Notes	The 2 samples differed significantly on some independent (e.g. perceived peer and family drug use, delinquency) and dependent (use of marijuana) variables, although demographic and sensation-seeking variables were consistent between the 2 samples	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 293 "Interviews were private and anonymous, with self-administration of drug and alcohol items via laptop computer"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Polansky 1999

Methods	<p>Study design: randomised controlled trial</p> <p>Sampling: systematic sampling (gender, classroom)</p> <p>Comparison group(s): 2 × 2 × 4 design (replication × gender × treatment)</p> <p>Follow-up duration: not specified</p> <p>Study time span: not specified</p>
Participants	312 7th through to 9th graders from a rural south-western Mexican-American community
Interventions	3 substance abuse prevention videotapes (USA) derived from different theoretical frameworks: information-based programming, social skills approach and assertiveness training (a subset of social skills approach)
Outcomes	<ul style="list-style-type: none"> • Attitudes towards drugs • Use of drugs • Other: knowledge of videotape content and disposition to select socially appropriate responses

Polansky 1999 (Continued)

Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation procedure not clearly reported p. 189 "...and then randomly assigned to one of the four treatment and control conditions"
Allocation concealment (selection bias)	Unclear risk	Not reported No baseline comparisons reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 191 "to permit collating pre-post protocols while preserving respondent anonymity, the students devised an identification code that they placed on all materials"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear reporting of the size of both the intervention and control group Moreover unclear whether the final number of students (312) is the initial sample or is the final number of just those who answered (i.e. after drop-out) Abstract "participants were 312 students" p. 189 "153 seventh and eighth grade student responses and 159 ninth-grader responses were analysed"
Selective reporting (reporting bias)	Low risk	No study protocol available but all outcome measures expected (per hypothesis p. 188) have been reported, including those not statistically significant (p. 192/194)

Scheier 2010

Methods	Study design: prospective cohort study Sampling: systematic sampling (representative of major racial groups) Comparison group(s): lower exposure to intervention Follow-up duration: 48 months Study time span: April 1999 to March 2003 (48 months)
Participants	2515 youth aged 12 to 18 interviewed by the National Survey of Parents and Youth (NSPY)

Scheier 2010 (Continued)

Interventions	The National Youth Anti-Drug Media Campaign (USA), already described in Hornik 2006	
Outcomes	<ul style="list-style-type: none"> • Past 12-month episodes of drunkenness or cannabis intoxication • Past 30-day binge drinking (5 or more drinks in a row) • Past 30-day use of cigarettes 	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous and computer-administered questionnaire p. 248 "Assessment of alcohol and drug use relied on an Anonymous Computer Assisted Self-report Interview (ACASI)"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Same as Hornik 2008 ("The overall response rate among youths for the first round was 65%, with 86% to 93% of still eligible youths interviewed in subsequent rounds", page 2230 Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, page 2-12, table 2-A "Completed interviews by wave")
Selective reporting (reporting bias)	Unclear risk	Not applicable

Schwinn 2010

Methods	Study design: randomised controlled trial Sampling: random sampling Comparison group(s): no intervention Follow-up duration: 6 months Study time span: at least 8 months (not directly specified, but pretest was administered 6 weeks before intervention and last follow-up was assessed after 6 months)
Participants	236 girls aged 13 to 14 from 42 US states and 4 Canadian provinces, recruited through the youth-oriented website Kiwibox.com TM

Interventions	Internet-based gender-specific intervention (USA, Canada) composed by 12 sessions. This intervention is a pilot test of a gender-specific intervention based on the social learning theory and employs a social competence and skill building strategy. High interaction	
Outcomes	<ul style="list-style-type: none"> ● Past 30-day alcohol, cigarette, marijuana, poly drug and total substance use ● Mediator variables <ul style="list-style-type: none"> ○ Decision-making skills ○ Goal-setting skills ○ Drug resistance/refusal skills ○ Stress management ○ Social skills ○ Self esteem ○ Body esteem ○ Self efficacy 	
Notes	Baseline and 6-month follow-up	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	p. 26 "After study enrolment, girls were randomly assigned to the intervention or control arm"
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 26 "After completing online pretest measures, intervention girls were immediately directed to the first program session. Control girls were thanked for their time and reminded that they would be notified when the next survey was available."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Computer-administered questionnaire p. 26 "After completing online pretest measures, intervention girls were immediately directed to the first program session. [...] Immediately following completion of the last program module, girls in the intervention group completed the post-test"
Incomplete outcome data (attrition bias) All outcomes	Low risk	p. 28 "Differential attrition was assessed across the three measurement occasions using the same variables analysed in baseline"

Schwinn 2010 (Continued)

		equivalency. Pretest to posttest attrition was 6.8%; the attrition rates for girls in intervention and control groups did not differ, $X^2(1) = 1.74, p > 0.05$. At final follow-up, attrition was 9%; again, rates did not differ by study group, $X^2(1) = 0.84, p > 0.05$ "
Selective reporting (reporting bias)	High risk	Protocol not mentioned. Subjective outcomes were not described in full but only as predictors of objective outcomes (substance use)

Slater 2006

Methods	Study design: quasi-randomised controlled trial (assignment to media condition was random; assignment to school condition was not fully random because of problem of staff scheduling in 7 of the 16 communities) Sampling: randomised cluster sampling (treatment and control communities were extracted from 4 major regions of the US) Comparison group(s): no intervention (8 intervention versus 8 non-intervention communities) Follow-up duration: 24 months Study time span: Autumn 1999 to Spring 2003 (-42 months; but intervention lasted 24 months for each community, entry to the in project was different in different communities)
Participants	4216 6th- and 7th-grade students; mean age at baseline was 12.2 years
Interventions	The 'Be Under Your Own Influence' programme (USA) is a school- and community-based media effort on marijuana, alcohol and tobacco uptake. The programme emphasised "non-use as an expression of personal identity and the consistency of non-use with youth aspiration". The school-based intervention was research-based All Stars™ (13 sessions in the first year + 7 booster sessions in the second year); the community intervention was composed of workshops held by trained project staff
Outcomes	<ul style="list-style-type: none"> • Lifetime and past 30-day use of marijuana • Lifetime and past 30-day episodes of alcohol intoxication • Lifetime and current smoking of cigarettes
Notes	This intervention ran concurrently with the Office of National Drug Policy's national anti-drug campaign (Hornik 2006; Scheier 2010), but their simultaneous effect was not assessed in this study

Risk of bias

Bias	Authors' judgement	Support for judgement
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Slater 2006 (Continued)

Random sequence generation (selection bias)	Unclear risk	Matching procedure described but no specification of random sequence generation
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding of outcome assessors not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing data have been imputed using appropriate methods (p. 161)
Selective reporting (reporting bias)	Low risk	No protocol available but the we do not suspect selective reporting bias

Slater 2011

Methods	<p>Study design: randomised controlled trial with a nested prospective cohort study</p> <p>Sampling: systematic sampling (schools were recruited based on National Center for Educational Statistics district listings)</p> <p>Comparison group(s): 4 groups, each including 10 schools and each comprising low to high exposure to the ONDCP campaign</p> <ul style="list-style-type: none"> • Be Under Your Own Influence (BUYOI) intervention both at school and in the community • BUYOI intervention at school but not in the community • BUYOI intervention in the community but not at school • no BUYOI intervention neither at school nor in the community <p>Follow-up duration: 24 months</p> <p>Study time span: Autumn 2005 to Spring 2009 (-42 months)</p>
Participants	3236 students, mean age 12.4 ± 0.6 years
Interventions	<p>The Office of National Drug Control Policy's (ONDCP) 'Above the Influence' media campaign (USA) and a school- and community-based mass media intervention, 'Be Under Your Own Influence' (BUYOI; USA). They both started in 2005 and ran concurrently</p> <ul style="list-style-type: none"> • The ONDCP's campaign is the rebranded version of the national anti-drug campaign launched in 1998 (Hornik 2006; Palmgreen 2007; Scheier 2010). This version, like the original one, used televised ads supplemented by printed ads (e.g. posters) • The BUYOI campaign is a replication and extension of a campaign launched in 1999 (Slater 2006). This campaign employed only printed ads and was implemented both in schools and communities <p>Although the ONDCP's campaign used far more creative executions given its funding</p>

	levels, both campaigns were similar in concept, i.e. both linked substance use with autonomy and aspiration threats	
Outcomes	<ul style="list-style-type: none"> • Attitudes: autonomy and aspiration inconsistent with marijuana use • Lifetime, past 90-day and past 30-day use of marijuana 	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Page 15 "Random assignment used a group-matching procedure: NCES data on community demographics and location were used to generate possible randomization schemes in which major demographics and location were balanced to the degree possible across experimental conditions and one of the acceptable schemes was randomly selected."
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	It is unclear who administered the questionnaires and whether they were anonymous
Incomplete outcome data (attrition bias) All outcomes	Low risk	Reasons for missing outcome data unlikely to be related to true outcome
Selective reporting (reporting bias)	Low risk	No protocol available but the we do not suspect selective reporting

Wyoming Meth 2011

Methods	<p>Study design: interrupted time series study</p> <p>Sampling: 4-stage probability sampling</p> <p>Comparison group(s): pre-intervention survey</p> <p>Follow-up duration: n/a</p> <p>Study time span: April 2008 to May 2011 (34 months)</p>
Participants	5700 youths (909 + 913 + 2652 + 1226)

Wyoming Meth 2011 (Continued)

Interventions	Meth Project (USA), a “messaging campaign, supported by community outreach, and public policy initiatives”. The campaign comprises “television, radio, print, billboard, and Internet advertising”	
Outcomes	<ul style="list-style-type: none"> • Past-month use of methamphetamine • Attitudes towards methamphetamine and other drugs • Perceptions concerning methamphetamine and other drugs • Informations sources and advertising awareness • Statewide Meth Project awareness and perceptions 	
Notes		
Risk of bias		
Bias	Authors’ judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not applicable
Allocation concealment (selection bias)	Unclear risk	Not applicable
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaires
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No information regarding potential reporting bias

Yzer 2003

Methods	<p>Study design: randomised controlled trial</p> <p>Sampling: random sampling (from middle and high schools)</p> <p>Comparison group(s):</p> <ul style="list-style-type: none"> • no intervention (documentary with no advertisements) • gateway condition (explicit: 4 anti-hard drug followed by a teenage girl’s testimonial about how her trial use of marijuana led to using hard drugs) • implicit gateway condition (2 anti-marijuana and 2 anti-hard drugs advertisements without explicit reference to the gateway concept) • hard drugs condition (same advertisements of gateway condition, but not followed by testimonials) <p>Follow-up duration: not applicable (post-only design)</p> <p>Study time span: March 2000 to not specified</p>
Participants	418 students of middle/high schools in urban Philadelphia, mean age 14 ± 1.89 years

Yzer 2003 (Continued)

Interventions	Anti-marijuana and anti-hard drugs advertisements embedded in a documentary video (USA)	
Outcomes	<ul style="list-style-type: none"> • Intention to use marijuana in the next 12 months • Attitude towards marijuana • Perceptions about marijuana 	
Notes	Similar to Zhao 2006 , many of the authors wrote both papers	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were randomly assigned to 1 of the 4 experimental conditions, and the stimuli were randomly presented using a randomisation feature in MediaLab software. (Personal communication with the author)
Allocation concealment (selection bias)	Low risk	Participants did not know which condition they were assigned to, and thus did not know which stimuli they and participants in other conditions were exposed to. (Personal communication with the author)
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Anonymous questionnaire p. 135 "All videos and the questionnaire were programmed onto a laptop computer using an interactive program that allows random ordering of questions and videos within blocks"
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were no missing data. (Personal communication with the author)
Selective reporting (reporting bias)	Low risk	No protocol available but the we do not suspect selective reporting bias

Zhao 2006

Methods	<p>Study design: randomised controlled trial</p> <p>Sampling: not specified (informational letters to parents in the 2 school-based studies, mall-intercept of lists held by market researchers for the mall-based study)</p> <p>Comparison group(s): no intervention (documentary about television production, without the embedded anti-marijuana advertisements)</p> <p>Follow-up duration: not applicable (post-only design)</p> <p>Study time span: not specified</p>
Participants	435 youths whose mean age was 15.2 ± 1.88 years
Interventions	3 anti-marijuana advertisements (USA) addressing normative beliefs. The advertisements were embedded and randomly included in a video documentary about television production
Outcomes	<ul style="list-style-type: none"> • Behavioural beliefs towards marijuana (perceptions) • Intention to use marijuana • Social norms on marijuana (perceptions)
Notes	Results were based on combined data from 3 studies done at different points in time, but “identical in terms of methodology, procedures, experimental conditions, and the structure of the outcome questionnaire”. However, whereas study 1 and 2 were collected at middle and high schools, study 3 was conducted at various malls around the country

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	p. 190 “Participants were randomly assigned to condition”, but randomisation details are not reported
Allocation concealment (selection bias)	Low risk	Although full allocation concealment is not possible for this kind of study, there is low risk of selection bias because researchers administering the intervention were unlikely to know the children. See p. 190: “The experimental group saw the three advertisements that challenged undesirable normative beliefs about marijuana use (see Table 1 for a description of the messages). The advertisements were embedded and randomly rotated in a video documentary about television production. The control group was not exposed to any anti-marijuana messages but saw the same documentary as the experimental group”

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Computer-administered questionnaire p. 191 “The instrument (including the video clips) was programmed onto laptop computers using an interactive program called MediaLab (Jarvis, 1998), which allows random ordering of blocks of questions and videos within the questionnaire”
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants completed the test (being a post-only design); p. 190 “All three studies used the same between-subjects, post-only design, with one experimental condition and one control condition”
Selective reporting (reporting bias)	Unclear risk	No study protocol was mentioned

n/a: not applicable

PSA: public service announcement

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Alemi 1996	Target population is pregnant women who already use or used cocaine
An 2007	This intervention aims to promote inquiry of prescription medicines/treatments, not to hinder use of illicit drugs
Andrews 1995	The purpose of the campaign was to promote public awareness of the link between addiction and child maltreatment, not to prevent addiction
Barber 1990	Target population mean age is 40
Beaudoin 2007	Presented outcomes are not included among those of this review
Beck 2008	Overview of drugs prevalence and school-based prevention interventions in France. Some information about therapeutic interventions, but no information about mass media prevention interventions
Belenko 2009	This study analyses data from the National Survey of Parents and Youth, which was not designed to provide quality information about exposure to anti- or pro-drug websites. This study aims to find factors (e.g. gender, parent-reported income, prior exposure to drugs) associated with viewing of drug websites, not to assess whether viewing of anti-drug websites can influence outcomes included in the protocol of this review

(Continued)

Black 1994	This study aims to assess consistency of data collected with 2 different sampling methods
Brannon 1989	None of the evaluated outcomes (i.e. participation, satisfaction and perceived efficacy of programme) met the inclusion criteria for this review
Chambers 2005	Not a mass media intervention
Chiauzzi 2008	This study assesses the effectiveness of an online stress management tool. Outcomes do not include substance use, intention to use or any other outcome relevant to this review
Collins 1991	This paper aims to prevent alcohol abuse
Cook 1999	Review of books and media, not of studies
David 2006	Evaluated intervention is adolescent discussion about anti-drug advertisements, not advertisements themselves
DeJong 1999	This paper raises concern about the Office of National Drug Control Policy (ONDCP)'s National Youth Anti-Drug Media Campaign without reporting results of its effectiveness assessment
Di Noia 2003	The majority of recruited professionals were older than 26 and the assessed outcomes are not among those needed for inclusion
Donohew 2000	The aim of the study is to understand the relationship between mediators (sensation-seeking and decision-making processes) and alcohol and risky sexual behaviours in adolescents
Epstein 1999	Survey with control group but without pre-intervention questionnaire
Erceg-Hurn 2008	It is not possible to compare different years due to the different methodology used in surveys (see also commentary paper Erceg-Hurn 2008)
Everett 1995	This study does not evaluate intervention effectiveness but matching between HSV/LSV interventions and HSV/LSV subjects
Flay 2000	Reviews of mainly anti-tobacco media-, school- and community-based interventions
Hannon 2000	Narrative review of key African American community values and provides recommendations as to how this information might be incorporated into the development of anti-drug messages and materials targeted at African Americans
Harrington 2003	This study does not evaluate intervention effectiveness but matching between HSV/LSV interventions and HSV/LSV subjects
Helme 2007	Intervention was an anti-smoking campaign
Johnson 1990	The mass media intervention was administered to both study groups
Jordan 2005	This study design (survey) does not allow us to evaluate intervention effectiveness

(Continued)

Kang 2009	This study is an evaluation of the perceived effectiveness of specific elements of the interventions, not the effectiveness of whole interventions on outcome variables included in the protocol for this review
Know the Score 2007	For the 2 cocaine reports: the 4 study waves differed slightly but in many respects (age and working status of respondents, survey locations and, more importantly, survey questions) For the 2 heroin reports: respondent age is not fully comparable across study waves. Additionally, participants in waves 1 and 3 were older than 25
Lorch 1994	No pretest drug-related measure was taken. This study aims to predict responses to PSA and drug use by different sensation-seeking profiles
Lubman 2007	Narrative review on substance addiction prevention. Data were not presented here
Marsiglia 2009	This study evaluates a school-based intervention which has no media-related component
Myers 2006	Not a prevention intervention. It does not include illicit drug-related outcomes
Palmgreen 2007	This study does not evaluate intervention effectiveness but matching between the intervention and HSV/LSV subjects
Pentz 1990	The effect of the mass media component could not be disentangled from other components
Ramirez 1999	Description of theoretical basis, development and implementation of 'Mirame!/Look at Me!' media- and school-based programme for substance abuse among Hispanic youth. However, the programme's effectiveness was not assessed
Reis 1994	Survey. This study design does not allow us to evaluate intervention effectiveness
Ruggiero 2006	Participants are older than 26
Schmeling 1980	Intervention targets prescription drug abusers
Siegel 2008	No blank control, one group focusing on physical harms of inhalant use, the other focusing on social harms
Skinner 1995a	The outcome (perceived persuasiveness) is not among the outcome measures included in our protocol
Sloboda 2006	This book does not include data on studies evaluating mass media programmes
Spitzer 2010	Outcomes concern 'values' and therefore do not meet the inclusion criteria
Stephenson 2002	The aim of this study was to find predictors of exposure from an anti-marijuana media campaign, not to evaluate the effectiveness of the campaign
Stephenson 2002a	CBA study aiming to link perceived message sensation value and viewer's reaction to an anti-heroin PSA
Stephenson 2003	Survey with control group aiming to evaluate sensation-seeking as a moderating variable

(Continued)

Stephenson 2005	This study analyses the content of ads but does not assess their effectiveness
Stevens 1996	School-based intervention with added community activities
Stryker 2003	Ecological study about the impact of media coverage of the negative consequences of marijuana use. This study does not assess the effectiveness of a single prevention intervention
Sussman 1987	Survey with a control group but without a pre-intervention questionnaire
Tait 2010	Systematic review on Internet-based interventions for the treatment of alcohol misuse
Taylor 1984	Outcomes in the pilot study (the statewide intervention was not evaluated) were knowledge, attitudes and behaviours about friendships and human relationships, not substance use/misuse
Varshavsky 2003	Qualitative content analysis of a national campaign
Werch 2010	Not a mass media intervention

CBA: controlled before and after (study)

PSA: public service announcement

HSV: high sensation value

LSV: low sensation value

Characteristics of studies awaiting assessment [ordered by study ID]

Block 2002

Methods	
Participants	
Interventions	
Outcomes	
Notes	We contacted authors for results and are waiting for a response

Duncan 2000

Methods	
Participants	
Interventions	

Duncan 2000 (Continued)

Outcomes	
Notes	We contacted authors for results and are waiting for a response

Flay 1986

Methods	
Participants	
Interventions	
Outcomes	
Notes	We were unable to retrieve the paper's full text

Longshore 2006

Methods	
Participants	
Interventions	
Outcomes	
Notes	We contacted authors for results and are waiting for a response

Marsch 2007

Methods	
Participants	
Interventions	
Outcomes	
Notes	We were unable to retrieve the paper's full text

Moore 2011

Methods	
Participants	
Interventions	
Outcomes	
Notes	We were unable to retrieve the paper's full text

Moreno 2009

Methods	
Participants	
Interventions	
Outcomes	
Notes	We contacted authors for results and are waiting for a response

Skinner 1995

Methods	
Participants	
Interventions	
Outcomes	
Notes	We were unable to retrieve the paper's full text

Williams 2005

Methods	
Participants	
Interventions	
Outcomes	
Notes	We contacted authors for results and are waiting for a response

DATA AND ANALYSES

Comparison 1. Mass media versus no mass media intervention (RCT)

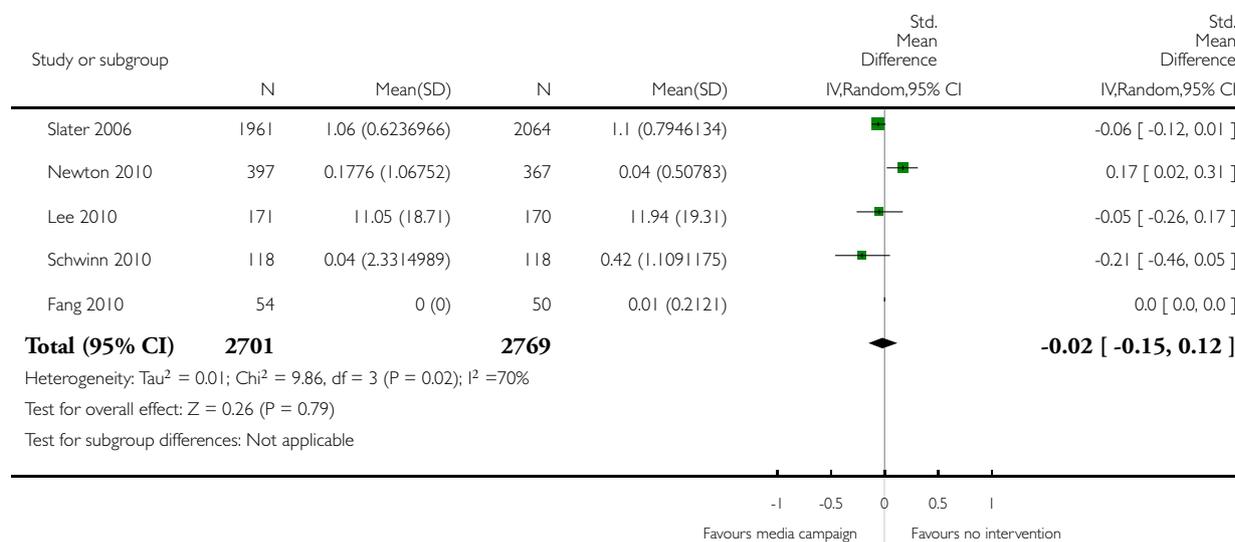
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Drug use	5	5470	Std. Mean Difference (IV, Random, 95% CI)	-0.02 [-0.15, 0.12]
2 Intention to use drugs	4	1270	Std. Mean Difference (IV, Fixed, 95% CI)	-0.07 [-0.19, 0.04]

Analysis 1.1. Comparison 1 Mass media versus no mass media intervention (RCT), Outcome 1 Drug use.

Review: Media campaigns for the prevention of illicit drug use in young people

Comparison: 1 Mass media versus no mass media intervention (RCT)

Outcome: 1 Drug use

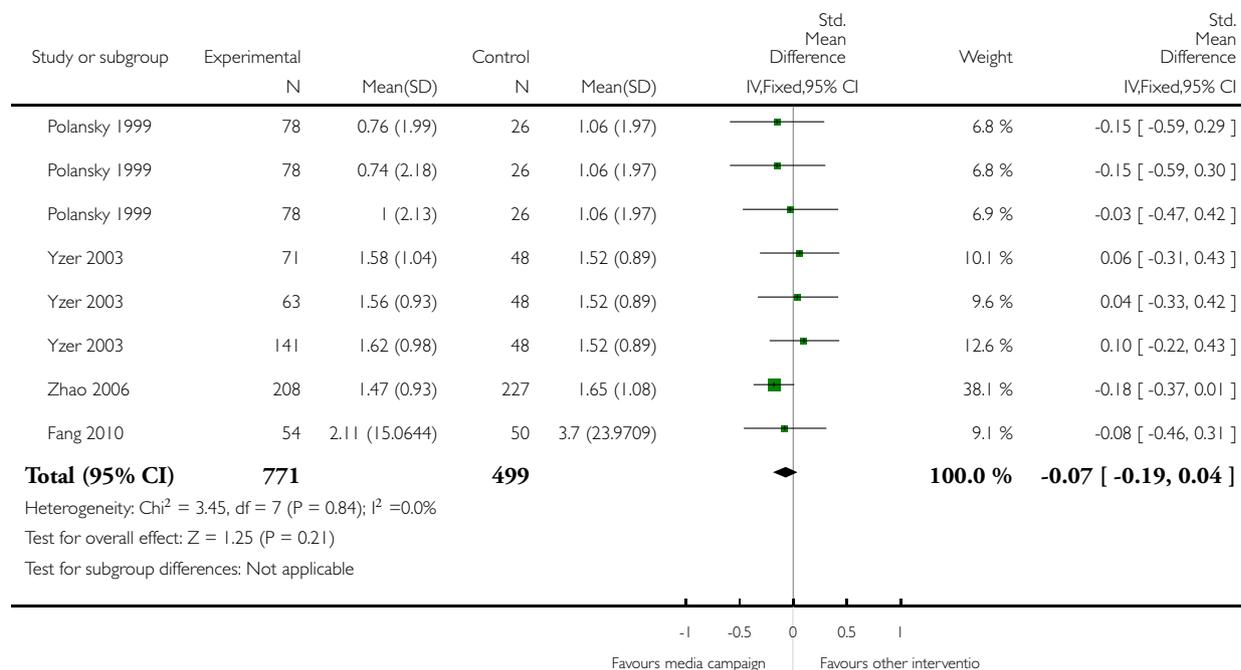


Analysis 1.2. Comparison 1 Mass media versus no mass media intervention (RCT), Outcome 2 Intention to use drugs.

Review: Media campaigns for the prevention of illicit drug use in young people

Comparison: 1 Mass media versus no mass media intervention (RCT)

Outcome: 2 Intention to use drugs



ADDITIONAL TABLES

Table 1. 'Risk of bias' assessment of interrupted time series studies

Miller 2000		
Criterion	Score	Notes
<i>a) Protection against secular changes</i>		
The intervention is independent of other changes	Done	"The usual environmental influences such as prices, taxes, state regulations, campus policies, and enforcement did not change substantially during the study period. Neither was there any reason to expect that students on the two campuses would respond differentially to anonymous surveys. The only obvious difference between the two campuses that might be expected to affect substance use differentially was the implementation of the prevention

Table 1. 'Risk of bias' assessment of interrupted time series studies (Continued)

		program at UNM", page 756
There are sufficient data points to enable reliable statistical inference	Not done	2 data points (before and after)
Formal test for trend. Complete this section if authors have used ANOVA modelling	Done	
<i>b) Protection against detection bias</i>		
Intervention unlikely to affect data collection	Done	"All questionnaires were completed anonymously. To encourage participation, those who returned the survey (by mail) were entered into a lottery for cash prizes by separating a numbered ticket, returning one part with the completed survey and retaining the other half. Winning numbers were announced through the campus newspaper, the Daily Lobo. As an additional incentive for the follow-up survey, respondents were invited to participate in a contest to guess the actual levels of alcohol/drug use on campus, as revealed by the first survey", page 750
Blinded assessment of primary outcome(s)	Done	Anonymous surveys, page 750
<i>c) Completeness of data set</i>		
	Done	"At baseline (fall) assessment, 1,400 surveys were distributed to enrolled UNM students, a sample of approximately 6% selected randomly by the university's computerized mailing list program. Of these, 567 surveys were returned and usable (41%). At the control campus, 1,080 surveys were distributed to a random sample of students, 457 of whom returned them (42.3%). [...] The return rates were 431 (31%) at UNM and 434 (34%) at NMSU", page 751
<i>d) Reliable primary outcome measure(s)</i>		
	Done	"Use measures (14 items) included a frequency (number of drinking days per 30) and quantity index of drinking (number of standard drinks consumed per drinking occasion; range: 0-15) that were multiplied to form a single quantity frequency measure (number of drinks per month) [...]", page 750 "Problem measures included 14 indicators of alcohol dependence and adverse consequences of heavy drinking or illicit drug use in the prior year. [...]", page 750 "Risk assessment included 13 items regarding the extent to which students perceived risk or consequences related to alcohol or other drug use [...]", page 750
Palmgreen 2001 (includes Stephenson 1999)		
Criterion	Score	Notes
<i>a) Protection against secular changes</i>		

Table 1. 'Risk of bias' assessment of interrupted time series studies (Continued)

The intervention is independent of other changes	Unclear	
There are sufficient data points to enable reliable statistical inference	Done	32 data points
Formal test for trend. Complete this section if authors have used ANOVA modelling	Done	ANOVA modelling was used. See from page 186 on
<i>b) Protection against detection bias</i>		
Intervention unlikely to affect data collection	Done	Methodology of data collection is not reported to have changed across data points
Blinded assessment of primary outcome(s)	Done	Anonymous computer-administered questionnaire (p. 293)
<i>c) Completeness of data set</i>		
<i>d) Reliable primary outcome measure(s)</i>	Done	30-day use of marijuana, attitudes, beliefs, intentions
Idaho Meth 2010, Colorado Meth 2011, Georgia Meth 2011, Hawaii Meth 2011 and Wyoming Meth 2011		
Criterion	Score	Notes
<i>a) Protection against secular changes</i>		
The intervention is independent of other changes	Unclear	
There are sufficient data points to enable reliable statistical inference	Done	Data points for each study ranged from 2 to 4 including only one baseline survey. However, overall, there are a sufficient number of observations
Formal test for trend. Complete this section if authors have used ANOVA modelling	Not done	
<i>b) Protection against detection bias</i>		
Intervention unlikely to affect data collection	Done	Despite some slight changes, methodology of data collection is consistent across studies and across data points
Blinded assessment of primary outcome(s)	Done	Anonymous questionnaires
<i>c) Completeness of data set</i>		
<i>d) Reliable primary outcome measure(s)</i>	Done	Past-month use of marijuana, attitudes, perceptions

Table 1. 'Risk of bias' assessment of interrupted time series studies (Continued)

Carpenter 2011		
Criterion	Score	Notes
<i>a) Protection against secular changes</i>		
The intervention is independent of other changes	Done	Adjustment by many individual and market variables (page 949)
There are sufficient data points to enable reliable statistical inference	Not done	3 data points (page 949)
Formal test for trend. Complete this section if authors have used ANOVA modelling	Done	“multivariate logistic regression” (page 949)
<i>b) Protection against detection bias</i>		
Intervention unlikely to affect data collection	Done	Ads were broadcasted independently on the surveys
Blinded assessment of primary outcome(s)	Done	Monitoring the Future (MTF) surveys used anonymous questionnaires
<i>c) Completeness of data set</i>		
	Unclear	
<i>d) Reliable primary outcome measure(s)</i>		
	Done	Past-month and lifetime marijuana use (page 951)

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011)

Hornik 2006		
Criterion	Score/Info	Notes
<i>In a well-conducted cohort study:</i>		
The study addresses an appropriate and clearly focused question	Well covered	“We examined the cognitive and behavioral effects of the National Youth Anti-Drug Media Campaign on youths aged 12.5 to 18 years and report core evaluation results”, abstract
<i>Selection of subjects</i>		
The 2 groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation	Well covered	“The sample was selected to provide an efficient and nearly unbiased cross-section of US youths and their parents. Respondents

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		were selected through a stratified 4-stage probability sample design: 90 primary sampling units-typically county size-were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.”, page 2229-30
The study indicates how many of the people asked to take part did so, in each of the groups being studied	Well covered	Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, Appendix A, page A-6, table A-1 and page A-11 tables A-8 to A-10
The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis	Well covered	“Analyses were restricted to youths who were nonusers of marijuana at the current round (for cross-sectional analyses) or at the previous round (for lagged analyses).”, page 2232
What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed	35%	“The overall response rate among youths for the first round was 65%, with 86% to 93% of still eligible youths interviewed in subsequent rounds.”, page 2230 Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, page 2-12, table 2-A “Completed interviews by wave”
Comparison is made between full participants and those lost to follow-up, by exposure status	Not reported	
<i>Assessment</i>		
The outcomes are clearly defined	Well covered	“For 3 reasons, all drug-related measures reported here relate to marijuana use. [...] Four measures or indices represented the following constructs: (1) marijuana intentions, (2) marijuana beliefs and attitudes, (3) social norms, and (4) self-efficacy to resist use.”, page 2230
The assessment of outcome is made blind to exposure status	Not applicable	Blinding to exposure status was not applicable for this study

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome	Well covered	"A measure of general exposure to antidrug advertising was derived from responses to questions about advertising recall for each medium or media grouping: television and radio, print, movie theatres or videos, and outdoor advertising.", page 2230
The measure of assessment of exposure is reliable	Well covered	"For 3 reasons, all drug-related measures reported here relate to marijuana use.", page 2230
Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable	Well covered	"For 3 reasons, all drug-related measures reported here relate to marijuana use. First, marijuana is by far the illicit drug most heavily used by youths. Second, for other drugs, the low levels of use meant that the NSPY sample sizes were not large enough to detect meaningful changes in use with adequate power. Third, to the extent that the campaign did target a specific drug, it was almost always marijuana. [...] The cognitive measures were developed on the basis of 2 health behavior theories, the theory of reasoned action and social cognitive theory", page 2230
Exposure level or prognostic factor is assessed more than once	Well covered	"3 nationally representative cohorts of US youths aged 9 to 18 years were surveyed at home 4 times.", abstract
<i>Confounding</i>		
The main potential confounders are identified and taken into account in the design and analysis	Well covered	"Potential confounder measures. The analyses employed propensity scoring for confounder control by weighting adjustments, 9-14 incorporating a wide range of standard demographic variables and variables known to be related to youths' drug use or thought likely to be related to exposure to antidrug messages. Propensity scores were developed for the general and specific exposure measures. More than 150 variables were considered possible confounders.", page 2231
<i>Statistical analysis</i>		
Have confidence intervals been provided?	Well covered	Tables 1-4, pages 2233-4

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

<i>Overall assessment of the study</i>		
How well was the study done to minimise the risk of bias or confounding, and to establish a causal relationship between exposure and effect? <i>Code ++,+, or –</i>	++	Propensity scoring from 150 confounders, page 2231
Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the exposure being investigated?	Yes	This study includes very good control for possible confounders
Are the results of this study directly applicable to the patient group targeted in this guideline?	Unclear	Results are applicable to US youth; it is unclear whether they are generalisable outside the US
<i>Description of the study</i>		
Do we know who the study was funded by?	Public Funds (NIDA), Government (Congress)	“Research for and preparation of this article were supported by the National Institute on Drug Abuse (grants 3-N01-DA085063-002 and 1-R03-DA-020893-01). The evaluation of the National Youth Anti-Drug Media Campaign was funded by Congress as part of the original appropriation for the campaign. The White House Office of National Drug Control Policy directly supervised the campaign. The National Institute on Drug Abuse supervised the evaluation; Westat, with the Annenberg School for Communication at the University of Pennsylvania as a subcontractor, received the contract. All authors were funded for this evaluation and other projects by the National Institute on Drug Abuse.”, page 2235
How many centres are patients recruited from?	USA as a whole	“90 primary sampling units-typically county size-were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that house-

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		hold.”, page 2230
From which countries are patients selected? (Select all those involved. Note additional countries after 'Other')	USA	
What is the social setting (i.e. type of environment in which they live) of patients in the study?	Mixed	“More than 150 variables were considered possible confounders. [...] They include [...] urban-rural residency; [...]”, page 2231
What criteria are used to decide who should be INCLUDED in the study?	4-stage selection	“Respondents were selected through a stratified 4-stage probability sample design: 90 primary sampling units-typically county size-were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.”, page 2229-30
What criteria are used to decide who should be EXCLUDED from the study?	Youth living in boarding schools and college dormitories	“As mentioned previously, youth residing in group quarters were not eligible for selection in any of the three recruitment waves. Thus, youth living in boarding schools and college dormitories were excluded from the scope of the survey. This exclusion was made because it was felt that dormitory residents could not be easily interviewed at their parents' homes and that their experiences were so”, Report, A-10
What intervention or risk factor is investigated in the study? (Include dosage where appropriate)	The National Youth Anti-Drug Media Campaign	
What comparisons are made in the study (i.e. what alternative treatments are used to compare the intervention/exposure with). Include dosage where appropriate	Lower exposure versus higher exposure to anti-drug campaign	“The analyses reported here were based on 3 types of measures: recalled exposure to antidrug messages aired by the campaign and other sources; cognitions and behavior related to marijuana, as outcomes; and individual and household characteristics, including a wide range of variables known to be related to drug cognitions and use and to exposure to antidrug messages.”, page 2230

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

What methods were used to randomise patients, blind patients or investigators, and to conceal the randomisation process from investigators?	Randomisation: not applicable, but propensity scoring was employed Blinding of patients: not applicable Blinding of investigators: not reported Randomisation concealment: not applicable	
How long did the active phase of the study last?	September 1999 to June 2004 (58 months)	
How long were patients followed up for, during and after the study?	November 1999 to June 2004 (56 months)	
List the key characteristics of the patient population. Note if there are any significant differences between different arms of the trial	Representative of US youths aged 9 to 18	"The sample was selected to provide an efficient and nearly unbiased cross-section of US youths and their parents", page 2229
<i>Record the basic data for each arm of the study. If there are more than 4 arms, note data for subsequent arms at the bottom of the page</i>		Tables 1-4, pages 2233-4
<i>Record the basic data for each IMPORTANT outcome in the study. If there are more than 4, note data for additional outcomes at the bottom of the page</i>		Tables 1-4, pages 2233-4
<i>Notes. Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question</i>	Through June 2004, the campaign is unlikely to have had favourable effects on youths and may have had delayed unfavourable effects The evaluation challenges the usefulness of the campaign	
Scheier 2010		
Criterion	Score/Info	Notes
<i>In a well-conducted cohort study:</i>		
The study addresses an appropriate and clearly focused question	Well covered	"In this study, we examined whether awareness (recall) of the National Youth Anti-Drug Media Campaign (NYADMC) benefited youth by attenuating their drug use.", abstract
<i>Selection of subjects</i>		

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

<p>The 2 groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation</p>	<p>Well covered</p>	<p>Same as Hornik 2008 (“The sample was selected to provide an efficient and nearly unbiased cross-section of US youths and their parents. Respondents were selected through a stratified 4-stage probability sample design: 90 primary sampling units—typically county size—were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.”, page 2229-30)</p>
<p>The study indicates how many of the people asked to take part did so, in each of the groups being studied</p>	<p>Well covered</p>	<p>Same as Hornik 2008 (Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, Appendix A, page A-6, table A-1 and page A-11 tables A-8 to A-10)</p>
<p>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis</p>	<p>Well covered</p>	<p>Same questionnaire was administered at baseline and at follow-up. “National Survey of Parents and Youth (NSPY) [...] could be used to assess youths’ awareness of the campaign messages and monitor any corresponding changes in drug use trends.”, page 241-2</p>
<p>What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed</p>	<p>35%</p>	<p>Same as Hornik 2008 (“The overall response rate among youths for the first round was 65%, with 86% to 93% of still eligible youths interviewed in subsequent rounds”, page 2230 Evaluation of the National Youth Anti-Drug Media Campaign: 2004 Report of Findings, page 2-12, table 2-A “Completed interviews by wave”)</p>
<p>Comparison is made between full participants and those lost to follow-up, by exposure status</p>	<p>Well covered</p>	<p>“Attrition analyses were structured to determine whether certain factors operate systematically to cause dropout from the study. Proportional analyses using the v2 test were used for cross tabulation of binary measures and logistic regression modelling to examine the optimal predictors of retention (coded '1' stay and '0' dropout). We</p>

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		<p>used the WesVar software program to estimate logistic regression models of panel attrition. This statistical modelling program enables us to adjust (through poststratification) the sample variance estimators for the undersampling of primary sampling units and correct any bias in parameter estimates related directly to the complex sampling design (using replicate variance estimators to adjust standard errors for design effects)</p> <p>Proportional tests indicated that panel youth were significantly more likely to be female, smoke more cigarettes, drink alcohol, and smoke marijuana (all v2 proportional tests significant at the p .0001) compared with dropout youth. Given the large number of variables possibly related to retention status, logistic models were run separately for five individual domains (demographics, campaign awareness, drug use, school-related factors, and psychosocial risk).⁷ Following tests of the individual domains, we culled only significant predictors and tested these in a combined model predicting retention. The final model indicated that retained youth were less at risk for marijuana use (unstandardized b = -3.51, p <= .0001, OR = .03), engaged in more antisocial behavior (evidencing suppression: [b = .23, p <= .0001, OR = 1.26]), spent fewer hours listening to the radio on a daily basis (b = -.09, p <= .01, OR = .91), and were more likely to have attended school in the past year (b = 1.05, p <= .01, OR = 2.87) compared with their dropout counterparts. Using the Cox-Snell likelihood pseudo-R² statistic, the model accounted for 12% of the variance in retention status, F(14,87) = 12.127, p <= .0001.”,</p> <p>page 250</p>
<i>Assessment</i>		
The outcomes are clearly defined	Well covered	<p>“Assessment of alcohol and drug use relied on an Anonymous Computer Assisted Self-report Interview (ACASI). Two alcohol use items⁶ assessed being drunk or high (“How many times were you drunk or very high from alcohol in the last 12 months?”) with</p>

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		response categories ranging from "I don't use alcohol" (0) through "40 or more occasions" (7); and heavy alcohol use based on a measure of binge drinking ("How many days have you had five or more drinks in the last 30 days?") with response categories ranging from "I don't drink" (0) through "10 or more times" (6). Cigarette use was assessed with a single item ("How many cigarettes smoked a day during the last 30 days?") with response categories ranging from "None" (0) through "More than 35 per day, about 2 packs or more" (7). A single frequency item assessed marijuana involvement ("How many times have you used marijuana in the last 12 months?") with response categories ranging from "I have never used marijuana" (0) through "40 or more occasions" (6).", page 248
The assessment of outcome is made blind to exposure status	Not applicable	Blinding to exposure status was not applicable for this study
Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome	Not reported	
The measure of assessment of exposure is reliable	Well covered	<p>"Turning to the campaign awareness parameters, we see two findings worth noting. First, growth in campaign awareness is positive for the earlier years (12 to 14), except for television viewing behavior, which had a slope not significantly different from zero. As these youth became older (14 to 18), their awareness declined for every media venue except specific recall (videos shown on laptops) and radio listening behavior. Also, the magnitude of the slope terms were considerably larger at the younger age for recall of stories about drugs and youth, brand awareness, specific recall, and radio listening but larger in magnitude for television (declining) as these youth transitioned to high school.", page 253</p> <p>"Figure 2 graphically presents a generic template for testing the bivariate cohort growth models. Again, two slope trends are posited to capture the different rates of</p>

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		growth for youth when they were younger versus when they were older, and this is repeated for both drug use (D) and awareness (A) measures.”, page 253
Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable	Well covered	“Assessment of alcohol and drug use relied on an Anonymous Computer Assisted Self-report Interview (ACASI). Two alcohol use items ⁶ assessed being drunk or high (“How many times were you drunk or very high from alcohol in the last 12 months?”) with response categories ranging from “I don’t use alcohol” (0) through “40 or more occasions” (7); and heavy alcohol use based on a measure of binge drinking (“How many days have you had five or more drinks in the last 30 days?”) with response categories ranging from “I don’t drink” (0) through “10 or more times” (6). Cigarette use was assessed with a single item (“How many cigarettes smoked a day during the last 30 days?”) with response categories ranging from “None” (0) through “More than 35 per day, about 2 packs or more” (7). A single frequency item assessed marijuana involvement (“How many times have you used marijuana in the last 12 months?”) with response categories ranging from “I have never used marijuana” (0) through “40 or more occasions” (6).”, page 248
Exposure level or prognostic factor is assessed more than once	Well covered	Yes: 4 rounds of data collection. Table 1, page 249
<i>Confounding</i>		
The main potential confounders are identified and taken into account in the design and analysis	Not reported	
<i>Statistical analysis</i>		
Have confidence intervals been provided?	No	Page 264
<i>Overall assessment of the study</i>		
How well was the study done to minimise the risk of bias or confounding, and to establish a causal relationship between expo-	-	“...there was no “intervention“ to speak of, but rather the campaign took shape as a naturalistic observational study conducted

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

sure and effect? Code ++, +, or –		at a particular point in time with no clear demarcation from various historical influences that could affect patterns of reported drug use”, page 264
Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the exposure being investigated?	No, because no adjustment for confounders was reported	
Are the results of this study directly applicable to the patient group targeted in this guideline?	Unclear	Results are applicable to US youth; it is unclear whether they are generalisable outside the US
<i>Description of the study</i>		
Do we know who the study was funded by?	No	
How many centres are patients recruited from?	USA as a whole	Same as Hornik 2008 (“90 primary sampling units-typically county size-were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.”, page 2230)
From which countries are patients selected? (Select all those involved. Note additional countries after 'Other')	USA	
What is the social setting (i.e. type of environment in which they live) of patients in the study?	Mixed	Same as Hornik 2008 (“More than 150 variables were considered possible confounders. [...] They include [...] urban-rural residency; [...]”, page 2231)
What criteria are used to decide who should be INCLUDED in the study?	4-stage selection	Same as Hornik 2008 (“Respondents were selected through a stratified 4-stage probability sample design: 90 primary sampling units-typically county size-were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.”, page 2229-30)
What criteria are used to decide who should be EXCLUDED from the study?	Youth living in boarding schools and college dormitories	Same as Hornik 2008 (“As mentioned previously, youth residing in group quarters were not eligible for selection in any of the three recruitment waves. Thus, youth living in boarding schools and college dormitories were excluded from the scope of the survey. This exclusion was made because it was felt that dormitory residents could not be easily interviewed at their parents’ homes and that their experiences were so”, Report, Appendix A, A-10)
What intervention or risk factor is investigated in the study? (Include dosage where appropriate)	The National Youth Anti-Drug Media Campaign	“...there was no ”intervention“ to speak of, but rather the campaign took shape as a naturalistic observational study conducted at a particular point in time with no clear demarcation from various historical influences that could affect patterns of reported drug use”, page 264
What comparisons are made in the study (i.e. what alternative treatments are used to compare the intervention/exposure with). Include dosage where appropriate	Exposure versus drug use	Variuos models, e.g. see page 256
What methods were used to randomise patients, blind patients or investigators, and to conceal the randomisation process from investigators?	Randomisation: not applicable Blinding of patients: not applicable Blinding of investigators: not reported Randomisation concealment: not applicable	
How long did the active phase of the study last?	September 1999 to June 2004 (58 months)	
How long were patients followed up for, during and after the study?	November 1999 to June 2004 (56 months)	
List the key characteristics of the patient population. Note if there are any significant differences between different arms of the trial	Representative of US youths aged 9 to 18	Same as Hornik 2008 (“The sample was selected to provide an efficient and nearly unbiased cross-section of US youths and their parents”, page 2229)
<i>Record the basic data for each arm of the study. If there are more than 4 arms, note data for subsequent arms at the bottom of the page</i>	Table 2, page 251	

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

<p><i>Record the basic data for each IMPORTANT outcome in the study. If there are more than 4, note data for additional outcomes at the bottom of the page</i></p>	<p>Tables 3-4-5, pages 252-7</p>	
<p><i>Notes. Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question</i></p>	<p>When they were younger, these youth accelerated their drug use and reported increasing amounts of campaign awareness. When they were older, [...] no effects for marijuana were significant but trended in the direction of increased awareness associated with declining drug use</p>	<p>“Behavior change is guided by the Theory of Reasoned Action (TRA: Ajzen & Fishbein, 1973, 1977) and draws also from social persuasion (McGuire, 1961, 1966, 1968) and communication theories (Hovland, Janis, & Kelley, 1953). According to the TRA, the influence of attitudes (i.e., subjective evaluations of behavior consequences) and beliefs (subjective norms and behavioral outcomes or expectancies) on behavior is mediated through intentions (i.e., future intent to engage the behavior). In other words, youth form impressions of whether drugs are good or bad, and they combine this information with normative beliefs (whether their close friends approve of drug use) and behavioral expectations (perceived benefits and negative consequences of drug use) toward drug use. These steps are necessary but not sufficient conditions, as the final decision to use drugs is guided by their behavioral willingness or intentions.”, page 242</p> <p>“To date, analyses of the media campaign efficacy have used traditional linear regression or correlation techniques to examine campaign effects. While this tactic has been useful to delineate the basic statistical associations between campaign awareness and drug use, a major weakness of this approach is that it fails to provide a developmental perspective and incorporate systematic features of change in either awareness or drug use.[...] Growth modelling is clearly a more definitive way to address the question of change and increasingly has been advocated as a means to assess prevention effects that unfold over time (Brown, Catalano, Fleming, Haggerty, & Abbott, 2005; Mason, Kosterman, Hawkins, Haggerty, & Spoth, 2003; Park et al., 2000; Taylor, Graham, Cumsille, & Hansen, 2000). [...] The age</p>

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		mixture within each round makes it imperative to estimate growth using age-cohort models", page 242-3
Slater 2011		
Criterion	Score/Info	Notes
<i>In a well-conducted cohort study:</i>		
The study addresses an appropriate and clearly focused question	Well covered	"...(a) provide two simultaneous tests of autonomy and aspiration perceptions as mediators of impact on marijuana use as a consequence of exposure to each of these campaigns, b) conduct the first independent assessment of the ONDCP media campaign, which did not have a formal independent evaluation in place during the years of this study, and c) assess the simultaneous impact of a national campaign and a similar community/in-school effort.", page 12-13
<i>Selection of subjects</i>		
The 2 groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation	Not reported	"3,236 students participated in at least one survey, with 48% males, 52% females and a mean age at baseline of 12.4 years (SD = 0.6); 75% were European-American, 11.5% African-American, and 13.5% of other racial backgrounds. One-quarter of the youth were of Hispanic ethnicity.", page 15
The study indicates how many of the people asked to take part did so, in each of the groups being studied	Poorly addressed	Only average: "The average rate of student participation in each school was 32% of total student enrolment, lower than the prior study because of stricter IRB requirements being imposed on recruitment procedures. 57.1% of respondents provided data at all four measurement occasions; 27.2% provided data on three, 9.4% provided data on two and 5.3% provided data on just one of the measurement occasions. Missed surveys appear to be a matter more of absenteeism or slips in getting students to survey sessions, than of panel mortality; 84.5% of participants filled out the wave 1 survey,

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		86.2% wave 2, 86.1% wave 3, and 81.3% wave 4.", page 15
The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis	Well covered	"Lifetime use of marijuana was measured at each measurement wave [..]", page 15
What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed	42.9%	"The average rate of student participation in each school was 32% of total student enrolment, lower than the prior study because of stricter IRB requirements being imposed on recruitment procedures. 57.1% of respondents provided data at all four measurement occasions; 27.2% provided data on three, 9.4% provided data on two and 5.3% provided data on just one of the measurement occasions. Missed surveys appear to be a matter more of absenteeism or slips in getting students to survey sessions, than of panel mortality; 84.5% of participants filled out the wave 1 survey, 86.2% wave 2, 86.1% wave 3, and 81.3% wave 4.", page 15
Comparison is made between full participants and those lost to follow-up, by exposure status	Not reported	
<i>Assessment</i>		
The outcomes are clearly defined	Well covered	"Autonomy and Aspirations Inconsistent With Marijuana Use Autonomy inconsistent with marijuana use was measured using responses to four items following the phrase "Not using marijuana": 1) is a way to be true to myself; 2) is an important part of who I am; 3) is a way of being in control of my life; and 4) is a way of showing my own independence, where responses ranged from 1 = definitely disagree to 4 = definitely agree. Similarly, aspirations inconsistent with marijuana use were measured using the responses to three items following the phrase "Using marijuana would: 1) keep me from doing the things I want to; 2) mess up my plans for when I am older; and 3) get in the way of what is important to me." Because responses to each

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		<p>scale's items were heavily skewed, with 82% of respondents selecting "definitely agree" for all aspiration items and 84% of respondents selecting "definitely agree" for all autonomy items, each scale was dichotomized such that a "1" was assigned if all responses to the scale items were "definitely agree" and a "0" otherwise. The Cronbach's alpha values (Cronbach 1951) for each dichotomized measure were .9 or greater at each of the four waves</p> <p>Marijuana Use Lifetime use of marijuana was measured at each measurement wave using four questions: "How old were you the first time you used marijuana?", "How often in the last month have you used marijuana?", "How often in the last 3 months have you used marijuana?", and "Have you ever tried marijuana? (pot, grass, hash, etc.)?" If a subject responded affirmatively to any one question (or indicated an age when they first used marijuana), lifetime marijuana use was scored a "1", while an indication of never using marijuana resulted in a score of "0". The reliability for the scale was above 0.7 for the first two measurement occasions, .64 on the third occasion, and .69 at the fourth occasion.", page 15</p>
The assessment of outcome is made blind to exposure status	Not applicable	Blinding to exposure status was not applicable for this study
Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome	Not reported	
The measure of assessment of exposure is reliable	Well covered	p. 15
Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable	Well covered	= 1.7
Exposure level or prognostic factor is assessed more than once	Well covered	4 waves, page 17
<i>Confounding</i>		

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

The main potential confounders are identified and taken into account in the design and analysis	Adequately addresses	p. 16
<i>Statistical analysis</i>		
Have confidence intervals been provided?	Well covered	Standard errors, e.g. Table 1 and 2, p. 18
<i>Overall assessment of the study</i>		
How well was the study done to minimise the risk of bias or confounding, and to establish a causal relationship between exposure and effect? Code ++, +, or –	+	
Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the exposure being investigated?	Fairly: selectivity (do not know if representative); no propensity scoring for national media campaign	
Are the results of this study directly applicable to the patient group targeted in this guideline?	Unclear	Results are applicable to US youth; it is unclear whether they are generalisable outside the US
<i>Description of the study</i>		
Do we know who the study was funded by?	Public Funds (NIDA)	“This research was supported by grant DA12360 from the National Institute on Drug Abuse (NIDA) to the first author.”, page 12
How many centres are patients recruited from?	20 communities	
From which countries are patients selected? (Select all those involved. Note additional countries after 'Other')	USA	
What is the social setting (i.e. type of environment in which they live) of patients in the study?	Mixed	p. 14
What criteria are used to decide who should be INCLUDED in the study?	IRB requirements	“The average rate of student participation in each school was 32% of total student enrolment, lower than the prior study because of stricter IRB requirements being imposed

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

		on recruitment procedures", page 15
What criteria are used to decide who should be EXCLUDED from the study?	Exaggerators	"Students who responded that they had tried all drugs listed including one that had been invented were considered exaggerators and were excluded from analyses; there were no more than 0.4% of such exaggerators in any given wave of data collection.", page 15
What intervention or risk factor is investigated in the study? (Include dosage where appropriate)	(a) school- and community-based media intervention 'Be Under Your Influence' and (b) national anti-drug media campaign 'Above the Influence'	p. 12
What comparisons are made in the study (i.e. what alternative treatments are used to compare the intervention/exposure with). Include dosage where appropriate	Exposure versus drug use/aspirations/autonomy; exposure x time versus drug use/aspirations/autonomy	
What methods were used to randomise patients, blind patients or investigators, and to conceal the randomisation process from investigators?	Randomisation: not applicable for mass media campaign, but done for 'Be Under Your Own Influence' school- and community-based media intervention	
How long did the active phase of the study last?	Autumn 2005 to Spring 2009 (-42 months)	
How long were patients followed up for, during and after the study?	24 months	
List the key characteristics of the patient population. Note if there are any significant differences between different arms of the trial	48% males, 52% females and a mean age at baseline of 12.4 years (SD = 0.6); 75% were European-American, 11.5% African-American, and 13.5% of other racial backgrounds One-quarter of the youth were of Hispanic ethnicity	p. 15
<i>Record the basic data for each arm of the study. If there are more than 4 arms, note data for subsequent arms at the bottom of the page</i>		Table 1 and 2, page 18
<i>Record the basic data for each IMPORTANT outcome in the study. If there are more than 4, note data for additional outcomes at the bottom of the page</i>		Table 1 and 2, page 18

Table 2. 'Risk of bias' assessment of cohort studies (Hornik 2006, Scheier 2010, Slater 2011) (Continued)

<p><i>Notes. Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question</i></p>	<p>Results indicate that earlier effects of the 'Be Under Your Own Influence' intervention replicated only in part and that the most plausible explanation of the weaker effects is high exposure to the similar but more extensive ONDCP 'Above the Influence' national campaign. Self reported exposure to the ONDCP campaign predicted reduced marijuana use, and analyses partially support indirect effects of the 2 campaigns via aspirations and autonomy</p>
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SD: standard deviation

IRB= Institutional Review Board, is a [committee](#) that has been formally designated to approve, monitor, and review [biomedical](#) and [behavioral research](#) involving [humans](#)

Table 3. Measurement scales used in included studies

Study	Was a specific scale developed? (Yes/no/unclear)	Measurement scale(s) used	Reference	Was the scale adapted? (Yes/no/unclear)
Palmgreen 1991	No	Sensation seeking Scale, Form V	Zuckerman, M (1979) . Sensation seeking: beyond the optimal level of arousal. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc	No
	No	Instruments used in a continuing survey of young people by the Institute for Social Research at the University of Michigan (NB to measure levels of use of illicit drugs)	Johnston LD, Bachman JG, O'Malley PM (1982). Monitoring the future: questionnaire responses from the nations' high school seniors, 1981. Ann Arbor: University of Michigan, Survey Response Centre, Institute for Social Research	Yes
	Yes	Behavioural Intention Index p. 221 "immediately after the second viewing of the PSA, subjects were asked "If you wanted information about alterna-	n/a	n/a

Table 3. Measurement scales used in included studies (Continued)

		tives to drug use, how likely it is, on a scale of 1 to 5, that you would call a 800 hotline?”		
	Yes	Attitude towards drug use p. 222 “After behavioural intention was measured, subjects were asked to indicate on a scale of 1 to 5 how they felt about their personal use of drugs in relation to each of six adjectives word pairs.”	n/a	n/a
Kelly 1992	Unclear	Not mentioned	n/a	n/a
Polansky 1999	No	Drug Attitude Scale (12 items on a Likert scale)	Swisher JD, Horan JJ (1973). The Pennsylvania State University Evaluation Scales. In LA Abrams, E Garfield & JD Swisher (eds). Accountability in drug education: a model for evaluation (pp 87-99). Washington, DC: Drug Abuse Council	Unclear (: in the text is mentioned “updated version” but no further clarification)
	No	Tentative Drug Use Scale (10 items scale)	Horan JJ, Williams JM (1975). The tentative drug use scale: a quick and relatively problem free outcome measure for drug abuse prevention projects. Journal of Drug education; 5: 381-4	No
	Yes	Help-Seeking Questionnaire and Knowledge Questionnaire p. 190 “two 10-items achievement tests were developed for this study”	n/a	n/a

Table 3. Measurement scales used in included studies (Continued)

	No	Drug Conformity Scale (16 questions reflecting varying levels of assertive competency)	Horan JJ, Williams JM (1982) . Longitudinal study of assertion training as a drug abuse prevention strategy. American Educational Research Journal; 19: 341-51	No
Palmgreen 2001 (Stephenson 1999)	Yes	Beliefs 12 marijuana-related beliefs about occasional use of marijuana and 12 belief items about regular marijuana use were assessed on a 4-point scale with the response options of disagree strongly, disagree somewhat, agree somewhat and agree strongly	n/a	n/a
	Yes	Attitudes Seven marijuana-related attitudes about occasional use and 7 items about regular use were assessed on a 4-point scale, with the response options of disagree strongly, disagree somewhat, agree somewhat and agree strongly	n/a	n/a
	Yes	Intentions Participants were asked their intent to engage in experimental or regular marijuana use in the future. With 2 items on a 3-point scale with the response options probably will not, probably will and definitely will	n/a	n/a
Miller 2000	Yes	Use Recent drug use was measured by asking respondents about the fre-	n/a	n/a

Table 3. Measurement scales used in included studies (Continued)

		quency and recency with which they used 10 types of drugs (using commonly recognised names): cannabis, cocaine, other stimulants, tranquillisers, sedative-hypnotics, hallucinogens, opioids, phencyclidine, amyl and butyl nitrates and inhalants such as glue, paint or gasoline (4- point scale ranging from 1 = never to 4 = at least once in the past month)		
	Yes	Risks perception Risk assessment included 13 items regarding the extent to which students perceived risk or consequences related to alcohol or other drug use. Personal risk for alcohol and other drug problems was judged relative to students' perceptions of "most people" (ranging from 1 = higher than most people to 3 = lower than most people)	n/a	n/a
Palmgreen 2001	No	Brief Sensation Seeking Scale	Hoyle RH, Stephenson MT. The sensation seeking scale for adolescents. In: Lennox RD, Scott-Lennox JA, Cutler BL, eds. Applied Psychometrics for Health Outcomes Research. Chapel Hill, NC: Health Statistics Lab.	No
Fishbein 2002	Yes	Specifically developed instrument p. 241 "the instrument for the study consisted	n/a	n/a

Table 3. Measurement scales used in included studies (Continued)

		<p>of questionnaire with 3 parts.”</p> <p>First: demographic questions</p> <p>Second: series of questions on realism/content/recall of intervention</p> <p>Third: assessment of the respondent perceptions of the danger and harmful effects of engaging in 8 risky behaviours</p> <ul style="list-style-type: none"> - perceived danger = 1 item per behaviour on yes/no basis - perceived harmfulness = 1 item per behaviour on a 5-point scale - perceived norms = 1 item per behaviour on a 5-point scale 		
Yzer 2003	Yes	<p>A specific questionnaire was developed for the study. Available upon request by the authors (p. 135)</p> <p>Intention to use marijuana: 1 to 2 (depending on the first answer) items using a 4-point scale</p> <p>Attitude: 4 items using a 7-point scale</p> <p>Outcome beliefs: 36 items using a 5-point scale</p>	n/a	n/a
Slater 2006	No	<p>Selected items from the American Drug and Alcohol Survey</p> <p>Alcohol lifetime score: 3 items</p> <p>Smoking lifetime score: 3 items</p> <p>Marijuana lifetime score: 5 items</p>	American Drug and Alcohol Survey, with permission by the Rocky Mountain Behavioural Science Institute	No

Table 3. Measurement scales used in included studies (Continued)

Zhao 2006	Yes	Intentions not to use/to reduce use/to stop use	n/a	No
	Unclear	Attitudes towards illicit drug use: 7-point scale from -3 (bad/foolish/...) to +3 (good/wise/...)	n/a	n/a
	Yes	Perceptions (including perceptions of peer norms and perceptions about illicit drug use): 5-point scales from -2 to +2. "Although we did some analyses at the level of individual beliefs, we generally used two types of belief clusters in our analyses"	n/a	No
Czyzewska 2007	Unclear	Declared intention to use marijuana		n/a
	Unclear	Attitudes towards illicit drug use (pre-test explicit attitudes): 10-point Likert scales		n/a
	Yes	Attitudes towards illicit drug use (post-test implicit attitudes): IAT test. "Two computerized Implicit Association Tests (IAT) were designed to assess implicit attitudes to tobacco and marijuana. [...] The only difference to the standard IAT procedure was the extended number of practice trials to 40 in order to reduce the typical effect of order in which the combined categorization tasks are performed"	See Table 1 for IAT test content Scale was adapted from: Greenwald AG, McGhee DE, Schwartz JLK (1998). Measuring individual differences in social cognition: The Implicit Association Test. <i>Journal of Personality and Social Psychology</i> ; 74: 1464-80 With updates from: Greenwald AG, Nosek BA, Banaji MR (2003) . Understanding and using the Implicit Association Test: An improved scoring algorithm. <i>Jour-</i>	Yes

Table 3. Measurement scales used in included studies (Continued)

			nal of Personality and Social Psychology; 85(2):197-216	
	Unclear	Attitudes towards illicit drug use (post-test explicit attitudes): 3 sets of 7 5-point scales (= 21 5-point scales)		n/a
Hornik 2006	No	National Survey of Parents and Youth (NSPY). 3 types of measures: recalled exposure to anti-drug messages aired by the campaign and other sources; cognitions and behavior related to marijuana, as outcomes; and individual and household characteristics, including a wide range of variables known to be related to drug cognitions and use and to exposure to anti-drug messages	http://archives.drugabuse.gov/initiatives/westat/	No
Scheier 2010	Yes	Alcohol and Drug Use Assessment of alcohol and drug use relied on an Anonymous Computer Assisted Self-report Interview (ACASI)	n/a	n/a
Fang 2010	No	Occasions of use in the past 30 days ± standard error, SE	None, but it is a standard question in this field	No
	Unclear	Intentions not to use/to reduce use/to stop use: 5-point scales; higher scores are better. No additional information		Unclear
Lee 2010	No	90-day marijuana use: “items were adapted from the Global Appraisal of Individual Needs-I”	Dennis ML, Titus JC, Diamond G, Donaldson J, Godley SH, Tims FM. The CYT Steering Committee (2002)	Yes

Table 3. Measurement scales used in included studies (Continued)

			. The cannabis youth treatment (CYT) experiment: Rationale, study design and analysis plans. <i>Addiction</i> ; 97 (Suppl 1): 16-34	
	No	Intentions not to use/to reduce use/to stop use: 4-point score (higher = more “contemplation”). “Contemplation to change marijuana use was assessed with four items (alpha = 0.79) adapted from the Readiness to Change Questionnaire (RTCQ)”	Heather N, Gold R, Roll-nick S (1991). <i>Readiness to change questionnaire: User’s manual</i> . (Tech. Rep. 15). Kensington, Australia: National Drug and Alcohol Research Center, University of New South Wales	Yes
	No	Knowledge about the effects of illicit drugs on health: negative consequences due to marijuana use. 5-point score (from 0 = never to 4 = more than 10 times). “Consequences of marijuana use were assessed using the Rutgers Marijuana Problem Index (RMPI)”	White HR, Labouvie EW, Papadaratsakis V (2005). <i>Changes in substance use during the transition to adulthood: A comparison of college students and their non-college age peers</i> . <i>Journal of Drug Issues</i> ; 35: 281-306	Unclear
Newton 2010	No	Frequency of cannabis use: times per week ± SE in the past 12 months “Cannabis use was assessed from a questionnaire in the 2007 National Drug Strategy Household Survey (NDSHS) that identified the frequency of use of cannabis [1].”	Australian Institute of Health and Welfare. 2007 National Drug Strategy Household Survey: First Results. Canberra: AIHW; 2008	Yes
	No	Attitudes towards illicit drug use: score ± SE “Attitudes towards cannabis were measured by four items from the Life Skills	National Health Promotion Associates (NHPA) Incorporated. <i>Life Skills Training Questionnaire-</i>	Unclear

Table 3. Measurement scales used in included studies (Continued)

		Training Questionnaire [37], which has acceptable internal consistency ($\alpha = 0.86$)."	Middle School. New York: NHPA; 2004	
	No	Knowledge about the effects of illicit drugs on health: score \pm SE "The cannabis knowledge questionnaire was adapted from the Cannabis Quiz and included 16 items [33]."	Bleeker A, Malcolm A. The Cannabis Quiz. Sydney: Manly Drug Education and Counselling Centre; 2001	Yes
	No	Knowledge about the effects of illicit drugs on health: score \pm SE "Cannabis harms were assessed with six questions derived from the Adolescent Cannabis Problems Questionnaire (test-retest reliability, $r = 0.91$) [35]."	Martin G, Copeland J, Gilmour S, Gates P, Swift W. The adolescent cannabis problems questionnaire (CPQ-A) : psychometric properties. Addictive Behaviors 2006; 31: 2238-48	No
Schwinn 2010	No	Past 30-day drug use (marijuana) : occasions of use (0 to 40) "...adapted from the CDC's Youth Risk Behavior Survey (YRBS; Centers for Disease Control and Prevention 2005), asked girls to report how many times in the past month and week they used alcohol, cigarettes, marijuana, cocaine, inhalants, methamphetamines, and ecstasy. Response options ranged from "0 times" to "40 or more times." Test-retest reliability for YRBS items is 0.82 to 0.95 (Centers for Disease Control and Prevention 2004)"	Centers for Disease Control and Prevention. (2005). Youth Risk Behavior Survey. Retrieved February 20, 2009, from http://www.cdc.gov/healthyyouth/yrbs/	Yes

Table 3. Measurement scales used in included studies (Continued)

	No	Past 30-day drug use, poly drug use (cigarettes, marijuana cocaine, inhalants, met., ecstasy): 7-point score (0 to 6). Same as above	Same as above	Yes
	No	Past 30-day drug use, total substance (= poly drug use + alcohol): 8-point score (0 to 7). Same as above	Same as above	Yes
Idaho Meth 2010; Colorado Meth 2011; Georgia Meth 2011; Hawaii Meth 2011; Wyoming Meth 2011	No	Past-year and past-month use of methamphetamine: "Have used meth in past year"; "Have used meth in past month"	n/a	Unclear
	Unclear	Attitudes towards illicit drug use: "Please indicate how much you approve or disapprove of the following activities." (Strongly disapprove, strongly/somewhat approve)	n/a	Unclear
	Unclear	Perceptions (including perceptions of peer norms and perceptions about illicit drug use: binary and categorical questions, such as "How difficult, or easy, do you think it would be for you to get each of the following types of drugs?" (easy, difficult) and "Please indicate how much risk, if any, you think there is involved in each of the following activities." (Great risk, great/moderate risk, little/no risk)	n/a	Unclear

Table 3. Measurement scales used in included studies (Continued)

Slater 2011	Yes	Description of study measures and survey components (p. 15) Autonomy inconsistent with marijuana use: 4 items on a 4-point scale Aspirations inconsistent with marijuana use: 3 items on a 4-point scale Lifetime marijuana use: 4 items Exposure to ONDCP's campaign: 1 item on a 3-point scale	n/a	n/a
Carpenter 2011	No	Lifetime marijuana use	n/a	Unclear
	No	Past-month marijuana use	n/a	Unclear
	No	Alcohol use	n/a	Unclear

IAT: Implicit Association Test

n/a: not applicable

ONDCP: Office of National Drug Control Policy

SE: standard error

APPENDICES

Appendix I. CENTRAL search strategy

ID	Search	Hits
#1	MeSH descriptor: [Substance-Related Disorders] explode all trees	10,355
#2	((stimulant* or polydrug* or drug* or substance) near/3 (abuse* or abusing or consumption or addict* or disorder* or intoxicat* or misus* or use*)):ti,ab	14,750

(Continued)

#3	(abuse* or abusing or consumption or addict* or disorder* or intoxicat* or misus* or use*):ti,ab	198,966
#4	MeSH descriptor: [Narcotics] explode all trees	681
#5	heroin:ti,ab	762
#6	MeSH descriptor: [Street Drugs] explode all trees	196
#7	MeSH descriptor: [Amphetamine] explode all trees	632
#8	(amphetamine* or dextroamphetamine* or methamphetamine or Methylamphetamine*):ti,ab,kw (Word variations have been searched)	1442
#9	(ecstasy or MDMA or hallucinogen*):ti,ab,kw (Word variations have been searched)	234
#10	MeSH descriptor: [Cocaine] explode all trees	576
#11	(crack or cocaine):ti,ab,kw (Word variations have been searched)	1953
#12	MeSH descriptor: [Cannabis] explode all trees	245
#13	(cannabis or marijuana or marihuana or Hashish):ti,ab,kw (Word variations have been searched)	1158
#14	(Lysergic next Acid):ti,ab,kw	76
#15	LSD:ti,ab,kw (Word variations have been searched)	131
#16	(benzodiazepine* or barbiturate* or ketamine or solvent or inhalant):ti,ab,kw (Word variations have been searched)	6370
#17	(benzodiazepine* or barbiturate* or ketamine or solvent or inhalant):ti,ab,kw (Word variations have been searched)	6370
#18	#4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17	11,919
#19	#3 and #18	6547
#20	#1 or #2 or #19	26,077
#21	MeSH descriptor: [Mass Media] explode all trees	1337
#22	MeSH descriptor: [Internet] explode all trees	1248

(Continued)

#23	MeSH descriptor: [Videotape Recording] explode all trees	790
#24	“TV”:ti,ab,kw (Word variations have been searched)	386
#25	(media or communication* or audiovisual or telecommunication* or radio or television or internet or campaign* or advert* or twitter or facebook) (Word variations have been searched)	27,766
#26	#21 or #22 or #23 or #24 or #25	28,828
#27	MeSH descriptor: [Adolescent] explode all trees	68,885
#28	adolescen* or preadolescen* or child* or teen* or youth* or young or kid* or juvenile* or minors or boy* or girl*:ti,ab,kw (Word variations have been searched)	157,753
#29	#27 or #28	157,753
#30	#20 and #26 and #29	566

Appendix 2. PubMed (MEDLINE) search strategy

Search	Query	Items found
#16	Search (((#3) AND #4) AND #11) AND #15	5877
#15	Search ((#12) OR #13) OR #14	3,041,802
#14	Search adolescen*[tiab] OR preadolescen*[tiab] OR child*[tiab] OR teen*[tiab] OR youth*[tiab] OR young[tiab] OR kid*[tiab] OR juvenile*[tiab] OR minors[tiab] OR boy*[tiab] OR girl*[tiab]	1,662,519
#13	Search “Child”[Mesh]	1,457,004
#12	Search “Adolescent”[Mesh]	1,498,465
#11	Search (((#5) OR #7) OR #8) OR #9) OR #10	797,788
#10	Search media[tiab] OR Communication*[tiab] OR audiovisual[tw] OR telecommunication*[tw] OR Educat*[tiab] OR radio[tw] OR television[tw] OR TV[tiab] OR internet[tw] OR campaign*[tw] OR advert*[tw] OR twitter[tw] OR facebook[tw] OR “instant messaging”[tw]	751,996

(Continued)

#9	Search “Telecommunications”[Mesh]	54,815
#8	Search Videotape Recording[Mesh]	9970
#7	Search “Internet”[Mesh]	43,359
#5	Search “Mass Media”[Mesh]	37,325
#4	Search “heroin”[Mesh] OR heroin[tiab] OR “Street Drugs”[Mesh] OR “Designer Drugs”[Mesh] OR “Crack Cocaine”[Mesh] OR “Lysergic Acid Diethylamide”[Mesh] OR drug*[tiab] OR polydrug[tiab] OR substance[tiab] OR hallucinogen*[tw] OR cocaine[tw] OR amphetamine*[tw] OR “lysergic acid diethylamide”[tw] OR LSD [tiab] OR ketamine[tw] OR cannabis[tw] OR marijuana[tw] OR marijuana[tiab] OR hashish[tw] OR steroid*[tw] OR morphine[tiab] OR ecstasy[tw] OR MDMA[tw] OR benzodiazepine[tw]	1,136,251
#3	Search (#1) OR #2	1,812,638
#2	Search abus*[tiab] OR consumption[tiab] OR misus*[tiab] OR use*[tiab] OR addict*[tiab] OR disorder*[tiab]	1,570,344
#1	Search “Substance-Related disorders”[Mesh]	344,574

Appendix 3. EMBASE search strategy

ID	Query
#1	'substance abuse'/exp
#2	'drug abuse'/exp
#3	abus*:.ab,ti OR consumption:.ab,ti OR misus*:.ab,ti OR use*:.ab,ti OR addict*:.ab,ti OR disorder*:.ab,ti
#4	#1 OR #2 OR #3
#5	heroin:.ab,ti OR drug*:.ab,ti OR polydrug:.ab,ti OR substance:.ab,ti OR hallucinogen*:.ab,ti OR cocaine:.ab,ti OR amphetamine*:.ab,ti OR 'lysergic acid diethylamide':.ab,ti OR lsd:.ab,ti OR ketamine:.ab,ti OR cannabis:.ab,ti OR marijuana:.ab,ti OR marijuana:.ab,ti OR hashish:.ab,ti OR steroid*:.ab,ti OR morphine:.ab,ti OR ecstasy:.ab,ti OR mdma:.ab,ti OR benzodiazepine:.ab,ti
#6	'diamorphine'/exp

(Continued)

#7	'designer drug'/exp
#8	'street drug'/exp
#9	'cocaine'/exp
#10	'cannabis smoking'/exp
#11	#5 OR #6 OR #7 OR #8 OR #9 OR #10
#12	'mass medium'/exp
#13	'internet'/exp
#14	'videorecording'/exp
#15	'telecommunication'/exp
#16	media:ab,ti OR communication*:ab,ti OR audiovisual:ab,ti OR telecommunication*:ab,ti OR educat*:ab,ti OR radio:ab,ti OR television:ab,ti OR tv:ab,ti OR internet:ab,ti OR campaign*:ab,ti OR advert*:ab,ti OR twitter:ab,ti OR facebook:ab,ti
#17	#12 OR #13 OR #14 OR #15 OR #16
#18	'adolescent'/exp
#19	'child'/exp
#20	adolescen*:ab,ti OR preadolescen*:ab,ti OR child*:ab,ti OR teen*:ab,ti OR youth*:ab,ti OR young:ab,ti OR kid*:ab,ti OR juvenile*:ab,ti OR minors:ab,ti OR boy*:ab,ti OR girl*:ab,ti
#21	#18 OR #19 OR #20
#22	#4 AND #11 AND #17 AND #21 AND [embase]/lim

Appendix 4. EPOC criteria for quality assessment of interrupted time series

The following seven standard criteria should be used to assess the methodological quality of ITS designs included in EPOC reviews. Each criterion is scored DONE, NOT CLEAR or NOT DONE. The results of the quality assessment for each study are reported in the [Characteristics of included studies](#) table in RevMan. Examples can be obtained from the EPOC Group Co-ordinator.

Criterion	Score		
	DONE	NOT CLEAR	NOT DONE
<i>a) Protection against secular changes</i>			
The intervention is independent of other changes	If the intervention occurred independent of other changes over time	If not specified (will be treated as NOT DONE if information cannot be obtained from the authors)	If reported that intervention was not independent of other changes in time
There are sufficient data points to enable reliable statistical inference	(a) If at least 20 points are recorded before the intervention AND the authors have done a traditional time series analysis (ARIMA model) OR (b) If at least 3 points are recorded pre and post intervention AND the authors have done a repeated measures analysis OR (c) If at least 3 points are recorded pre and post intervention AND the authors have used ANOVA or multiple t-tests AND there are at least 30 observations per data point	If not specified in paper, e.g. number of discrete data points not mentioned in text or tables (will be treated as NOT DONE if information cannot be obtained from the authors)	If any of the above conditions are unmet
Formal test for trend. Complete this section if authors have used ANOVA modelling	If formal test for change in trend using appropriate method is reported (e.g. see Cook & Campbell 1979)	If not specified in the paper (will be treated as NOT DONE if information cannot be obtained from the authors)	If formal test for change in trend has not been done
<i>b) Protection against detection bias</i>			
Intervention unlikely to affect data collection	If the investigators report that the intervention itself was unlikely to affect data collection (for example, sources and methods of data collection were the same before and after the intervention)	If not reported (will be treated as NOT DONE if information cannot be obtained from the authors)	If the intervention itself was likely to affect data collection (for example, any change in source or method of data collection reported)
Blinded assessment of primary outcome(s)*	If the authors state explicitly that the primary outcome variables were assessed blindly OR the outcome variables are objective, e.g. length of hospital stay,	If not specified (will be treated as NOT DONE if information cannot be obtained from the authors)	If the outcomes were not assessed blindly

(Continued)

	drug levels as assessed by a standardised test		
c) <i>Completeness of data set</i>	If data set covers 80% to 100% of the total number of participants or episodes of care in the study	If not specified (will be treated as NOT DONE if information cannot be obtained from the authors)	If data set covers less than 80% of the total number of participants or episodes of care in the study
d) <i>Reliable primary outcome measure(s)**</i>	If 2 or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome is obtained from some automated system, e.g. length of hospital stay, drug levels as assessed by a standardised test	If reliability is not reported for outcome measures that are obtained by chart extraction or collected by an individual (will be treated as NOT DONE if information cannot be obtained from the authors)	If agreement is less than 90% or kappa is less than 0.8

*Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, score each separately.

**In the event that some outcome variables were assessed in a reliable fashion and others were not, score each separately.

Appendix 5. Quality Criteria for Cohort Controlled Studies (SIGN)

SIGN	Methodology Checklist 3: Cohort studies		
Study identification (<i>include author, title, year of publication, journal title, pages</i>)			
Guideline topic:		Key Question No:	Reviewer:
<p>Before completing this checklist, consider:</p> <p>1. Is the paper really a cohort study? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist</p> <p>2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist</p>			
Reason for rejection: 1. Paper not relevant to key question ☐ 2. Other reason ☐ (please specify):			
Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +			
Section 1: Internal validity			
<i>In a well-conducted cohort study:</i>		Does this study do it?	
1.1	The study addresses an appropriate and clearly focused question. [i]	Yes ☐ Can't say -	No ☐

(Continued)

Selection of subjects			
1.2	The 2 groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.[ii]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>
1.3	The study indicates how many of the people asked to take part did so, in each of the groups being studied.[iii]	Yes <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>
1.4	The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.[iv]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>
1.5	What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed. [v]		
1.6	Comparison is made between full participants and those lost to follow-up, by exposure status.[vi]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>

ASSESSMENT			
1.7	The outcomes are clearly defined.[i]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/>
1.8	The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable.[ii]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>
1.9	Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. [iii]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/>
1.10	The method of assessment of exposure is reliable.[iv]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/>
1.11	Evidence from other sources is used to demonstrate that	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>

(Continued)

	the method of outcome assessment is valid and reliable.[v]		
1.12	Exposure level or prognostic factor is assessed more than once.[vi]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/> Does not apply <input type="checkbox"/>
CONFOUNDING			
1.13	The main potential confounders are identified and taken into account in the design and analysis.[vii]	Yes <input type="checkbox"/> Can't say <input type="checkbox"/>	No <input type="checkbox"/>
STATISTICAL ANALYSIS			
1.14	Have confidence intervals been provided?[viii]	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Section 2: OVERALL ASSESSMENT OF THE STUDY			
2.1	How well was the study done to minimise the risk of bias or confounding?[ix]	High quality (++) <input type="checkbox"/> Acceptable (+) <input type="checkbox"/> Unacceptable - reject 0	
2.2	Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, how strong do you think the association between exposure and outcome is?		
2.3	Are the results of this study directly applicable to the patient group targeted in this guideline?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2.4	Notes. Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above		

[i] This relates to the risk of **detection bias**.^{*} Once enrolled in the study, participants should be followed until specified end points or outcomes are reached. In a study of the effect of exercise on the death rates from heart disease in middle aged men, for example, participants might be followed up until death, or until reaching a predefined age. **If outcomes and the criteria used for measuring them are not clearly defined, the study should be rejected.**

[ii] This relates to the risk of **detection bias**.^{*} If the assessor is blinded to which participants received the exposure, and which did not, the prospects of unbiased results are significantly increased. Studies in which this is done should be rated more highly than those where it is not done, or not done adequately.

[iii] This relates to the risk of **detection bias**.^{*} Blinding is not possible in many cohort studies. In order to assess the extent of any bias that may be present, it may be helpful to compare process measures used on the participant groups - e.g. frequency of observations, who carried out the observations, the degree of detail and completeness of observations. If these process measures are comparable between the groups, the results may be regarded with more confidence.

[iv] This relates to the risk of **detection bias**.^{*} A well-conducted study should indicate how the degree of exposure or presence of prognostic factors or markers was assessed. Whatever measures are used must be sufficient to establish clearly that participants have or have not received the exposure under investigation and the extent of such exposure, or that they do or do not possess a particular prognostic marker or factor. Clearly described, reliable measures should increase the confidence in the quality of the study

[v] This relates to the risk of **detection bias**.^{*} The primary outcome measures used should be clearly stated in the study. **If the outcome measures are not stated, or the study bases its main conclusions on secondary outcomes, the study should be rejected.** Where outcome measures require any degree of subjectivity, some evidence should be provided that the measures used are reliable and have been validated prior to their use in the study.

[vi] This relates to the risk of **detection bias**.^{*} Confidence in data quality should be increased if exposure level is measured more than once in the course of the study. Independent assessment by more than one investigator is preferable.

[vii] Confounding is the distortion of a link between exposure and outcome by another factor that is associated with both exposure and outcome. The possible presence of confounding factors is one of the principal reasons why observational studies are not more highly rated as a source of evidence. The report of the study should indicate which potential confounders have been considered, and how they have been assessed or allowed for in the analysis. Clinical judgement should be applied to consider whether all likely confounders have been considered. If the measures used to address confounding are considered inadequate, the study should be downgraded or rejected, depending on how serious the risk of confounding is considered to be. **A study that does not address the possibility of confounding should be rejected.**

[viii] Confidence limits are the preferred method for indicating the precision of statistical results, and can be used to differentiate between an inconclusive study and a study that shows no effect. Studies that report a single value with no assessment of precision should be treated with extreme caution.

[ix] Rate the overall methodological quality of the study, using the following as a guide: **High quality** (++) : Majority of criteria met. Little or no risk of bias. Results unlikely to be changed by further research. **Acceptable** (+) : Most criteria met. Some flaws in the study with an associated risk of bias. Conclusions may change in the light of further studies. **Low quality** (0) : Either most criteria not met, or significant flaws relating to key aspects of study design. Conclusions likely to change in the light of further studies.

CONTRIBUTIONS OF AUTHORS

Marica Ferri and Fabrizio Faggiano conceived the systematic review and overviewed study inclusion and exclusion, methodological assessment of studies, and wrote the review. Marica Ferri and Elias Allara selected the studies for inclusion. Alessandra Bo and Elias Allara extracted the data from the studies and contributed to writing the review; Elias Allara contacted the trial authors for further information. Along with Alessandra Bo, Elias Allara input data for meta-analysis into Review Manager. Antonio Gasparrini and Elias Allara did the meta-analysis of interrupted time series studies.

Marica Ferri, Fabrizio Faggiano, Elias Allara and Alessandra Bo regularly discussed each step of review process and equally participated in each decision regarding the studies and the analysis.

Marica Ferri, Gregor Burkhardt and Fabrizio Faggiano conceived the protocol, Elias Allara and Alessandra Bo performed the preliminary search strategy and participated in writing the protocol. Anna V Gyarmathy provided input to the protocol for the theories description and editing of the text.

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None of the authors report conflict of interest.

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Washington State Retail Marijuana Legalization: Parent and Adolescent Preferences for Marijuana Messages in a Sample of Low-Income Families

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ABSTRACT. Objective: As legalization of nonmedical retail marijuana increases, states are implementing public health campaigns designed to prevent increases in youth marijuana use. This study investigated which types of marijuana-related messages were rated most highly by parents and their teens and whether these preferences differed by age and marijuana use. **Method:** Nine marijuana-focused messages were developed as potential radio, newspaper, or television announcements. The messages fell into four categories: information about the law, general advice/conversation starters, consequences of marijuana use/positive alternatives, and information on potential harmful effects of teen marijuana use. The messages were presented through an online survey to 282 parent (84% female) and 283 teen (54% female) participants in an ongoing study in Washington State. **Results:** Both parents and youth

rated messages containing information about the law higher than other types of messages. Messages about potential harms of marijuana use were rated lower than other messages by both generations. Parents who had used marijuana within the past year ($n = 80$) rated consequence/positive alternative messages lower than parent nonusers ($n = 199$). Youth marijuana users ($n = 77$) and nonusers ($n = 202$) both rated messages containing information about the law higher than other types of messages. Youth users and nonusers were less likely than parents to believe messages on the harmful effects of marijuana. **Conclusions:** The high ratings for messages based on information about the marijuana law highlight the need for informational health campaigns to be established as a first step in the marijuana legalization process. (*J. Stud. Alcohol Drugs*, 79, 309–317, 2018)

IN 2012, WASHINGTON BECAME one of the first states to legalize retail marijuana for adults, and, in the summer of 2014, retail outlets began selling marijuana across the state. Although sale to youth under age 21 remains illegal, legalization of retail sale might lead to greater exposure to and availability of marijuana for adolescents. The marijuana market may start to mirror that of other legal substances, where easy availability of alcohol and cigarettes for youth, from both commercial and social sources, is widespread (Everett Jones & Caraballo, 2014). Prevalence of marijuana use among adolescents has changed little during the past 15 years and still lags behind alcohol use. In 2016, 23.9% of 10th-grade and 35.6% of 12th-grade students reported using marijuana in the past year, compared with 38.3% and 55.6%, respectively, for alcohol (Johnston et al., 2017). As the legal marijuana market becomes established and prices

begin to drop, it is possible that adolescent marijuana use could increase.

Parents have expressed confusion over how to communicate with their adolescent children about marijuana now that it is legal for adults (Kosterman et al., 2016; Mason et al., 2015; Roffman, 2012). Furthermore, both parents and teens have reported a lack of knowledge about the specifics of the law (Mason et al., 2015). When the sample used in the current study was asked three basic questions about the content of the marijuana law (legal age of use, legal amount of possession, whether homegrown marijuana is legal), about 60%–70% of parents and youth knew answers to individual questions, yet less than 30% answered all three questions correctly (Mason et al., 2015). Because parents' behavior and attitudes about substance use and their communications with their adolescents on the topic predict use levels among their teens (Jackson & Dickinson, 2003; Kelly et al., 2002), parental knowledge of what is and is not legal may help them better communicate with their children in this changing environment (Jackson, 2002).

Public information campaigns have demonstrated some effectiveness in relation to law changes related to seatbelt use (Vasudevan et al., 2009), texting and driving (Kareklas & Muehling, 2014), and driving under the influence (Elder et al., 2004). Moreover, some research indicates that communi-

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ty-wide health communication campaigns can reduce youth marijuana use. Televised campaigns with high reach and frequency targeting high-risk adolescent populations have been shown to significantly reduce marijuana use (Palmgreen et al., 2001), and national campaigns such as “Above the Influence” have also shown potential (Slater et al., 2011). Yet, creating such campaigns in the age of retail marijuana legalization is uncharted territory. Colorado’s “Don’t Be a Lab Rat” campaign, which depicted human-sized laboratory cages containing information on the effects of marijuana on teen brain development, had mixed results. Some questioned the effectiveness of cages in helping youth understand the potential harms of marijuana; others argued that, regardless of any backlash, the campaign at least started a conversation about youth marijuana use in a legal environment (Frosch, 2014).

The somewhat negative reaction to the Colorado campaign demonstrates the need for further development and testing of marijuana messages that are positively received. Research tells us that messages must be perceived as relevant, trustworthy, credible, and persuasive in order to gain the attention of the target audience and, ultimately, have an impact (Lewis et al., 2016; Voltmer & Römmele, 2001). For this study, we applied those characteristics to the development and testing of messages about marijuana as retail stores began to open in Washington State.

Based on themes extracted from focus groups conducted with youth and parent participants in an experimental trial of a parenting intervention in urban Washington State (Skinner et al., 2017), we developed four styles of messages for parents and teens: informational messages about the law; messages containing general advice/conversation starters for parents; messages with a focus on consequences and offering positive alternatives for youth; and messages about potential harmful effects of youth marijuana use. The purpose of this study was to understand how each of these four types of messages was received by parents and their teens who were participating in the parenting intervention trial. We also investigated whether messages were perceived differently by users and nonusers of marijuana to see if certain message types resonate better within population subgroups.

Method

Message development

We conducted six focus groups in Tacoma, Washington, in 2013, about a year after the law legalizing adult use of marijuana was passed, but before retail outlets were open. The focus groups were semi-structured discussions on issues such as current names for marijuana, concerns about legalization, and what type of messaging might be effective in preventing youth marijuana use (see Skinner et al., 2017). Participants were not specifically asked to draw comparisons

with other substances, although alcohol and tobacco communications were brought up by both parents and youth. Key themes were identified and included both parents and teens expressing an interest in more and better information about marijuana and the law, reliable information about the risks of marijuana use during adolescence, and real people’s stories about the consequences of use. Focus group participants also emphasized the need for trustworthy messengers. Discussions with teens focused on whether parents were trustworthy sources; parents felt that messages from doctors, schools, or churches could be effective, but that messages should not come from law enforcement or celebrities (Skinner et al., 2017). These themes formed the foundation of our message development.

In the winter of 2014, 18 people (6 project staff and 12 design students and faculty) attended a 4-hour design meeting to review the focus group findings and translate them into potential messages for parents and teens. This yielded message prototypes that were then provided to a design student who, along with input from researchers, turned the ideas into testable messages. Nine messages, falling into four general categories, were developed through this process. Two of these were radio messages that were developed by the Washington Traffic Safety Commission in collaboration with the study. Five messages were formatted as posters that could potentially be displayed on billboards or buses, and two messages were rough sketches of possible television or other visual media messages, displayed in a slideshow format. To recognize the request for trustworthy messengers, one radio message was recorded by a physician from Seattle Children’s Hospital. Although parents specifically noted that law enforcement may not be an effective source, one poster featured a member of the Washington State Patrol and was included because it provided information about the law and was already developed and in use by the Traffic Safety Commission.

Messages were grouped according to the themes that emerged in the focus groups. Because our messages were presented in a variety of formats, grouping messages allowed us to investigate how well a particular theme versus a particular message resonated with our audience. One radio message and one poster provided information about the law such as legal age for marijuana use, rules regarding use in public, and reminders that it is illegal to drive while under the influence of marijuana. Another two messages, one radio and one poster, offered parents advice on having conversations with their children about marijuana, encouraging parents to initiate conversations and listen to their child’s opinions. One poster and two slideshows touched briefly on potential negative consequences of marijuana use (unemployment, school dropout, missed opportunities) while providing suggestions for positive alternative activities. These messages were designed to increase awareness of potential problems caused by marijuana use while providing nonconfrontational motivation



FIGURE 1. Example of message containing information about the law. *Note:* This message was presented with both visual and audio components.

to make positive choices. Two posters highlighted possible harmful physiological and psychological effects of youth marijuana use, such as addiction, lack of judgment, memory loss, and depression stemming from use during adolescence. See Figures 1 and 2 for example messages and Table 1 for a summary of message types and content.

Some of the messages were focused more toward parents, some more toward youth, and some were applicable to both generations. Messages on conversation starters were designed more for parents, whereas messages emphasizing positive choices spoke to a younger audience; information about the law and messages on potential harmful effects of marijuana use were relevant to all ages. Even though some messages were geared more toward particular age groups, all messages were presented to each respondent, as feedback from both youth and parents offered unique perspectives (e.g., Do youth feel that a particular message will encourage their parents to start a discussion about marijuana use?).

Study sample

The participants in this study were part of an ongoing longitudinal study in Tacoma, Washington, examining the effects of a parenting program, Common Sense Parenting® (Burke et al., 2006; Mason et al., 2016). Each family included a target parent and eighth-grade student who attended one of five middle schools at the time the study started. Two waves of families were enrolled in the initial study, the first during the 2010–2011 school year followed by the second a year later. Most students at the schools were from low-income families and were specifically selected for being at elevated risk for high school dropout. At the recruitment schools, just over 70% of the students received free or reduced-price school lunch in the 2010–2011 school year. All study procedures, including those for obtaining consent/assent, were approved by the human subjects review committees at the University of Washington, Father Flanagan's Boys'

Home, and the participating school district. Participants were randomly assigned to the Common Sense Parenting condition (CSP, a parent training program currently in widespread use by Boys Town), CSP Plus Stepping up to High School (an adaptation of the standard curricula that includes adolescents in the workshops), or a control group. No intervention effects on either parent or teen attitudes or beliefs about substance use were evident in the larger study (Mason et al., 2016).

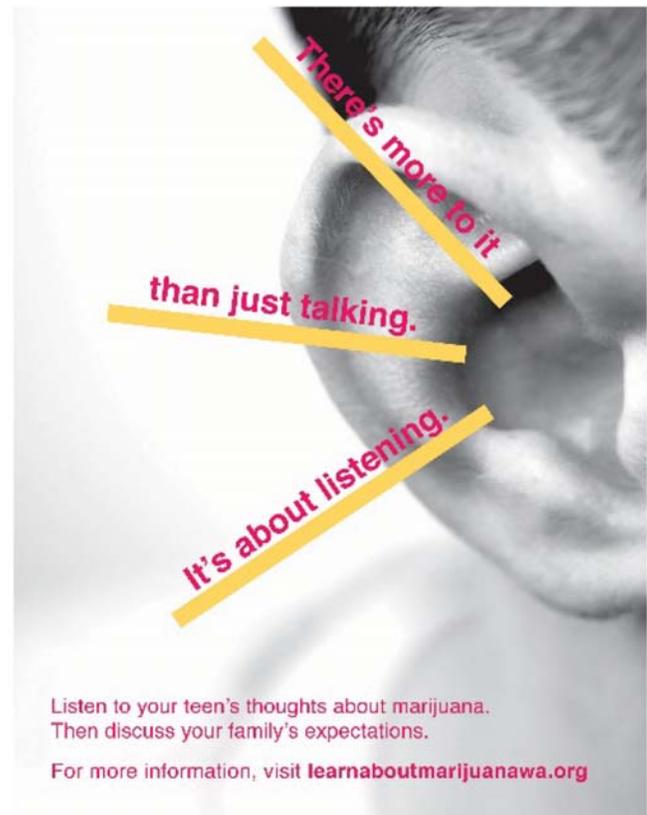


FIGURE 2. Example of advice/conversation starter message

TABLE 1. Summary of message types and content

	Number of messages	Message format	Excerpt of message text
Information about the law	2	Text with audio	“It is important to know what was approved. It is still illegal to use marijuana in public. Just like alcohol, it’s illegal to use marijuana under the age of 21.”
		Poster	“With marijuana stores opening we need to remember that DUI doesn’t change. It’s still illegal.”
Advice/conversation starters	2	Text with audio	“Now that it’s legal for those over 21, it’s more important than ever to talk with your kids about the risks of marijuana use. They really do hear you.”
		Poster	“There’s more to it than just talking. It’s about listening. Listen to your teen’s thoughts about marijuana. Then discuss your family’s expectations.”
Consequences/positive alternatives	3	Poster	“Some people say that ‘everybody’s doing it’ to justify using marijuana themselves. Nobody can make you use. It’s a choice.”
		Slide show	“Smoking weed once might not kill you, but repeated use can lead to problems you may not expect. [Image of person getting DUI.] Marijuana can close doors to opportunities. Keep your doors open.”
		Slide show	“Adolescence is a period of exploration and creative development. [Image of hands with cigarette rolling paper, turns it into origami bird.] It’s your life, make something cool.”
Harmful effects of marijuana use	2	Poster	“Marijuana use can lead to health, safety, social and learning problems – especially for young people.”
		Poster	“Marijuana use affects developing brains differently than adult brains. Young people lack the judgement skills of adults, and early-onset marijuana use is more likely to lead to addiction.”

Note: DUI = driving under the influence.

Three hundred and twenty-one families were enrolled in the original longitudinal project. The data for this study were collected in 2014 and include 283 youth and 282 parents recruited from both waves. The youth were 54% female, 32% White, 33% African American, 16% Hispanic/Spanish/Latino, and 19% other race/ethnicity. At the time of the survey, 66% of the youth were in 10th grade (the remainder in 11th grade), and the mean age was 17 years (range: 15–18). Parents/caregivers were 84% female, 39% White, 28% Black/African American, 13% Hispanic/Spanish/Latino, and 20% other race/ethnicity. The mean age of parents at the time of the survey was 43 years. Twenty-eight percent of youth and 29% of parents reported having used marijuana in the past year.

Measures

Study participants were invited to complete an online survey. The survey took about 20 minutes, and respondents were visually shown each message (audio recordings were included for two of the messages) followed by a series of questions asking them to rate each message on characteristics identified as salient for public service messages to be impactful (Pfleiderer, 2001; Schönbach, 2001). Respondents were also asked open-ended questions about what they liked and did not like about the message. After reviewing the messages and considering the pros and cons, participants were asked to provide an overall summary rating for each message

(“Overall, how would you rate this message?”) on a Likert scale ranging from 1 (*very poor*) to 9 (*very good*). Messages were grouped by the four message categories (information about the law, advice/conversation starters, consequences/positive alternatives, and potential harmful effects), and the mean score on the overall rating scale was calculated for each message type. Given the importance of persuasive appeal in health-related messages, this initial study focused on evaluating overall ratings of messages.

Analysis

We assessed differences in overall ratings between message types within groups using matched-pairs *t* tests. Independent sample *t* tests were used to compare mean scores reported by different groups (i.e., parents and youth or marijuana users and nonusers). Standardized differences (*d*) were calculated by dividing differences by the average standard deviation of ratings for message types or for different groups’ ratings.

The open-ended responses were initially coded into general themes by a group of three researchers (a single response could be coded into multiple categories). One individual reviewed the themes and generated a final list of broader themes into which the categories were collapsed. The percentage of respondents whose comments were coded into each theme was calculated for each message type, and these percentages were ranked to determine the most common themes.

TABLE 2. Mean values of overall rating scores for parents and youth

Variable	Information about the law <i>M (SD/range)</i>	Advice/ conversation starters <i>M (SD/range)</i>	Consequences/ positive alternatives <i>M (SD/range)</i>	Harmful effects of marijuana use <i>M (SD/range)</i>
Parents (<i>n</i> = 282)	7.26 ^{a,b,c,*} (1.73/1.0–9.0)	7.01 ^{a,d,*} (1.66/1.5–9.0)	6.95 ^{b,e,*} (1.78/1.0–9.0)	6.76 ^{c,d,e,*} (2.11/1.0–5.0)
Youth (<i>n</i> = 283)	6.63 ^{a,b,c} (1.79/1.5–9.0)	5.92 ^{a,d} (1.88/1.0–9.0)	6.43 ^{b,d,e} (2.01/1.0–9.0)	5.98 ^{c,e} (2.19/1.0–9.0)

Notes: Means with shared superscript in each row differ significantly ($p < .05$). *Means in the top row with an asterisk denote a significant ($p < .05$) difference between values in that column.

Results

Table 2 provides mean scores of the overall ratings of the messages by type for parents and youth. Although all the messages were rated highly (average scores ranged from 6.76 to 7.26 on a scale of 1–9), parents rated messages more favorably than youth for all four message types (d s = 0.27–0.62). There were no differences by gender in message ratings for either parents or youth. Both parents and youth rated messages containing information about the law higher than messages containing advice/conversation starters, messages focusing on consequences/positive alternatives, and messages about potential harmful effects of teen marijuana use (d s = 0.11–0.39).

Not surprisingly, youth rated messages about advice/conversation starters lower than other types (e.g., $d = 0.39$ compared with ratings for messages containing information about the law), as those messages were geared toward parents. Even though messages about the potential harmful effects of marijuana focused on risks of use during adolescence, both parents and youth rated these messages lower than almost all other types. Parents rated messages about the harms of marijuana use lower than all other message types (d s = 0.10–0.26), whereas youth rated them significantly lower than messages about the law ($d = 0.33$) and those aimed toward consequences/positive alternatives ($d = 0.21$).

Because people who use marijuana may have different attitudes toward marijuana messaging than those who do not use, we investigated if there were differences in message ratings based on whether respondents reported marijuana use at

least once in the past year. Similar to the overall responses, parent nonusers rated messages containing information about the law higher than all other messages; they rated messages on potential harmful effects of marijuana lowest. Among parent users, only the difference between informational messages versus consequences/positive alternatives ($d = 0.31$) and harmful effects of marijuana versus consequences/positive alternatives ($d = 0.24$) were statistically significant (Table 3). Comparing parent users and nonusers, parents who reported using marijuana in the past year rated messages about consequences and positive alternatives lower than parents who said they had not used marijuana in the past year ($d = 0.36$).

For youth, messages about what is contained in the law were again rated highly by youth who reported using marijuana in the past year and those who did not (Table 4). Both youth groups also rated messages about consequences/positive alternatives higher than those containing information on potential harmful effects of marijuana use ($d = 0.19$ and $d = 0.29$, respectively). Comparing youth users and nonusers, nonusers rated messages about consequences/positive alternatives and potential harmful effects of marijuana higher than users ($d = 0.43$ and $d = 0.52$, respectively).

The open-ended responses allowed us to further investigate what respondents liked and did not like about the four message types. For messages containing information about the law, the most common theme, reported by 36% of parents and 35% of youth, was appreciation that the messages provided information about the law (Table 5). For example, they wrote, “I like the fact that it gives more information about the law. I was unsure about the factors of this law (age

TABLE 3. Overall ratings by category for past-year parent users and nonusers

Variable	Information about the law <i>M (SD/range)</i>	Advice/ conversation starters <i>M (SD/range)</i>	Consequences/ positive alternatives <i>M (SD/range)</i>	Harmful effects of marijuana use <i>M (SD/range)</i>
Past-year nonusers (<i>n</i> = 200)	7.36 ^{a,b,c} (1.77/1.0–9.0)	7.08 ^{a,d} (1.74/1.5–9.0)	7.11 ^{b,e,*} (1.82/1.0–9.0)	6.67 ^{c,d,e} (2.20/1.0–9.0)
Past-year users (<i>n</i> = 80)	7.00 ^a (1.61/2.5–9.0)	6.81 (1.42/3.5–9.0)	6.50 ^{a,b} (1.59/2.7–9.0)	6.92 ^b (1.87/1.5–9.0)

Notes: Means with shared superscript in each row differ significantly ($p < .05$). *Means in the top row with an asterisk denote a significant ($p < .05$) difference between values in that column.

TABLE 4. Overall ratings by category for past-year youth users and nonusers

Variable	Information about the law <i>M (SD/range)</i>	Advice/conversation starters <i>M (SD/range)</i>	Consequences/positive alternatives <i>M (SD/range)</i>	Harmful effects of marijuana use <i>M (SD/range)</i>
Past-year nonusers (<i>n</i> = 202)	6.76 ^{a,b} (1.73/1.5–9.0)	6.06 ^{a,c} (1.88/1.0–9.0)	6.67 ^{c,d,*} (1.94/1.0–9.0)	6.29 ^{b,d,*} (2.09/1.0–9.0)
Past-year users (<i>n</i> = 77)	6.33 ^{a,b,c} (1.86/1.5–9.0)	5.57 ^a (1.79/1.5–9.0)	5.80 ^{b,d} (2.08/1.0–9.0)	5.19 ^{c,d} (2.18/1.0–9.0)

Notes: Means with shared superscript in each row differ significantly (*p* < .05). *Means in the top row with an asterisk denote a significant (*p* < .05) difference between values in that column.

limit, where it can be used, etc.)”; and “I had no idea it was illegal to drive after smoking. I thought DUI [driving under the influence] was only for drinking and driving.” Although respondents approved of the information provided, a request by 22% of parents and 16% of youth was for these messages to contain even more information or the addition of a website as a further resource. For example: “It doesn’t share how you would know if you were driving impaired under marijuana. What is the test/limits/quantity to prove if you are impaired or not?” and “There is nothing showing where more information can be found.” Messages containing advice were thought to encourage family conversations (“It gives me a reminder to talk to my kids about it, also opens the doors to discussion if we see the ad together.”) but were considered somewhat bland (“Kids these days like to read what catches their eye; I would’ve never read this.”).

Messages about consequences and positive alternatives provided a creative spin and offered choices (“I like that it focused on positive things and teens versus the bad things that can happen.”). Our rudimentary slideshow format, however, was met with criticism: “While the message is right, the cartoons were childish and kind of corny for a teenager to take it seriously.” Both parents and youth liked that our messages discussed potential harmful effects of teen marijuana use, but some respondents felt that these messages were not convincing enough: “People know the risks but continue to do it. Telling them what happens is just another thing they don’t care about.”

Despite the lower ratings of messages about the harmful effects of marijuana, both parents (26%) and youth (26%) commented that they appreciated the messages that discussed possible risks and harms from marijuana use. However, they differed in how much they believed the information about these risks. Twenty percent of youth wrote something to the effect that they did not believe the information presented about the effects of marijuana or that they thought the message was negative toward marijuana use, compared with only 7% of parents. For example, youth wrote, “Other research shows there is no evidence on memory loss and it helps people cope with anxiety and actually opens up imagination in an individual’s brain”; “I know plenty of kids who smoke weed and get into college and get good grades”; “It instantly assumes and tries to convince people that marijuana is a harmful and negative substance”; and “I don’t see any real risk of marijuana. It has more than 150 uses including paper or even medicine.” This distrust was consistent across youth marijuana users and nonusers; 47% of the comments along this theme were made by youth who reported not using marijuana in the past year.

Discussion

Our analyses show a general preference for messages based on information about the marijuana law. Messages containing details of the law such as legal age, public use, and driving under the influence were consistently rated high-

TABLE 5. Summary of likes and dislikes by message type

Variable	Most common favorable observations	Most common unfavorable observations
Information about the law	Presents facts about the law (36% of parents, 35% of youth)	Needs more statistics/information/website (22% of parents, 16% of youth)
Advice/conversation starters	Encourages family conversations (20% of parents, 20% of youth)	Boring/not engaging or attention getting (22% of parents, 26% of youth)
Consequences/positive alternatives	Positive/offers choices (19% of parents, 22% of youth)	Didn’t like presentation (picture, color, format) (31% of parents, 20% of youth)
Harmful effects of marijuana use	Discusses risks/effects of marijuana use (26% of parents, 26% of youth)	Not convincing/no one will listen to this (15% of parents, 13% of youth)

er than all other message types. Review of the open-ended comments revealed that study participants did not have a strong understanding of the contents of the marijuana law even though the marijuana initiative was approved in Washington State 2 years before our study. These results not only are consistent with research showing that knowledge levels about basic aspects of the law are relatively low (Mason et al., 2015) but also highlight the need for educational media campaigns to be established early in the marijuana legalization process.

Current public health campaigns for alcohol and tobacco focus mainly on behavior and/or attitude change, drawing on a history of research into the perceived effectiveness of tobacco-related media messages (Davis et al., 2013; Niederdeppe et al., 2011; Wong & Cappella, 2009). These campaigns, however, are aided by a general understanding of laws surrounding alcohol and tobacco use, leaving them to focus on other outcomes. Many laws regarding legalized marijuana are still in development, differing across and even within states, and a general understanding of these laws appears to be lacking. Although informational messages may be most effective when combined with other strategies (National Cancer Institute, 2008; Robinson et al., 2014), our study emphasizes the need for states legalizing marijuana to initially develop public health campaigns designed to increase knowledge and awareness of the basic facts of the law.

Our results also showed that ratings of messages differed based on use and nonuse of marijuana. Although parents reporting use in the past year still ranked messages containing information about the law highly, the ratings were not as high as among parent nonusers and both youth users and nonusers. This possibly reflects a greater knowledge of the law among parents who have used marijuana and may have a greater interest in tracking changes in the laws. Both parent and youth users of marijuana rated messages about consequences/positive alternatives lower than their nonuser counterparts, which is consistent with research on tobacco campaigns showing minimal impact of negative consequence advertising on casual users (Goldman & Glantz, 1998). These differences in message ratings indicate that targeting messages toward specific groups may be more effective than a "one-size-fits-all" approach. Research on targeted versus general messages is still evolving, especially with new technologies allowing for greater customization of messages across an array of media. However, using data-driven messages aimed toward particular groups has been shown to be effective in general health communications (Kreuter et al., 2003).

Although parents and youth both rated messages containing information on the potential harm of marijuana use lower than other types of messages, skepticism about marijuana risks was more pronounced by youth in the open-ended responses. These insights are consistent with research using the Washington State Healthy Youth Survey, which shows

a significant decrease in Washington State 10th graders' perceived harm of marijuana from 2000 to 2014, combined with a significant increase in favorable attitudes toward marijuana over the same period (Washington State Healthy Youth Survey, 2015). Although research on the link between early marijuana use and a range of behavioral and physiological problems is well established (Hall, 2015; Volkow et al., 2014), these data are often countered by messages about the benefits of marijuana, particularly in the age of social media and marijuana legalization (Roditis et al., 2016). Youth perceive marijuana as less risky and more socially acceptable than cigarettes, and these changing attitudes toward marijuana among youth may require rethinking how best to reach youth with public health campaigns on the risks of marijuana.

This study has notable limitations. First, our sample was part of an existing study and was not recruited specifically to test marijuana messaging. A larger sample more representative of families across Washington State would have been preferable. Second, the messages, developed by a design student and researchers based on information from focus groups, were unpolished. This may have diminished their overall effectiveness. Likewise, given the exploratory, first-step nature of this study, it was not designed to disentangle the formatting, ordering, or platform of the messages from the content. Further, some messages, such as those emphasizing negative consequences of marijuana use alongside suggestions for positive alternatives, included multiple components, and we were only able to get ratings of the combination of these components. This study takes an important first step in examining parents' and teens' overall ratings of messages, rather than attempting to assess efficacy with respect to influencing behavior. Of course, messages that are positively rated may not have the desired impact. Future research is needed to test whether the messages developed here actually prevent adolescent marijuana use.

Conclusions

Providing clear information to parents and teens about changes to the law emerged as an important issue from the testing of messages. With more states legalizing medical and nonmedical marijuana in November 2016, marijuana use and its negative consequences could increase. States with legalization should recognize the need for information campaigns specific to their state to ensure that their residents are provided with clear, basic information about these new laws. Public health campaigns that disseminate details about marijuana laws should be included in state budgets and roll out before the opening of retail stores. In addition, targeting of messages toward users and nonusers of marijuana might be an effective means of reaching subpopulations, and states wanting to disseminate messages on potential harms of marijuana should account for youth skepticism and consider

thorough testing of messages to evaluate their effectiveness. Although it remains to be seen what, if any, impact retail marijuana might have on youth substance use, states that have legalized marijuana and those considering legalization should be proactive in developing public information campaigns designed to increase knowledge and understanding of the law as a first step in the marijuana legalization process.

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Effects of the National Youth Anti-Drug Media Campaign on Youths

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Between 1998 and 2004, the US Congress appropriated nearly \$1 billion for the National Youth Anti-Drug Media Campaign. The campaign had 3 goals: educating and enabling America's youths to reject illegal drugs; preventing youths from initiating use of drugs, especially marijuana and inhalants; and convincing occasional drug users to stop.¹ The campaign, which evolved from advertising efforts by the Partnership for a Drug-Free America,² did not expect to affect heavy drug users.

The campaign was designed to be a comprehensive social marketing effort that aimed antidrug messages at youths aged 9 to 18 years, their parents, and other influential adults. Messages were disseminated through a wide range of media channels: television (local, cable, and network), radio, Web sites, magazines, movie theaters, and several others. Additionally, the campaign established partnerships with civic, professional, and community groups and outreach programs with the media, entertainment, and sports industries. Across its multiple media outlets, the campaign reported buying advertising from September 1999 through June 2004; it was expected that, on average, a youth would see 2.5 targeted ads per week. Sixty-four percent of the gross rating points (GRPs) purchased for the ads were on television and radio. (Within the advertising industry, GRPs are the customary units for measuring exposure to ads. If 1% of the target population sees an ad 1 time, that ad earns 1 GRP).

The youth-focused ads, including ads targeted at African American youths and Hispanic youths (in Spanish), fell into 3 broad categories: (1) resistance skills and self-efficacy, to increase youths' skill and confidence in their ability to reject drug use; (2) normative education and positive alternatives, addressing the benefits of not using drugs; and (3) negative consequences of drug use, including effects on academic and athletic performance. The emphasis on each theme varied across the 5 years of the campaign studied here. To unify its advertising, beginning in 2001, the campaign incorporated

Objectives. We examined the cognitive and behavioral effects of the National Youth Anti-Drug Media Campaign on youths aged 12.5 to 18 years and report core evaluation results.

Methods. From September 1999 to June 2004, 3 nationally representative cohorts of US youths aged 9 to 18 years were surveyed at home 4 times. Sample size ranged from 8117 in the first to 5126 in the fourth round (65% first-round response rate, with 86%–93% of still eligible youths interviewed subsequently). Main outcomes were self-reported lifetime, past-year, and past-30-day marijuana use and related cognitions.

Results. Most analyses showed no effects from the campaign. At one round, however, more ad exposure predicted less intention to avoid marijuana use ($\gamma = -0.07$; 95% confidence interval [CI] = $-0.13, -0.01$) and weaker antidrug social norms ($\gamma = -0.05$; 95% CI = $-0.08, -0.02$) at the subsequent round. Exposure at round 3 predicted marijuana initiation at round 4 ($\gamma = 0.11$; 95% CI = $0.00, 0.22$).

Conclusions. Through June 2004, the campaign is unlikely to have had favorable effects on youths and may have had delayed unfavorable effects. The evaluation challenges the usefulness of the campaign. (*Am J Public Health.* 2008;98:2229–2236. doi:10.2105/AJPH.2007.125849)

a youth brand phrase: “——: My Anti-Drug” (with “Soccer,” for example, filling in the blank). Most campaign ads up to late 2002 did not concentrate on a specific drug, although some ads named marijuana. In late 2002, the campaign introduced the Marijuana Initiative, which altered the ads' mix of messages to a focus on specific potential negative consequences of marijuana use. In the final 6 months evaluated here, about half of the ads were focused on an “early intervention” initiative, that encouraged adolescents to intervene with their drug-using friends.

The campaign involved many institutions. It was supervised by the White House Office of National Drug Control Policy, with overall campaign management by advertising agency Ogilvy and Mather and public relations and outreach efforts by Fleishman Hillard. Most ads were developed on a pro bono basis by individual advertising agencies working with the Partnership for a Drug-Free America. The evaluation, mandated by Congress, was supervised by the National Institute on Drug Abuse and undertaken by Westat and the Annenberg School for Communication at the University of Pennsylvania.

We examine the campaign's effects on youths between September 1999 and June 2004, from its full national launch to 9 months after a major refocusing, partly in response to earlier evaluation results.³ Effects on parents are reported separately.⁴

METHODS

Sample and Procedure

Our primary evaluation tool was the National Survey of Parents and Youth (NSPY), an in-home survey of youths and their parents living in households in the United States. The first round of data collection consisted of 3 waves, approximately 6 months apart, between November 1999 and June 2001. Eligible youths (aged 9–18 years) were reinterviewed for the second round (July 2001–June 2002), third round (July 2002–June 2003), and fourth round (July 2003–June 2004). Across rounds 1 through 4, a total of 8117, 6516, 5854, and 5126 youths were interviewed, respectively. The sample was selected to provide an efficient and nearly unbiased cross-section of US youths and their parents. Respondents were selected through a stratified

4-stage probability sample design: 90 primary sampling units—typically county size—were selected at the first stage, geographical segments were selected within the sampled primary sampling units at the second stage, households were selected within the sampled segments at the third stage, and then, at the final stage, 1 or 2 youths were selected within each sampled household, as well as 1 parent in that household.

The sample for the initial round of the study comprised 3 cohorts that were interviewed in different waves of data collection. The first cohort (from wave 1) was interviewed again at waves 4, 6, and 8. The second and third cohorts (from waves 2 and 3, respectively) were combined and reinterviewed at waves 5, 7, and 9. Waves 1 through 3 were considered round 1, with pairs of subsequent waves combined for rounds 2, 3, and 4. The overall response rate among youths for the first round was 65%, with 86% to 93% of still eligible youths interviewed in subsequent rounds. (A table giving an overview of the study sample cohorts and a data collection timeline is available as a supplement to the online version of this article at <http://www.ajph.org>)

NSPY questionnaires were administered on laptop computers brought into the respondents' homes. The interviewer recorded answers for the opening sections, but for most of the interview, to protect privacy, respondents heard prerecorded questions and answer categories through headphones and responded via touch-screen selection on the computer. Interviews could be conducted in English or Spanish.

Measures

The analyses reported here were based on 3 types of measures: recalled exposure to antidrug messages aired by the campaign and other sources; cognitions and behavior related to marijuana, as outcomes; and individual and household characteristics, including a wide range of variables known to be related to drug cognitions and use and to exposure to antidrug messages.

Exposure measures. A measure of general exposure to antidrug advertising was derived from responses to questions about advertising recall for each medium or media grouping: television and radio, print, movie theaters or videos, and outdoor advertising. An example question, based on wording from the

Monitoring the Future Survey,⁵ read, "The next questions ask about antidrug commercials or ads that are intended to discourage drug use. In recent months, about how often have you seen such antidrug ads on TV, or heard them on the radio?"

In addition, the NSPY measured prompted recall of specific campaign television and radio ads. In general, up to 4 television and 2 radio ads scheduled to air in the 2 months preceding the interview were randomly selected and presented in full via the computer. Respondents were asked, "Have you ever seen or heard this ad?" and "In recent months, how many times have you seen or heard this ad?" Respondents answered through precoded response categories. If more than 4 television or 2 radio youth-targeted ads had been on the air in the previous 2 months, recall data were imputed for all those not presented. There is substantial evidence for the validity of this specific measure when recall of a campaign ad is compared with that of ads never broadcast and to total GRPs purchased for that ad.⁶

Outcome measures. For 3 reasons, all drug-related measures reported here relate to marijuana use. First, marijuana is by far the illicit drug most heavily used by youths.⁵ Second, for other drugs, the low levels of use meant that the NSPY sample sizes were not large enough to detect meaningful changes in use with adequate power. Third, to the extent that the campaign did target a specific drug, it was almost always marijuana.

The behavior measures reported here include lifetime, past-year, and past-30-day use of marijuana. To measure lifetime use, the respondent was told, "The next questions are about marijuana and hashish. Marijuana is sometimes called pot, grass, or weed. Marijuana is usually smoked, either in cigarettes, called joints, or in a pipe. Hashish is a form of marijuana that is also called hash. From now on, when marijuana is mentioned, it means marijuana or hashish. Have you ever, even once, used marijuana?" This was followed up by the question, "How long has it been since you *last* used marijuana?" Possible responses were (1) "During the last 30 days," (2) "More than 30 days ago but within the last 12 months," and (3) "More than 12 months ago."

The cognitive measures were developed on the basis of 2 health behavior theories, the

theory of reasoned action⁷ and social cognitive theory.⁸ Four measures or indices represented the following constructs: (1) marijuana intentions, (2) marijuana beliefs and attitudes, (3) social norms, and (4) self-efficacy to resist use.

The intention measure was based on one question that asked, "How likely is it that you will use marijuana, even once or twice, over the next 12 months? When we say marijuana, we mean marijuana or hashish." The answer categories provided the following alternatives: "I definitely will not," "I probably will not," "I probably will," and "I definitely will." For analytic purposes, the responses were dichotomized into "I definitely will not" vs other responses. Consistent with the theory of reasoned action, this intention measure proved to be a powerful predictor of future behavior: among those aged 12.5 to 18 years who said they had never used marijuana, 9% of those who answered "definitely will not" at a given round reported use when they were reinterviewed 12 to 18 months later at the next round. By contrast, 39% of prior nonusers who gave any other answer said at the next interview that they had initiated use.

The antimarijuana attitudes and beliefs index included responses to 8 specific expected-outcome questions (e.g., "How likely is it that the following would happen to *you* if you used marijuana, *even once or twice*, over the next 12 months? I would: Get in trouble with the law," with responses on a 5-point scale from "very unlikely" to "very likely"). Initially, respondents who had never used marijuana were randomly selected to be asked about the consequences of marijuana use on a trial basis ("even once or twice") or regularly ("nearly every month"), whereas all of those who had previously used marijuana were asked regular-use questions.

For trial use, respondents were asked how they rated ("very unlikely" to "very likely") the following possible consequences of marijuana use: "Upset my (parents/caregivers)," "Get in trouble with the law," "Lose control of myself," "Start using stronger drugs," "Be more relaxed," "Have a good time with my friends," "Feel better," and "Be like the coolest kids." For regular use, possible consequences were as follows: "Damage my brain," "Mess up my life," "Do worse in school," "Be acting against my moral beliefs," "Lose my ambition," "Lose my

friends' respect," "Have a good time with my friends," and "Be more creative and imaginative."

The index also included responses to 2 attitude scales in a semantic differential format: "Your using marijuana *nearly every month* for the next 12 months would be —," with 2 sets of responses, both on a scale of 7: "extremely bad" to "extremely good" and "extremely unenjoyable" to "extremely enjoyable." For these items, respondents were again assigned trial-use or regular-use questions, depending on whether they had previously used marijuana.

To create the overall index, we used data from waves 1 and 2, regressing all of the belief and attitude items on the intention question and assigning weights to each item for the overall scale that reflected those coefficients. The summed index was then scaled so that the mean (and standard deviation) for the entire population of nonusers aged 12 to 18 years at wave 1 was set to 100. Among all youths (users and nonusers) aged 12.5 to 18 years, those who scored above the median on the index had a relative odds of 21.7 of responding "definitely will not" to the intention measure compared with those who scored below the median.

The anti-marijuana social norms index was created with a statistical approach parallel to that of the attitudes and beliefs index. There were 5 parallel questions that assessed social normative pressure regarding marijuana use. They asked about perceptions of friends' marijuana use, other peers' marijuana use, parents' disapproval of "your" marijuana use, friends' disapproval of "your" marijuana use, and disapproval of "your" marijuana use by most people important to you, in the context either of use "even once or twice" or of use "nearly every month" over the next year. Through use of a regression model, the questions were then weighted according to their ability to predict the intention to use marijuana once or twice in the next year. The summed index was scaled so that the mean (and standard deviation) for the entire population of nonusers aged 12 to 18 years at wave 1 was set to 100. Among all youths (users and nonusers) aged 12.5 to 18 years, those who scored above the median on the index had a relative odds of 17.4 of responding "definitely will not" to the intentions measure compared with those who scored below the median.

Finally, for the antimarijuana self-efficacy index, all respondents were asked the same 5 questions about their confidence that they could turn down use of marijuana under various circumstances: "How sure are you that you can say no to marijuana, *if you really wanted to*, if: You are at a party where most people are using it? A very close friend suggests you use it? You are home alone and feeling sad or bored? You are on school property and someone offers it? You are hanging out at a friend's house whose parents aren't home?" Through use of a regression model, these 5 questions were then weighted according to their ability to predict the intention to use marijuana once or twice in the next year. Once again, the summed index was scaled so that the mean (and standard deviation) for the entire population of nonusers aged 12 to 18 years at wave 1 was set to 100. Among all youths (users and nonusers) aged 12.5 to 18 years, those who scored above the median on the index had a relative odds of 4.0 of responding "definitely will not" to the intentions measure compared with those who scored below the median, making this the least predictive of the 3 indices.

Potential confounder measures. The analyses employed propensity scoring for confounder control by weighting adjustments,^{9–14} incorporating a wide range of standard demographic variables and variables known to be related to youths' drug use or thought likely to be related to exposure to antidrug messages. Propensity scores were developed for the general and specific exposure measures. More than 150 variables were considered possible confounders. (For a detailed description of the propensity scoring process and the confounders included in the final models, see Orwin et al.⁴) They include age; gender; race/ethnicity; wave of survey response; urban–rural residency; neighborhood characteristics from the 2000 US Census¹⁵; school-related variables, including self-reported academic performance, family functioning, extracurricular activities, perceived parental supervision, association with antisocial peers, and media consumption. A wide range of parents' questionnaire items were also considered potential confounders, including household income; responding parent's demographics; media use; use of alcohol, tobacco, and illicit drugs; and involvement with their children. In addition to

the variables listed here, an overall estimate of the level of risk of marijuana use was developed and used as a potential confounder in the propensity scoring models.

Regarding individual risk of marijuana use, an empirically derived risk score was created as the regression-defined weighted sum of a set of youth and parent risk factors that were predictive of marijuana use. Those that had independent predictive weight included youth's age, sensation seeking,¹⁶ urbanicity, cigarette and alcohol use more than 12 months prior to the date of questionnaire completion, and religious involvement, along with shared parenting and marijuana, tobacco, and alcohol use by the parent. Risk was an important predictor of marijuana initiation. Among the 12.5- to 18-year-olds, 1 in 4 of those with a higher risk score (> 0.08 on a 0–1 scale), but 1 in 12 of those with a lower risk score (≤ 0.08), reported initiation at the next interview.

Statistical Analyses

Given the campaign's national coverage, our evaluation was forced to rely on naturally occurring variation in campaign exposure among individuals to estimate the campaign's effects, after adjustment for variation in potential confounders, including the amount and type of media consumption. Whereas comparisons between geographic areas were considered an alternative approach for providing exposure variation, the advertising agency's projected buying plans did not forecast such variation. Three types of analysis were conducted, with claims of effect strongest if the results of all 3 were consistent.

First, the evaluation examined changes over time in each outcome, on the assumption that a successful campaign would produce trends in desired antidrug directions. However, upward or downward trends can be the result of many influences, without the campaign necessarily being the cause.

Second, the evaluation examined the associations of individuals' exposures to antidrug advertising with concurrent drug-related outcomes, with statistical control for potential confounders through the use of propensity scoring. These associations were computed from data pooled across all survey rounds. The relationship between exposure and each outcome was estimated by Goodman and

Kruskal's gamma statistic (see, for example, Agresti¹⁷). The gamma statistic, which estimates both the direction and strength of an association between 2 ordinal variables, can vary between -1 and 1 , with 0 indicating no association. These cross-sectional gamma statistics provide evidence as to whether variations in individual exposure and outcomes are associated, once likely confounders are controlled, but they do not establish whether exposure influenced the outcome or whether the supposed outcome influenced recall of exposure.

The third mode of analysis addressed the issue of causal direction by examining whether exposure at one round of data collection was associated with outcomes at the next round, once confounders, including prior round outcomes, were controlled. The analyses (referred to as lagged analyses) were also pooled across rounds, with exposure measures taken from the first 3 rounds and the outcome measures taken from the second through fourth rounds.

Each of the analyses was performed for all youths, as well as for important subgroups defined by gender, age, race/ethnicity (White, African American, Hispanic), and risk of marijuana use (lower and higher). Analyses were restricted to youths who were nonusers of marijuana at the current round (for cross-sectional analyses) or at the previous round (for lagged analyses). The focus on nonusers and their transition to first use is consistent with one of the campaign's goals: preventing any drug use. The campaign also aimed to encourage those who were using occasionally to reduce their use. However, that objective is not examined here because the sample sizes of occasional users did not provide sufficient power to detect effects on that subpopulation.

Weights were used in all analyses to compensate for differential probabilities of selection, nonresponse, and undercoverage. We adjusted the cross-sectional weights for nonresponse by using demographic, household, and neighborhood characteristics. In addition to these variables, prior-round measures of general exposure and marijuana-related outcomes were used to adjust the longitudinal weights. Sampling errors were computed with a jackknife replication methodology that accounted for the NSPY's complex sample design.⁴

To maintain consistency for all analyses, and because by the fourth round the sample

contained few youths younger than 12.5 years, only those youths aged between 12.5 and 18 years at the time of outcome measurement are included. However, all conclusions presented here were supported by prior analyses with the broader age range of youths.¹⁸

RESULTS

Youths reported substantial exposure to antidrug advertising. Overall, 94% of youths reported general exposure to 1 or more antidrug messages per month, with a median frequency of about 2 to 3 ads per week, consistent with the campaign's GRP purchases. Fifty-four percent of youths recalled at least weekly exposure to specific campaign television ads that had aired in recent months. At the same time, there was considerable variability among youths in their exposure levels. Across the campaign, 15%, 31%, 38%, and 16% recalled seeing less than 1, 1 to less than 4, 4 to less than 12, and 12 or more campaign television ads per month, respectively.

There was no change in the prevalence of marijuana use among those aged 12.5 to 18 years between 2000 and 2004. A small but significant increase in antimarijuana beliefs and attitudes was not accompanied by significant parallel gains in intentions not to use, social norms, or self efficacy (Table 1). There were some significant year-to-year changes (including an antimarijuana shift in intentions from 2002 to 2004) and a few significant changes for subgroups of the population.⁴

In general, lower- and higher-risk youths, and younger and older youths, differed markedly in their absolute levels of marijuana use and in antimarijuana cognitions, whereas there were minimal differences in these outcomes by gender or race/ethnicity. In most cases, the changes from 2000 to 2004 for subgroups were broadly similar to those displayed in Table 1 for all youths.⁴

There is little evidence for a contemporaneous association between exposure to antidrug advertising and any of the outcomes, after adjustment for confounders. Nonusers who reported more exposure (general or specific) to antidrug messages were no more likely to express antidrug cognitions than were youths who were less exposed (Table 2). The same analyses were undertaken for subgroups

defined by age, gender, race/ethnicity, and risk score. Only 3 of the 80 gammas in these analyses were significant; they may easily be chance findings.

The final set of analyses examined whether exposure during an earlier round of measurement was associated with outcomes among 12.5- to 18-year-olds at the next round of measurement, after we controlled for confounders measured at the earlier round. These analyses were conducted separately for each pair of consecutive rounds, as well as with data pooled across all 3 round pairs (i.e., pairs of consecutive rounds). Outcomes included cognitive measures and initiation of marijuana use since the prior round. The results from the pooled data show no evidence of antimarijuana lagged effects. Rather, they indicate the possible presence of pro-marijuana effects: 2 of 10 associations were statistically significant, both in a pro-marijuana direction, and results for 6 of the remaining 8 lagged analyses were in an unfavorable direction (Table 3). Examination of the 80 subgroup analyses reveals 20 significant effects, with 19 of those in a pro-marijuana direction. Thus, there is an overriding pattern of unfavorable lagged exposure effects.

To investigate whether the effects of the campaign differed over its duration, the lagged analyses were carried out separately for each of the paired rounds. The results in Table 4 show no significant antimarijuana lagged associations, and at least 1 significant pro-marijuana lagged association, for each of the paired rounds. In the analysis of round 3 to round 4, the effect of exposure to general antidrug messages also includes a barely significant association in the direction of increased initiation of marijuana use.

DISCUSSION

Overall, the campaign was successful in achieving a high level of exposure to its messages; however, there is no evidence to support the claim that this exposure affected youths' marijuana use as desired. Analyses of the NSPY data for the full sample yielded no significant associations of exposure with cognitive outcomes when both were measured simultaneously. There is some evidence that exposure to the campaign messages was related to pro-marijuana cognitions on a delayed basis

TABLE 1—Changes Among Youths Aged 12.5 to 18 Years in Marijuana Use Cognitions and Behavior: National Survey of Parents and Youth, United States, 2000–2004

Outcome	Year					Change ^a From 2000 to 2004 (95% CI)
	2000	2001	2002	2003	2004	
All youths, %						
Lifetime use of marijuana	23.6	24.8	25.5	23.7	23.5	-0.1 (-2.9, 2.8)
Past-year use of marijuana	17.1	16.9	17.7	17.4	16.7	-0.4 (-2.6, 1.9)
Used marijuana in past 30 days	7.8	8.6	9.6	8.5	8.2	0.4 (-1.4, 2.2)
Nonusers of marijuana						
Definitely not intending to use marijuana, %	86.7	85.3	85.4	86.3	87.5	0.8 (-1.0, 2.6)
Antimarijuana self-efficacy index score, mean ^b	102.6	100.8	106.3	107.9	105.0	2.4 (-3.3, 8.2)
Antimarijuana social norms index score, mean ^b	103.6	98.7	103.3	99.8	104.8	1.2 (-5.1, 7.3)
Antimarijuana attitudes and beliefs index score, mean ^b	105.1	101.3	108.5	108.8	111.4	6.3* (0.4, 12.2)

Note. CI = confidence interval. Data pertain to the National Youth Anti-Drug Media Campaign.

^aPercentage-point change.

^bThe outcome indices were scaled so that the mean (and standard deviation) for the entire population of nonusers aged 12 to 18 years at wave 1 was set to 100.

*P < .05.

throughout the campaign. In light of these findings, we examined the apparent implication that the campaign was not effective and discuss possible mechanisms by which it could have had unfavorable effects. The findings of unfavorable effects are particularly worrisome because they were unexpected and were found not only for cognitions but also for actual initiation of marijuana use.

Comparison of These Results With Other Relevant Evidence

There are a number of other sources that provide trend data concerning marijuana use.^{19–21} Some sources have shown a downturn in use among some youths from 1999 to 2004, whereas the NSPY did not show a parallel

change over the same period. However, results from the NSPY are similar to those from the National Survey on Drug Use and Health (to the extent that they are comparable), and the other surveys are quite different in that they are conducted in schools and not households.⁴ Furthermore, even if they were entirely consistent and universally present, trend results alone would not provide solid grounds for a claim of success or failure of the campaign, because they may have been influenced by secular forces other than the campaign’s ads and public relations efforts. The presence of such other forces is suggested by the fact that there are even larger declines in both tobacco and alcohol use than in marijuana use in 2 other surveys,^{19,20} suggesting that all substance

use was on a downward trend regardless of the campaign. No other studies have provided information that is comparable to the lagged associations between exposure and subsequent outcomes shown in Tables 3 and 4, and such additional evidence is crucial for making causal inferences about the campaign’s effects.

Possible Reasons for Lack of Evidence of Success

Two alternative explanations for the sparse evidence of the campaign’s success are that (1) the evaluation was insensitive to its success or (2) the campaign was indeed not successful. Each alternative is worth some discussion.

Is it possible that the program was successful but the evaluation failed to find supporting

TABLE 2—Cross-Sectional Association of Exposure to Antidrug Advertising and Marijuana-Related Outcomes Among Nonusers of Marijuana Aged 12.5 to 18 Years: National Survey of Parents and Youth, United States, 1999–2004

	General Exposures per Month				Specific Exposures per Month				
	<4	4–11	≥12	γ (95% CI)	<1	1–3	4–11	≥12	γ (95% CI)
Definitely not intending to use marijuana, %	86.9	85.1	86.2	-0.01 (-0.06, 0.05)	87.5	86.3	85.0	87.4	-0.02 (-0.07, 0.03)
Antimarijuana self-efficacy index score, mean ^b	101.7	102.7	107.5	0.03 (-0.00, 0.07)	106.4	102.9	103.8	110.3	0.02 (-0.01, 0.05)
Antimarijuana social norms index score, mean ^b	100.6	100.4	102.3	0.00 (-0.03, 0.02)	111.6	100.4	101.1	103.3	-0.02 (-0.04, 0.01)
Antimarijuana attitudes and beliefs index score, mean ^b	104.5	105.3	108.6	0.02 (-0.01, 0.04)	109.9	105.1	103.3	112.1	0.00 (-0.02, 0.02)

Note. CI = confidence interval. Data pertain to the National Youth Anti-Drug Media Campaign. Estimates were adjusted for confounders (see “Methods” section for details). General and specific exposures refer to exposure to campaign ads as a whole and exposure to specific ads, respectively.

TABLE 3—Lagged Association of Exposure to Antidrug Advertising at Earlier Round and Marijuana-Related Outcomes at Next Round Among Nonusers of Marijuana Aged 12.5 to 18 Years at Earlier Round: National Survey of Parents and Youth, 1999–2004

	General Exposures per Month			γ (95% CI)	Specific Exposures per Month				γ (95% CI)
	<4	4-11	≥ 12		<1	1-3	4-11	≥ 12	
Definitely not intending to use marijuana, %	82.3	78.2	78.4	-0.07* (-0.13, -0.01)	84.0	78.8	77.6	78.5	-0.02 (-0.07, 0.03)
Antimarijuana self-efficacy index score, mean ^b	98.0	95.5	98.2	-0.01 (-0.05, 0.03)	107.3	95.2	96.4	91.4	0.00 (-0.04, 0.03)
Antimarijuana social norms index score, mean ^b	95.3	87.0	87.7	-0.03 (-0.06, 0.00)	107.1	91.3	83.3	76.9	-0.05* (-0.08, -0.02)
Antimarijuana attitudes and beliefs index score, mean ^b	100.3	91.8	95.2	-0.01 (-0.04, 0.02)	105.6	94.8	91.3	90.4	-0.02 (-0.04, 0.00)
Initiating marijuana use, %	10.7	11.2	12.5	0.07 (-0.01, 0.15)	10.8	12.6	11.5	13.2	-0.02 (-0.13, 0.08)

Note. CI = confidence interval. Data pertain to the National Youth Anti-Drug Media Campaign. Data were pooled across round pairs (i.e., pairs of consecutive rounds). General and specific exposures refer to exposure to campaign ads as a whole and exposure to specific ads, respectively. Estimates were adjusted for confounders (see “Methods” section for details). *Significantly different from 0 at $P < .05$.

evidence? There are some possible circumstances under which the evaluation might not have detected true effects. The evaluation focused on comparing youths who reported different levels of ad exposure. There was substantial variation in self-reported exposure. However, if youths who were personally exposed shared their new learning with those who were not personally exposed, the campaign’s effects would be diffused across social networks so that analyses focused on

individual differences in exposure would underestimate the effects. However, except in the implausible case that the effects diffused across the entire population of the United States, there should still be some associations between individual exposure and outcomes.

Another concern might be that the first round of NSPY data collection was undertaken simultaneously with the launch of the full campaign, and after substantial prior efforts in its developmental stages. Thus, the evaluation

might have missed startup effects. However, the other national surveys of drug use found no significant decreases between 1998 and 2000 in the outcomes they measured related to marijuana use, making it unlikely that the effects were already present by 2000. Also, if exposure to the campaign after 1999 was not positively associated with the outcomes, as both the trend and association data show, then the conclusion that the campaign after 1999 was unsuccessful remains correct, regardless of what happened before.

Alternatively, if the campaign actually has been unsuccessful, how can that be explained? A number of previous mass-media, anti-substance abuse campaigns have affected the substance use of young people, including their use of tobacco^{22–28} and marijuana^{29–31} and possibly of alcohol consumption before driving.^{32,33} Although not all such campaigns are effective, there are now a reasonable number of examples of successful campaigns.^{34,35} Why, then, does this campaign appear to have been unsuccessful thus far?

One explanation is that the campaign did not add appreciably to the large quantity of anti-drug messages youths were already receiving. In 2000, recent background exposure to anti-drug messages was reported by more than 50% of youths—through, for example, in-school drug education (66%), conversations with friends about negative consequences of drug use (52%), 2 or more conversations with parents about drugs (54%), and weekly exposure to nonadvertising mass-media content about drugs and youths (54%). Relative to this

TABLE 4—Lagged Association of Exposure to Antidrug Advertising at Earlier Round and Marijuana-Related Outcomes at Next Round Among 12.5- to 18-Year-Olds Who Were Nonusers of Marijuana at Earlier Round, by Round Pair: National Survey of Parents and Youth, 1999–2004

	Round 1 Effects on Round 2, γ (95% CI)	Round 2 Effects on Round 3, γ (95% CI)	Round 3 Effects on Round 4, γ (95% CI)
General exposure			
Definitely not intending to use marijuana	-0.16* (-0.27, -0.06)	0.01 (-0.07, 0.09)	0.01 (-0.08, 0.09)
Antimarijuana self-efficacy index	-0.05 (-0.10, 0.01)	0.02 (-0.04, 0.09)	0.01 (-0.05, 0.06)
Antimarijuana social norms index	-0.06* (-0.12, -0.01)	0.02 (-0.03, 0.06)	-0.02 (-0.07, 0.02)
Antimarijuana attitudes and beliefs index	-0.03 (-0.08, 0.02)	0.02 (-0.03, 0.07)	-0.01 (-0.05, 0.04)
Initiating marijuana use	0.08 (-0.05, 0.20)	0.01 (-0.11, 0.13)	0.11* (0.00, 0.22)
Specific exposure			
Definitely not intending to use marijuana	-0.05 (-0.13, 0.03)	0.01 (-0.06, 0.09)	-0.01 (-0.09, 0.08)
Antimarijuana self-efficacy index	-0.03 (-0.08, 0.03)	0.01 (-0.06, 0.07)	0.02 (-0.05, 0.08)
Antimarijuana social norms index	-0.04 (-0.08, 0.00)	-0.05* (-0.10, -0.00)	-0.07* (-0.12, -0.02)
Antimarijuana attitudes and beliefs index	-0.01 (-0.05, 0.02)	0.00 (-0.04, 0.03)	-0.03 (-0.08, 0.01)
Initiating marijuana use	0.02 (-0.09, 0.14)	0.00 (-0.12, 0.12)	0.07 (-0.02, 0.16)

Note. CI = confidence interval. Data pertain to the National Youth Anti-Drug Media Campaign. General and specific exposures refer to exposure to campaign ads as a whole and exposure to specific ads, respectively. Estimates were adjusted for confounders (see “Methods” section for details). *Significantly different from 0 at $P < .05$.

level of background exposure, across the NSPY's 4 rounds, youths recalled a median frequency of exposure to campaign ads of once to twice per week, mostly through television. Because an ad is typically 15 to 30 seconds in length, 2 such ads would produce up to about one minute per week of antidrug message exposure. Given all the antidrug messages to which youths were already subject prior to the campaign, the fact that the implicit messages of the campaign were not novel and that the incremental exposure was small, a lack of campaign effects is perhaps unsurprising.

What is harder to explain is the possibility suggested by the lagged results of an *unfavorable* influence of exposure to the campaign. This is sometimes called a boomerang effect.³⁶ Of several possible explanations, we offer here 2 speculative ideas, which admittedly are somewhat at odds with the reasons just given for the lack of favorable results.

One idea, which comes from psychological reactance theory,^{37,38} argues, in part, that youths react against threats to their freedom of choice by experiencing and succumbing to pressure to reestablish that freedom, including some pressure to engage in the proscribed behavior. By this explanation, youths who were exposed to these antidrug messages reacted against them by expressing pro-drug sentiments; the greater the exposure, the stronger this reaction. In analyses reported elsewhere, however, we did not find support for this explanation.^{39,40}

The second idea is that antidrug advertising conveys an implicit meta-message that drug use is commonplace. As a result, youths who saw the campaign ads took from them the message that their peers were using marijuana. In turn, those who came to believe that their peers were using marijuana were more likely to initiate use themselves. There was evidence consistent with this speculation: more ad exposure was associated with the belief that other youths were marijuana users, and this belief was predictive of subsequent initiation of marijuana use (data not shown).^{4,40}

Conclusions

The evidence does not support a claim that the campaign produced antimarijuana effects. Palmgreen et al. have reported such effects, but only in 2 medium-sized cities for one 6-month

period of the campaign.⁴¹ In contrast, the current evaluation provides some evidence that the campaign had pro-marijuana effects. The boomerang pattern, however, was irregular: it was not evident among cross-sectional associations, was significant for only some outcomes and time periods in the lagged analyses, and showed an increase in initiation of marijuana use only between rounds 3 and 4. At the start of this project, the evaluation team stipulated that it would confidently claim an antimarijuana effect for the campaign only if it were to affect trends, cross-sectional associations, and lagged associations. Against these criteria, the claim that the campaign produced pro-marijuana effects has tentative but not definitive support.

Despite extensive funding, governmental agency support, the employment of professional advertising and public relations firms, and consultation with subject-matter experts, the evidence from the evaluation suggests that the National Youth Anti-Drug Media Campaign had no favorable effects on youths' behavior and that it may even have had an unintended and undesirable effect on drug cognitions and use. This evaluation challenges the usefulness of the campaign as implemented between 2000 and 2004. ■

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Contributors

R. Hornik had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis; he contributed to the study's concept, design, and supervision; the drafting of the article; and statistical expertise. L. Jacobsohn contributed to the drafting of the article. R. Orwin provided statistical expertise and contributed to the study's concept, design, and supervision. A. Piesse provided statistical expertise. G. Kalton provided statistical expertise and contributed to the study's concept and design. All authors contributed to the analysis and interpretation of data and the critical revision of the article for important intellectual content.

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Note. The views expressed are those of the authors and do not necessarily reflect those of the study's sponsors.

Human Participant Protection

The study protocol was approved by the institutional review board of Westat. Parental permission was obtained to conduct interviews with youthful participants, who gave their consent and were ensured of the confidentiality of all their responses.

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The Effect of Marijuana Scenes in Anti-marijuana Public Service Announcements on Adolescents' Evaluation of Ad Effectiveness

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Abstract

This study explored the possible negative impact of a specific ad feature—marijuana scenes—on adolescents' perception of ad effectiveness. A secondary data analysis was conducted on adolescents' evaluations of 60 anti-marijuana public service announcements (PSAs) that were a part of national and state anti-drug campaigns directed at adolescents. The major finding of the study was that marijuana scenes in anti-marijuana PSAs negatively affected ad liking and thought valence toward the ads among adolescents who are at higher levels of risk for marijuana use. This negative impact was not reversed in the presence of strong anti-marijuana arguments. The results may be used to partially explain the lack of effectiveness of the anti-drug media campaign. It may also help us design more effective anti-marijuana PSAs by isolating adverse elements in the ads that may elicit boomerang effects in the target population. Limitations of the study and future directions were discussed.

Keywords

marijuana scene; anti-marijuana public service announcement; perceived ad effectiveness; adolescent; risk

Marijuana is the most commonly used illicit drug in the United States (ONDCP Fact Sheet, 2004). According to the report based on The Youth Risk Behavior Survey, 22 % of high school students currently use marijuana and one tenth of them had their first trial of marijuana before age 13 (Grunbaum et al., 2004). Marijuana use poses a serious health threat to adolescents as it is related to negative health consequences, including defects in immune system, lung damage, depression, and anxiety (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001). Moreover, although not necessarily a gateway drug, those who use marijuana may be more likely than others to use cocaine or other hard drugs (Merrill, Kleber, Shwartz, Liu, & Lewis, 1999).

Several nationwide anti-drug media campaigns have been carried out to reduce and prevent drug use among youth. By far the largest anti-drug media effort in history is the National Youth Anti-Drug Media Campaign (NYADMC) initiated by the White House Office for National Drug Control Policy. Through 2003, this campaign cost \$1.2 billion (House Report 107–575, 2003). The President's fiscal year 2006 budget proposed an additional \$120 million for this media campaign (Walters, 2005, June). Eighty two percent of this budget

was required to be used for advertising time and placement (Walters, 2005, June). Currently, anti-drug public service announcements (PSAs) comprise the centerpiece of these anti-drug media efforts (Varshavski, 2003). Despite the huge amount of money spent on the NYADMC, researchers evaluating the effectiveness of this media campaign have found no evidence that exposure to the anti-marijuana campaign for youth 12 to 18 years old reduced their marijuana use between 2002 and 2003. Instead, there was an increase in the past-month and past-year marijuana use in the target audience of 14 to 16 year olds during this period, although this upward trend appears to have already been in place before the start of the marijuana initiative (Hornik et al., 2003). This finding is not surprising. In fact, a meta-analysis of 72 anti-substance abuse media campaigns has revealed mostly inconclusive results (Derzon & Lipsey, 2002).

Careful attention to these media messages can be critical for understanding the lack of effectiveness of the campaign. Recent behavioral science theory and research have pointed out the importance of message content in the success of behavioral change interventions (Fishbein, Hall-Jamieson, Zimmer, von Haefen, & Nabi, 2002). Prior studies have identified certain content and format features in anti-drug PSAs that appear to be conducive to positive or negative effects. For example, PSAs emphasizing social implications are more effective than those focusing on physical harms of drug usage (Shoenbachler & Whittle, 1996). Anti-marijuana ads targeting the belief that marijuana is a gateway to stronger drugs were counterproductive, actually increasing positive attitudes and intentions toward marijuana use (Yzer, Cappella, Fishbein, Hornik, & Ahern, 2003). Ads that use deliberate fear appeals may be risky as they may elicit psychological reactance from the viewers, which can reduce an ad's effectiveness (Shoenbachler & Whittle, 1996). In fact, it has been suggested that by alarming the audience through portraying the proscribed behaviors, the PSAs may serve to normalize the unhealthy behavior, and promote competition and imitation from the audience (Wagner & Sundar, 1999) as audience "becomes curious, learns it is fun, or regards it as challenging" (Atkin, 2001, p.31). This is especially the case for high-risk adolescents (Atkin, 2001).

In addition to the content components, the executional styles of the messages also contribute to varied levels of ad effectiveness. For example, anti-drug ads with high sensation value (i.e., ads that can elicit higher levels of sensory, affective and arousing reactions from the target audience) are found to attract more attention and increase message processing in high-sensation seeking adolescents (Donohew, Lorch, & Palmgreen, 1991, Lorch et al., 1994). Controlled community trials also show that anti-drug PSAs embedded in high sensation value TV programs are able to reverse upward trends in 30-day marijuana use among high-sensation seeking adolescents (Palmgreen et al., 2001). High message sensation value of the antidrug PSAs may also attract more attention to the executional features and hence interfere with one's processing of the antidrug argument of the ad (Kang, Cappella, & Fishbein, 2006).

Compared to the number of studies on the effectiveness of antismoking messages on audience reactions (e.g., Beaudoin, 2002; Biener, 2000, 2002; Farrelly et al., 2002; Goldman & Glantz, 1998; Pechmann & Reibling, 2000; Pechmann, Zhao, Goldberg, & Reibling, 2003; Shadel, Niaura, & Abrams, 2002), studies on anti-drug and specifically anti-marijuana

messages are limited (Harrington et al., 2003; Palmgreen et al., 2001). This may partly reflect the difficulty of finding significant impacts of these anti-marijuana messages, which further calls for innovative ways to explore message features that may affect ad effectiveness. The current study responds to this need and explores one ad feature that may negatively affect an ad's effectiveness, given sufficient exposure. A secondary data analysis is conducted to test the hypothesized effects of this ad feature. The results may help our understanding of the conditions under which anti-drug ads are ineffective. It may also help us to design more effective anti-marijuana PSAs, by isolating adverse elements in the ads and reducing the likelihood that certain PSAs may elicit boomerang effects in the target population (Fishbein et al., 2002).

Marijuana Scenes in Anti-marijuana PSAs

The ad feature examined in this study is the presence of marijuana scenes. They are defined as any visual scene that portrays (a) mere presence of marijuana-related materials (e.g., marijuana cigarette); (b) holding and handling of marijuana cigarettes (e.g., preparing the cigarette for smoking, holding, ignition), or (c) actual marijuana smoking behavior (e.g., puffing, inhaling). Similar drug use cues in the context of tobacco and other hard drugs have been used in cue-reactivity studies (Juliano & Brandon, 1998; Sayette & Hufford, 1994). However, to our knowledge, no study has specifically linked the marijuana scenes in anti-marijuana PSAs to adolescents' perception of ad effectiveness.

This study explores the role of marijuana scenes in anti-marijuana PSAs. It addresses a series of questions: (a) Do marijuana scenes negatively affect adolescents' ad effectiveness evaluation? (b) If so, do strong anti-marijuana arguments help to offset this negative impact? (c) If marijuana scenes indeed negatively affect ad effectiveness evaluation, on which population is the impact more evident? If there is evidence for the negative effects of marijuana scenes on message effectiveness, then the use of marijuana scenes may produce second thoughts when considering ad design. Even if anti-marijuana arguments overcome any negative impact of marijuana scenes, the net effect may still be counterproductive. Thus it is important to understand the impact of marijuana scenes in anti-marijuana PSAs to exploit their values or to avoid possible boomerang effect. Considering the huge amount of money spent on the war on drugs, understanding which anti-drug messages are most effective and which message features contribute to success and failure in the target population is a requirement.

Two theoretical perspectives suggest that marijuana scenes may negatively affect message effectiveness. First, according to social cognitive theory (Bandura, 1986), people learn from observing others' behaviors. Television and other mass media can serve as presentational or educational tools through which people can learn vicariously. Social cognitive theory posits that one's modeling behavior is influenced by one's judgment of personal ability to accomplish the modeled behavior, perception of the nature and the consequences of the modeled behavior, and the likelihood that the same consequences would occur if one performs the same behavior. However, the nature and consequence of the modeled behavior is "largely determined by its relation to other outcomes rather than inherent in their intrinsic qualities" (Bandura, 2002, p. 132). In anti-marijuana PSAs, the presence of marijuana scenes

often implies that marijuana is easy to get (e.g., drug dealers are just around the corner), it is not hard to use (e.g., kids similar to you use it), it is widely used or accepted among adolescents (e.g., a group of kids are passing around the marijuana cigarette), and the users may even look cool (e.g., adolescents users are often presented as rebellious with cool attires and postures). Although these scenes often lead to an anti-marijuana argument either through voiceover or screen verbals or the languages and behaviors of the actors or actresses, the presence of marijuana scenes nevertheless serve as a direct illustration of marijuana use and, according to social cognitive theory, affect adolescents' perception of the behavior. To adolescents who are curious to learn new things and to be accepted by their peers, these scenes may arouse curiosity, teach or illustrate details related to marijuana use, create an illusion that everyone else is using marijuana, and even normalize the proscribed behavior and promote competition and modeling from nonusers (Wagner & Sundar, 1999; Atkin, 2001).

Second, the theory of attentional bias suggests that individuals tend to be attracted and pay more attention to stimuli related to their current concerns or pathologies (Waters & Feyerabend, 2000). For example, people are more alert and attentive to their names. In experimental settings, a performance degradation (usually indicated by a slower response to a task) during exposure to relevant stimuli is used as evidence of attentional bias to those stimuli. Theoretically, these stimuli are perceived by the target population as having some kind of "incentive salience" which indicates the relevance of the stimuli for reinforcement and hence demands the organism's attention (Robinson & Berridge, 1993). Attentional bias can interfere with one's performance on other cognitive tasks, indexed through increased reaction time to audio probes or reduced comprehension accuracy for a subsequent sentence-processing task (e.g., Cepeda-Benito & Tiffany, 1996; Juliano & Brandon, 1998; Madden & Zwaan, 2001; Sayette & Hufford, 1994; Zwaan & Truitt, 1998). For adolescents who are interested in using marijuana, who have tried it a few times, or who are even addicted to marijuana use, presence of marijuana scenes may elicit an attentional bias, which in turn may interfere with their ability to process the anti-marijuana arguments embedded in the message, leading to lowered levels of perceived ad effectiveness.

Marijuana scenes, as elicitors of attentional bias, may work as cognitive distracters reducing the processing of anti-marijuana arguments or as social cues operating as counterarguments to the anti-drug arguments in the ad. In both cases, marijuana scenes would reduce the ad effectiveness evaluation. Thus, it is hypothesized that,

H1: Ads with marijuana scenes will lead to lower ad effectiveness evaluation than ads without marijuana scenes.

Social cognitive theory also suggests that the modeling behavior will be minimized when the negative consequences of the behavior are clearly presented. Since anti-marijuana PSAs also contain anti-marijuana arguments, which often illustrate the negative consequences of marijuana use, the imitation or modeling effects resulted from marijuana scenes, if any, should be minimal from a social learning perspective. Thus the anti-marijuana arguments in the ads may serve as a protection against the possible negative effects of marijuana scenes. Stronger arguments should be more effective than weaker arguments in this respect as they often illustrate the negative consequences of marijuana use more effectively (e.g., either

through more persuasive languages or through more relevant examples). This would make ads with marijuana scenes and stronger arguments appear more effective than ads with marijuana scenes and weaker arguments. Thus it is hypothesized that:

H2: Stronger anti-marijuana arguments can overcome the negative impact of marijuana scenes on ad effectiveness evaluation to a larger extent than weaker arguments.

For H1, an additional individual difference factor may make the effect more evident. This factor is the risk status of the adolescent audience. The risk of marijuana use is defined as a risk index for adolescents' possible marijuana use. Since adolescents often do not truthfully report their marijuana use behavior, this measure is designed to predict their risk of marijuana usage based on predictors that have been found to relate to adolescents' marijuana use behavior obtained in the previous national surveys. These predictors of marijuana use include age, sensation seeking tendency, and immediate social network, including the number of friends who use marijuana and the number of times marijuana is offered (Yzer et al., 2004).

There are several reasons that high-risk adolescents will be more affected by marijuana scenes than low-risk adolescents. First, adolescents with a higher risk of marijuana use are more interested in marijuana use, are more likely to be past users and tend to hold a more positive attitude toward marijuana use (Yzer et al., 2004). Hence marijuana scenes are more salient to high-risk adolescents and more likely to elicit attentional bias among them. Second, this group of adolescents also tends to be high sensation seekers. According to the Activation Model of Information Exposure (Donohew, Lorch, & Palmgreen, 1998; Zuckerman, 1979), high sensation seekers are more attracted to messages with high sensation values. Ads with marijuana scenes are more sensational than those without such scenes, especially when such scenes portray a proscribed behavior. Thus high-risk adolescents are more likely to be distracted by the marijuana scenes and hence less likely to fully process the anti-marijuana arguments embedded in the ads. Third, high-risk adolescents have more marijuana encounters (e.g., more friends using marijuana, more opportunity to be offered marijuana, Yzer et al., 2004). For them, marijuana scenes may serve as an illustration for marijuana use details (e.g., how to use it and where to get it), or a reminder of their past experience, or a justification of the behavior, and hence promote more competition and modeling behavior from this segment of the population. Hence we expect to see that:

H3: The negative impact of marijuana scenes on ad effectiveness evaluation is larger among high-risk adolescents than among low-risk adolescents.

It is important to recognize that evaluation of ad effectiveness may or may not relate to the actual ad effect, i.e., change in drug use behaviors. However, judgment of ad effectiveness is often a necessary (although not sufficient) condition for producing actual change in beliefs, attitudes and behavioral intentions that are important determinants of drug use behaviors (Fishbein et al., 2002). Moreover, prior studies have shown that perceived ad effectiveness provides important information about audience attitudes and can be a good proxy measure of actual effectiveness (Biener, 2002; Biener & Taylor, 2002).

Methods

A secondary data analysis was conducted on adolescents' evaluations of 60 anti-marijuana and general anti-drug PSAs that were part of national and state anti-drug campaigns directed at adolescents. Three sources of data were employed in this study. The first source provided data on ad effectiveness evaluations. The second source provided information on the strength of the arguments used in the ads. The third source supplied the coding of marijuana scenes. Details about the measures used in each study and each study's sample characteristics are described below. It is important to recognize that the evaluations of argument strength are provided by a sample of adolescent respondents different from the sample that rated the ad effectiveness. Unlike some ad evaluation studies, this study poses and answers its questions at the ad level, in which multiple adolescents' ad evaluations of the same ad were averaged into a single score. So the new data set contained aggregated ad and argument evaluations, as well as marijuana scene coding for each of the ads ($N=60$). In the original studies, individual adolescents' risk of marijuana use was also calculated. Each individual was put into a high or low risk category based on the median split on this measure. The aggregate ratings for each ad were also calculated separately for high- and low-risk adolescents. Thus the final data contained aggregate-level ratings for each ad among all adolescents as a whole as well as among high- and low-risk adolescents respectively.

Samples

Ad effectiveness evaluation—601 youths aged 12–18 ($M = 15.3$) participated in this research in exchange for \$10 in cash as compensation for their time. The sample included approximately equal numbers of males (301) and females (300), and was predominantly Caucasian (71.9% Caucasians, 23.6% African Americans, and 4.5% other race/ethnicity). Participants were recruited from shopping malls in urban locations throughout the US, including San Diego, Atlanta, Detroit, and New York, by Opinion One, a market research firm. Signed parental consent and youth assent forms were obtained prior to participation.

Argument strength evaluation—The sample included 322 adolescents, 49.7% of whom were male. About two thirds (66.8%) of the sample were Caucasians, 22.4% African Americans, and 10.8% from other ethnic or racial groups. Age ranged from 12 to 18, with a mean of 15.4 ($SD = 1.95$). Respondents were recruited through mall intercept solicitations at 15 locations across the country, including Oakland, St. Louis, Cincinnati, San Antonio, Charlotte, Washington DC, and Kansas City. Signed parental consent and youth assent forms were obtained prior to participation. Respondents were paid \$5 each for their participation.

Measures

Trained coders coded marijuana scenes in the ads. Ads with any of the three types of marijuana scenes (mere presence, holding and handling, and actual smoking of marijuana cigarettes) were coded as 1 and ads without such scenes were coded as 0 (Krippendorff's $\alpha = 1.00$). The resulting "marijuana scene" variable had two categories: "ads with marijuana scenes" ($N=24$) and "ads without marijuana scenes" ($N=36$).

Argument strength is conceptualized as the strength of the argument presented in the PSA. One comprehensive argument per ad was extracted by experts using both the verbal claims and visual arguments presented by the ads. Adolescents evaluated the extent to which each argument was convincing, strong, believable, important, made them feel confident to say no to marijuana, kept them away from using marijuana, elicited agreement from them and put thoughts in their mind about staying away from marijuana. Each of these judgments was measured on a 5-point scale (0=strongly disagree, 5=strongly agree). The mean of these items were used to indicate argument strength ($M = 3.70$, $SD = .15$, Cronbach's $\alpha = .90$). A description of the argument evaluation process and the scale reliability and validity is presented in Zhao, Cappella, Fishbein, & Barrett (2005). This measure was dichotomized at median in the analyses. The two argument strength conditions ($M_{low} = 3.58$, $SD_{low} = .10$ vs. $M_{high} = 3.82$, $SD_{high} = .09$) were significantly different from each other, $F(1, 59) = 100.34$, $p < .001$.

Three measures of ad effectiveness were used: perceived ad effectiveness, ad liking and the predominant valence of thoughts generated by the ad. These measures are originated from different research traditions and are conceptually distinct from each other. Perceived message effectiveness is developed in the area of argument studies to directly measure one's perception and evaluation of the convincingness of the message. Ad liking is common in advertising literature to measure one's overall attitude toward the ad. An overall positive attitude toward the ad is used as an important antecedent to ad effectiveness, together with positive attitude toward the brand and purchase intention. Thought listing is widely used in attitude change literature. It looks at the predominant valence of the thoughts generated by the message to indirectly assess message effectiveness (Haugtvedt & Priester, 1997). It is often considered as a gold standard to assess message strength. The separation of these three measures helps illustrate the robustness of the patterns observed from two message features and facilitates our interpretation of ad effects.

Perceived ad effectiveness was measured with four items on a 5-point scale (1=strongly disagree, 5=strongly agree): "This ad was convincing", "The ad said something important to me", "Watching this ad helped me feel confident about how to best deal with using marijuana", and "If my friends were offered marijuana, this ad would help keep them from using marijuana"¹. The mean of the four items was used to indicate the perceived anti-marijuana effectiveness of the ad ($M = 3.36$, $SD = .23$, Cronbach's $\alpha = .79$). A similar scale used in a previous study successfully distinguished between ads with different message features and targeting different types of drugs (Fishbein et al., 2002). Ad liking was measured with a single 7-point item (1= not at all, 7= very much): "Do you like the ad" ($M = 4.88$, $SD = .45$). Thoughts about each ad were generated following the conventional thought listing procedure (Petty & Cacioppo, 1986). Adolescents were asked to report as many as

¹Although argument strength and perceived message effectiveness adopted similar items in their measurement scales, they represented distinct concepts and were evaluated differently. First, argument strength was an assessment of the argument component of the ads while perceived message effectiveness was an assessment for the ads as a whole, including verbal, audio and visual components. Second, different samples evaluated argument strength and perceived message effectiveness. Arguments were rated as pure verbal sentences extracted from the ads, while ads were evaluated in an audiovisual format. Third, perceived ad effectiveness was a holistic evaluation of the ads and hence was influenced by not only the arguments, but also other message features, including marijuana cues and MSV, etc. Thus no significant correlation was found between argument strength and perceived message effectiveness ($r = .17$, $p = ns$).

four thoughts per ad after viewing it. Positive and negative thoughts were coded ($\kappa > .80$). The number of negative thoughts ($M = 14.9$, $SD = 7.6$) was subtracted from the number of positive thoughts ($M = 39.1$, $SD = 7.7$) to get a score of the dominant thought valence for each ad ($M = 24.0$, $SD = 13.8$). An ad that elicited predominantly positive thoughts was considered to be of a higher quality or effectiveness, following the conventional interpretation of thought listing procedure (Petty & Cacioppo, 1986). The inter-correlations among the three indicators of ad effectiveness evaluation were .71 between perceived ad effectiveness and thought valence, .78 between perceived ad effectiveness and ad liking, and .82 between ad liking and thought valence. Because of the conceptual distinctiveness and need for interpretation mentioned above, we kept them as separate indicators.

Risk of marijuana use in the previous year was assessed in the original studies for both the sample which provided the argument evaluation data and the sample that supplied the ad evaluation measures. It is a behavioral measure developed from a previous independent survey on adolescent marijuana use ($N = 600$). Based on parameters developed in that survey, risk of marijuana use was calculated as $\text{risk} = -9.34 + .19 \times (\text{age}) + .62 \times (\text{the number of friends who used marijuana}) + .66 \times (\text{the number of times marijuana was offered}) + .11 \times (\text{sensation seeking})$ (Yzer et al., 2004). The adolescents in the original sample were put into either a higher and lower risk group based on median-split of this measure. It is important to note that the parameters for the risk measure were calculated in the original studies. The current secondary analysis only had access to the aggregated data for the high and low risk adolescents. Hence the statistics for this risk measure were not available in this analysis.

To rule out possible confounders for the impact of marijuana scenes and argument strength, we controlled two sets of message features in the study. One was a message format variable—message sensation value (MSV). It is a set of message features designed to elicit sensory, affective and arousal responses (Everett & Palmgreen, 1995; Palmgreen et al., 1991). These structural features, including formal video, audio and content features (Morgan, Palmgreen, Stephenson, Hoyle, & Lorch, 2003), are found to be able to distract attention away from processing of the central argument (Kang et al., 2006). Hence MSV is controlled to make sure that the distraction effect, if any, is due to marijuana scenes rather than MSV. MSV features were coded using the coding scheme developed by Morgan et al. (2003). The MSV total score was calculated as the sum of all individual MSV features ($M = 5.63$, $SD = 2.55$, $\kappa > .79$).

The second set of message features is argument content. Argument content concerns the different outcomes of marijuana use mentioned in the ad. Four types of argument content related to the consequences of marijuana use (1= not at all about a certain belief, 5= strongly about that belief), including health costs ($M = 1.40$, $SD = 1.08$), social costs ($M = .84$, $SD = .89$), self-esteem costs ($M = 1.63$, $SD = .79$), and positive outcomes of using marijuana ($M = .24$, $SD = .35$), were coded. The intercoder reliability was acceptable ($\kappa > .79$), assessed following the procedure suggested by Rosenthal (1987). The detailed information about the coding of these variables can be found in the original study by Yzer et al. (2003). Because it is possible that ads with strong arguments mentioned more health consequences of

marijuana use, controlling argument content allows us to separate the impact of argument strength from that of argument content.

Results

Marijuana scene (with two categories: presence versus absence) was not correlated with argument strength ($r = -.05, p = .71$), suggesting that two factors were not confounded. The correlations between marijuana scene and two sets of possible confounding variables (MSV and argument content) revealed one significant relationship. Ads with marijuana scenes were more likely than their counterparts to mention positive outcomes of marijuana use, $r = .33, p = .01$. All the following analyses were conducted with ANCOVA with MSV and argument content as covariates. Table 1 presents the means and standard deviations of three dependent measures of ad effectiveness evaluation by ad and participant condition.

Marijuana Scene and Argument Strength on Ad Effectiveness Evaluation

There was a marginally significant main effect of marijuana scene on ad liking, $F(1, 51) = 3.69, p = .06$, partial $\eta^2 = .07$. Ads with marijuana scenes were liked less ($M = 4.73, SD = .50$) than ads without such scenes ($M = 4.98, SD = .39$). Similar but non-significant patterns were found on dominant thought valence and perceived ad effectiveness. H1 received partial support. There was no main effect of argument strength or interaction between marijuana scene and argument strength on any ad effectiveness evaluation measure. H2 was not supported.

Post-Hoc analyses indicated that the negative effect of marijuana scenes was purely driven by the category of actual marijuana smoking scenes. After controlling for MSV and argument content, the contrast between ads with actual marijuana smoking scene ($N = 15$) and ads without marijuana scene ($N = 36$) produced significant main effect on all three ad evaluation measures. Specifically, adolescents perceived ads with actual smoking scenes as less effective ($M = 3.19, SD = .23$) than ads without marijuana scenes ($M = 3.40, SD = .23$), $F(1, 42) = 6.15, p < .02$. They did not like the ads with actual smoking scenes ($M = 4.55, SD = .48$) as much as the ads without such scenes ($M = 5.00, SD = .39$), $F(1, 42) = 8.65, p = .005$. They also had fewer net positive thoughts about ads with actual marijuana smoking scenes ($M = 18.28, SD = 16.27$) than about ads without marijuana scenes ($M = 27.10, SD = 12.03$), $F(1, 42) = 7.72, p = .008$. In contrast, the comparison between ads with presence, holding and handling of marijuana cigarettes ($N = 9$) and ads without marijuana scenes showed no significant effect on any ad evaluation measure.

High-risk versus Low-risk Adolescents

Risk of marijuana use (dichotomized) exhibited a significant main effect on all three ad evaluation measures. The low-risk adolescents perceived the ads to be more effective ($M = 3.58, SD = .25$) than the high-risk adolescents ($M = 3.17, SD = .27$), $F(1, 107) = 66.98, p < .001$, partial $\eta^2 = .39$. They also liked the ads more ($M_{lo-risk} = 5.14, SD_{lo-risk} = .45$ vs. $M_{hi-risk} = 4.50, SD_{hi-risk} = .59$), $F(1, 107) = 44.42, p < .001, \eta^2 = .29$, and gave more net positive thoughts to the ads ($M_{lo-risk} = 15.72, SD_{lo-risk} = 7.19$ vs. $M_{hi-risk} = 8.28, SD_{hi-risk}$

= 9.09, $F(1, 107) = 32.50$, $p < .001$, $\eta^2 = .23$) than their high-risk counterpart, regardless of marijuana scenes and argument strength.

The interaction between risk and marijuana scene was significant on thought valence ($F(1, 107) = 4.40$, $p < .05$, partial $\eta^2 = .04$), marginally so on ad liking ($F(1, 107) = 3.03$, $p < .09$, partial $\eta^2 = .03$) and not significant on perceived ad effectiveness. The high-risk adolescents had significantly more net positive thoughts about the no-marijuana-scene ads ($M = 10.70$, $SD = 8.33$) than the marijuana-scene ads ($M = 3.67$, $SD = 9.46$), $F(1, 51) = 7.69$, $p = .008$, partial $\eta^2 = .13$. The high-risk adolescents also liked the ads without marijuana scenes ($M = 4.74$, $SD = .55$) more than ads with such scenes ($M = 4.26$, $SD = .58$), $F(1, 51) = 8.99$, $p < .005$, partial $\eta^2 = .15$. However, marijuana scenes did not affect any ad evaluation measure among the low-risk group. Figures 1 and 2 present the interaction between risk and marijuana scenes on thought valence and ad liking respectively. H3 was partially supported. For this analysis, ads with actual marijuana smoking scenes and ads with presence, holding and handling of marijuana cigarette scenes revealed similar patterns of effects both among low-risk and among high-risk adolescents. Thus the impacts of marijuana scenes on ad effectiveness evaluation were more driven by the risk level of adolescents than the type of marijuana scenes.

Risk also interacted with argument strength on thought valence, $F(1, 107) = 4.67$, $p < .04$, partial $\eta^2 = .04$. For high-risk adolescents, stronger arguments received fewer net positive thoughts ($M = 4.58$, $SD = 8.87$) than weaker arguments ($M = 9.79$, $SD = 9.29$), $F(1, 51) = 4.04$, $p = .05$, partial $\eta^2 = .07$. For low-risk adolescents, no significant effect of argument strength was found on thoughts valence. Figure 3 presents this interaction. No other significant effects were found on the other two ad evaluation measures.

In sum, the negative effect of marijuana scenes was only revealed for the high-risk group. The high-risk group responded more favorably to ads with no marijuana scenes and ads with weaker than stronger arguments. For the low-risk group, marijuana scene or argument strength did not affect their ad evaluations. They seem to evaluate the ads with or without marijuana scenes, with stronger or weaker arguments, as equally effective or ineffective. Their overall evaluation of ad effectiveness was also more positive than that from the high-risk adolescents.

Discussions

The major finding of the study is that marijuana scenes in anti-marijuana PSAs can negatively affect high-risk adolescents' liking toward the ads and their thought valence during ad viewing. Although the current study does not have a control group, and hence can not show whether there is a boomerang effect associated with marijuana scenes, the study nevertheless suggests ads with this message feature as significantly less effective than others. This negative impact of marijuana scenes is not reversed in the presence of strong anti-marijuana arguments in the ads and is mainly present for the group of adolescents (i.e., high-risk adolescents) who are often the targets of such anti-marijuana ads. For these adolescents, stronger anti-marijuana arguments have in fact produced more negative thoughts about the ads than weaker arguments. This may be a result of psychological

reactance or defensive processing. Since these high-risk adolescents have more positive attitude toward marijuana use as found both in previous studies (e.g., Yzer et al., 2004) and in the current analysis (i.e., high-risk adolescents generally rated the anti-marijuana ads as less effective than low-risk adolescents), they are more likely than the low-risk adolescents to be psychologically reactant to the anti-marijuana messages. When facing stronger rather than weaker anti-marijuana arguments, their personal beliefs and values about marijuana are more challenged and they are hence more likely to activate defensive processing of the ads in the presence of stronger arguments.

Possible Mechanism for the Negative Impact of Marijuana Scenes

The negative impact of marijuana scenes is found to be stronger for ads with actual marijuana smoking scenes than ads with other types of marijuana scenes among the whole sample. However, this effect may result from the smaller number of ads that contain mere presence, holding and handling of marijuana cigarettes ($N=9$). The difference between various types of marijuana scenes disappeared after taking into account adolescents' risk level. This suggests that adolescents' risk of marijuana use more than the type of marijuana scenes explain the negative impacts of marijuana scenes on ad effectiveness evaluation.

To find out why marijuana scenes negatively affect ad liking and thought valence, we further explored the emotional impacts of these ads. In the original studies, adolescents also rated all 60 ads with regard to how the ads made them feel emotionally. Four emotions were assessed, including fear ($M = 1.60, SD = .23$), sadness ($M = 1.72, SD = .33$), inspiring ($M = 2.30, SD = .24$), and sympathy ($M = 1.89, SD = .28$), on a 4-point scale (0=not at all, 4=very much). An aggregate score on each emotion was obtained by averaging across the adolescents who viewed the same ad (the same procedure used with ad evaluation data). Presence of marijuana scenes was negatively correlated with "feeling inspired" for both high-risk ($r = -.41, p < .001$) and low-risk adolescents ($r = -.31, p = .02$)². "Feeling inspired" was positively correlated with all three ad evaluation measures for both high-risk (r ranged from .67 to .79, $p < .003$) and low-risk adolescents (r ranged from .39 to .52, $p < .003$). The more one feels inspired after viewing the ads, the more one considers the ad as effective or vice versa. When inspire was controlled in the path analyses, the negative impact of marijuana scenes on ad effectiveness evaluation found among the high-risk group disappeared. Only the effect of argument strength on thought valence remained the same ($F(1, 59) = 3.95, p = .05, \text{partial } \eta^2 = .07$) after controlling for inspire. Moreover, the impact of marijuana scenes on inspire did not change when ad effectiveness measures were controlled in the analysis. This suggests that "feeling inspired" fully mediated the impact of marijuana scenes on ad effectiveness evaluation. The presence of marijuana scenes reduced one's feeling of inspiration, which in turn reduced their evaluation of ad effectiveness. Because emotional reactions and ad effectiveness evaluations were collected at the same time, the causal direction is only empirically explored than confirmed.

²For the high-risk adolescents, feeling inspired was the only emotion that was significantly correlated with marijuana scenes. For the low-risk adolescents, feeling afraid was the only other emotion that was significantly related to marijuana scene, $r = .26, p < .05$.

Implications for Anti-Marijuana PSAs

Based on the current findings, the presence of marijuana scenes appears to undermine ad liking and thought valence when the target audience is at a higher risk of marijuana use. The high-risk group is often the primary target of anti-marijuana PSAs with message strategies specially designed for this group of people (e.g., Palmgreen et al., 2001). For this segment of adolescents, including marijuana scenes in anti-marijuana PSAs may not be a good strategy. When the risk level of adolescents is uncertain or not considered, the current study suggests that the actual marijuana smoking scenes may be more troublesome in comparison to other types of marijuana scenes. The actual marijuana-smoking scenes are most explicit as they directly illustrate the active marijuana using behavior. Their impacts on modeling behaviors and attentional bias should be stronger compared to marijuana scenes that only present the possibility of marijuana use (in the case of mere presence of marijuana cigarettes), or that only suggest an incident of marijuana use (in the case of holding and handling of marijuana cigarettes). However, readers should be cautioned that the results on the different impacts of different types of marijuana scenes are not conclusive and they may be simply a result of the small number of ads in the latter categories.

The current study also suggests that the ads that make one inspired are perceived as effective, especially among the high-risk adolescents. However, the presence of marijuana scenes reduces this feeling. It is possible that the marijuana scenes used in a specific context may have reignited these high-risk adolescents' positive attitude about marijuana use or reduced their admiration for the character(s) in the ads, which ultimately reduces the instructive value of the ads and hence ad effectiveness. Although the specific mechanism still awaits future test, this result may underline the importance of using certain positive emotional appeals in PSA design. The positive effect of inspire is similar to that of some other positive emotions, such as hope and pride. A prior study on cigarette smoking has reported that the emotions of hope and pride both contribute to one's intention to quit smoking (Cappella, Romantan, Lerman, & Patterson, 2006).

Limitation and Future Direction

The study was conducted with a limited set of ads ($N = 60$). The adolescent participants producing these effects cannot be considered a random or a representative sample. The current study is concerned only with anti-marijuana PSAs directed at adolescents. All of these factors will limit the generalizability of the findings. Nevertheless the number of ads per condition classified by argument strength and marijuana scenes was at least 24 and the mean estimates used in the analyses came from a diverse group of adolescents in terms of age, race, gender, residence, and socio-economic status (as indicated by mother's education).

The study does not test the actual effects of ads on behavioral intention or behaviors. Instead judgments of ad effectiveness are employed as surrogate measures of more direct consequences. The surrogates we employed allow us to evaluate many ads simultaneously but run the risk that the ad evaluation judgments employed are only weak predictors of behavioral intention or actual behavior change. We have used three evaluation measures to help reduce this risk. The fact that thought valence has exhibited most significant findings,

followed by ad liking and last by perceived ad effectiveness may be a direct reflection of the varied levels of range restrictions of each measure ($SD_{\text{thought valence}} = 13.79$, $SD_{\text{ad liking}} = .45$, $SD_{\text{perceived effectiveness}} = .23$). Because these three measures are all indicators of ad effectiveness evaluation, the results suggest that given sufficient variance, the impact of marijuana scenes may be observable on all three ad evaluation measures.

The lack of strong effect from argument strength in the current study may reflect the fact that most anti-marijuana arguments are not strong compared to those directed at hard drugs (e.g., methamphetamine or heroin, Fishbein et al., 2002). What makes this issue more prominent is that the current data are aggregate level data. Averaging across multiple individuals' argument evaluations has further limited the variance of this measure. In the present study, argument strength has a moderate mean and a very small range ($M = 3.70$, $SD = .15$ on a 5-point scale). The difference between strong and weak arguments (i.e., .24 on a 5-point scale) is rather small in magnitude and both levels of arguments may be considered as representing a moderate level of argument strength. In the context of much stronger arguments than are available with marijuana or with this set of ads, the effect of argument strength on ad evaluation may be stronger.

As a secondary data analysis, the study only hypothesizes the underlying causal mechanisms of the negative impacts of marijuana scenes on high-risk adolescents' ad evaluations. Feeling inspired is found to be able to account for this negative impact. However, other alternative explanations not explored in this study may also hold (e.g., the presentation of marijuana use ritual, context or the consequences of use may be viewed as unreal, reducing the ad's effectiveness, Fishbein et al., 2002) and feeling inspired maybe a spurious factor. Subsequent studies may pay special attention to the possible mechanisms to explain the negative impact of marijuana scenes on ad evaluation and even behavioral intention.

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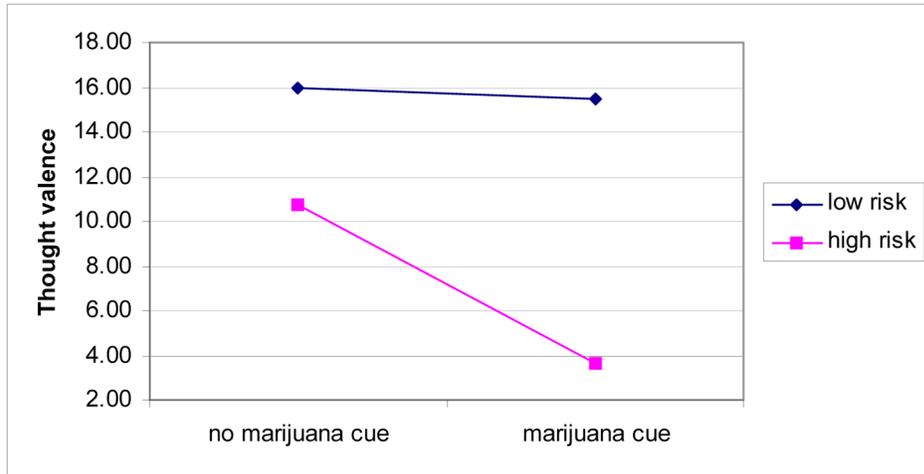


Figure 1.
Impact of marijuana scenes and risk of marijuana use on thought valence

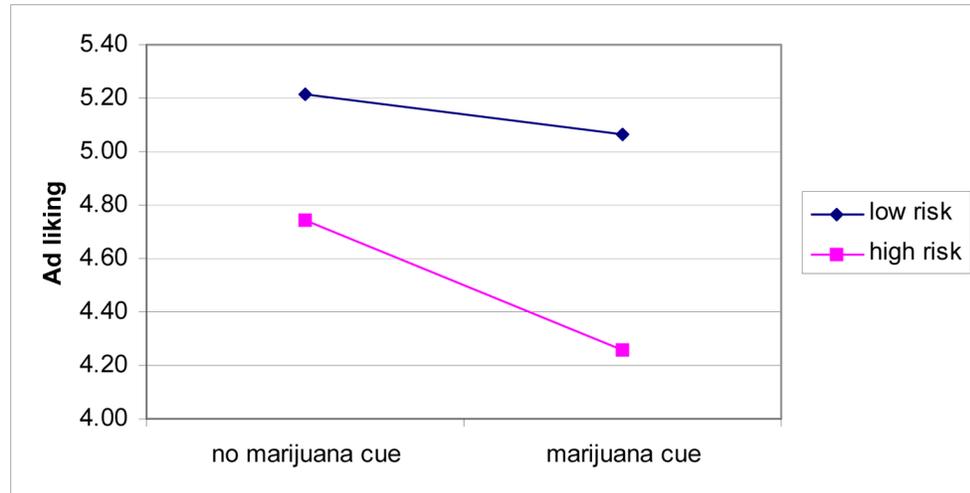


Figure 2.
Impact of marijuana scenes and risk of marijuana use on ad liking

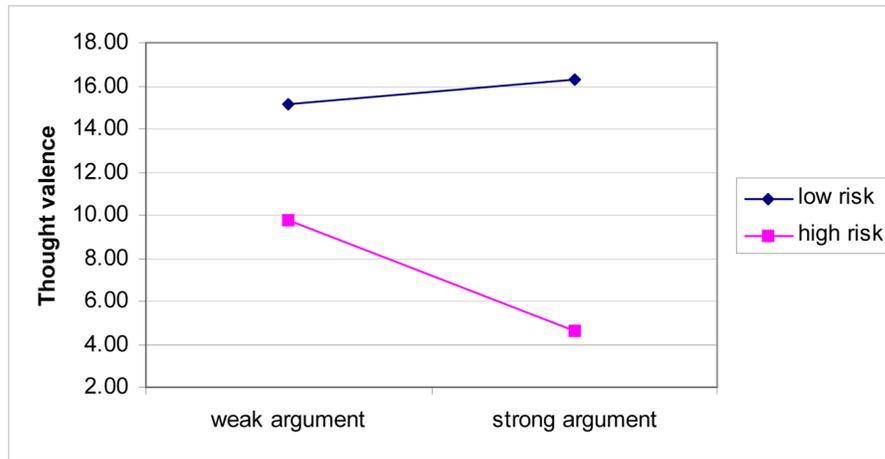


Figure 3.
Impact of argument strength and risk of marijuana use on thought valence

Means of Perceived Ad Effectiveness, Ad Liking and Thought Valence by Marijuana Scene, Argument Strength and Risk of Marijuana Use

Table 1

Risk of marijuana use	Argument strength	Marijuana scene	Perceived ad effectiveness	Ad liking	Thought valence	N
Low	Low	No	3.57 (.17)	5.17 (.32)	14.71 (5.41)	14
		Yes	3.54 (.35)	5.04 (.65)	14.69 (10.15)	16
	High	No	3.62 (.24)	5.22 (.39)	16.50 (6.60)	22
		Yes	3.60 (.22)	5.18 (.32)	17.50 (4.60)	8
High	Low	No	3.17 (.28)	4.68 (.55)	10.43 (8.30)	14
		Yes	3.11 (.30)	4.33 (.52)	5.81 (9.49)	16
	High	No	3.26 (.27)	4.73 (.56)	10.32 (8.54)	22
		Yes	3.16 (.14)	4.31 (.72)	3.88 (9.91)	8

Note: Values in parentheses are standard deviations.

Screening and Brief Advice to Reduce Adolescents' Risk of Riding With Substance-Using Drivers

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ABSTRACT. Objective: Alcohol- and drug-related car crashes are a leading cause of death for adolescents in the United States. This analysis tested the effects of a computer-facilitated Screening and Brief Advice (cSBA) system for primary care on adolescents' reports of driving after drinking or drug use (*driving*) and riding with substance-using drivers (*riding*). **Method:** Twelve- to 18-year-old patients ($N = 2,096$) at nine New England pediatric offices completed assessments only during the initial 18-month treatment-as-usual (TAU) phase. Subsequently, the 18-month cSBA intervention phase began with a 1-hour provider training and implementation of the cSBA system at all sites. cSBA included a notebook-computer with self-administered screener, immediate scoring and feedback, and 10 pages of scientific information and true-life stories illustrating substance-related harms. Providers received screening results, "talking points" for 2 to 3 minutes of counseling, and a Contract

for Life handout. Logistic regression with generalized estimating equations generated adjusted relative risk ratios (aRRR) for past-90-day driving and riding risk at 3- and 12-month follow-ups, controlling for significant covariates. **Results:** We found no significant effects on driving outcomes. At 3 months, cSBA youth were less likely than TAU to report riding with a drinking driver (aRRR = 0.70, 95% CI [0.49, 1.00]), and less likely to report riding with a driver who had used cannabis or other drugs (aRRR = 0.46, 95% CI [0.29, 0.74]). The effect was even greater (aRRR = 0.34, 95% CI [0.16, 0.71]) for riding with drinking drivers who were adult family members. All effects dissipated by 12-month follow-up. **Conclusions:** Screening and pediatrician brief advice shows promise for reducing adolescents' risk of riding with substance-using drivers. (*J. Stud. Alcohol Drugs*, 79, 611–616, 2018)

THOUSANDS OF ADOLESCENTS in the United States die in motor vehicle crashes each year, and alcohol and drug use are major contributors (DuPont, 2011; Rehm et al., 2009). In 2015, one in four fatally injured teen drivers

(26%) had a blood alcohol concentration (BAC) greater than .01 g/dL, and one in five (21%) had a BAC greater than .08 g/dL (National Highway Traffic Safety Administration [NHTSA], 2017a). Among younger motor vehicle fatalities (ages 14 and younger), one in six (17%) were driven by an alcohol-impaired driver (NHTSA, 2017b). In recent years, the rates of adolescents reporting recent (past 2 weeks) driving after using cannabis (12%) and riding with a driver who had used cannabis (19%) have steadily increased and now surpass alcohol-involved driving (9%) and riding (17%) rates (O'Malley & Johnston, 2013). Therefore, it is important to identify strategies that can effectively identify and mitigate these potentially fatal risky behaviors.

Youth should be screened for riding with an alcohol- or drug-using driver (hereafter, "riding") beginning at age

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12 years (Ewing et al., 2015) and for alcohol- and drug-involved driving (hereafter “driving”) at age 15 when driving usually begins. The CRAFFT, a widely recommended assessment developed specifically for use in pediatric medical settings, offers a brief screen for driving/riding risk (Knight et al., 2002). CRAFFT is a mnemonic acronym composed of the first letters of the key words in its six questions. The “C” question is, “Have you ever ridden in a CAR driven by someone (including yourself) who was ‘high’ or had been using alcohol or drugs?”

Several recent studies have validated substance use screens that only include questions about the frequency of past-12-months use (Clark et al., 2016; Levy et al., 2016a). A recent American Academy of Pediatrics Clinical Report recommends this approach (Levy et al., 2016b), but limiting screening to an assessment of patients’ personal use results in a lost opportunity to identify and intervene with those at risk because of riding with a substance-using driver, regardless of their own substance use.

To inform this discussion, we performed a secondary analysis of data from a 2012 study testing a computer-facilitated screening and pediatrician brief advice (cSBA) system based on the CRAFFT (Harris et al., 2012). Patients self-administered the screen on a computer in a private location before the physician visit, immediately received their CRAFFT score and risk level, and viewed 10 pages presenting science and true-life stories illustrating the health risks of alcohol and drug use. The system produced a report for the pediatrician with the screening results and a brief list of “talking points” designed to prompt 2 to 3 minutes of counseling.

All patients received a printed copy of the Contract for Life (Students Against Destructive Decisions [SADD], 2016), which asks adolescents never to drive after substance use or accept a ride from a substance-using driver. Instead, they agree to call their parent(s) for a safe ride home. Parents, in turn, agree to provide safe and sober transportation home and postpone any discussion until the following day. Pediatricians were instructed to ask all patients to discuss the Contract for Life with their parent(s) and to follow up with the provider if additional discussion was needed. This strategy preserved the confidentiality of high-risk patients while serving as a prevention strategy for both high- and low-risk patients.

The objective of this analysis was to examine the effect of cSBA at 3- and 12-month follow-ups on adolescents’ reports of substance-involved driving/riding and, specifically, riding with a substance-using adult family member.

Method

This was a secondary analysis of data collected during 2005–2009. Detailed methods are published elsewhere (Harris et al., 2012). Briefly, we conducted the study in nine primary care offices in New England. We compared

cSBA to treatment as usual (TAU) in a quasi-experimental comparative effectiveness trial in which each site served as its own historical control group. At the start of the study, we instructed providers to continue their usual standard of care, and for the next 18 months we recruited and tested the TAU group. At crossover, we held a 1-hour provider training that comprised a demonstration of the cSBA system; a review of screening reports for low-, medium-, and high-risk patients; and a video that showed how to use the talking points and Contract for Life document in brief counseling. We then initiated the cSBA computer system at all sites and recruited and tested the cSBA group over the final 18 months.

Participants were 12- to 18-year-old patients arriving for routine primary care visits who provided informed assent/consent. They completed the baseline assessment battery before the provider visit and identical assessments at 3 and 12 months after the visit. They received a \$15 merchandise certificate after completing each measurement. The Institutional Review Boards of Boston Children’s Hospital and all other sites approved the study protocol.

Measures

The measures have been previously described in detail (Harris et al., 2017). Participants completed a computer self-administered questionnaire assessing demographics; visit/provider characteristics; substance use by peers, siblings, and parents (scales derived from the Personal Experience Inventory; Winters, 1993); and a branching questionnaire assessing past-90-day driving and riding risks for alcohol and cannabis or other drugs. Only participants ages 16 years or older received the driving risk items. Participants indicating any riding were asked follow-up questions to determine if they rode with a driver who was age 21 or older and lived in the home. Youth answering affirmatively were categorized as riding with an adult family member. To assess for historical confounding within this asynchronous study design, we measured differences in the frequency of past-year exposure to substance use–related messages received outside of the study intervention and found no differences.

Data analyses

We conducted all analyses using SUDAAN® v.11.0 with site as the nest variable to appropriately account for correlated error arising from our multisite cluster-sampling design. We used an “intent-to-treat” approach, analyzing cSBA adolescents regardless of whether they reported receiving provider advice. We used chi-square tests for categorical variables and *t* tests for continuous variables to assess baseline equivalence of the two groups and to compare characteristics of those retained versus lost to follow-up. We dichotomized race (White non-Hispanic vs. other), parents in home (two vs. other), parent education level (\geq college

graduate vs. other), and type of visit (well visit vs. other) to ensure adequate cell sizes. All analyses of driving outcomes included data only for those ages 16 years or older ($N = 1,068$, 51% of total sample).

Because even one driving or riding instance could result in tragedy, we computed risks for any driving or riding with a drinking or cannabis/other-drug-using driver by collapsing responses into *none/any*. For analysis of the intervention effect at 3- and 12-month follow-ups, we used logistic regression modeling with generalized estimating equations to compute adjusted relative risk ratios (aRRR) for cSBA compared with TAU, controlling for baseline driving and riding variables, other identified baseline between-group differences, and the multisite sampling design.

Model-based missing data imputation was conducted to evaluate potential response bias in our follow-up effect estimates. Estimates of effect using the imputed data set were generally slightly stronger than the non-imputed, and our findings did not change, so we report non-imputed results.

Results

Sample characteristics

A total of 2,096 of 2,435 eligible patients (86.1%) completed baseline assessments. The mean (SD) age was 15.8 (2.0) years, 58.2% were girls, 64.6% were White/non-Hispanic, 11.0% were Hispanic, 7.2% were Asian/non-Hispanic, 10.4% were Black/non-Hispanic, and 6.9% self-categorized as other. At 3- and 12-months follow-up, retention rates for TAU were 70.7% and 72.4%, respectively, and for cSBA 74.0% and 75.1%, respectively. Compared with those retained at 3 months, noncompleters were older ($M_{age} = 15.8$ vs. 15.6, $F = 10.4$, $p < .01$); less likely to be White non-Hispanic (54% vs. 68%), $\chi^2(1) = 41.9$, $p < .01$; and more likely to come from a single-parent household (38% vs. 28%), $\chi^2(1) = 181$, $p < .01$; to have ever used alcohol (42% vs. 36%), $\chi^2(1) = 5.5$, $p < .01$ or cannabis (28% vs. 20%) $\chi^2(1) = 19.4$, $p < .01$; and to report having a substance-using parent (19% vs. 14%); $\chi^2(1) = 7.4$, $p < .01$. We found the same differences between 12-month completers and noncompleters. However, the profiles of noncompleters did not differ between cSBA and TAU.

Driving after drinking or drug use

At baseline, 4.7% of youth ages 16 years old and older reported past-90-days driving after drinking, 5.2% after cannabis/other drug use, and 8.9% after alcohol or drug use.

Riding with a substance-using driver

At baseline, 22.4% of youth (all ages) reported past-90-days riding with a drinking driver, 17.8% with a cannabis/

drug-using driver, and 30.7% with a driver using alcohol or drugs. The TAU group had a significantly higher baseline rate compared with cSBA of reporting riding with a driver who had used cannabis/other drugs (Table 1).

Nearly 1 in 10 (8.2%) reported being driven in the past 90 days by an adult family member who had been drinking, 1.8% by an adult family member who had been using drugs, and 9.3% by an adult family member who had used alcohol or drugs.

Among youth who reported any riding, 44.2% had not used any substances themselves during the past 12 months.

Intervention effect for driving

There were no significant intervention effects on driving outcomes at either 3- or 12-month follow-ups, likely because of small numbers (Table 1).

Intervention effect for riding

Interestingly, past-90-day riding rates showed substantial drops from baseline to follow-up in both cSBA and TAU. After adjustment for baseline riding and other covariates, cSBA youth had, compared with TAU, a 30% lower risk of riding with a drinking driver and 54% lower risk of riding with a driver using drugs at the 3-month follow-up, but the effects dissipated by 12 months (Table 1). The apparent effect size at 12 months for alcohol (19%), however, may warrant further testing in a larger sample.

Intervention effect for riding with substance-using adult family member

Similarly, in adjusted analysis, we found a 66% lower risk at 3 months for cSBA compared with TAU of riding in a car with an adult family member who had been drinking. This effect dissipated by the 12-month follow-up. For riding with an adult family member who had been using cannabis/other drugs, there were too few reports to draw any meaningful conclusion.

Discussion

This study shows that a brief primary care counseling intervention that includes the Contract for Life is a promising strategy to reduce the short-term risk of adolescents riding with a substance-using driver. The effect sizes of 30% and 54% for alcohol and drug use, respectively, required only a few minutes of clinician time. We found an even larger short-term effect when the driver in question was an adult family member.

Unfortunately, all effects dissipated by the 12-month follow-up, consistent with prior studies of brief interventions in primary care, which found that effect sizes tend to be

TABLE 1. Unadjusted group prevalence rates and adjusted relative risk ratios (aRRRs) for past-90-day driving and riding risk behaviors at baseline and 3- and 12-month follow-ups

Variable	TAU n/N (%)	cSBA n/N (%)	aRRR [95% CI] ^a	p
Drove after drinking (among ≥16-year-olds)				
Baseline	35/667 (5.2)	24/591 (4.1)	1.05 [0.57, 1.92]	.71
3 months	8/451 (1.8)	6/459 (1.3)	0.77 [0.25, 2.37]	.64
12 months	15/468 (3.2)	10/442 (2.3)	1.00 [0.64, 1.57]	.80
Drove after using cannabis or other drugs (among ≥16-year-olds)				
Baseline	23/667 (3.4)	42/591 (7.1)	0.79 [0.44, 1.40]	.48
3 months	14/451 (3.1)	8/459 (1.7)	0.63 [0.25, 1.63]	.34
12 months	18/468 (3.8)	14/442 (3.2)	1.01 [0.36, 2.85]	.84
Rode with any driver who had been drinking				
Baseline	278/1,068 (26.0)	192/1028 (18.7)	0.84 [0.65, 1.07]	.20
3 months	103/755 (13.7)	60/761 (7.9)	0.70 [0.49, 1.00]	.05
12 months	109/773 (14.4)	79/772 (10.3)	0.81 [0.59, 1.11]	.26
Rode with an adult family member who had been drinking				
Baseline	101/1,068 (9.5)	71/1028 (6.9)	0.77 [0.56, 1.06]	.11
3 months	37/775 (4.9)	11/761 (1.4)	0.34 [0.16, 0.71]	.001
12 months	33/773 (4.4)	28/772 (3.5)	0.88 [0.51, 1.50]	.62
Rode with any driver who had used cannabis or other drugs				
Baseline	228/1,068 (21.4)	145/1028 (14.1)	0.75 [0.58, 0.98]	.05
3 months	82/755 (10.9)	43/761 (5.7)	0.46 [0.29, 0.74]	.005
12 months	80/773 (10.6)	64/772 (8.4)	0.88 [0.61, 1.29]	.36
Rode with an adult family member who had used cannabis or other drugs				
Baseline	27/1,068 (2.5)	10/1028 (1.0)	0.47 [0.22, 1.02]	.06
3 months	9/755 (1.2)	4/761 (0.5)	0.54 [0.15, 1.87]	.19
12 months	6/773 (0.8)	6/772 (0.8)	1.29 [0.34, 4.84]	.71

Notes: TAU = treatment as usual; cSBA = computer-facilitated screening and brief advice; CI = confidence interval.
^aAll baseline aRRR models adjusted for baseline past-12-month substance use, age, gender, race, and parent education, with precision estimates adjusted for the multisite sampling design. All 3- and 12-month follow-up models also included baseline driving/riding variables as control variables.

strongest at earliest follow-up points, with decay in intervention effects over time (O'Donnell et al., 2014). These results highlight the need for future research to identify practical strategies for use in primary care that reinforce and extend brief intervention effects over time.

The sizeable drop of approximately 50% in riding for the TAU group could have been a result of assessment reactivity (Walters et al., 2009) or a Hawthorne effect of being observed (Murray et al., 1988). However, we also found that about one third of TAU pediatricians advised their patients about driving/riding-related risk behaviors, which was about half the rate reported in the cSBA group. Yet, the drop in the cSBA group was significantly larger. A recent systematic review and meta-analysis of brief alcohol interventions for drinking and driving among youth (Steinka-Fry et al., 2015) identified 12 studies that tested an alcohol intervention of 5 hours or less duration over a 1-month period among 11- to 25-year-olds. Overall, they found a modest (0.15 *SD*) improvement but significant effect on drinking and driving that was primarily correlated with a post-intervention reduction

in heavy use of alcohol. We could find no published studies examining the effects of brief interventions on riding with a substance-using driver (Williams et al., 2007), despite a number of reports showing that this is a serious concern among youth (Beck et al., 2010; Bell et al., 2005; Cartwright & Asbridge, 2011).

A number of potential study limitations should be noted. First, these data were collected in 2005–2009 and may not reflect current adolescent behavior. The assessment battery relied on adolescent self-report, which could introduce recall or social-desirability bias. Although we were not able to identify any reports assessing the reliability of adolescent self-report of riding/driving behaviors, research suggests that computer self-administered confidential questionnaires are associated with higher disclosure of sensitive behaviors (Beck et al., 2014; Newman et al., 2002). To avoid making parents secondary subjects, we did not ask participants directly whether it was a parent who was driving the car after drinking or drug use. In some instances it could have been an over-21 sibling. However, in a previous study, we found a

significant correlation between adult family member driving after substance use and other items that measured parents' substance use (e.g., "I am worried about my parent(s) drinking/drug use"; Harris et al., 2017). Our measure of riding with a driver under the influence of "cannabis or other drugs" does not allow differentiation of specific drugs and required adolescents to subjectively judge what the driver had been using. This study used a quasi-experimental asynchronous comparison group design, which can be subject to historical confounding. Future studies should be randomized trials. Additionally, although we gave all patients the Contract for Life, we do not know how often family members actually received these or made agreements to request and provide safe transportation home. Finally, we did not ask about drivers' licenses, which would have given a more accurate denominator for our driving rates.

Study strengths included a large and diverse sample from a variety of primary care settings over several U.S. states, and testing an intervention approach that required minimal pediatrician time and preserved the confidentiality of youth at risk.

This study provides initial evidence supporting pediatrician screening and brief counseling for riding risk. It also highlights the importance of screening youth for riding with substance-using drivers. An updated version of the CRAFFT screener (CRAFFT 2.0) begins with simple questions regarding frequency of use during the past 12 months and then uses a skip-pattern to maximize efficiency (Harris et al., 2016). Those who report no use answer the CAR question only, whereas those who report use answer all six CRAFFT questions (www.CRAFFT.org). The computer-facilitated approach takes adolescents on average less than 5 minutes to complete (Showalter et al., 2016) and requires only minutes of a pediatrician's time, making it a practical and efficient way to reduce risk of car crash injuries and death. Although the number of alcohol-related car crashes has recently declined, the rate of cannabis-related vehicle crashes is rising, especially in states that have legalized its use (Salomonsen-Sautel et al., 2014).

Conclusion

Pediatrician screening and brief counseling appears promising for reducing adolescents' short-term risk of riding with a substance-using driver, especially when the driver is an adult family member. More studies are needed using randomized designs that test new strategies to extend the effect of the intervention.

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National Youth Anti-Drug Media Campaign and school-based drug prevention: Evidence for a synergistic effect in ALERT Plus

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Abstract

This analysis examined the possible synergistic effect of exposure to the National Youth Anti-Drug Media Campaign and a classroom-based drug prevention curriculum among 9th grade students participating in a randomized trial of ALERT Plus. A total of 45 South Dakota high schools and their middle-school feeder(s) were randomly assigned to an ALERT condition (basic prevention curriculum delivered in 7th and 8th grades), an ALERT Plus condition (basic curriculum with booster lessons added for 9th and 10th grades), or a control condition. Marijuana use in the past month was significantly less likely among ALERT Plus students reporting at least weekly exposure to anti-drug media messages. The National Youth Anti-Drug Media Campaign may have led to reductions in marijuana use among youth who simultaneously received school-based drug prevention.

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The National Youth Anti-Drug Media Campaign (the Campaign) is part of an effort by the Office of National Drug Control Policy to combat illegal drug use among America's youth by means of an advertising and social marketing program focusing on the dangers of drug use (Hornik et al., 2003b). Prevention of marijuana use has been a particular objective of the Campaign from its inception (Hornik et al., 2003a; Kelder, Pechman, Slater, Worden, & Levitt, 2002). There have been three Campaign phases, culminating in a "full implementation" phase that began in September 1999 and covered the entire nation. A large-scale multi-year evaluation of the Campaign indicates that it has raised exposure to

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anti-drug media messages among young people but thus far has shown no favorable effect on marijuana use or on relevant cognitive variables.

A randomized trial of ALERT Plus was launched in South Dakota in 1997 and continued through 2002. Forty-five high schools and their middle-school feeder(s) were randomly assigned to an ALERT condition (basic drug prevention curriculum delivered in 7th and 8th grades), an ALERT Plus condition (basic curriculum with booster lessons added for 9th and 10th grades), or a control condition. Students in ALERT Plus schools received the 9th grade lessons in Fall 1999 and completed a follow-up survey on drug use and other outcomes in Spring 2000. Thus the 9th grade year of the ALERT Plus trial coincided with the first year of the Campaign's full implementation phase. The fortuitous timing made it possible to test for a synergistic effect between exposure to the Campaign's anti-drug messages and participation in a school-based drug prevention curriculum. Questions on exposure to anti-drug messages were included in the 9th grade survey completed by students in all study schools. This paper compares effects of Campaign exposure among 9th grade students in ALERT Plus, ALERT, and control schools.

1. Background

1.1. Drug prevention in media campaigns

The target audience for National Youth Anti-Drug Media Campaign is young people between 9 and 18 years old and their parents. (In 2002, the youth focus was narrowed to ages 11 through 17.) After a pilot phase in 12 metropolitan areas from January to June 1998, the Campaign "went national" in a second phase from July 1998 to July 1999. Newly produced messages reflecting three themes of the Campaign's communication strategy—resistance self-efficacy, anti-drug norms, and negative consequences of use—were aired in paid and donated advertising on a full range of media. In a third phase, which began in September 1999 and was planned to run at least through Spring 2004, the Campaign continued to air ads reflecting these three themes and added outreach programs to the media, entertainment, and sports industries as well as partnerships with civic, professional, and community groups (Hornik et al., 2003a). During this "full implementation" phase, the intended degree of Campaign exposure was 2.5 youth-oriented ads per week.

Because the Campaign was implemented throughout the United States, there is no unexposed control group to which a Campaign-exposed group can be compared, and it was not practical to divide the nation into media markets that might have been randomized to receive ads with differing anti-drug content or different amounts of Campaign exposure (Lu, Zanutto, Hornik, & Rosenbaum, 2001). Hence the Campaign's evaluators have employed national trends in adolescent drug use and annual surveys as the chief indicators of effectiveness. About 77% of young people (ages 12 to 18) surveyed between 2000 and 2003 have reported seeing at least one anti-drug ad per week. More specifically, recall of television ads aired by the Campaign has increased over time from 37% in 2000 to 76% in 2003. Success in delivering anti-drug messages has not led to reductions in adolescent drug use, however. National trends in marijuana use do not suggest any favorable effect of the Campaign (Hornik et al., 2003a). Campaign survey data continue to show no relationship between cross-sectional exposure to anti-drug ads and marijuana use, intention to try marijuana, attitudes about marijuana, perceived norms regarding its use, or self-efficacy for avoiding use (Hornik et al., 2003a). When survey data are analyzed longitudinally,

there is some evidence to suggest that ad exposure has had an *unfavorable* effect on intentions to use marijuana, although no such effect has emerged for actual use (Hornik et al., 2003b).

Research on other media campaigns targeting drug use has shown favorable effects on drug-related cognitions. Effects on behavior (e.g., initiation, frequency of use, and cessation of use) have been mixed and generally modest (Fishbein, Hall-Jamieson, Zimmer, Haeflten, & Nabi, 2002). In an analysis of ads aired by the Partnership for a Drug-Free America between 1987 and 1990, Block, Morwitz, Putsis, and Sen (2002) found consistent evidence for reduced use of marijuana and cocaine among youth who reported greater exposure to the ads. Similarly, Snyder et al. (2004) found “small but measurable” effects of media campaigns targeting a broad range of health outcomes, e.g., drinking, smoking, and seat belt use. Derzon and Lipsey (2002) conducted a meta-analysis of 72 anti-drug media campaigns targeting young people and found that effects, while small overall, were larger for campaigns using a series of ads rather than a “one shot” ad and larger for campaigns supplemented with additional resources (e.g., educational programs in community organizations and peer advocacy) to reinforce and provide depth to the media messages.

Studies of multi-component prevention programs suggest that media messages may have more effect when delivered in tandem with prevention curricula taught in the classroom (Pentz, 2003). Flynn et al. (1994, 1997) found stronger effects on smoking among youth in communities where a combined media and school intervention was delivered than among youth receiving only the school intervention. The multi-component intervention called Project STAR has shown favorable effects on tobacco and marijuana use (Johnson et al., 1990; Pentz et al., 1989). The study design precluded estimation of effects for school, media, and community components separately, but Flay (2000: 876) has read the study’s findings to suggest that “the media and community components had little effect on students not exposed to the school curriculum.” In an evaluation of a statewide smoking prevention program, Murray et al. (1992) found dramatic effects on adolescents’ exposure to antismoking messages but no effect on their tobacco use. The program included media and school components, but delivery of the school component was reportedly weak. In contrast, a school-based prevention program designed to help adolescents identify and combat various alcohol marketing practices actually counteracted the impact of exposure to in-store beer displays on future drinking by 9th graders (Ellickson, Collins, Hambarsoomians, & McCaffrey, 2005).

1.2. *ALERT and ALERT plus*

The school-based ALERT curriculum seeks to help adolescents recognize that most people do not use drugs or approve of doing so, understand the benefits of not using, develop reasons not to use, and understand the immediate and long-term consequences of use. It also seeks to build resistance self-efficacy by helping adolescents identify and resist both internal and external pressures to use drugs and by providing role models for non-use.

The original ALERT included eight lessons in 7th grade and three lessons in 8th grade. Two more lessons were later added in 8th grade (see below). The ALERT Plus curriculum added five booster lessons in 9th grade and five more lessons in 10th grade. Lesson development in ALERT and ALERT Plus was guided by three theoretical models applicable to health promotion and behavior change: the health belief model, self-efficacy theory, and social influence theory. The health belief model informed the curriculum’s emphasis on helping adolescents understand the salience and seriousness of consequences associated with drug use, reducing barriers to effective drug resistance, and highlighting

the benefits of non-use. Self-efficacy theory fostered the curriculum's emphasis on building confidence in one's ability to resist pro-drug pressures, the lack of which is deemed an important barrier to effective drug resistance. Social influence theory contributed to the curriculum's focus on modifying two additional barriers to effective resistance—normative perceptions that drug use is widespread and socially approved, particularly among one's peers, and lack of resistance skills. Lessons are taught using interactive question-and-answer techniques and small group activities, which appear to be crucial elements in the effectiveness of social influence prevention curricula (Tobler, 1997). Lessons include material for students at all levels of experience with drugs. In particular, lessons on smoking cessation are designed to appeal to more committed and alienated smokers and to highlight student susceptibility to the negative consequences of use. The 9th and 10th grade booster lessons seek to reinforce the middle-school curriculum while also strengthening norms against high-risk drug use, enhancing adolescents' capacity to protect themselves against risky drug situations, and helping them develop alternative strategies for coping with stress.

The original ALERT curriculum (7th and 8th grades) was tested in 30 schools across California and Oregon in urban and suburban settings and found to prevent or reduce initial, current, and monthly marijuana use among 8th grade adolescents who had not tried marijuana by 7th grade (baseline). It also curbed regular marijuana use among the high-risk youth who had already started using by 7th grade. In addition, it helped keep high-risk tobacco experimenters from becoming weekly or daily smokers and induced some to quit smoking. However, the program did not help the more committed early smokers, who reported higher rates of monthly and weekly smoking than their counterparts in the control schools (Ellickson & Bell, 1990).

In view of these findings, Project ALERT was strengthened with the addition of parent involvement activities, material on alcohol misuse, and a lesson designed to help smokers quit. The revised ALERT curriculum includes two additional lessons, one on smoking cessation and one on alcohol misuse, plus a series of home-learning activities that encourage parental involvement in substance-use prevention during 7th and 8th grades. These additions were designed to improve the program's impact on alcohol use and to overcome its ineffectiveness with committed smokers.

A recent evaluation of the revised curriculum in South Dakota schools showed that ALERT curbed alcohol misuse as well as initial, monthly, and weekly use of tobacco and marijuana among all adolescents in 8th grade. Reductions in use were observed among adolescents at low, moderate, and high risk. The curriculum held down alcohol misuse among the high-risk early drinkers, curbed both current and regular smoking among baseline tobacco experimenters and users, and prevented onset of marijuana use among low- and moderate-risk adolescents (Ellickson, McCaffrey, Gosh-Dastidar, & Longshore, 2003).¹ Favorable effects were also observed on drug-relevant cognitive factors such as perceived prevalence of use, resistance self-efficacy, peer approval of use, beliefs about use, and intentions to use (Ghosh-Dastidar, Longshore, Ellickson, & McCaffrey, 2004; see also Orlando, Ellickson, McCaffrey, & Longshore, 2005). Favorable effects at 8th grade faded by the end of 9th grade among students who did

¹ The low-risk alcohol group included only students who had never used alcohol by baseline (38.8%). The moderate-risk alcohol group included "experimenters" who had used alcohol less than three times in the past year and not at all in the past month (45.3%). The high-risk alcohol group had used alcohol three or more times in the past year or one or more times in the past month (15.9%). Similar criteria were employed to define students at low (62.5%), moderate (21.4%), or high (16.1%) risk for tobacco use. The low-risk marijuana group included only students who had used neither marijuana nor tobacco by baseline (65.0%). The moderate-risk group included those who had tried tobacco but not marijuana (28.5%); the high-risk group, those who had used marijuana by baseline (6.5%).

not receive the 9th grade ALERT Plus booster lessons. On the other hand, ALERT Plus succeeded in sustaining the curriculum's earlier effects on drug use and cognitive factors among high-risk adolescent girls (Longshore, McCaffrey, St.Clair, & Ellickson, submitted for publication) and curbed drinking among 9th grade adolescents who had tried alcohol by 7th grade as well as those who had not (Ellickson et al., 2005).

Because prevention of marijuana use has been a particular objective of the Campaign (Hornik et al., 2003a; Kelder et al., 2002), favorable effects on marijuana use among low- and moderate-risk adolescents in ALERT schools and among high-risk girls in ALERT Plus schools are particularly notable. The media campaign has had no apparent effect on marijuana use, but studies of multi-component prevention programs (e.g., Pentz, 2003) suggest that anti-drug media messages may have value in boosting the effectiveness of school-based prevention curricula. In the ALERT Plus context, this booster effect might take the form of an enhancement of favorable outcomes already apparent among high-risk girls or emergence of a favorable interaction between Campaign exposure and curriculum exposure in the overall adolescent sample. To test these possibilities, we examined effects of Campaign exposure on marijuana use among students also exposed to the school-based curriculum in 9th grade (i.e., students in ALERT Plus schools) and students not exposed to the curriculum in 9th grade (i.e., students in ALERT and control schools).

2. Methods

In ALERT Plus, 45 school clusters, i.e., high schools and their associated middle-school feeder(s), were randomly assigned to two treatment conditions or a control condition.² In one treatment condition, adolescents received the revised ALERT curriculum in 7th and 8th grades but not the ALERT Plus booster lessons in 9th and 10th grades. We refer to this condition as ALERT. In a second treatment condition, adolescents received the middle-school curriculum in 7th and 8th grades and booster lessons in 9th and 10th grades. We refer to this condition as ALERT Plus. Adolescents in the control condition received other prevention curricula already in place at their schools but were not exposed to any part of the ALERT curriculum in any grade. Four school clusters were in cities with more than 50,000 residents; 12 school clusters were in towns of 5000 to 25,000 residents; and the remaining clusters were in rural communities. To enhance pretreatment equivalence across conditions, we used blocking by geographic region and community size and restricted assignment when randomizing schools to conditions (Ellickson et al., 2003).

Data collection procedures and instruments were approved by RAND's institutional review board. To motivate adolescents to participate and to tell the truth, data collectors who administered the surveys in class described the study's procedure for ensuring privacy. Data collectors informed students of their right not to participate and, for those who gave assent, collected a saliva specimen that could be tested to detect drug use. Make-up sessions at school and tracking by mail and telephone were used to request survey completion by students missed in class. Internal consistency of self-report data was quite high within and across waves of data collection (Ellickson et al., 2003).

² The full study design randomized 48 clusters. However, assignment of three clusters was restricted to the ALERT or ALERT Plus conditions. Those clusters were not included in this analysis.

2.1. Analytic sample

Of the 4689 adolescents who completed the baseline survey, 616 (13.1%) missed the 9th grade survey, resulting in a 9th grade sample of 4073. In that sample, 58 were missing data on Campaign exposure. The remaining 4015 adolescents (85.6% of the baseline sample) comprised the analytic sample for this set of analyses. Of that total, 1379 were in 16 clusters receiving ALERT, 1023 were from 14 clusters receiving ALERT Plus, and 1613 were from 15 control clusters. Half of the sample were girls, and 11.7% were non-White, mostly American Indian. Marijuana use was reported by 5.4% in the 7th grade baseline survey. By 8th grade (the year preceding exposure to the media campaign), 19.1% had tried marijuana. See [Table 1](#) for additional background characteristics of the analytic sample.

2.2. Missing data

Adolescents who missed the 9th grade survey were more likely to be non-White and male; to have low grades (C or below); to live with a single parent or stepparent; to have reported use of alcohol, tobacco, or marijuana at baseline; and to have elevated risk factors at baseline (e.g., offers to use drugs and intentions to use drugs). We computed non-response weights to adjust the results for attrition between 7th and 9th grade. Weights equaled the reciprocal of the probability of each adolescent's inclusion at follow-up. This probability was computed from a logistic regression model. Predictors for the model were carefully selected with an indicator of non-response as the modeled outcome, and a rich set of baseline demographic, attitudinal, and behavioral variables as the potential set of predictors, using a boosted regression algorithm ([Ridgeway, 1999](#)) for a binary outcome. The final model for estimating probability of sample inclusion included main effects for sex, race/ethnicity, and monthly smoking at baseline, along with all two- and three-way interactions among these variables. The model also included an indicator of positive beliefs about drugs and the average of the adolescent's estimates of the percentages of tobacco, alcohol, and marijuana users in his/her class.

To compensate for data lost because of item non-response in the predictors, data were multiply imputed using a Bayesian model for the joint distribution of the first two waves of data collection at baseline and 8th grade. We used the NORM software ([Schafer, 1999](#)) to create five sets of imputations

Table 1
Sample characteristics (percent)

Female	49.4
Non-White	11.7
Single parent or stepparent	28.8
Dad high-school dropout	7.5
Mom high-school dropout	5.1
Low grades (mostly Ds or Fs)	3.3
Used tobacco in past month	9.4
Used alcohol in past month	13.0
Tried marijuana (7th grade)	5.4
Tried marijuana (8th grade)	19.1

for each missing value among the predictors. Each imputed dataset was separately analyzed. To produce the overall results reported in this paper, results from the five imputed datasets were combined using Rubin's rules of multiple-imputation inference (Rubin, 1987).

2.3. Measures

2.3.1. Marijuana use

The survey asked, "On how many days did you use marijuana in the last month (past 30 days)?" We converted number of days to a dichotomous measure indicating any use in the past month.

2.3.2. Campaign exposure

Adolescents were asked how often they had seen anti-drug ads "in recent months" in any of five media: television, radio, newspapers or magazines, billboards (on buses, in malls or at sports events), and movie theaters or rental videos. All of these media were targeted in the "full implementation" phase of the Campaign. There were six possible responses: not at all, less than 1 time per month, 1 to 3 times per month, 1 to 3 times per week, daily or almost daily, and more than 1 time per day. Evaluators have analyzed Campaign outcomes in relation to weekly exposure to ads in at least one medium (Hornik et al., 2003b). To maintain consistency with that criterion, we adopted an exposure measure indicating whether or not the adolescent reported seeing ads at least 1 to 3 times per week in any of the five media: television, radio, newspapers or magazines, billboards, and movies or rental videos.³

2.3.3. Covariates

We included covariates to adjust for possible self-selection in Campaign exposure and for propensity to use marijuana. Baseline individual-level covariates were selected by using backwards stepwise deletion on a prediction model fit to a subsample of adolescents in control schools and cross-validated on a holdout sample. These covariates remained in the model: tobacco use, intentions to use tobacco, intentions to use marijuana, resistance self-efficacy in a party situation, beliefs about the consequences of drug use, beliefs about getting addicted to drugs, deviance, drug use by peers and best friends, perceived approval of smoking by friends, offers to use tobacco, and offers to use marijuana. We also controlled for several demographic and family variables including adolescent's sex, race/ethnicity (White or non-White), school grades, parental education and monitoring, tobacco use by an important adult, and whether or not the adolescent lives with both biological parents. All covariates except the following were measured with single items. The resistance self-efficacy measure was based on three items asking what you would do if you were offered a [cigarette, drink, or marijuana] when all your friends at the party were [smoking, drinking, using marijuana] ($\alpha = .85$). The measure of beliefs about drug use consequences was based on 24 items pertaining to perceived consequences of alcohol, cigarette and marijuana use ($\alpha = .89$, see Ghosh-Dastidar et al., 2004). The measure of beliefs about getting addicted was based on three items asking about the likelihood of getting addicted if you [smoked, drank, used marijuana] every weekend ($\alpha = .80$). The six-item deviance measure was based on frequency of stealing; cheating; damaging others' belongings;

³ Some Campaign exposure may have occurred in the past month, but data on the timing of youth-targeted Campaign ads between September 1999 and May 2000 show a slight decline over the period. Thus, almost all exposure to the Campaign occurred before the month for which marijuana use was reported.

Table 2
Effects of weekly Campaign exposure and curriculum exposure on marijuana use among 9th grade adolescents

	Model 1 β	Model 1 t statistic	Model 2 β	Model 2 t statistic
Weekly exposure	−0.18	−1.76	0.06	0.48
Weekly exposure, ALERT	–		−0.27	−1.41
Weekly exposure, ALERT Plus	–		−0.62*	−2.37

Results were adjusted for a total of 20 covariates (see text).

* $p=0.03$.

skipping school; being sent out of class; and breaking into a house, school or place of business ($\alpha=.80$). Peers' drug use was based on six items asking how often you are around kids who [smoke, drink, or use marijuana] and whether your best friend [smokes, drinks, or uses marijuana] ($\alpha=.84$). Parental education was the average educational attainment of father and mother (1=graduated from college to 4=did not finish high school). The three-item parental monitoring scale asked adolescents how often their parents know where they are, how often their parents tell them what time to be home, and how much of their free time is spent with their parents ($\alpha=.50$).⁴ Finally, to account for blocking in the assignment of schools to experimental conditions, we included covariates for the school's geographic location and enrollment size.

2.4. Analytic procedure

As noted above, we used backwards stepwise deletion to select a common set of covariates that predicted Campaign exposure among a subsample of control school adolescents, cross-validating the results on a holdout sample. To account for the fact that drug use among adolescents within the same school is likely to be similar, we adjusted for clustering. To conduct efficient estimation in the presence of intra-cluster correlation, we used the generalized estimating equation (GEE) methods introduced by Liang and Zeger (1986). These methods produce adjusted standard errors and statistical tests that are unbiased in the presence of intra-cluster correlation.

We ran logistic regression models with baseline covariates; the Campaign exposure measure; indicator variables for the two treatment conditions—ALERT and ALERT Plus; and interaction terms crossing exposure with each of the two treatment conditions. The interaction terms compared, within each treatment condition, adolescents reporting weekly exposure to those not reporting weekly exposure.

3. Results

Weekly exposure to the Campaign had no significant main effect on adolescents' marijuana use in the past month ($\beta=-0.18$, $p=0.09$). See Model 1 of Table 2. When interaction terms were added (see Model 2), we saw no evidence that weekly exposure had helped to sustain the prior (8th grade) effect of ALERT on marijuana use. However, the coefficient for weekly exposure in ALERT Plus schools was

⁴ Alpha indicated marginally acceptable internal consistency for the parental monitoring scale. We retained this scale in the model because our purpose was to improve the precision of the model, not to focus on the predictive value of parental monitoring.

negative and statistically significant ($\beta = -0.62$, $p = 0.03$), indicating that the exposure to the Campaign reduced marijuana use among 9th grade adolescents also exposed to a school-based prevention curriculum during the same timeframe. Although the Campaign's main effect approached significance ($p = 0.09$), the sizable difference between coefficients in the two models ($\beta = -0.18$ versus $\beta = -0.62$) confirms the nature of the Campaign's effect—not independent but synergistic.

As reported above, ALERT Plus had a favorable effect on marijuana use among high-risk girls at 9th grade but not in the overall 9th grade sample (Longshore et al., *under review*). It therefore seemed possible that the apparent synergy between ALERT Plus and Campaign exposure, found here in the overall sample, might reflect an interaction occurring only among high-risk girls or among high-risk boys and girls. We first repeated the analysis for high-risk girls, defined as those who reported use of either marijuana or tobacco at baseline. (Tobacco users were included because the number of girls reporting marijuana use at baseline was too low for reliable analysis.) The coefficient for weekly exposure among high-risk girls in ALERT Plus schools was nonsignificant ($\beta = -0.89$, $p = 0.13$). We then combined girls and boys at high risk, defined on the basis of marijuana use at baseline. (Tobacco users were excluded because the number reporting marijuana use sufficed for analysis.) In this combined high-risk subsample, interaction between weekly exposure and ALERT Plus was nonsignificant ($\beta = -1.24$, $p = 0.23$). Finally, we ran the analysis among low-risk adolescents, defined as those who reported no marijuana use at baseline. The interaction between weekly exposure and ALERT Plus was negative and marginally significant ($\beta = -0.53$, $p = 0.06$).

Although ALERT Plus targeted tobacco and alcohol use as well as marijuana use, the Campaign focused on marijuana use. Main analyses therefore focused on possible interaction between ALERT Plus and the Campaign with respect to marijuana use. In ancillary analyses (data not shown), we determined whether ALERT Plus and the Campaign interacted in predicting tobacco or alcohol use. No such interaction was apparent in the overall sample or any of the high- and low-risk subsamples.

4. Discussion

The goal of the National Youth Anti-Drug Media Campaign is to combat adolescents' use of illegal drugs, marijuana in particular, by means of an advertising and social marketing program focusing on the dangers of drug use. The multiyear evaluation of the Campaign has found no evidence of a favorable effect on marijuana use or related cognitive outcomes. However, evaluations of multi-component prevention programs suggest that anti-drug media messages may be effective if delivered in tandem with prevention lessons taught in the classroom.

The 9th grade year of ALERT Plus coincided with the "full implementation" phase of the Campaign and thus enabled us to examine the possibility that the Campaign had a favorable effect among 9th grade adolescents exposed both to anti-drug media messages and to school-based prevention during the same timeframe. Because main effects of ALERT Plus on marijuana use were confined to high-risk girls at 9th grade, our analyses extended beyond the overall sample to focus additionally on high- and low-risk subsamples. Results in the overall sample showed that marijuana use in the past month was significantly less likely among adolescents who received both the ALERT Plus curriculum and weekly exposure to the Campaign's anti-drug media messages. ALERT

Plus also appeared to have a moderator effect on exposure to pro-alcohol advertising (Ellickson et al., 2005). In analyses of high- and low-risk subsamples, marijuana use was consistently less likely among ALERT Plus adolescents with weekly Campaign exposure. Significance levels in subsample analyses did not meet the conventional .05 criterion. While the coefficient in the low-risk subsample was close to significant ($p=.06$), we believe the most defensible conclusion is that interaction between ALERT Plus and the Campaign occurred in the overall sample. First, significance for that interaction did meet the conventional .05 criterion. Second, coefficients in subsample analyses were consistently negative and substantial, even if not statistically significant; the interaction was apparent “across the board.” Finally, and most important, the coefficient in the overall sample was no weaker (was actually slightly stronger) than the coefficient in the low-risk subsample. Thus there was no indication that merging high- and low-risk adolescents diminished the strength of the signal detected in the low-risk subsample.

Murray, Prokhorov, and Harty (1994) concluded that media campaigns may be a useful supplement to school-based drug prevention. However, “in the absence of a sufficiently strong school-based program, even a strong mass-media campaign may have little impact...” (Murray et al., 1994: 59). We concur with this view but also note that the effect of ALERT Plus on marijuana use at 9th grade was confined to high-risk girls. ALERT Plus had no apparent effect in the full sample. On the other hand, when testing for synergy between the Campaign and ALERT Plus in the full sample, we observed a reduction in marijuana use among adolescents who received ALERT Plus lessons as well as weekly exposure to the Campaign. Hence, in this analysis, the synergy was reciprocal. Neither ALERT Plus nor the Campaign had a substantial effect on marijuana use in the absence of the other. It is also notable that our measure of the Campaign’s impact was based on weekly exposure, not on any exposure. The meta-analysis by Derzon and Lipsey (2002) showed that favorable if modest effects are more likely in media campaigns delivering anti-drug messages repeatedly than in “one shot” campaigns.

While amount of exposure appears important, the content of Campaign messages may also have been crucial. Like ALERT Plus and other effective school-based curricula, the Campaign was based on a social influence model. Media messages consistently reflected the three themes of its communication strategy—resistance self-efficacy, anti-drug norms, and negative consequences of use. Thus, the synergy achieved between the Campaign and ALERT Plus was in substantive content as well as timing. As argued by Flay (2000, page 861), school-based prevention programs “cannot hope to have lasting effects unless the broader social environment is also changed to be more supportive of . . . newly changed attitudes, normative beliefs, and social skills.”

Exposure to ALERT Plus was under experimental control, but exposure to the Campaign was not. A causal reading of these results is therefore uncertain. However, for three reasons, that reading is supportable. First, causal interpretation is consistent with the temporal order of our data. The recall period for marijuana use (past month) covered a time period subsequent to exposure to the Campaign (recent months) and to the curriculum (typically several months prior). Second, we conducted a systematic search for background variables related to Campaign exposure and included these as covariates in all analyses as a control for self-selection. Third, if either self-selection or social desirability were affecting reports of marijuana use, we might have seen evidence of similar effects on other substance use. However, we found no evidence of the interaction between ALERT Plus and Campaign exposure in predicting either tobacco or alcohol use. Slater and Kelly (2002) have argued that nonexperimental outcome data can be examined for evidence of discriminant validity. That is, exposure

to a media campaign should influence outcomes that are addressed in the messages and have little or no impact on outcomes that the messages do not address. “The presence of discriminant validity in exposure effects is strong evidence” that outcomes are not an artifact of social desirability or other alternative explanations (Slater & Kelly, 2002, p. 373).

Limitations of this analysis should nevertheless be noted. First, while we were able to maintain contact with most adolescents across multiple years of data collection, attrition was neither negligible nor random. Adolescents who missed the 9th grade survey were more likely to be non-White and male; to have low grades, to live with a single parent or stepparent; to have reported use of alcohol, tobacco, or marijuana at baseline; and to have elevated risk factors at baseline (e.g., offers to use drugs and intentions to use drugs). We carefully adjusted findings to account for possible effects of attrition, but we cannot be sure that such effects were eliminated.

Second, for comparability to the Campaign evaluation, we converted the exposure data to a dichotomous measure indicating whether the adolescent reported seeing an ad in any medium at least weekly. Because an adolescent could have seen messages in two or more media on a weekly basis and in any single medium more often than weekly, this measure does not capture all possible variation at the upper end of exposure, i.e., beyond the weekly level. However, the measure does suffice to establish the existence of a “dose response” relationship between marijuana use and exposure to the Campaign among adolescents in ALERT Plus schools, and such evidence provides additional support for a causal interpretation of these results (Slater & Kelly, 2002).

Third, we were not able to delve into the processes underlying synergy between ALERT Plus and the Campaign. Adolescents were not asked to indicate which of the Campaign’s messages they had seen or when they had seen them. Thus, outcomes could not be linked to the content or format of specific messages, and it was not possible to test the possible relevance of sequence in exposure to school-based lessons and messages in the media.

Anti-drug messages may, on their own, have a modest influence on the behavior of youth at low risk—a possibility detected in the meta-analysis by Derzon and Lipsey (2002) and hinted in our own results. Favorable effects on youth at high risk may also be possible if campaign messages are tailored specifically to that subpopulation (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001; Stephenson, 2003). However, tailoring messages to adolescents at high risk may undermine effectiveness with those at moderate and low risk, resulting in a lost opportunity to maximize overall impact. Our results suggest that the effects of anti-drug media messages and school-based drug prevention are broadest and most substantial when both are delivered in tandem.

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COMMUNITY REACTIONS TO CAMPAIGNS ADDRESSING CRYSTAL METHAMPHETAMINE USE AMONG GAY AND BISEXUAL MEN IN NEW YORK CITY*

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Abstract

Crystal methamphetamine (*aka* “crystal meth”) use with high-risk sex has become an emerging health problem for gay and bisexual men in New York City since the late 1990s. Public health campaigns were eventually developed to encourage gay and bisexual men to avoid or reconsider using crystal meth. Reactions to three campaigns were measured with a cross-sectional survey administered in 2004. Among an ethnically-diverse sample of 971 gay and bisexual men, 61.8% reported seeing the campaigns. Those who reported ever using crystal meth, recent use, and recent use with sex were significantly more likely to have seen the campaigns. In general, white men, HIV-negative men, and men not currently using crystal meth responded more positively to the campaigns than their counterparts; yet, more men of color reported having discussions with partners and friends about their crystal use as a result of these campaigns. Implications for researchers and practitioners are discussed.

The National Survey on Drug Use and Health (NSDUH) revealed that, in 2004, over 19 million Americans ages 12 and over (i.e., 8% of this population) were estimated as current illicit drug users (i.e., drug use within the month prior to the survey) (SAMHSA, 2005). More specifically, the regional rate of current illicit drug use reported for the Northeast (i.e., Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, Pennsylvania, and New York) was 8.4% (SAMHSA, 2005). Regarding stimulant use, over 1.2 million people ages 12 and over reported current use of these drugs; almost half (583,000) were methamphetamine users (SAMHSA, 2005).

Recent media coverage has brought much attention to the negative impact of crystal methamphetamine (or “crystal meth”) use on the biopsychosocial health of many Americans. An article from *Newsweek* magazine refers to the surge in crystal meth use as “America’s new drug crisis” (Jefferson, 2005). A recent survey of law enforcement agencies in 45 American

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states highlighted crystal meth use as the nation's top drug problem (O'Bryan, 2005). This problem has even prompted United States government officials to pass a law that severely limits the amount of pseudoephedrine sold over the counter at numerous retailers around the country; pseudoephedrine, the main ingredient in many cold and allergy medications, is used to manufacture crystal meth (Associated Press, 2006). Meanwhile, recent studies have documented how rates of crystal meth use among gay and bisexual men have been steadily increasing since the late 1990s (Frosch, Shoptaw, Huber, Rawson, & Ling, 1996; Nanín & Parsons, 2006; Reback, Larkins, & Shoptaw, 2004; Semple, Patterson, & Grant, 2002).

Crystal meth is also known as "Tina," "crystal," "ice," and "speed," among other names (Halkitis & Parsons, 2002; Jones, 2005; Nanín & Parsons, 2006). Its use is feared to be reaching epidemic levels and driving increases in HIV infections and other STIs, including syphilis, due to unsafe sexual practices among some MSM (men who have sex with men) (Jacobs, 2002; Nanín & Parsons, 2006; Purcell, Moss, Remien, Parsons, & Woods, 2005; Purcell, Parsons, Halkitis, Mizuno, & Woods, 2001; Urbina & Jones, 2004; Wong, Chaw, Kent, & Klausner, 2005). MSM in San Francisco who report crystal meth use are at least three times more likely to be living with HIV (Gordon, 2005). A recent San Francisco study reported HIV incidence of 6.3% per year among a sample of 290 MSM meth users compared to 2.1% per year among a sample of 2701 non-meth users (Buchacz et al., 2005). In addition, HIV-positive MSM methamphetamine users reported more acts of unprotected receptive anal sex with HIV-negative or unknown status partners and reported being twice as likely to have unprotected anal sex with partners of HIV-negative and unknown status (Purcell et al., 2005).

Crystal meth use may be driven by numerous factors, some which may be perceived by users as positive ones. The drug has been described as increasing sexual arousal, lowering inhibitions, increasing self-confidence, and influencing decisions to have unsafe sex with partners (Jones, 2005; Semple et al., 2002; Semple, Patterson, & Grant, 2003; Shoptaw et al., 2005). This drug is popular among gay and bisexual men for use in PnP, or "Party-n-Play." (i.e., drug use before and during sexual activity) (Hirshfield, Remien, Humberstone, Walavalkar, & Chiasson, 2004; Nanín & Parsons, 2006). In addition to smoking and snorting the drug, some MSM report administering the drug anally (Halkitis, Parsons, & Wilton, 2003; Parsons, 2005). This type of administration of the drug along with unprotected "marathon sex" with numerous partners can damage the rectal lining and increase the likelihood of HIV and other STI transmission (Semple et al., 2002).

Use of crystal meth has made its way eastward across the United States, heavily impacting states, like New York and Florida (ASTHO, 2005). Toward the late 1990s, crystal meth became an emerging drug of choice among a significant number of gay men on the East coast, particularly in New York City (Halkitis, Parsons, & Wilton, 2003). Most published articles on crystal meth use among gay and bisexual men focus on samples from the West coast; recent studies in Miami (Kurtz, 2005) and New York (Nanín & Parsons, 2006) have described what appears to be an emerging phenomenon among East coast gay men. A recent study of a community-based sample of MSM in New York City found a slight decrease in lifetime use of crystal meth among MSM (19.9% in 2003 vs. 20.5% in 2002), but increased recent use (10.6% used meth in the 3 months prior to survey administration vs. 7.8% in 2002) (Nanín & Parsons, 2006). Because of these and similar results in other studies, New York City health advocates are forging ahead with efforts to combat this emerging public health issue (New York City Department of Health and Mental Hygiene, 2004; Reuters, 2004). Considering the increased documentation of HIV risk behaviors linked to crystal meth use (Halkitis, Parsons, & Stirratt, 2001; Nanín & Parsons, 2006; Semple et al., 2002; Semple et al., 2003), the response has never been more timely.

A significant response from the service provider community concurrently emerged along with the documented rise in HIV risk behaviors and crystal meth use. More than 20 Crystal Meth Anonymous (CMA) meetings are now conducted weekly at various locations around New York City (Owen, 2004). In addition, just as in other parts of the country with significant populations of crystal meth-using MSM [e.g., Boston, Fort Lauderdale, Los Angeles, Provincetown, and Seattle (Kaufman, 2003; O'Bryan, 2005)], community activists and health professionals in New York City have developed public health messages used in social marketing campaigns to help stop the rise of crystal meth use among gay male New Yorkers (ASTHO, 2005; Douglas, 2005).

Social marketing and similar public health campaign approaches have been used widely to promote healthy behaviors among specific sectors of large communities (e.g., adolescents, women, and gay men) (Andreasen, 1995; Kotler, Roberto, & Lee, 2002; Siegel & Doner, 1998; Weinrich, 1999). Social marketing is defined as “a process of designing, implementing, and controlling programs to increase the acceptability of a pro-social idea among population segments of consumers” (Dearing et al., 1996, p. 345). It is an approach that, until recently, was rarely used with marginalized populations (e.g., gay and bisexual men) (Dearing et al., 1996), yet it is recognized by the United States Centers for Disease Control and Prevention (CDC) as an effective health communication strategy that works well with health education and health promotion for various populations (CDC, 2005).

To reach large communities of gay and bisexual men, this approach can be less expensive and more cost-effective for heightening awareness of important health and psychosocial issues. These types of community-oriented health communication strategies have been widely used and can be effective when health messages are disseminated in a culturally-competent manner with language and images that community members can comprehend and relate to (GLMA, 2001). For example, Montoya et al. (2005) found that an effective social marketing campaign in San Francisco helped in increasing syphilis testing rates among gay and bisexual men because of its frank approach and creative imagery.

Anti-crystal meth social marketing campaigns in New York City started in early 2004 when activist Peter Staley used his own money to fund a campaign in response to what he perceived as a situation that was getting out of control in the gay male community (Osborne, 2003; Owen, 2004). Staley's campaign consisted of colorful, eye-catching phone booth posters and magazine ads (“Buy Crystal, Get HIV For Free,” see Figure 1). Public reaction was intense on both sides; some supported his need to raise awareness while others accused him of trying to stagnate gay men's sexual liberation (Owen, 2004).

As a result, public forums were conducted by a newly-formed grassroots group called the HIV Forum, which included Staley. These community forums allowed gay and bisexual men who were concerned about this issue to voice their concerns as well as learn more about this drug (Owen, 2004). As a result of rising concern, the HIV Forum and Gay Men's Health Crisis followed with public health campaigns to address the issue (refer again to Figure 1) (Osborne, 2004; Owen, 2004). To date, there has been no empirical study to assess the gay community's reactions to these pioneering campaigns. The purpose of the present study was to fill this void in the literature.

METHOD

Participants and Procedure

In fall 2004, a cross-sectional brief street-intercept survey method (Miller, Wilder, Stillman, & Becker, 1997) was used to administer a questionnaire to 1617 participants at two large-scale gay, lesbian, and bisexual (GLB) community events in New York City through the Sex and

Love v3.0 Survey Project. This approach to collecting data has been used in numerous studies (Carey, Braaten, Jaworski, Durant, & Forsyth, 1999; Chen, Kodagoda, Lawrence, & Kerndt, 2002; Kalichman & Simbaya, 2004a, 2004b), including those focused on GLB persons (Benotsch, Kalichman, & Cage, 2002; Kalichman, et al., 2001) and has been shown to provide data that are comparable to those obtained from other more methodologically rigorous approaches (Halkitis & Parsons, 2002). The two events required paid admission to gain entry. The Institutional Review Board at the second author's home institution approved the project.

At both two-day events, the research team hosted a booth, and each person who passed by the booth was actively approached by outreach staff trained in survey administration and working with the GLBT community. Potential participants were provided with information about the project and offered the opportunity to participate. The response rate was high, with 84.4% of individuals consenting to participate. Those who consented and completed the 15–20 minute survey were provided with a voucher for free admission to a movie as an incentive. To help ensure their confidentiality, participants were given the survey on a clipboard so that they could step away from others to complete the questionnaire. In addition, upon completion, participants deposited their own survey into a secure box at the booth.

Complete surveys were obtained from 1214 gay and bisexual men over the age of 18. The data analyzed for this study is based upon the 80% of the men in the sample who provided zip codes from NYC, northeast NJ, Long Island or Westchester/Rockland counties ($n = 971$). Even though the campaign was implemented only in Manhattan, these zip codes represent the residence areas of respondents who visit venues in Manhattan and were potentially exposed to these campaigns.

Measures

The larger survey assessed a broad range of sexual behaviors, history of sexually transmitted infections, substance use, physical health, and a series of scales related to psychological health and well-being. The researchers chose specific scales from the survey in order to produce and analyze the data reported in this article.

In order to measure the relationship between unsafe sexual behavior and crystal meth use, one of the most pertinent issues addressed by the campaigns discussed in this article, respondents were asked whether or not they identified as “barebackers.” The practice of barebacking refers to intentional as well as unintentional unprotected sex, primarily anal sex (Bimbi & Parsons, 2005; Silverstein & Picano, 2003). Responses to our survey item were based on a dichotomous “Yes/No” response scheme.

Crystal meth use for each of the following time periods was also assessed using items with “Yes/No” response schemes: lifetime use (“ever used in your life?”), recent use (“used in the last 3 months?”), and recent use with sexual activity, colloquially referred to as “Party-n-Play,” or “PnP” (“used with sex in the last 3 months?”).

Respondents were also asked to mark “yes” or “no” to an item assessing exposure to the anti-crystal meth campaigns: “Have you seen any of the following advertisements: ‘Crystal Meth: Nothing to Be Proud Of,’ ‘Buy Crystal, Get HIV Free,’ and ‘Crystal Meth: Know the Risks’?” Because all the campaigns were disseminated simultaneously, the research did not set out to assess exposure and reaction to each individual campaign. Those who answered in the affirmative were then asked five questions regarding their reactions to the advertisements (e.g., “These ads made me think about not starting to use crystal or cutting down on my use,” “These ads made me want to talk to my friends/partner about their use of crystal”). The items were developed based on information gathered from gay press reports on community reactions to

these campaigns (e.g., Owen, 2004). In addition, the items set out to test diffusion of messages disseminated by these campaigns. Responses were coded on a Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree). Exploratory factor analyses revealed that the 5 items loaded on a single factor accounting for 47.36% of the variance. The scale achieved an alpha of .72. (See Table 1 for specific survey items.)

For demographic characteristics, respondents were asked to indicate their age, sexual identity, and race/ethnicity, by checking all that apply. Response categories to race/ethnicity included “European/White,” “African-American,” “Asian/Pacific Islander,” “Hispanic/Latino,” and “Other (Specify).” The latter four categories comprise the new category, “men/MSM of color,” which was used in data analysis. (*Please note:* This last category is represented as “non-white” in Table 2.)

Analyses

Data were entered into an SPSS database. These data were subsequently verified by project staff for accuracy. In addition to routine frequency distributions determined for demographic variables, chi-square statistical tests with relevant odds ratios were conducted to test for differences between subgroups in the sample. Because there were no differences in key variables by the two recruitment events, the data for this study were combined for all analyses.

RESULTS

The majority of the sample (93.7%) was gay-identified, with the remainder identifying as bisexual. Most reported having full-time jobs (71.4%; $n = 688$) and living in Manhattan (54.3%; $n = 527$). Other sample characteristics, including age, education, self-reported HIV status, and income, are presented in Table 3. The majority of respondents reported being HIV negative, with 73.3% ($n = 561$) of the overall sample having tested negative within the last year. Over seven percent of the sample (7.8%; $n = 76$) reported never being tested or not knowing their status and 13.4% ($n = 130$) reported being HIV positive, a third of which learned about their HIV status 4 years ago or sooner.

Respondent Crystal Meth Use

“Crystal meth use ever” was reported by 19.3% of the sample. Recent use (i.e., in the last 3 months) was reported by 9.4%. Recent use with sex (i.e., “PnP”) was reported by 73.4% of users (or 6.9% of the total sample). No significant racial, educational, or employment differences in use of crystal were found; *however*, in terms of HIV serostatus, HIV positive men were significantly more likely to report ever using crystal meth (38.7% vs. 16.3%, OR = 3.23, $p < .001$) and recent use of crystal (22.7% vs. 7.4%, OR = 3.66, $p < .001$) as well as recent PnP behaviors (16.8% vs. 5.5%, OR = 3.49, $p < .001$).

Manhattan residents were more likely than residents outside of the borough to report ever using crystal meth (25.0% vs. 12.5%, OR = 2.35, $p = .000$), recent use (11.9% vs. 6.4%, OR = 1.98, $p < .01$), and recent PnP behaviors (9.2% vs. 4.1%, OR = 2.40, $p < .01$). Men who reported annual incomes of less than \$80,000 were less likely than men making more than \$80,000 annually to report ever using crystal meth (28.4% vs. 16.6%, OR = 2.00, $p = .000$), recent use (14.8% vs. 7.7%, OR = 2.10, $p < .01$), and recent PnP (11.6% vs. 5.3%, OR = 2.33, $p < .01$). (Note: All other income categories were statistically different from the “\$80,000 and over” category; thus, the former categories were collapsed to determine appropriate odds ratios.)

Exposure and Reactions to Anti-Crystal Campaigns

A total of 61.8% of the sample reported being exposed to the anti-crystal campaigns (i.e., seeing any of the three campaign slogans previously mentioned). No differences were observed in campaign exposure in terms of data collection site, race, HIV status, or age. Those who reported lifetime use (82.6% vs. 64.5%, OR = 2.61), recent use (85.5% vs. 64.8%, OR = 3.10), and recent PnP use of crystal (85.2% vs. 66.2%, OR = 2.95) were significantly more likely to have seen the campaigns ($p < .001$).

The proportions of the sample that answered in the affirmative for each of the five items regarding the campaigns are presented in Table 1. Even though many men responded positively to the campaigns, there was a sizable proportion of respondents (11.9%) who reported wanting to use crystal *more* as a result of seeing the campaigns.

Summary of Significant Differences for Survey Items

Table 2 summarizes various differences between groups for each of the survey items that assess reactions to the New York City anti-crystal meth campaigns. Results show that white gay and bisexual men in comparison to gay and bisexual men of color (represented as “non-white” in the table) were more likely to agree with statement 1 (“Think about not starting to use crystal or cutting down on my use”) and statement 2 (“Glad someone was doing something about crystal use in the gay community”), as were HIV negative men and men who indicated they were not barebackers. Among men who reported ever using crystal, those who had NOT used crystal recently or NOT used recently with sex were more likely to agree with statement 2, while men who participated in recent crystal use with sex were more likely to agree with statement 3 (“Want to start using crystal or to use crystal more”). Among all men in the sample, men of color (“non-White”) were more likely to agree with statement 4 (“Want to talk to my friends/partner about their use of crystal”). Men who did NOT identify as barebackers were also more likely to agree with statement 5 (“Want to get help to stop using crystal or avoid starting to use”). All resulting p -values were less than .05.

DISCUSSION

In this New York City sample, gay and bisexual male Manhattan residents with annual incomes of more than \$80,000 reported the most lifetime and recent use as well as recent PnP use of crystal meth. In addition, gay and bisexual male community reactions to the anti-crystal methamphetamine campaigns appear to have been mixed. White men, HIV-negative men and men not currently using crystal responded more positively to the campaigns. The campaign may have intended to reach out to a broader population of gay and bisexual men, including HIV-positive men and men of color, but the present study shows it was less effective in this sense.

It must be mentioned that the campaign materials featured white men and were disseminated mostly in Chelsea, a neighborhood in New York City with a significant proportion of white gay and bisexual male residents. Over a decade ago, Stall (1994) called for a re-evaluation of HIV prevention efforts, including public health campaigns, to focus on expanding its messages beyond the reach of middle class, white gay men in order to effectively win the battle against HIV/AIDS. Results of the current study should encourage creators of anti-crystal meth campaigns in New York City and other urban areas in the United States to include communities of color as well as communities of current meth users in the planning and development process of these campaigns in order reach these communities more effectively.

As reported in this study, more men of color responded positively to the item asking about having discussions with partners and friends about their crystal use (i.e., survey item 4). There is no known literature showing evidence that gay and bisexual men can be encouraged by social marketing campaigns to speak with their peers and their partners, yet it has been reported that young gay and bisexual men of color with good sexual communication skills may be less likely to contract HIV (Seal et al., 2000). Better sexual communication skills may be related to HIV protective behaviors for young gay and bisexual men of color. A possible contributing factor to this may be comfort with confronting their friends and partners about the effects of their crystal use. Young men of color need to be involved in activities where they communicate with each other in order to challenge peer norms, in this case, those norms that relate to the acceptance of crystal meth use among peers (Mason, 2003).

On another note, several findings demonstrated that the campaigns may not be as effective with certain types of gay and bisexual men. Men who reported recent use of crystal meth with sex were more likely to report that the campaigns triggered urges to use, an unfortunate unintended result of the campaigns. It is possible that the campaigns were perceived by some gay and bisexual men as trying to instill fear of HIV infection or negative consequences of crystal meth use. If this is the case, then this result provides further evidence that fear-based campaigns are ineffective at preventing negative health behaviors because they run the risk of reinforcing these behaviors and may encourage denial among some members of the intended population of interest (Murphy & Bennett, 2004; Shernoff, 2005). A recent meta-analysis by Albarracín et al. (2005) further supports the idea that fear-based approaches do not seem effective in changing health behaviors.

It was found that men who did not identify themselves as barebackers and men who did not report unprotected sex with HIV serodiscordant partners agreed that they wanted to get help to stop or avoid using crystal (statement 5). Such non-sexual risk taking men may be concerned about the risk of unprotected sex widely associated with crystal. This result can be considered the inverse of rising evidence showing that barebackers and men who have unprotected sex with serodiscordant partners are more likely to use crystal meth (Halkitis, Parsons, & Stirratt, 2001). Health promotion messages that challenge the perceived sexual benefits of crystal meth use and clearly delineate the relationship of crystal use to unprotected sex may be more appropriate for campaigns focusing on MSM in New York City. Gay Men's Health Crisis (GMHC), the first AIDS organization in New York City and the second oldest in United States, supports the idea of the gay community creating messages that provoke its members in thinking differently about the "benefits" of crystal meth use (Osborne, 2004). In addition, Wong et al. (2005) advocates for the integration of messages addressing crystal meth and Viagra[®] use in syphilis prevention efforts due to evidence showing that simultaneous use may be very dangerous to physical and mental health.

Limitations

Although the men in the sample reported residences in all five boroughs of New York City, this study used a sample of gay men who attended a LGBT-oriented event that required paid admission. Because of this, it is not known how men who did not attend this event reacted to the campaigns described in this article. In addition, statement 4 ("... want to talk to my friends/partner about their use of crystal") is phrased in such a way that directionality and focus of the conversation is not clear. Thus, we cannot report whether respondents who answered in the affirmative were implying that they wanted to speak to their friends or partners about the negative uses or the positive uses of crystal. It may also be argued that these discussions may be very different with friends and partners.

Implications

The fact that in this study white men, HIV-negative men and men not currently using crystal responded more positively to the campaigns may indicate positive implications for prevention efforts prioritized for this particular segment of gay and bisexual men. Yet, the plight of gay and bisexual men, particularly Black, and Latino men, is duly noted. Recent reports show that, in a study of MSM across five U.S. cities, HIV-positive Black MSM report a staggering disproportionate rate of unrecognized HIV infection (64%) compared to Latino (18%), white (11%), and other race (6%) (CDC, 2005). The same report shows that HIV prevalence was highest among Black MSM (46%) compared to whites (21%) and Latinos (17%). Whether or not these high rates are due in part to crystal meth use is not yet clear. Community organizations in New York City such as Gay Men of African Descent are embarking on educational interventions and political activities to address this issue (Nanín, 2004). Researchers need to collaborate with educators, health department officials, and community members to ensure proper and effective assessment of HIV risk behaviors among MSM, including crystal meth use, in all communities.

Since this study revealed a link between crystal meth use and income as well as area of residence, researchers and service providers may also need to assess the impact of social and contextual factors (e.g., social proximity, social status, sexual and other social relationships) on sexual risk behaviors and drug use in order to develop a more complete picture of this phenomenon. Social network analysis, an increasingly popular academic perspective, uses theoretical models, methods, and techniques from various disciplines (i.e., anthropology, psychology, and sociology) to better understand social relationships and how these relationships impact individual and group behavior (Valente, Gallaher, & Mouttapa, 2004). It may behoove creators of HIV and anti-crystal meth campaigns to link with the social networks of particular sectors of gay and bisexual men (e.g., gay and bisexual men of color) in order to create better health promotion messages based on community norms and to disseminate prevention messages more effectively. Fortunately, anti-crystal meth campaigns for gay and bisexual men of color have recently been developed and implemented by the Lesbian, Gay, Bisexual, and Transgender Community Center, Harlem United, and People of Color in Crisis, Inc., all community-based social service agencies located in New York City.

Lastly, assessments of community reactions to campaigns in other cities dealing with crystal meth and HIV concerns (e.g., Washington, DC; O'Bryan, 2005) need to be implemented. Assessment of current and future public health campaigns will ensure effective and timely approaches are always in existence when necessary. In addition to campaigns that extol the virtues of not using crystal meth at all (i.e., a primary prevention messages), messages that extol the offer to help when one is ready to give up crystal use need to be disseminated (Weinstein, 2005).

Information from this study can assist in the formation of future anti-crystal meth and other health promotion campaigns targeting specific groups of gay/bisexual men. Fisher et al. (1996) acknowledged that HIV-related social marketing to gay and bisexual men is an immense task; campaigns will be more likely to increase motivation for healthy behavior change as long as they incorporate acknowledgment of personal losses, concerns about the epidemic, and conflicting feelings about one's personal decision-making into related health promotion messages. Today, health officials may find it necessary to recognize the many issues related to crystal meth and other drug use use along with other HIV prevention messages.

In addition, knowledge of trends in risk and protective behaviors that exist in this community can effectively guide the formation of public health and social marketing campaigns (Dodds, Mercey, Parry, & Johnson, 2004). Longitudinal studies assessing the prevalence of crystal meth

use among gay and bisexual men and related risk behaviors is absolutely necessary to inform effective educational efforts, including public health campaigns. Increased amounts of timely campaigns can assist in meeting the objectives of reducing health disparities as outlined in Healthy People 2010 (DHHS, 2000). More importantly though, in addition to effective campaigns, holistic anti-crystal meth prevention and treatment programs for gay men on individual, group, and community levels are absolutely necessary to aid in the reduction of these health disparities, especially in relation to HIV/AIDS. To quote Burney (2005), “[c] onfronting the HIV epidemic without an effective anti-crystal meth program is like trying to reduce heart disease without tackling cigarette smoking.”

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Gay Pride 1994

Gay Pride 2004

WHEN WE CAME TOGETHER TO CELEBRATE STEADYROLL 25, HIV INFECTION RATES AMONG GAY MEN WERE IN A STEADY DECLINE. TODAY YOU CAN PARTY ANY NIGHT EVER LEAVING YOUR APARTMENT, AND HIV INFECTION RATES ARE INCREASING AGAIN ON THE HEELS OF A 1000% INCREASE IN SYRILIX AND AN EPIDEMIC OF CRYSTAL METH USE.

Crystal Meth: Nothing to be proud of.

CRYSTAL METH WORKING GROUP • HIV FORUM WWW.HIVFORUM.ORG

HUGE SALE!

BUY CRYSTAL get HIV FREE

BONUS SPECIAL

Buy 100mg quantity FREE & 100mg quantity FREE

My rule was to always use condoms... then I tried some crystal and forgot all my rules. Now I have HIV.

Crystal: It's dangerous. Know the risks.

If you use crystal and want to stop or reduce your use, we are here to support you. GMHC offers drop-in substance use and sexual health counseling weekdays from 4:00-7:00 PM. Other times available by appointment. All services are free, confidential and available in Spanish.

For information about crystal, our services, and HIV testing, call 1-800-AIDS-4YOU or visit www.gmhc.org.

GMHC The Trust Building 110 West 20 Street
L30 10015 • NYC • 212-693-1100

HIV Next

Figure 1. Anti-crystal meth campaign ads.

Table 1
Proportions of Affirmative Responses to Campaign Exposure Statements

These ads made me . . .	% agree
1. Think about not starting to use crystal or cutting down on my use	58.4%
2. Glad someone was doing something about crystal use in the gay community	75.9%
3. Want to start using crystal or to use crystal more	11.9%
4. Want to talk to my friends/partner about their use of crystal	38.7%
5. Want to get help to stop using crystal or avoid starting to use	36.1%

Table 2
Group Differences in Reaction to Anti-Crystal Meth Campaigns in New York City

Groups compared	Percentage of agreement	OR	CI
Item 1. Think about not starting to use crystal or cutting down on my use			
White vs. Non-white *	62% vs. 52%	1.49	1.05– 2.11
HIV negative/unknown vs. HIV positive *	60% vs. 47%	1.68	1.04– 2.70
Non-barebacking vs. Barebacking *	60% vs. 43%	2.05	1.16– 3.62
Crystal users: No recent use vs. recent use	63% vs. 52%		
Crystal users: No PnP vs. recent PnP	63% vs. 46%		
Item 2. Glad someone was doing something about crystal use in the gay community			
White vs. Non-white *	81% vs. 68%	2.0	1.35– 2.95
HIV negative/unknown vs. HIV positive *	78% vs. 61%	2.29	1.39– 3.76
Non-barebacking vs. Barebacking *	78% vs. 56%	2.81	1.58– 5.0
Crystal users: No recent use vs. recent use	89% vs. 68%	3.66	1.36– 9.9
Crystal users: No PnP vs. recent PnP *	88% vs. 64%	4.03	1.59– 10.2
Item 3. Want to start using crystal or to use crystal more			
White vs. Non-white	10% vs. 15%		
HIV negative/unknown vs. HIV positive	11% vs. 15%		
Non-barebacking vs. Barebacking	11% vs. 13%		
Crystal users: No recent use vs. recent use	10% vs. 23%		
Crystal users: No PnP vs. recent PnP *	11% vs. 27%	2.95	1.09– 7.98
Item 4. Want to talk to my friends/partner about their use of crystal			
White vs. Non-white *	35% vs. 45%	1.49	1.05– 2.11
HIV negative/unknown vs. HIV positive	39% vs. 36%		
Non-barebacking vs. Barebacking	39% vs. 31%		
Crystal users: No recent use vs. recent use	48% vs. 44%		
Crystal users: No PnP vs. recent PnP	49% vs. 40%		
Item 5. Want to get help to stop using crystal or avoid starting to use			
White vs. Non-white	35% vs. 39%		
HIV negative/unknown vs. HIV positive	37% vs. 33%		
Non-barebacking vs. Barebacking *	37% vs. 24%	1.91	1.01– 3.65
Crystal users: No recent use vs. recent use	40% vs. 36%		
Crystal users: No PnP vs. recent PnP	40% vs. 35%		

* $p < .05$

Table 3

Participant Demographics

Sample characteristics	%	<i>n</i>
Race/Ethnicity		
African-American	9.1	88
European/White	61.6	598
Latino	16.4	159
Asian/Pacific Islander	7.5	73
Other	5.5	53
Age		
18–30	26.9	261
31–40	33.6	326
41–49	25.4	247
50 and over	14.1	137
HIV status		
Positive	13.4	130
Negative	78.8	765
Unreported	7.8	76
Education (<i>n</i> = 964)		
Less than Bachelor's degree	33.0	318
Bachelor's degree	32.1	309
More than Bachelor's degree	35.0	337
Relationship status		
Single	57.5	558
Partnered, non-monogamous	20.1	195
Partnered, monogamous	22.5	218
Income (<i>n</i> = 954)		
Less than 20K	17.4	166
20–40K	20.3	194
40–60K	24.9	238
60–80K	14.8	141
More than 80K	22.5	215

Television Campaigns and Adolescent Marijuana Use: Tests of Sensation Seeking Targeting

ABSTRACT

Objectives. This study evaluated the effectiveness of targeted televised public service announcement campaigns in reducing marijuana use among high-sensation-seeking adolescents.

Methods. The study used a controlled interrupted time-series design in 2 matched communities. Two televised antimarijuana campaigns were conducted in 1 county and 1 campaign in the comparison community. Personal interviews were conducted with 100 randomly selected teenagers monthly in each county for 32 months.

Results. All 3 campaigns reversed upward developmental trends in 30-day marijuana use among high-sensation seekers ($P < .002$). As expected, low-sensation seekers had low use levels, and no campaign effects were evident.

Conclusions. Televised campaigns with high reach and frequency that use public service announcements designed for and targeted at high-sensation-seeking adolescents can significantly reduce substance use in this high-risk population. (*Am J Public Health*. 2001;91:292–296)

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Marijuana use among adolescents has become a major public health problem in the United States. According to the annual Monitoring the Future Study, lifetime, annual, and 30-day prevalence of marijuana use rose steeply in the 1990s.¹ For example, lifetime prevalence among 12th graders rose from 32.6% in 1992 to 49.7% in 1999 and nearly doubled among 8th and 10th graders. One recent study concluded that risk of initiation of marijuana use spans the entire course of adolescent development.² Moreover, research has now clearly documented several negative public health consequences and correlates of marijuana use, including lung damage, psychologic and physical dependence, impaired judgment and coordination, reckless driving, depression, and anxiety.^{3,4}

Obviously, more effective ways of reducing marijuana and other illicit drug use must be found. A recent editorial in the *Journal* called for the development of a public health perspective on psychoactive drug use, with primary and secondary prevention as important cornerstones.⁵ Although several prevention modalities have been tried, it is clear that the mass media, especially television, remain major vehicles for disseminating messages directed at preventing drug abuse and other unhealthy behaviors.^{6–8} For example, the largest drug abuse prevention effort in history—The Office of National Drug Control Policy's 5-year, \$1 billion National Youth Anti-Drug Media Campaign—has as its central component the targeted dissemination of televised antidrug (especially marijuana) advertisements and public service announcements.

The effectiveness of such campaigns, especially those that rely primarily on television, is unknown. Unfortunately, attempts to isolate television's effects in public health interventions have had shortcomings in campaign execution or evaluation. Campaigns often fail to ensure widespread, frequent, and prolonged exposure to messages; to target specific audience segments; or to use control communities.⁶ Evaluations of such campaigns typically do not account sufficiently for precampaign and postcampaign trends, although some exceptions exist.^{9–16} Thus, whether television-only campaigns can produce changes in public health behaviors is unknown. This brief addresses this issue with a controlled study of the effects of 3 televised antimarijuana campaigns targeted at adolescents.

Sensation Seeking Targeting (SENTAR) Prevention Approach

The intervention approach tested here revolved around a potent drug use risk factor: sensation seeking. Sensation seeking is a personality trait associated with the need for novel, complex, ambiguous, and emotionally intense stimuli and the willingness to take risks to obtain such stimulation.^{17,18} Persons who rank high in their tendency to seek sensation (high-sensation seekers), relative to those who rank low (low-sensation seekers), are much more at risk for use of a variety of drugs and earlier onset of use,^{17,18} with these relationships documented among adolescents and across long developmental time spans.^{19–23}

High-sensation seekers' needs for stimulation are associated with distinct preferences for high-sensation-value messages, which elicit greater sensory, affective, and arousal responses.^{18,24,25} Such messages are novel, dramatic, emotionally powerful or physically arousing, graphic or explicit, unconventional, fast-paced, or suspenseful. High-sensation-value messages have proven more effective with high-sensation-seeking teenagers and young adults than have low-sensation-value messages in producing intentions to call a prevention hotline, message recall, more negative attitudes toward drugs, and lower behavioral intentions to use drugs.^{24–27} Antidrug public service announcements placed in high-sensation-value television programming also elicit significantly greater attention from high-sensation seekers than do those placed in low-sensation-value programs.²⁸

These findings led to the development of the SENTAR (sensation seeking targeting) prevention approach. This approach includes 4 principles: (1) use sensation seeking as a targeting variable, (2) conduct formative research

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with target audience members, (3) design high-sensation-value prevention messages, and (4) place messages in high-sensation-value contexts (e.g., television programs).

These principles guided a campaign study that found that high-sensation-value public service announcements placed in television programming watched by high-sensation-seeking older teenagers and young adults were effective in persuading this audience to call a drug hotline.²⁹ The current study sought to determine whether SENTAR-based televised public service announcement campaigns could lead to changes in 30-day marijuana use among at-risk adolescents.

Methods

Study Design

The design was a 32-month controlled interrupted time series with switching replications. Antimarijuana public service announcements developed for high-sensation-seeking adolescents were televised from January through April 1997 in Fayette County (Lexington), Ky. Similar campaigns were conducted from January through April 1998 in Fayette County and in Knox County (Knoxville), Tenn. Beginning 8 months before the first Fayette campaign and ending 8 months after the 1998 campaigns, individual interviews were conducted with 100 randomly selected public school students each month in each county (Fayette $n=3174$; Knox $n=3197$). Interviews assessed television viewing and exposure to public service announcements, attitudes toward and use of marijuana and other substances, and various risk and protective factors, particularly sensation seeking. Both population cohorts initially were in grades 7 to 10. Cohorts aged as the study progressed, so marijuana use tended to increase as a result of sociodevelopmental factors. Since teenagers in both counties reflected this secular trend, each county served as an appropriate control for the other.

Samples

The population of Knox County, Tenn (335 000), is about 50% greater than that of Fayette County, Ky (225 000); however, the populations are comparable on demographic and cultural variables. Systematic random sampling with geographic and grade stratification was used in each county to draw 32 monthly pools of potential respondents from enrollment lists of 7th to 10th graders in spring 1996. Because neither school system would allow telephone recruiters to ask for students by name, recruiters asked parents or guardians if a child lived in their household in the specified age

range. If so, the recruiter described the interview (including measurement of drug use) and sought oral permission, first from the parent or guardian and then from the student, to interview the student in the home. Because monthly sample pools were selected in advance, dropouts were not excluded. Written parental consent and student assent were obtained. Interviews were private and anonymous, with self-administration of drug and alcohol items via laptop computer. Respondents received \$10 gift certificates.

Three response rates were estimated for Fayette County. These rates could not be estimated for Knox County because they required separating total refusals into 3 categories not available from Knox. However, the recruiting and interviewing procedures were identical in both counties, and the numbers of completions, refusals, and households with no eligible children in Knox were very similar to the Fayette figures.

The minimal Fayette response rate (35.4%) involved dividing the number of completions by the number of students known (by screening) or estimated (by standard algorithms) to be eligible. Subtracting the *estimated* number of eligible students from the denominator yielded a response rate of 50.8%, the rate among adolescents known to be eligible. Finally, because nonresponse resulting from a child's refusal was most likely to introduce bias in substance use estimates, a third response rate (63.8%) involved dividing the number of completions by the sum of completions and child refusals.

The Fayette and Knox samples matched closely on demographic variables, paralleling census and school population figures. The samples also did not differ significantly on sensation seeking, but the Fayette sample was significantly higher ($P<.001$) on most other drug risk factors (e.g., perceived peer and family drug use, delinquency) and significantly lower ($P<.001$) on most protective factors (e.g., religiosity, perceived sanctions for marijuana use, perceived future opportunities). Fayette County students showed significantly higher levels of use of marijuana, tobacco, alcohol, and hallucinogens, whereas Knox County students showed greater use of inhalants and equivalent rates of cocaine or crack use. Still, levels of marijuana use (and other substance use) by 8th, 10th, and 12th graders in both counties were consistent with national norms reported by the University of Michigan's annual Monitoring the Future Study.¹ For example, mean 30-day marijuana use among 12th graders (as of fall 1997 or fall 1998) was 25.5% for Fayette and 20.3% for Knox, compared with 1997 and 1998 Monitoring the Future national 12th grade estimates of 23.7% and 22.8%, respectively. In any case, the generally small between-

sample differences did not hamper the ability to relate substance use trends to the campaigns.

Public Service Announcement Development

Formative research with focus groups of high-sensation-seeking adolescents yielded opinions on existing antidrug public service announcements and discussions of marijuana risks. All public service announcements developed for the campaigns used teenage actors; employed high-sensation-value characteristics such as novelty, drama, surprise, and strong emotional appeal; and depicted several negative consequences of marijuana use. Risks incorporated were supported by previous research sponsored by the National Institute on Drug Abuse³ and were considered salient by the focus groups (e.g., effects on relationships, loss of motivation or coordination, lung damage, impaired judgment). Advertisement storyboards were evaluated by additional focus groups. Revisions based on these evaluations were incorporated into 5 professionally produced 30-second television spots used in all 3 campaigns. A more detailed description of the spots is available elsewhere.³⁰

The Television Campaigns

A media buyer purchased time from local television stations and companies, who also donated substantial public service announcement time. Spots were placed in programs that our survey indicated were watched by high-sensation-seeking adolescents. An average of 777 paid spots and 1160 unpaid spots were aired per campaign. According to standard advertising formulas, at least 70% of the targeted age group were exposed to a minimum of 3 campaign advertisements per week. Advertisement recall data from the monthly surveys indicated even higher exposure (>80%), particularly among high-sensation seekers.

Measures

Sensation seeking was measured with the Brief Sensation Seeking Scale, which includes 8 statements (e.g., "I prefer friends who are excitingly unpredictable") to which respondents indicated extent of agreement on 5-point Likert scales. The scale showed good reliability ($\alpha=.78$) and predicted drug use, drug attitudes, and various drug risk and protective factors.³¹ The dependent variable was the percentage of each monthly sample reporting marijuana use in the last 30 days. Expressing use in terms of prevalence allowed comparison with national norms.¹ This measure also reflects recent drug use and thus can be sensitive to campaign effects. Thirty-day use of alcohol, tobacco, and

other substances was measured as control constructs, along with several risk and protective factors evaluated extensively in other studies.³²

Results

Respondents whose score on the Brief Sensation Seeking Scale was higher or lower than full-sample medians (with age, sex, and race/ethnicity taken into account to reduce possible item bias) were designated high- and low-sensation seekers, respectively. To reduce sampling error and negative autocorrelation, we adjusted mean monthly estimates of 30-day marijuana use for 12 risk and protective factors that showed the strongest zero-order correlations with individual 30-day use. The adjusted monthly means were analyzed with a regression-based time-series procedure amenable to time series with fewer than 50 data points.³³

As expected, analyses involving low-sensation seekers found low levels of 30-day marijuana use, no developmental trends, and no campaign effects in either county. Initial regression analyses of means for high-sensation seekers showed 2 outliers in the Fayette County series and 1 in the Knox County series. Following standard guidelines,^{34,35} these were removed. Other procedures for addressing outliers without removal (e.g., logarithmic transformations³³) produced similar results. Regression plots for both counties are shown in Figure 1.

Knox County Time Series

The time-series regression model with terms for all slope and intercept changes was significant ($P < .001$; adjusted $R^2 = .442$, with very low autocorrelation, $\rho = .032$). Unlike low-sensation seekers, high-sensation seekers showed an upward developmental trend in 30-day marijuana use of 0.84% per month ($P < .001$) over the 20-month campaign period, for a total estimated absolute precampaign increase in use from 16.6% to 33.0%. This was followed by a significant downward change in slope immediately after the start of the campaign ($P = .001$), with the decline in use continuing to the completion of data gathering.

Fayette County Time Series

A series of regression analyses was required to clarify a more complex pattern of results because of the use of 2 campaigns in Fayette County and an apparent wearing off of the effects of the first campaign. The first regression model containing all slope and inter-

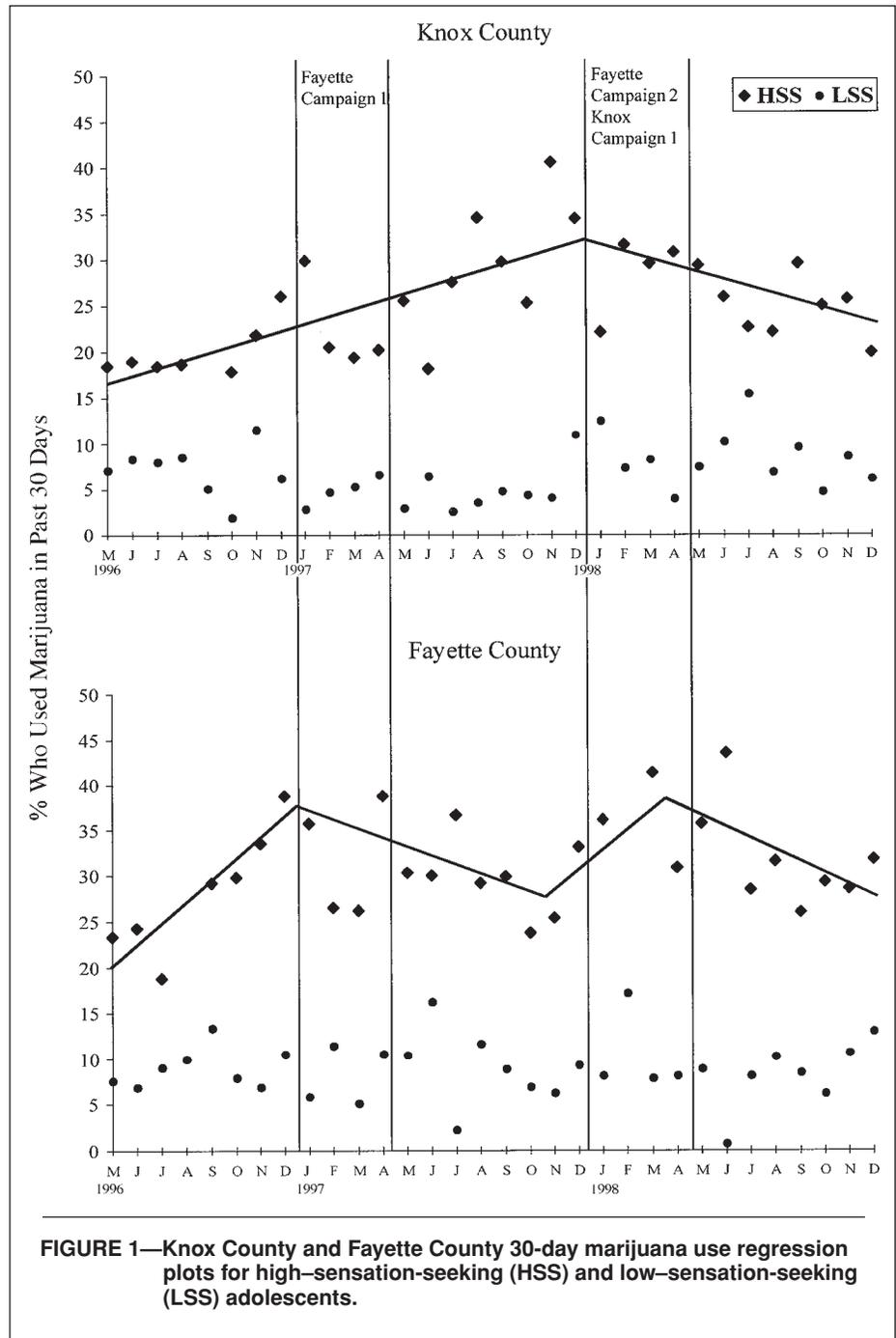


FIGURE 1—Knox County and Fayette County 30-day marijuana use regression plots for high-sensation-seeking (HSS) and low-sensation-seeking (LSS) adolescents.

cept change terms was significant ($P < .007$; adjusted $R^2 = .351$, with acceptable autocorrelation, $\rho = -.243$).

The downward change in slope at the start of campaign 1 was significant ($P = .002$). However, the effects of campaign 1 appeared to wear off after approximately 6 months. The shape of the wear-off trend (often observed in product advertisement campaigns) suggested that this portion of the time series would be more appropriately modeled as a linear regression line than as an intercept change. A model incorporating this change and also re-

moving the nonsignificant first intercept change term was statistically significant ($P = .003$), with a higher R^2 (.384) and lower autocorrelation ($\rho = -.14$) than the original model. The change in slope at the start of campaign 1 was significant ($P = .001$), as were the shift from the downward post-campaign 1 trend to the upward wear-off trend ($P = .003$) and the negative slope change from the wear-off trend to the post-campaign 2 period ($P = .002$). This model is depicted in Figure 1. A more detailed discussion of the analyses and campaign effects is available elsewhere.³⁰

Discussion

Although research generally has shown that media campaigns coupled with other kinds of interventions are the most successful,^{7,14,15} this study's results add to documentation that media campaigns alone can have significant effects on public health behaviors.^{10,36-38} All 3 campaigns resulted in significant reductions in marijuana use in high-sensation-seeking adolescents. In Knox County, effects still were evident several months after the campaign. There, the estimated drop in the relative proportion of high-sensation seekers using marijuana was 26.7%. Additional analyses (not included for space reasons) also indicated that campaign effects were specific to marijuana use, with no effects on use of tobacco, alcohol, inhalants, cocaine or crack, or hallucinogens. The effects thus cannot be ascribed to overall drug use trends.

These findings do not indicate that all anti-drug public service announcements will produce behavior change or that public service announcements alone should be the only avenue to prevention. However, with carefully targeted campaigns that achieve high levels of reach and frequency, and with messages designed specifically for the target audience on the basis of social scientific theory and formative research, we believe that public service announcements can play an important role in future drug abuse prevention efforts. □

Contributors

P. Palmgreen, L. Donohew, E. P. Lorch, R. H. Hoyle, and M. T. Stephenson planned and executed the study, including development of both the questionnaire and the public service announcements. P. Palmgreen and M. T. Stephenson analyzed the data. P. Palmgreen and E. P. Lorch took primary responsibility for the writing of the paper, although all authors contributed to revisions.

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Effects of the Office of National Drug Control Policy's Marijuana Initiative Campaign on High-Sensation-Seeking Adolescents

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In July 1998, the Office of National Drug Control Policy (ONDCP) launched the National Youth Anti-Drug Media Campaign, the largest national antidrug media campaign in US history.¹⁻³ Initially designed as a 5-year, \$1 billion effort to prevent and reduce drug use (especially marijuana use) among youths, the campaign, which continues to this day, has been the subject of much controversy. Considered ineffective by many at reducing marijuana use 4 years into its execution, the campaign underwent a major revamping that involved a series of so-called "hard-hitting" antimarijuana messages (termed the "Marijuana Initiative") featuring the negative outcomes of marijuana use. These messages, which ran from October 2002 to June 2003, reached a large portion of their intended audience.⁴

A combination of elements makes the ONDCP campaign unique in the annals of public health communication efforts.¹⁻³ First, its high level of federal funding (approximately \$180 million per year for the first 5 years) and donated dollar-for-dollar media match are unprecedented; they have resulted in high audience penetration through multiple media channels, especially television.¹⁻³ Second, experts in substance abuse prevention, health campaigns, parenting, and public health have guided the campaign's planning and execution.^{1,3} Third, the campaign targets a specific adolescent audience: *at-risk nonusers* (adolescents predisposed to drug use by various factors) and *occasional users*, especially *high-sensation seekers* (i.e., youths with a strong need for novelty and stimulation),⁵ who have a high risk of using a variety of substances.⁶⁻⁹ Fourth, high-sensation seekers respond well to messages that are high in *sensation value* (i.e., dramatic messages that elicit strong sensory, emotional, and arousal responses),^{6,10-12} so many such messages have been created. Fifth, campaign messages are aimed at a wide variety of ethnic audiences, in several languages.^{1,3} Finally, message

Objectives. We evaluated the effects of the Marijuana Initiative portion of the Office of National Drug Control Policy's National Youth Anti-Drug Media Campaign on high-sensation-seeking and low-sensation-seeking adolescents.

Methods. Personal interviews were conducted via laptop computers with independent monthly random samples of 100 youths from the same age cohort in each of 2 moderate-sized communities over 48 months (April 1999–March 2003) of the campaign, including the critical first 6 months of the 9-month initiative. The start of the initiative was treated as an "interruption" in time-series analyses of the combined community sample.

Results. The Marijuana Initiative reversed upward developmental trends in 30-day marijuana use among high-sensation-seeking adolescents ($P < .001$) and significantly reduced positive marijuana attitudes and beliefs in this at-risk population. Use of control substances was not affected. As expected, low-sensation-seeking adolescents had low marijuana-use levels, and the campaign had no detectable effects on them. Other analyses indicated that the initiative's dramatic depiction of negative consequences of marijuana use was principally responsible for its effects on high-sensation-seeking youths.

Conclusions. Substance use prevention campaigns can be effective within an approach using dramatic negative-consequence messages targeted to high-sensation seekers. (*Am J Public Health.* 2007;97:1644–1649. doi:10.2105/AJPH.2005.072843)

concepts and finished ads are subjected to rigorous testing with high-sensation-seeking youths, and messages are placed in media channels most used by the target audiences.³

The youth campaign has been directed primarily at marijuana, although other substances have occasionally been targeted.^{1,2} In the first year, it used a variety of old ads. In the second year, new ads specifically designed for the campaign became available. In years 2 through 5, the campaign focused primarily on 2 youth message "platforms," or strategies: (1) negative consequences of drug use and (2) social norms regarding drug use and positive results of a drug-free lifestyle. Ads based on the latter platform depicted youths engaging in fun or rewarding activities not involving drug use. The platforms were run 1 at a time, normally in 1- to 3-month "flights" (an industry term for a continuous run of ads).

Despite its many elements characteristic of successful campaigns, the ONDCP campaign

has been criticized as ineffective.¹³⁻¹⁵ According to benchmark surveys, adolescent marijuana use, climbing since 1991, peaked in 1997 (1 year before the campaign began) and remained essentially flat during the campaign's first 4 years.^{16,17} The major evaluation of the campaign, the National Survey of Parents and Youth (NSPY), reported no evidence of positive effects on youths' marijuana use, attitudes, perceived social norms regarding marijuana use, or resistance skills during this period.¹⁵ Consequently, the ONDCP director strongly criticized the campaign in early 2002 as ineffective, claiming that the campaign's messages (most of which had concentrated on changing social norms and stressing the positive results of a drug-free lifestyle) had been "too indirect."^{13(p5)}

THE MARIJUANA INITIATIVE

The result was a major revamping called the Marijuana Initiative (October 2002–June

2003),^{4,13} by far the longest platform flight of the campaign to that point. The initiative, directed toward at-risk adolescents aged 14–16 years, used several “hard-hitting” ads (also appearing mostly on television) featuring several negative consequences of marijuana use in dramatic and novel fashion, making them similar to televised antimarijuana ads employed in a previously reported field experiment.¹⁸ The campaigns in that study successfully reduced current marijuana use by 27% to 38% in 2 medium-size cities, with lasting effects.

The Marijuana Initiative’s television and radio ads achieved very high exposure as measured by gross rating points (a standard ad industry measure of audience penetration) in months 2 through 6 (November 2002–March 2003). The January–March 2003 television ratings were the highest achieved for any ONDCP campaign quarter up to that time, and radio ratings also increased (total gross rating points dropped over the last 3 months of the initiative, a period not included in the present study). In addition, more ads were run. Previously, only 1 or 2 television ads with corresponding radio ads were run per flight of a platform, but the initiative ran 4 new television and corresponding radio ads each quarter, providing the content variety preferred by high-sensation seekers.⁶ The length and very different nature of the initiative made it, in effect, a separate campaign within the overall campaign, making it possible to evaluate the initiative’s impact through time-series analyses.

EVALUATION OF THE INITIATIVE

The NSPY reported no positive impact of the Marijuana Initiative.¹⁵ The NSPY is based on large nationally representative samples of youths aged 9 to 18 years and their parents from multiple data waves collected over 6-month intervals beginning in late 1999. Waves 1 through 3 were cross-sectional samples, although wave 1 respondents were reinterviewed in waves 4 and 6 and respondents from waves 2 and 3 were reinterviewed in waves 5 and 7. The survey’s assessment of the initiative focused on waves 6 (July–December 2002) and 7

(January–June 2003), independent samples composed of different groups of youths that encompassed the entire initiative.¹⁵ The survey’s assessment found no significant changes in marijuana use, intentions, attitudes, beliefs, social norms, or perceived ability to refuse marijuana between waves 6 and 7 for any group of adolescents, nor were there any cross-sectional associations between these variables and self-reported exposure to the messages.¹⁵

There are at least 3 major problems with this NSPY analysis. First, the survey was designed to evaluate the entire ONDCP campaign, not just a portion of it. Specifically, the 6 months of data gathering for wave 6 included the first 3 months of the initiative, whereas wave 7 coincided with the initiative’s final 6 months; thus, no true pre–post comparison can be made. Second, only nonusers of marijuana were employed in the analysis, even though the ONDCP campaign has focused on at-risk nonusers and occasional users.^{1,5,15} Third, although the campaign has largely concentrated on high-sensation seekers,⁵ particularly in the Marijuana Initiative, the NSPY’s analyses did not consider high-sensation seekers separately, and its decision to evaluate only nonusers should reduce the range of any risk measurement.

We examined the effectiveness of the Marijuana Initiative on high-sensation-seeking youths by using data from a 48-month time-series study involving 2 moderate-size communities. We hypothesized that the initiative would reduce or reverse upward age-related trends in current (30-day) marijuana use among high-sensation seekers.

METHODS

Study Design

We used data from a 48-month, independent-sample interrupted time-series project (one which tests trends before and after an intervention). The project was designed to investigate any differential effects of campaign message types on high- and low-sensation-seeking adolescents in 2 moderate-size communities: Fayette County (Lexington) Kentucky, and Knox County (Knoxville) Tennessee. The interrupted time-series design is one of the strongest

TABLE 1—Demographic Characteristics of Fayette County, Ky, and Knox County, Tenn: 2000 Census

	Fayette	Knox
Total population	260 512	382 032
Median age, y	33	36
Aged ≤ 25 y, %	35.9	33.9
Racial composition, %		
White	81.0	88.1
Black	13.5	8.6
Other	5.5	3.3
Aged ≥ 25 y, %		
High school graduates	85.8	82.5
Have undergraduate degree	35.6	29.0
Below poverty level, %	12.9	12.6
Median household income, \$	39 813	37 457
Median home price, \$	110 800	98 500

quasi-experimental designs for inferring causal effects of an intervention.¹⁹ We combined the data from the 2 counties for our analysis because (1) the campaign was national in scope and the 2 markets received nearly identical versions of the campaign and (2) the 2 communities were similar with regard to a range of relevant variables (Table 1).

Beginning April 1, 1999 (5 months prior to ONDCP’s use of new platform-based ads) and ending March 31, 2003, personal interviews were conducted with independent random samples of 100 public school students from the same age cohort in each month in each county (for Fayette, n=4795; for Knox, n=4803). Interviews assessed television viewing and exposure to ONDCP campaign television and radio ads, responses to many of the television ads, attitudes toward and use of marijuana and other substances, and various risk and protective factors, particularly sensation seeking. The population cohort followed was initially in the late 4th through 8th grades and at completion in the late 8th through 12th grades. This allowed us to plot trends in marijuana use and other variables in the cohort as it aged over the first 4 years of the platform-based ONDCP campaign, which included the first 6 months of the Marijuana Initiative, where most of the initiative’s media gross rating points were concentrated.

The start of the initiative was treated as an “interruption” in the time series. Study funding did not allow data gathering during the final 3 months of the initiative and afterward. Nonetheless, the time-series analyses were sensitive to any shifts in trends in marijuana use (or other variables) that might have been associated with the first 6 months of the initiative. Continuous analyses of the content of the major newspaper in each community and regular contacts with the local school systems indicated no new drug-related programs or events that coincided with the initiative. In addition, the NSPY found little evidence that antidrug messages from other sources increased during the campaign, although it noted some declines.¹⁵

Samples

Systematic random sampling with geographic and grade stratification was used in each county to draw 48 monthly pools of potential respondents from enrollment lists of 4th through 8th graders (aged 9 to 13 years) in public schools in spring 1999. Each pool was assigned randomly to 1 of the 48 study months. One hundred respondents (independent samples) in each community were recruited monthly by telephone from the appropriate pool. The participants were aged 13 to 17 years at the beginning of the Marijuana Initiative.

Recruiters asked parents or guardians if a child in their household was in the appropriate grade range. If so, the recruiter described the interview and sought permission, first from the parent or guardian and then from the student, to interview the student; most were interviewed in the home. Because sampling pools were selected prior to the start of interviewing, middle and high school dropouts were not excluded (nor were absentees, because interviews were not administered at school). Written parental consent and student assent were obtained. Interviews were private and anonymous, with self-administration of most, including all sensitive items via laptop computer, thus increasing the validity of self-report.^{20–23}

Response rates were similar for both counties. The combined sample minimum response rate (50.0%) was obtained by dividing the number of completions by the number of students known (by telephone

TABLE 2—Comparison of Respondents Interviewed in Fayette County, Ky, and Knox County, Tenn: April 1999–March 2003

	Mean Value		P ^c	Effect Size ^d
	Fayette ^a	Knox ^b		
Demographics				
Age, y	13.69	13.68	.919	none
Gender ^e	1.51	1.51	.977	none
Ethnicity ^f	1.21	1.10	<.001	0.33
Risk factors				
Sensation seeking ^g	3.05	3.06	.778	0.01
Deviant behavior ^g	0.46	0.34	<.001	0.21
Perceived peer marijuana use	1.78	1.66	<.001	0.13
Perceived family marijuana use	1.30	1.24	<.001	0.10
Protective factors				
School attachment ^g	3.89	3.96	<.001	0.08
Grades ^h	7.29	7.41	.001	0.07
Religiosity ^g	4.33	4.48	<.001	0.18
Family attachment ^g	3.84	3.90	.001	0.07
Substance useⁱ				
Marijuana (30-day use)	0.09	0.06	<.001	0.12
Alcohol (30-day use)	0.22	0.16	<.001	0.16
Tobacco (30-day use)	0.17	0.14	<.001	0.08
Inhalants (30-day use)	0.04	0.03	.012	0.05
Cocaine (ever used)	0.02	0.03	.605	0.01
Methamphetamine (ever used)	0.03	0.02	.397	0.02
Ecstasy (ever used)	0.03	0.02	.024	0.05
Hallucinogens (ever used)	0.03	0.03	.385	0.02

^aSample sizes for each variable ranged from 4759 to 4795, except for inhalant use, where n = 4473.

^bSample sizes for each variable ranged from 4765 to 4804, except for inhalant use, where n = 4549.

^cBy 2-tailed t test.

^dCohen's d. According to Cohen,²⁴ small effect size (ES) = 0.20, medium ES = 0.50, and large ES = 0.80.

^eMale = 1; female = 2.

^fWhite = 1; non-White = 2.

^gMeasured by multi-item scale; mean = total score divided by number of scale items.

^hSelf-report of grades in past year; 7 = mostly Bs, 8 = As and Bs.

ⁱNo use = 0; at least some use = 1. Thus, mean reflects percentage using.

screening) or estimated (by standard formulas) to be eligible by age. Excluding the estimated eligible students yielded a 63.8% response rate for known eligible students. A third response rate (87.0%) assessed the impact of child refusals by dividing the number of completions by this total plus the number of child refusals.

The Fayette and Knox student samples were similar according to demographic variables (except for a small difference in ethnicity) and sensation seeking, but the Fayette sample had significantly higher means on other drug risk factors (deviant behavior, perceived peer and family marijuana use) and

significantly lower means on protective factors (school attachment, grades, religiosity, and family attachment; Table 2). Fayette students also displayed significantly higher levels of use of marijuana, alcohol, tobacco, inhalants, and ecstasy, whereas they did not differ from the Knox students on use of cocaine, methamphetamines, or hallucinogens. Effect sizes for all differences were very small to small according to Cohen's criteria,²⁴ further supporting our decision to combine the 2 samples for the analysis. Marijuana use in the combined sample was consistent with national norms at the time of the Marijuana Initiative.^{16,17}

Measures

Sensation seeking was measured using the Brief Sensation Seeking Scale, where $\alpha = .74$.²⁵ The primary dependent variable was current (30-day) marijuana use in each monthly sample. Thirty-day use of alcohol and tobacco were measured as “control constructs.” Use of several other substances (Table 2) also was measured.

Attitude toward marijuana use was assessed using a 5-item scale ($\alpha = .86$). A 2-item marijuana beliefs scale employed the 2 negative consequences (“Makes you do stupid things” and “Hurts people’s coordination”) that featured consistently in the initiative’s messages ($\alpha = .73$). Risk and protective factors (Table 2) were measured with multi-item scales (except the single-item perceived peer and family marijuana use measures) with good reliability. Social norms were assessed by a 6-item scale that measured perceptions of use of marijuana by peers, social acceptance of marijuana, and friends’ approval of marijuana ($\alpha = .78$). Self-reported exposure to television and radio antimarijuana ads over the past month was measured via single-item frequency scales.

The perceived message sensation value¹² of 42 television antimarijuana ads produced by the ONDCP campaign, which represented most such ads shown during the study, was measured. The ads were displayed audiovisually on a laptop computer, with approximately 1000 respondents rating each ad. The sensation value of each ad was measured using a 5-item scale ($\alpha = .81$) based on a longer previously validated scale.¹² Higher scores on this scale have been associated with greater message effectiveness for high-sensation seekers.^{12,26,27}

RESULTS

Full-sample Brief Sensation Seeking Scale medians (with age, gender, and race/ethnicity controlled to reduce possible item bias and because these variables generally are correlated with sensation seeking) were used to divide the sample into high-sensation seekers and low-sensation seekers. We analyzed the aggregate monthly data points separately for high- and low-sensation seekers by employing a regression-based interrupted time-series

procedure amenable to series with fewer than 50 observations.²⁸

Marijuana Use, Attitudes, and Beliefs

The interrupted time-series regression plots of 30-day marijuana use for high- and low-sensation seekers for the 42 months before and the 6 months following the start of the Marijuana Initiative are shown in Figure 1. The strong linear upward developmental trend for high-sensation seekers before the initiative was followed by a sharp downturn in use ($P < .001$ for slope change) at the initiative’s onset, which continued over the last 6 months of data gathering (adjusted $R^2 = 0.718$). First-order autocorrelation was low ($\rho = -0.18$). This downturn was statistically significant in separate county analyses as well. Other interrupted time-series analyses for the combined sample also indicated statistically significant reductions in mediating variables such as positive marijuana attitudes ($P < .002$) and beliefs ($P < .04$) over the same period. Before the initiative, low-sensation seekers (not specifically targeted by the campaign) displayed much weaker upward developmental trends in marijuana use, attitudes, and beliefs; this trend was not altered by the initiative. The great majority of low-sensation seekers were nonusers of marijuana (30-day use) even at the end of data gathering.

Control Substances

Two control substances considered precursors to marijuana use—tobacco and alcohol—also showed strong upward trends in 30-day use before the initiative among high-sensation seekers ($P < .001$ for the linear trend for each substance). As expected, these trends were not affected by the Marijuana Initiative and thus cannot explain the downturn in marijuana use (for tobacco, $P < .33$; for alcohol, $P < .46$). The much weaker 30-day tobacco and alcohol upward trends among low-sensation seekers also were not affected.

Marijuana Social Norms

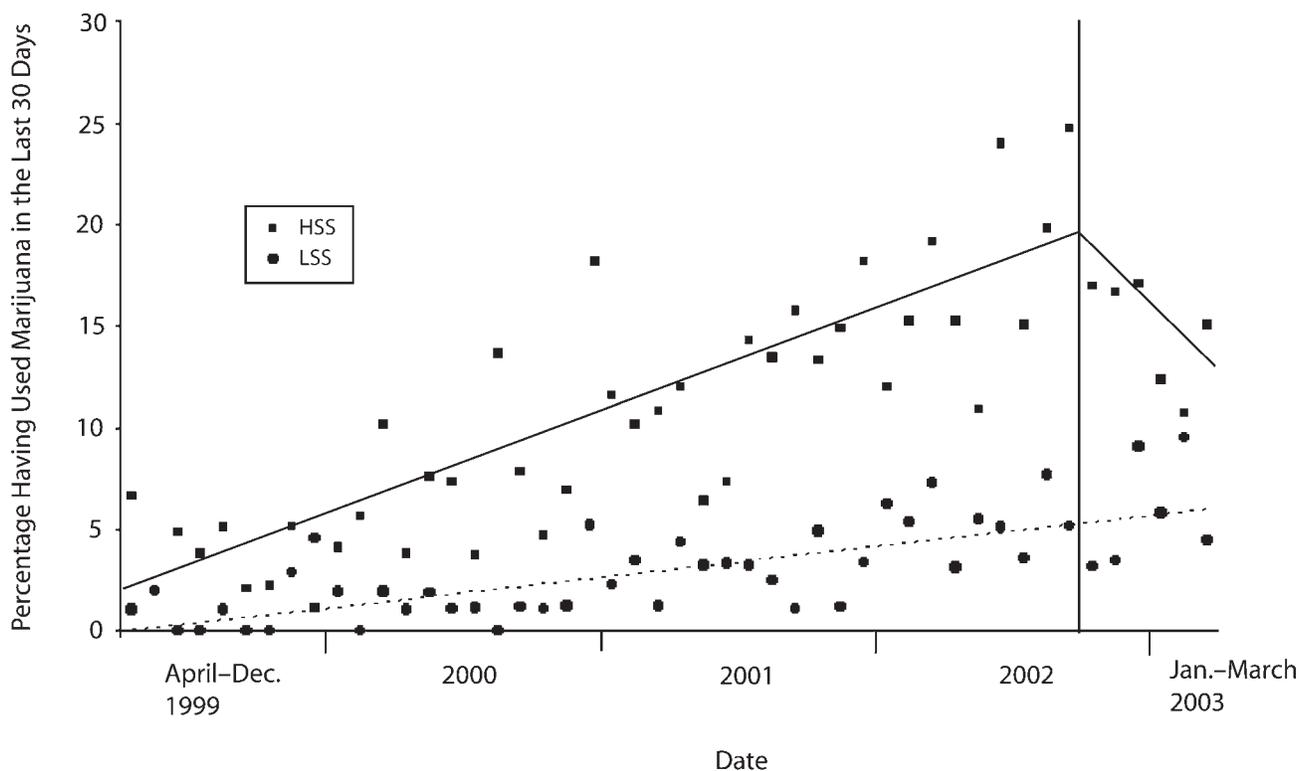
Both high- and low-sensation seekers displayed linear upward developmental trends ($P < .001$) on the 6-item scale assessing social norms. As expected, interrupted time-series

analyses showed that these trends were not interrupted by the initiative.

Gross Rating Points, Message Exposure, and Marijuana Use

The Marijuana Initiative was bolstered in months 2 through 6 by a sharp upturn in both radio and—in particular—television gross rating points. These were accompanied by statistically significant upturns (interrupted time-series analyses) in monthly aggregate reported exposure by both high- and low-sensation seekers to television ($P < .001$) and radio ($P < .001$) ads soon after the start of the initiative. This raises the question whether the sharp reductions in current marijuana use by high-sensation seekers were simply a function of higher exposure to campaign ads rather than the content and style of the ads. An aggregate level (monthly) multiple regression analysis ($n = 48$) was conducted for high-sensation seekers with 30-day mean marijuana use as the dependent variable, television mean ad exposure and radio mean ad exposure as independent variables, and television rating points, radio rating points, and month of interview as control variables. This analysis showed no significant effects on use of any exposure or rating point variable, indicating that aggregate monthly levels of exposure to campaign ads had no association with monthly levels of marijuana use by high-sensation seekers.

Although sensation value data for the initiative’s ads were available only for the 4 television ads shown during the Marijuana Initiative’s first 3 months, 1 of these ads had the highest sensation value among high-sensation seekers of all 42 ads tested; another was ranked seventh, and a third was well above the median. The 4 television ads run during the next 3 months also clearly had high sensation values. The initiative ads thus were truly “hard-hitting” in that they elicited strong sensory, emotional, and arousal responses. This finding, combined with the exposure analysis, indicates that the dramatic negative-consequence nature of the Marijuana Initiative ads was principally responsible for their various positive effects (although these effects may have been bolstered by the increased audience penetration achieved by the initiative).



Note. The vertical line denotes when the Marijuana Initiative Campaign began. The solid line represents HSS regression. The dotted line represents LSS regression.

FIGURE 1—Thirty-day marijuana use regression plots for high sensation-seeking (HSS) and low sensation-seeking (LSS) adolescents in the combined Knox County, Tenn, and Fayette County, Ky, sample: April 1999–March 2003.

DISCUSSION

Interrupted time-series analyses support the conclusion that in 2 southeastern cities, the first 6 (and most important) months of the ONDCP Marijuana Initiative had dramatic effects on the marijuana use, attitudes, and beliefs of a primary target audience—high-sensation-seeking adolescents. Because of the nature of the design and the interrupted time-series analyses, a key strength of this study is that the effects observed are not based on self-reported message exposure but are most plausibly a function of the campaign messages actually presented via various channels (especially television) at a given time. Additional data suggest that these effects were partly caused by the strong dramatic nature of the initiative's negative-consequence messages. The extended length, number of messages, and high audience

penetration of the initiative undoubtedly also played key roles.

The effects apparently were not caused, however, by (1) high levels of message exposure alone, (2) trends in the use of gateway substances like tobacco and alcohol, or (3) mediating variables like social norms, which were not addressed by the initiative. In addition, the effects did not carry over to low-sensation seekers, who because of their much lower use of marijuana, have not been a major target of the ONDCP campaign in general and certainly were not a target of the Marijuana Initiative, with its more graphic and stimulating messages more suited to high-sensation seekers.

Because this study is based on 2 moderate-size communities with primarily White youth populations, caution must be employed in attempts to generalize to the national impact of the Marijuana Initiative. However, the

initiative in these 2 cities was implemented in essentially the same manner as in most US markets. In addition, although the 2 major national drug use surveys, Monitoring the Future and the National Survey on Drug Use and Health, do not measure sensation seeking, both did find evidence of a decline in marijuana use by adolescents from 2002 to 2003 (the period during which the initiative took place).^{16,17}

Monitoring the Future found statistically significant declines in annual use among 8th graders. The National Survey on Drug Use and Health detected a statistically significant 2002–2003 decline in 30-day marijuana use by adolescents aged 12 to 13 years. More significantly, it found a 21.2% drop across this same period in the number of 12- to 17-year-olds reporting daily or almost daily use of marijuana and a corresponding 20.1% decline in the number of adolescents in this

age bracket reporting marijuana use on 20 or more days in the past month. Because heavy substance use is much more prevalent among high-sensation seekers than low-sensation seekers, it is plausible that these large declines were mostly among high-sensation-seeking youths.

This study provides additional support for the approach to drug abuse prevention termed SENTAR (for “sensation-seeking targeting”), which has received considerable empirical support.^{18,26,27} To prevent risky behaviors, this approach targets high-sensation seekers with messages containing high-sensation value. It was only when the ONDCP campaign introduced a sustained, high-saturation flight of such messages, which stressed the negative consequences of use, that this study witnessed an immediate and sharp downturn in current use of marijuana in a cohort of high-sensation-seeking youths in 2 communities.

We report on the effects of the Marijuana Initiative, not those of the entire ONDCP youth campaign. It is tempting, however, to interpret the upward developmental trend in marijuana use by high-sensation seekers during the 42 months prior to the initiative (Figure 1) as evidence that the earlier portion of the campaign was ineffective. Such an interpretation, however, fails to consider the possibility that, without the ONDCP campaign, the slope of this trend could have been significantly steeper. The lack of a comparison region for this national campaign makes it impossible to tell. The evidence is accumulating, however, that substance use prevention messages can be employed more effectively in media campaigns within the framework of a sensation-seeking approach to message design and audience targeting. ■

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P. Palmgreen was principal supervisor of the data analysis and led the writing of the article. E.P. Lorch assisted with the writing, M.T. Stephenson supervised portions of the data analysis and assisted with the writing, and R.H. Hoyle and L. Donohew reviewed the article and suggested revisions. All authors contributed to the design, planning, and execution of the study and helped to conceptualize ideas, interpret findings, and edit drafts.

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Human Participant Protection

This study was approved by the institutional review board of the University of Kentucky.

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Impact of messages about scientific uncertainty on risk perceptions and intentions to use electronic vaping products



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HIGHLIGHTS

- The health effects of using electronic vaping products (EVPs) are unclear.
- We used an online experiment to examine reactions to this scientific uncertainty.
- Adults who viewed an uncertainty message (vs. control) rated vaping as less risky.
- There were no effects of message on behavioral intentions to start or stop vaping.
- Health communications should consider the impact of uncertainty on EVP perceptions.

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ABSTRACT

Background: The science surrounding e-cigarettes and other electronic vaping products (EVPs) is rapidly evolving, and the health effects of vaping are unclear. Little research has explored how individuals respond to information acknowledging scientific uncertainty. The aim of the present study was to understand the impact of messages about scientific uncertainty regarding the health effects of vaping on risk perceptions and behavioral intentions.

Methods: Adults in an online experiment ($n = 2508$) were randomly exposed to view either a control message (a short factual statement about EVPs) or an uncertainty message (the control message plus additional information describing why EVP-related research is limited or inconclusive). Participants rated the risks of vaping and their intentions to try or stop vaping.

Results: Individuals who viewed the uncertainty message rated vaping as less risky than those who viewed the control message. Message exposure did not impact intentions to try vaping soon or intentions to stop vaping in the next 6 months.

Conclusions: Acknowledging scientific uncertainty made EVP use seem less risky. Future research should explore possible drivers of this response, such as deeper message processing or emotional reactions. Researchers and practitioners designing public health campaigns about vaping might consider a cautious approach to presenting information about scientific uncertainty.

1. Introduction

Use of e-cigarettes and other electronic vaping products (EVPs) has increased dramatically since their introduction to the U.S. market in 2007 (Glasser et al., 2017; King, Patel, Nguyen, & Dube, 2015; Singh et al., 2016), but much remains uncertain about their health effects

(Chun, Moazed, Calfee, Matthay, & Gotts, 2017; Goniewicz et al., 2014; Leigh, Lawton, Hershberger, & Goniewicz, 2016; Logue et al., 2017; McNeill et al., 2015; Nutt et al., 2014; Polosa et al., 2017) and ability to promote harm reduction at the population level (Kalkhoran & Glantz, 2015; Levy et al., 2018). Both EVP users and non-users have expressed uncertainty about the health effects of vaping (Coleman et al., 2016). In

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2015, nearly one-third of U.S. adults said they did not know how harmful EVPs were relative to cigarettes, and among those who expressed an opinion, there was little consensus (Majeed et al., 2017).

Perceptions of scientific uncertainty can impact emotional reactions, beliefs about source credibility, and behaviors like information seeking (Carpenter et al., 2016; Druckman, 2015; Jensen & Hurley, 2010). Information conveying uncertainty can also generate deeper message processing (Lang, 2000; Nabi, 2002). The Centers for Disease Control and Prevention's (CDC's) Clear Communication Index (CCI) recommends that health communication materials acknowledge uncertainty because acknowledgment helps lay people understand the scientific process and anticipate that findings or recommendations could change in the future (Centers for Disease Control and Prevention (CDC), 2014). However, it is not known whether acknowledgments of uncertainty are similarly helpful for all scientific topics. One study suggests that vapers are sensitive to scientific uncertainty. When asked in focus groups how they would respond if “scientific evidence collectively concludes” that vaping is unsafe, some EVP users stated that they would stop vaping entirely and others said that their response would depend on who conducted the studies (Kim, Davis, Dohack, & Clark, 2017).

The aim of the present study was to understand the impact of messages about scientific uncertainty regarding the health effects of vaping on risk perceptions, which are an important precursor to behavior, and on behavioral intentions. Specifically, we examined whether perceived risk of vaping and intentions to start or stop vaping differed after exposure to either a basic, factual message about EVPs or the basic, factual message plus additional text describing the scientific uncertainty about the health effects of using EVPs.

2. Materials and methods

2.1. Participants

We recruited participants for the online survey through an Internet research panel, Research Now. To be eligible for the study, respondents had to be 18 years of age or older, not be medical professionals, and fall into one of four user groups: nonsmokers who do not regularly vape (i.e., no current use of cigarettes and currently vape “not at all” or “rarely,” $n = 725$), nonsmokers who regularly vape (i.e., no current use of cigarettes and vape “every day” or “some days,” $n = 531$), smokers who do not regularly vape (i.e., smoked 100 cigarettes in their lifetime, currently smoke “some days” or “every day,” and currently vape “not at all” or “rarely,” $n = 722$), and smokers who regularly vape (i.e., smoked 100 cigarettes in their lifetime, currently smoke “some days” or “every day,” and currently vape “some days” or “every day,” $n = 530$). Because of difficulty recruiting individuals who vaped regularly, especially those who vaped regularly but did not smoke cigarettes, the predetermined sample sizes for those groups were smaller than the groups with infrequent or non-vapers. Our power analysis concluded that the sample sizes in all groups were sufficient to have 90% power to detect an effect size of 0.10. We closed recruitment once the quota sample size for each group was reached.

2.2. Procedures and messages

Panel members received a recruitment email with an invitation to the survey and a link to an online study screener. If eligible, interested participants proceeded to the online survey. Before being randomly assigned to view one of two messages (Appendix), participants answered survey items including perceived risks of vaping. The control message included a short statement containing facts about EVPs. The uncertainty message included the same content as the control, along with additional text describing scientific uncertainty about health effects (e.g., “Not enough scientific evidence exists to say for sure how using electronic vaping products could affect your health in the short or

long term”). After viewing the message, respondents completed additional survey items.

2.2.1. Message development

Decision making can be challenging when the evidence surrounding the impact of a health behavior is uncertain. We identified scientific literature and websites of key public health sources (e.g., CDC) and lay sources (e.g., WebMD) that presented mixed or unclear findings about health effects of EVP use. We did not review content related to the use of EVPs for smoking cessation. We transformed the information about health effects into messages by following the principles outlined in the CDC's CCI (Centers for Disease Control and Prevention (CDC), 2014). We initially developed a control message and two experimental messages: one highlighted lack of information about health effects, which was the predominant theme in all of the public health and lay websites we reviewed, and one highlighted conflicting information about health effects, which was present in the scientific literature but not mentioned in the reviewed websites. Next, we conducted two rounds of cognitive testing with a mix of EVP users and non-users and smokers and non-smokers (total $n = 24$ across the two rounds). In the first round, participants acknowledged that the two uncertainty messages were different but had difficulty articulating how they differed. They found the lack of evidence version more plausible given the short time that vaping products have been in the marketplace. Given this reaction from participants and the finding that existing online messages about health effects focused primarily on uncertainty due to lack of evidence, rather than uncertainty due to conflicting evidence, we proceeded only with the lack of information message and control message in the second round of cognitive testing. Cognitive testing participants easily distinguished the two and found both messages to be clear, realistic, and informative rather than biased.

2.3. Measures

2.3.1. Outcomes: Perceived risk and behavioral intentions

Both before and after viewing the message, participants answered an item assessing the perceived risk of vaping to health (“How harmful do you believe using electronic vaping products is to your health?”) on a scale from 1 = not at all harmful to 7 = extremely harmful, or “don't know”.

Individuals who responded “no” when asked about ever vaping indicated their intention to try vaping (“Do you think you will try an electronic vaping product soon?”). Responses of “probably yes” and “definitely yes” indicated an intention to try (coded as 1), and responses of “probably not” and “definitely not” indicated no intention to try (0).

Individuals who vaped some days or every day responded to the item “Do you plan to stop using electronic vaping products?” Responses of “Yes, within the next 30 days” and “Yes, within the next 6 months” were coded as 1 and responses of “Yes, but not within the next 12 months” and “No, I do not plan to stop using electronic vaping products” were coded as 0.

2.3.2. Other measures

Survey items also assessed demographics and health literacy, using four items from the validated Health Literacy Skills Index (McCormack et al., 2010). Participants who answered at least 3 of the items correctly were considered to have high health literacy.

2.4. Analyses

We used chi-square analyses to examine whether participants randomly assigned to the two message conditions differed prior to message exposure. There were no significant differences between the groups on age, gender, race/ethnicity, smoking status, health literacy, and frequency of EVP use. We used linear regression to examine the effects of message on perceived risk of vaping post-message exposure, controlling

for levels of perceived risk reported prior to message exposure. There were no differences by message condition in the proportion of respondents selecting “don't know” before or after message exposure; these respondents were not included in the linear regression. We used logistic regression to examine the effects of message on intention to try vaping (among individuals who reported never vaping) and intention to stop vaping (among individuals who currently vaped “some days” or “every day”). For regressions where message was significantly related to outcome, we conducted a second step of adding individual characteristics (i.e., smoking, vaping, the interaction of smoking and vaping, demographics, and health literacy) to see whether the experimental manipulation retained significance. We also tested for interactions of message condition with smoking status, vaping status, and health literacy; these interactions were not significant and, therefore, were not included in the final models. We report unstandardized regression coefficients or odds ratios with 95% confidence intervals. We used two-tailed statistical tests and an alpha level of 0.05.

3. Results

3.1. Sample description

Participant characteristics appear in Table 1. Four cases have missing data on gender and 17 cases have missing data on race/ethnicity.

3.2. Perceived risk of vaping (post-exposure to message)

After controlling for perceived health risks of vaping assessed prior to message exposure ($p < .001$), respondents who viewed the uncertainty message had lower ratings of perceived risk than those who viewed the control message ($B = -0.15, p < .01$) (Model 1 in Table 2). The effect of message retained significance after controlling for respondent characteristics (Model 2 in Table 2).

Table 1
Participant Characteristics ($n = 2508$).

Variable	n (%)
Message condition	
Uncertainty message	1253 (50.0)
Control message	1255 (50.0)
Current cigarette smoking	
Smoker ^a	1252 (49.9)
Nonsmoker	1256 (50.1)
Current EVP use	
Not at all	1179 (47.0)
Rarely	268 (10.7)
Some days	485 (19.3)
Every day	576 (23.0)
Gender	
Male	1185 (47.3)
Female	1319 (52.7)
Age	
18–29	336 (13)
30–49	1185 (47)
50 +	987 (39)
Race/ethnicity	
White, non-Hispanic	1674 (67.2)
Black, non-Hispanic	283 (11.4)
Hispanic	304 (12.2)
Other	230 (9.2)
Health literacy	
High ^b	1565 (62.4)
Low	943 (37.6)

EVP = electronic vaping product.

^a Smoked 100 cigarettes in lifetime and now smokes every day or some days.

^b Answered at least 3 of the 4 health literacy items correctly.

3.3. Intention to try vaping soon

Among individuals who had never tried vaping, there was no association of message type with intention to try vaping soon.

3.4. Intention to stop vaping within 6 months

Among current vapers, there was no association between message type and intention to stop vaping within the next 6 months.

4. Discussion

The science around EVP use is evolving, and the short-term and long-term effects of vaping are unclear. This study examined the reactions of EVP users and non-users to messages that did or did not acknowledge that uncertainty. Exposure to a message focused on scientific uncertainty resulted in lower perceived risk among both EVP users and non-users, even controlling for factors like EVP use and perceived risk prior to message exposure.

Although more research is needed to understand the mechanisms of this effect, there are some potential explanations for why the uncertainty message was related to lower ratings of perceived risk. First, research in the health communication literature suggests that a message generating uncertainty may also generate deeper message processing (Nabi, 2002). Deeper processing and internal elaboration of information about the uncertainty of health harms might have contributed to lower ratings of perceived risk in the uncertainty condition compared with the control condition. Second, many public health messages about tobacco use rely on fear appeals (Witte & Allen, 2000), and the public is likely accustomed to this style of messaging. The contrast between respondents' expectation of a “scary” public health message and what they encountered in the uncertainty message (i.e., the equipoise regarding health effects) may have resulted in lower ratings of perceived risk in that condition.

Alternatively, other content in the messages—unrelated to uncertainty—may have impacted risk perceptions. For example, the uncertainty message mentioned breathing cigarette smoke, which the general public universally recognizes as harmful (Kruger, Patel, Kegler, Babb, & King, 2016). Respondents' certainty about the harmfulness of smoking, paired with a message emphasizing uncertainty about EVP's health effects, might have made vaping seem less harmful in contrast.

The message manipulation did not impact behavioral intentions to start or stop vaping, potentially because it was low-dose (i.e., only a one-time exposure to a text-based message). However, the effect on perceived risk is still notable given that perceived risk is an important precursor to and predictor of many health behaviors (Brewer et al., 2007; Weinstein, 2003). Study limitations include the use of a non-probability sample and the existence of differences between the messages that were unrelated to uncertainty (e.g., length of message). These differences could have driven message effects.

Future research should explore the drivers of responses to scientific uncertainty about vaping, including emotional reactions, perceived message credibility, trust, and depth of message processing, as well as whether effects vary by presentation (e.g., videos instead of print messages) or audience (e.g., degree of knowledge about a topic). Additional research might also examine whether youth, particularly those at risk of vaping, respond to uncertainty information in a manner different from adults.

5. Conclusion

There are many types of uncertainty, including incomplete or conflicting research evidence, causal uncertainty, and uncertainty about the magnitude of personal risk associated with health-related behaviors. This study is a first step toward understanding how the public might respond to uncertainty about the health effects of vaping.

Table 2
Linear Regression Model of Perceived Risk of Vaping Assessed After Message Exposure (n = 2102).

Variable	Perceived risk of EVPs			
	Unadj. mean (SD)	Adj. mean (SE)	Model 1: Controlling for perceived risk before exposure Adj. coeff. (95% CI)	Model 2: Controlling for all factors Adj. coeff. (95% CI)
Perceived risk (before exposure)	–	–	0.70 (0.67, 0.73)***	0.64 (0.61, 0.67)***
Message				
Uncertainty message	4.78 (1.60)	4.72 (0.04)	–0.15 (–0.24, –0.05)**	–0.13 (–0.22, –0.04)**
Control message	4.87 (1.63)	4.85 (0.04)	REF	REF
Current EVP use				
Regular user ^a	4.13 (1.58)	4.54 (0.05)	–	–0.69 (–0.84, –0.55)***
Not a regular user ^b	5.36 (1.43)	5.02 (0.04)	–	REF
Current cigarette smoking				
Cigarette smoker ^c	4.83 (1.49)	4.87 (0.04)	–	–0.04 (–0.17, 0.09)
Nonsmoker	4.82 (1.73)	4.69 (0.04)	–	REF
EVP use x Smoking	–	–	–	0.43 (0.23, 0.63)***
Gender				
Male	4.86 (1.58)	4.67 (0.04)	–	–0.23 (–0.33, –0.14)***
Female	4.79 (1.65)	4.90 (0.04)	–	REF
Age				
18–29	4.72 (1.77)	4.72 (0.06)	–	REF
30–49	4.74 (1.59)	4.76 (0.04)	–	0.05 (–0.09, 0.19)
50+	4.97 (1.58)	4.87 (0.05)	–	0.15 (0.00, 0.30)
Race/ethnicity				
White, non-Hispanic	4.70 (1.60)	4.70 (0.03)	–	REF
Black, non-Hispanic	5.27 (1.62)	4.72 (0.07)	–	0.02 (–0.13, 0.17)
Hispanic	5.00 (1.65)	4.86 (0.07)	–	0.16 (0.01, 0.31)*
Other	5.04 (1.50)	4.84 (0.08)	–	0.14 (–0.03, 0.30)
Health literacy				
High ^d	4.82 (1.60)	4.85 (0.04)	–	0.13 (0.03, 0.22)*
Low	4.82 (1.64)	4.72 (0.04)	–	REF

Unadj. = Unadjusted. Adj. = Model-adjusted means or coefficients. SD = standard deviation. SE = standard error. Coeff = coefficient. EVP = electronic vaping product. Range of perceived risk scale: from 1 = not at all harmful to 7 = extremely harmful.

^a Currently vapes “some days” or “every day”.

^b Current vapes “rarely” or “not at all”.

^c Smoked 100 cigarettes in lifetime and now smokes every day or some days.

^d Answered at least 3 of the 4 health literacy items correctly.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

Tobacco control researchers and practitioners should take care when developing public health campaigns about vaping. Message creators might acknowledge scientific uncertainty in their materials to accurately reflect the state of the science and implement the CCI clear communication principles (Centers for Disease Control and Prevention (CDC), 2014) but should also be wary that introducing uncertainty could bias people toward positive responses, such as lowered perceptions of risk.

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Contributors

Drs. Pepper, Squiers, Peinado, Nonnemaker, and McCormack and Ms. Dolina and Lynch designed the study. All authors conceptualized the manuscript. Dr. Bann conducted the statistical analysis. Drs. Pepper, Squiers, and Peinado and Ms. Dolina wrote the first draft of the manuscript, and all authors contributed to and have approved the final manuscript.

Conflicts of interest

All authors declare that they have no conflicts of interest.

Declarations of interest

None.

Appendix A. Control and uncertainty messages

A.1. Control message

Vaping products

Electronic cigarettes (or e-cigarettes), vape pens, vaporizers, hookah pens, and e-pipes are different types of vaping products.

All vaping products use a battery to heat an e-liquid that releases a vapor that you inhale.

Most e-liquids have nicotine, which is made from tobacco plants. The e-liquid may also include flavoring, coloring, and other chemicals.

The U.S. Food & Drug Administration (FDA) regulates tobacco products, including vaping products with nicotine. According to the FDA, there are no safe tobacco products.

Scientists and the U.S. Surgeon General have concerns about the flavors in electronic vaping products. Studies show that flavors are one of the main reasons that youth use vaping products.

Studies have shown that the liquids in vaping products contain chemicals that are harmful when inhaled.

A.2. Uncertainty message

Vaping products

Electronic cigarettes (or e-cigarettes), vape pens, vaporizers, hookah

pens, and e-pipes are different types of vaping products.

All vaping products use a battery to heat an e-liquid that releases a vapor that you inhale.

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The U.S. Food & Drug Administration (FDA) regulates tobacco products, including vaping products with nicotine. According to the FDA, there are no safe tobacco products.

Scientists and the U.S. Surgeon General have concerns about the flavors in electronic vaping products. Studies show that flavors are one of the main reasons that youth use vaping products.

Studies show that the liquids in vaping products contain chemicals that are harmful when inhaled. However, the studies on these chemicals looked at other ways of inhaling (like breathing cigarette smoke), rather than vaping.

It's not known how vaping products affect your health

Not enough studies on vaping have been done for scientists to say how using electronic vaping products affects your health.

Here's why:

1. Vaping products are fairly new. Vaping products have only been on the U.S. market since 2007. So they haven't been around long enough for scientists to know how the chemicals in their vapor will affect your health in the future.
2. The levels of the chemicals in the vapor can be different. This depends on the type of product and how it's used. The chemicals in vapor vary:
 - between brands of vaping products
 - within the same brand of vaping products
 - depending on the voltage of the battery used.

This makes it hard for scientists to know

 - how much of each chemical you inhale when you vape
 - whether the amount of the chemicals you inhale is enough to harm your health.
3. Not enough studies have been conducted on the health effects of flavors. Many of the flavors in e-liquids have been approved by the FDA for use in food, but scientists do not yet know whether all of the flavors are safe to inhale.

The FDA and scientists continue to study the health effects of vaping.

Conclusion

Not enough scientific evidence exists to say for sure how using electronic vaping products could affect your health in the short or long term.

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A randomized controlled trial of a brief intervention for alcohol and drugs linked to the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) in primary health care in Chile

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ABSTRACT

Aim To study the effectiveness of a brief intervention (BI) associated with the ASSIST (Alcohol Smoking and Substance Involvement Screening Test) for alcohol and illicit drug use as part of a systematic screening program implemented in primary care. **Design** A multi-center randomized open-label trial stratified using the ASSIST-specific substance involvement score (for alcohol, scores ranged from 11 to 15 and 16 to 20; and for the other substances from 4 to 12 and 13 to 20). **Setting** A total of 19 primary care centers ($n = 520$), eight emergency rooms ($n = 195$) and five police stations ($n = 91$) were evaluated. **Participants** A total of 12 217 people aged between 19 and 55 years were screened for moderate alcohol and drug use risk as defined by the ASSIST Chilean version. A total of 806 non-treatment-seekers were randomized. **Intervention and comparison** ASSIST-linked BI ($n = 400$) compared with an informational pamphlet on risk associated with substance use ($n = 406$). **Measurements** Total ASSIST alcohol and illicit involvement score (ASSIST-AI), and ASSIST-specific score for alcohol, cannabis and cocaine at baseline and at 3-month follow-up. **Findings** Sixty-two per cent of participants completed follow-up. An intention-to-treat analysis showed no difference between the two groups for the ASSIST-AI score [mean difference (MD) = -0.17 , confidence interval (CI) = $-1.87, 2.20$], either for specific scores alcohol (MD = 0.18 , CI = $-1.45, 1.10$), cannabis (MD = -0.62 , CI = $-0.89, 2.14$) or cocaine (MD = -0.79 , CI = $-2.89, 4.47$). **Conclusion** It is not clear whether a brief intervention associated with the Alcohol Smoking and Substance Involvement Screening Test is more effective than an informational pamphlet in reducing alcohol and illicit substance consumption in non-treatment-seeking, primary care users with moderate risk.

Keywords Alcohol, brief intervention, cannabis, cocaine, illicit substances, primary care, randomized controlled trial, screening.

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INTRODUCTION

The Screening, Brief Intervention and Referral to Treatment (SBIRT) approach has been proposed as a suitable model for targeting risky substance users by

means of a brief intervention (BI), and in the provision of referral to treatment for an already developed clinical disorder [1–3].

The World Health Organization (WHO) has encouraged SBIRT implementation in primary care through the

development of the Alcohol Smoking and Substance Involvement Screening Test (ASSIST) [4], a comprehensive instrument that screens for nine substances. The ASSIST tool categorizes the severity of the consumption, leading to an appropriate intervention. Further, the ASSIST linked-brief intervention (BI) [5] attempts to modify substance use patterns by providing information, skills training and increased motivation in one session [6,7], lasting 5–15 minutes [8,9].

Current evidence supports screening and BI in the case of risky alcohol use [10,11]. However, evidence supporting the efficacy of BI on illegal drug use is still emerging in the context of opportunistic screening [12]. A multi-centric randomized controlled trial (RCT) undertaken in four countries was the first to report a reduction of risk among cannabis through the use of the ASSIST tool and the ASSIST-linked BI in cocaine, opiate and stimulant users [13]. Nevertheless, a recent systematic review did not find sufficient evidence of a positive or negative effect of BI on illicit drug use [14]. A study published after the review found positive results for reducing risky psychoactive drug use with a relatively intensive BI [15]. However, subsequent studies have again shown no effect in a BI [16–18].

Based on the preliminary evidence described by Humeniuk *et al.* [13], the Chilean National Service for the Prevention and Rehabilitation of Drugs and Alcohol (SENDA) ran a pilot implementation of a SBIRT program targeting at-risk alcohol and illegal drug users. For this purpose, the Chilean version of the ASSIST [19] was chosen for screening, and the ASSIST-linked BI was delivered to participants. A group of researchers, together with SENDA, validated the Chilean adaptation of the test deciding to reduce the cut-off point [19]. Based on these parameters, our team collaborated with SENDA to evaluate the effectiveness of the ASSIST-linked BI in subjects with moderate risk; that is, with a score between 4 and 20 for all substances, and between 11 and 20 for alcohol. The approach was pragmatic [20] in order to inform the development of public policy, and was carried out within primary care centers, local small emergency rooms and police stations. Two main questions were addressed, as follows:

- 1 Based on the Chilean version of ASSIST, is a BI more effective at reducing risk scores for patients with moderate risk at 3 months compared to those who receive only information via a pamphlet?
- 2 Is the effectiveness of BI dependent on the type of substance consumed?

To our knowledge, this is one of a few existing studies that have sought to evaluate the effectiveness of a BI to reduce the risky use of alcohol and drugs in Latin America.

METHODS

Study overview

The study was financed by SENDA, and developed in five municipalities (Conchalí, Peñalolén, Pudahuel, San Bernardo and Coquimbo). A total of 19 primary care centers ($n = 520$), eight emergency rooms ($n = 195$) and five police stations ($n = 91$) were evaluated. The first participant was enrolled on 1 December 2011, and the last follow-up contact was on 28 April 2013.

The protocol was approved by the Pontificia Universidad Católica de Chile ethics committee. Informed consent was obtained for every participant.

A total of 12 217 people aged between 19 and 55 years were screened for moderate alcohol and drug use risk as defined by the ASSIST Chilean version. A total of 806 non-treatment-seekers were randomized. Individuals with high risk for any substance except tobacco were excluded, as well as those who had received a similar intervention for alcohol or drugs in the last 3 months, people with cognitive or communicational impairment, individuals in treatment for mental disorders (self-reported) and people who had been charged with a crime. In Chile, pregnant women with any level of consumption are considered high risk and require assisted referral to treatment, so they were also excluded.

Design

This was an open-label parallel-group trial with participants randomized to receive either the ASSIST-linked brief intervention or an informative pamphlet. Figure 1 shows the flow of participants throughout the trial [21,22].

For the sample size estimation, we used the Brazilian arm of the World Health Organization (WHO) study [13]. A mean difference of 3.1 points in the ASSIST alcohol and illicit substance involvement score was expected. Given a normal distribution with standard deviation (SD) of 12, the sample size was 236 per group for a power of 80% and a type 1 error probability of 0.05.

The randomization was stratified using the ASSIST-specific substance involvement score: for alcohol, from 11 to 15 and 16 to 20; and for the other substances, from 4 to 12 and 13 to 20. Random-sequence was generated using SAS version 9.1 for Windows (SAS Institute Inc., Cary, NC, USA) with a 1 : 1 allocation, using random block sizes of 50. Each site received the sequence in sealed boxes with sealed opaque envelopes. The allocation was performed by the administrative staff and, when this was not possible, by the professional who administered the ASSIST.

Participants were followed-up at approximately 3 months after allocation [median = 107 days,

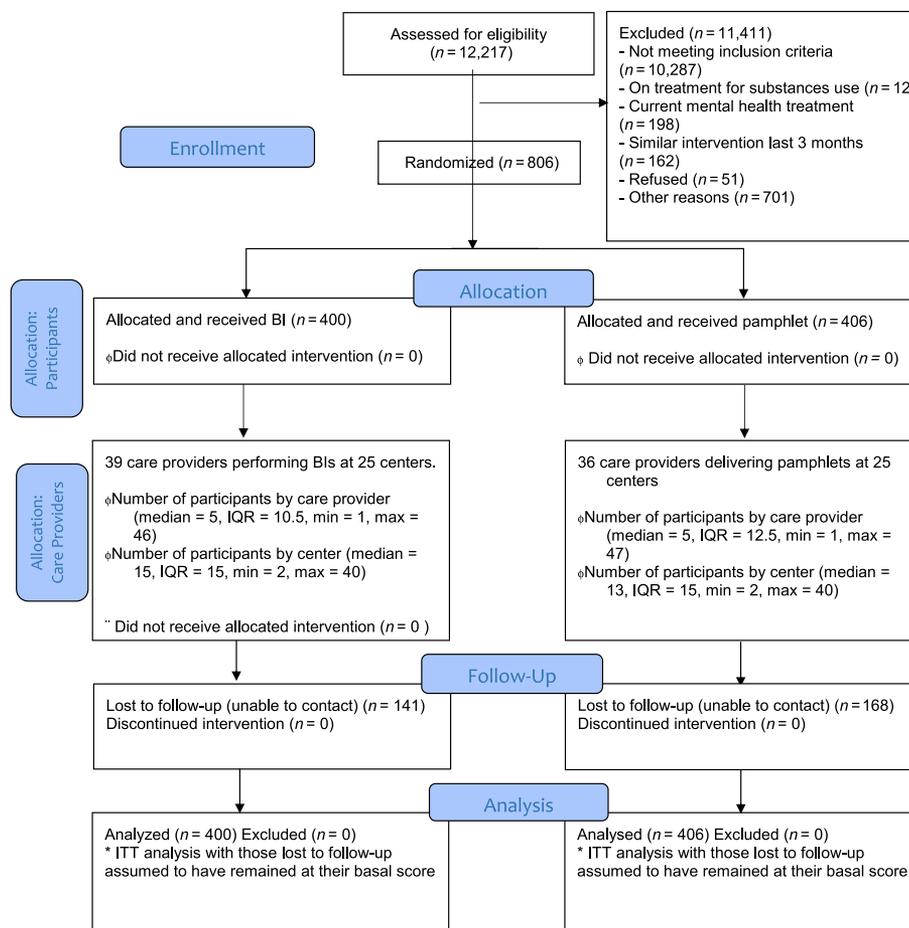


Figure 1 The flow of participants throughout the trial [21,22]. [Colour figure can be viewed at wileyonlinelibrary.com]

interquartile range (IQR) = 33, min = 34, max = 206; for the intervention group median = 107 days, IQR = 32, min = 34, max = 198; and for the control group median = 106 days, IQR = 36; min = 35, max = 206].

Instrument

The ASSIST investigates the use of alcohol, tobacco, cannabis, cocaine, amphetamine-type stimulants, sedatives, hallucinogens, inhalants, opioids and 'other' drugs. Question 1 asks about life-time use, and questions 2–7 describe the risk for that substance. Question 8 asks whether the participant has ever used drugs via injection.

The Chilean ASSIST [19] defines a score of 21 or more as high risk, different from the cut-off of 27 in the standard version [4]. Low-risk cut-off is the same. Thus, in our study moderate risk users scored between 4 and 20 for illegal drugs and between 11 and 20 for alcohol.

Demographic information was collected from all participants during the screening process. Considering the pragmatic aim of the study and to facilitate its implementation, no other instruments were used to measure variables.

Interventions

The treatment group received the ASSIST-linked BI [5] for the substance with the highest score, and the ASSIST self-help guide [23], with additional information regarding substances and high-risk situation management. When two substances had the same score, the participant had the choice to decide which one to receive counseling for. This intervention is based on the FRAMES (Feedback, Responsibility, Advice, Menu Options, Empathy and Self-Efficacy) model [24], which provides specific feedback, offers a menu of options, and enhances motivation to change. The average intervention time, including the initial screening, was 17.6 minutes (SD = 7.7).

Those in the control group received a pamphlet of their own choosing, containing broad information on substance use risk and harm. They did not receive the ASSIST-linked BI during the duration of the trial. The time of delivery of the pamphlet including the initial screening was 11.9 minutes (SD = 9.4) and was significantly lower than the intervention group [mean difference 5.7 minutes, confidence interval (CI) = 3.7–7.6; $P < 0.0$].

Outcomes

The primary outcome was the change in total alcohol and illicit substance involvement score (ASSIST-AI) between baseline and 3-month follow-up, calculated by adding up the responses to questions 1–8 for all substances except tobacco. This score reports on the overall risk associated with substances similar to the Global Risk Continuum of Substance score [25] but without tobacco, and similar to primary outcomes found from a WHO study [13].

The secondary outcomes were the ASSIST specific substance involvement scores [25] for the three main substances: alcohol, cannabis and cocaine, calculated by adding up the responses to questions 2–7 within each substance class.

Follow-up assessments were performed by a professional different from the one providing screening and BI. Due to the nature of the intervention, it was not possible to blind the participants or the providers of the BI.

Participants were compensated for participation in the study for an amount equivalent to US\$20. The participants were contacted by phone, and when necessary, in person at the provided address, to ask them to come to the site and complete the follow-up assessment.

Training

Social workers and psychologists at the sites were trained by two of the study researchers according to the ASSIST manual [5]. They were guided in the self-study of ASSIST materials, and participated in a 9-hour work-shop with

an emphasis in skills development. Following this, professionals were accredited as a requisite to participate in the study. For this purpose, they were observed via a two-way mirror with a simulated participant to evaluate the application of the screening test, the process for obtaining informed consent and the delivery of the BI. One hundred and twenty-four professionals were trained, 48 completed the double mirror session successfully and 41 participated finally in the trial, obtaining a high score in the accreditation process (average 5.7 on a scale of 1–7, SD = 0.4).

All centers were visited on a monthly basis, or weekly if needed to ensure quality. During these visits, study procedures were reviewed and assistance with the BI was provided.

All professionals worked in their own primary care facility; for the emergency rooms and police stations, professionals were selected from the nearest health center. Their participation in the study was part of their normal duties within the centers.

Statistical analysis

Analysis was undertaken for every sample following set protocol (62% of the original sample completed follow-up) and intention-to-treat (ITT). For the ITT analysis it was assumed that participants who did not complete follow-up ($n = 309$) remained with the same scores at entry (last observation carried forward).

We used χ^2 and t -tests for independent groups to search imbalances in demographic variables after randomization.

Table 1 Participant characteristics at the start of the trial.

	Intervention ($n = 400$)	Control ($n = 406$)
<i>Demographics</i>		
% Men (n)	79 (319)	78 (311)
Age, mean (SD)	28.6 (7.8)	29.7 (8.3)
Years of study, mean (SD)	11.8 (2.6)	11.7 (2.5)
% Married (n)	18 (72)	17 (69)
% Employed (n)	68 (273)	67 (270)
Total ASSIST-AI, mean (SD) ^a	27.1 (9.2)	26.6 (9.7)
<i>Participants at moderate risk by substance</i>		
Alcohol risk,% (n) ^b	52.75 (211)	52.21 (212)
Cannabis risk,% (n) ^c	46.75 (187)	50.73 (206)
Cocaine risk,% (n) ^c	17.5 (70)	19.7 (80)
Sedatives risk,% (n) ^c	5.5 (22)	3.4 (14)
Any other substance risk,% (n) ^d	5.3 (21)	4.4 (18)
<i>Participants at moderate risk for more than one substance</i>		
At risk for alcohol and cannabis,% (n)	11.0 (44)	14.0 (57)
At risk for alcohol and cocaine,% (n)	6.3 (25)	7.4 (30)

^aTotal ASSIST alcohol and illicit (ASSIST-AI) substances score for all participants; ^bparticipants with ASSIST alcohol-specific score between 11 and 20; ^cparticipants with ASSIST substance-specific score between 4 and 20; ^dparticipants with ASSIST substance-specific score between 4 and 20 for any of the following substances: amphetamines, inhalants, sedatives, hallucinogens, opioids, and 'other' drugs; there was no significant difference between the groups for any baseline variable. SD = standard deviation; ASSIST = Alcohol Smoking and Substance Involvement Screening Test.

ASSIST scores at follow-up were compared using the *t*-test for independent samples, and general linear model (GLM) [analysis of covariance (ANCOVA)] adjusted for sex, age, years of education, ASSIST–AI score at entry and type of site (primary care, emergency room and police office). As participants were at lower risk than in similar studies, we performed subgroup analysis for participants with higher scores within the moderate risk. We also conducted secondary analysis to explore different effectiveness according to the setting from which participants were recruited. All analysis were conducted using R version 3.3.0 for Mac OS X [26].

RESULTS

Participant characteristics

Table 1 shows participant characteristics for both study arms, treatment and control. Overall, 78% of participants were male and the mean age was 29 years. The average ASSIST–AI score at entry was 26.9 (SD = 9.42). Approximately 52% of participants were

at moderate risk for alcohol, 49% for cannabis and 19% for cocaine. Some participants were at moderate risk for more than one substance: 13% for alcohol and cannabis, 7% for alcohol and cocaine and 7% for cannabis and cocaine.

Of the 1930 participants with at-risk substance use at screening (Fig. 1), 198 were not enrolled for current mental health issues and 162 had received a similar intervention during the last 3 months. A total of 806 participants were enrolled; 386 (48%) received an alcohol–BI, 287 (36%) a cannabis–BI, 94 (12%) a cocaine–BI and 39 (4%) other substances–BI.

The follow-up rate for the primary outcome was 62% (497 participants), and there was no evidence of a significant difference in the follow-up rate between study groups ($\chi^2_{(1)} = 2.94, P = 0.09$). These participants did not differ significantly from those who did not complete follow-up on characteristics such as age, gender, educational level, marital status, substance use or ASSIST scores.

Table 2 ASSIST scores: total alcohol—illicit drugs and specific score for the three main substances.

	<i>n</i>	<i>At-entry</i>	<i>Follow-up</i>	<i>Mean difference (95% CI)</i>	<i>Adjusted mean difference (95%CI)^a</i>
<i>ITT sample^b</i>					
ASSIST–AI, mean (SD)					
Intervention	400	27.1 (9.2)	28.11 (14.4)	–0.17 (–1.87, 2.20)	–0.13 (–1.47, 1.74)
Control	406	26.6 (9.7)	27.94 (15.0)		
Alcohol ASSIST, mean (SD) ^c					
Intervention	192	14.68 (2.78)	12.94 (6.34)	0.18 (–1.45, 1.10)	–0.13 (–1.13, 1.39)
Control	194	14.65 (2.75)	13.12 (6.41)		
Cannabis ASSIST, mean (SD) ^c					
Intervention	143	9.60 (4.62)	10.43 (6.40)	–0.62 (–0.89, 2.14)	–0.21 (–1.25, 1.66)
Control	144	9.96 (4.29)	9.81 (6.65)		
Cocaine ASSIST, mean (SD) ^c					
Intervention	41	11.07 (5.14)	11.07 (9.24)	–0.79 (–2.89, 4.47)	–0.11 (–3.69, 3.48)
Control	53	10.43 (5.13)	10.28 (8.45)		
<i>Per protocol sample^d</i>					
ASSIST–AI, mean (SD)					
Intervention	259	26.69 (8.79)	28.31 (11.5)	0.20 (–3.24, 2.83)	0.01 (–2.59, 2.61)
Control	238	26.29 (9.84)	28.51 (11.9)		
Alcohol ASSIST, mean (SD) ^c					
Intervention	122	14.58 (2.78)	11.84 (7.47)	0.36 (–2.34, 1.61)	0.01 (–1.96, 1.95)
Control	115	14.79 (2.78)	12.20 (7.90)		
Cannabis ASSIST, mean (SD) ^c					
Intervention	90	9.92 (4.30)	10.67 (7.37)	–1.03 (–1.24, 3.29)	–0.87 (–1.35, 3.08)
Control	83	9.29 (4.36)	9.64 (7.69)		
Cocaine ASSIST, mean (SD) ^c					
Intervention	28	10.5 (4.89)	10.50 (10.55)	–0.60 (–4.94, 6.14)	–0.27 (–5.48, 6.01)
Control	29	10.17 (4.79)	9.89 (10.31)		

Primary outcome: Alcohol Smoking and Substance Involvement Screening Test drugs score (ASSIST–AI). Secondary outcomes: specific substance ASSIST involvement scores for the three main substances. ^aLinear regression model that adjusted for at entry ASSIST–AI score, age, gender, years of study and type of center. SD = standard deviation; CI = confidence interval. ^bIntention-to-treat (ITT) sample as randomized; for participants who did not complete follow-up it was assumed that they maintained baseline score; ^cparticipants analyzed by the substance for which the intervention was delivered; ^dper-protocol sample, excluding 309 participants for attrition.

Outcomes

ASSIST scores were compared in the full sample as randomized (ITT analysis) and in the per-protocol sample. There was no difference in effectiveness between the BI and the delivery of a pamphlet for primary or secondary outcomes in both per-protocol and ITT analyses (Table 2). Effect sizes were only marginally altered in linear regression models that adjusted for at entry ASSIST–AI score, age, gender, years of study and type of center.

Subgroup analysis

In a *post-hoc* analysis, we explored the effectiveness of the intervention in two subgroups, higher scores within the moderate risk category (specific alcohol ASSIST >15 and, for the other substances, a specific ASSIST score > 12), and participants at moderate risk for more than one substance simultaneously. We did not find any significant variation in the total ASSIST–AI score for these subgroups. Additionally, effectiveness was evaluated for subgroups based on the type of center, where no significance was found (not shown).

DISCUSSION

Our study showed no evidence of the effectiveness of ASSIST-linked BI compared to the delivery of a pamphlet for participants with moderate risk consumption detected by opportunistic screening in primary care. There was no significant difference between the groups in the overall ASSIST–AI score or specific ASSIST scores for alcohol, cannabis or cocaine.

It is important to highlight that the difference in the Chilean ASSIST [19] cut-off point compared to the original ASSIST version [4] used in this study for detecting participants at moderate risk has at least three main implications: (1) in part, it limits the comparability of our study to other studies that utilize the original cut-off version; (2) the exclusion of potential participants with scores between 21 and 27 could explain in part the inability to demonstrate effectiveness of the BI, as it is precisely in participants with riskier use, and therefore with greater consequences derived from the use, where it is more feasible to detect a change in the level of risk after BI; and (3) the calculated sample size could be insufficient to demonstrate differences among lower-risk participants, as the data available for calculation were based on a study that included participants with scores between 21 and 27 points and with a higher overall average score (27 in our study versus 36 in Humeniuk *et al.* [13]). Although several subgroups analysis were performed attempting to capture participants with higher risk, it was not possible to demonstrate the effectiveness of BI in these subgroups. In

this context, the results of the present study are particularly relevant for participants with relatively low risk within the moderate risk group.

However, our results are consistent with much of the recent literature [12]. Young's systematic review found insufficient evidence for the effectiveness of BI associated with screening for risky substance use [14]. A study conducted in the primary care by Roy-Byrne *et al.* showed no effect of a comparable BI on the reduction of days of problematic drug use [16]. Similar to our study, the intervention was implemented largely by social workers from participating clinics (US-Safety Net). The incorporation of professionals other than doctors is an important aspect of the implementation of a SBIRT program in primary care in the Latin American context. Social workers are crucial in the identification, outreach and support of participants, as well as the follow-up and maintenance of care. We believe that the provided training, accreditation and supervision of social workers and psychologists in our study support the quality of the ASSIST-linked BI and its fidelity to the intervention model.

Another study by Saitz *et al.* [18], which captured participants through systematic screening in primary care and tested two different models of BI, showed no decrease in drug use by self-report or biochemical validation. Similar findings were observed by Woodruff *et al.* [17] in the emergency department setting. These studies included participants with a broad spectrum of baseline risk, and all included participants who were in the higher risk categories of the instruments used.

Moreover, other studies have shown the effectiveness of BI. Humeniuk *et al.* [13] showed positive results using the ASSIST-linked BI. More recently, Gelberg *et al.* [15] also showed favorable results when evaluating a multi-component BI, resulting in 2.2 days less drug use for the main substance at 3 months' follow-up. The intensity of the intervention was greater than that of our study, involving a doctor, a video message and up to two 20–30-minute follow-up telephone coaching sessions.

To our knowledge, this RCT is the second to evaluate simultaneously a BI for alcohol and other substances in the context of systematic screening in primary care, which makes a great deal of strategic public health sense. Mertens *et al.* [27] addressed simultaneously the risky use of alcohol and illicit drugs in a SBIRT program. No decrease in the use of illicit drugs was found, but the BI was associated with a decrease in the alcohol-specific ASSIST score. However, in our study we observed a reduction of the alcohol-specific score for both groups, with no effect attributable to BI. Regression to the mean, natural cohort tendencies, an effect of the pamphlet delivery (minimal intervention) or effects of the research project itself on alcohol use are potential explanations [28].

The risk profile of the participants in our study presents some peculiarities. Fifty-two per cent had a risky use of alcohol, 49% of marijuana but only 19% of cocaine. This lower proportion may be due to an effect of the setting, as the majority of the participants came from health centers, where the risky use of cocaine reached 22%, compared to 30% in emergency rooms. In addition, in police stations risky cocaine use reached only 10%, possibly by subreport associated with fear of the legal consequences of reporting its use. Another possible explanation for the relatively low proportion of risky cocaine users is that, unlike alcohol and marijuana, approximately half of the people who have used cocaine last year already present a problematic use [29]; therefore, it is more likely that these participants have high ASSIST scores, and may have been excluded from the study.

Another consideration is that the study incorporated three different settings: health centers, low complexity emergency rooms and police stations. Some literature suggests differences in the effectiveness of BIs due to differences in the settings [30]. It is possible that our results are a mix of different effects over different settings. Despite the fact that we performed subgroup analyses, they were unpowered to detect possible differences between participants from different contexts of care.

Another limitation to our study includes a rate of loss of 38%, which limits the generalizability of the results. However, there were no differences on baseline demographic characteristics or ASSIST scores among those who completed follow-up versus those who did not. The main reason for attrition was the inability to contact participants. It is important to mention that the follow-up rate was higher in the intervention group compared to the control; however, this difference did not reach a significance level of 0.05, and is unlikely to have biased outcomes. Also, another potential limitation was the use of self-report for the outcomes measure, without biochemical validation, which may have introduced social desirability bias [31]. Finally, a potential major risk of study design is ascertainment bias, and that although the outcome assessment was blinded, it is possible that some participants reported their allocation group to the professional who evaluated them.

Conversely, the main strength of our study is its highly pragmatic emphasis, with daily practice conditions implemented with an experimental design. The participants were opportunistically screened, non-treatment-seekers; the intervention was performed on site by social workers and psychologists working in the centers, all of which represent primary care settings in a middle-income country. Further, fidelity to the intervention model was maintained throughout the trial, with a high-quality training procedure and ongoing supervision of BI

providers. The results report on the performance of BI in this context. Finally, it was important that our design included a blinded outcomes assessment which attempted to eliminate any bias in assessing the effects of BI.

CONCLUSION

Our findings were inconclusive as to whether or not a difference was present between ASSIST-linked BI and the delivery of an informational pamphlet in the reduction of alcohol and illicit substance consumption-associated risks in non-treatment-seeking users with moderate risk in primary care. The widespread implementation of an alcohol and illicit drugs SBIRT program, based on the effectiveness of ASSIST-linked BI, is not supported. However, there may be other reasons that encourage the implementation of such a program, such as the detection and referral of high-risk individuals, an increase in the capacity to address these issues in primary care or the eventual effect of minimal interventions in populations at moderate risk.

Clinical trial registration

ClinicalTrials.gov Identifier: NCT01573416.

Declaration of interests

None.

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Predicting Attitude Toward Methamphetamine Use: The Role of Antidrug Campaign Exposure and Conversations About Meth in Montana

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This investigation utilized the integrative model of behavioral prediction to assess the Montana Meth Project (MMP) campaign by testing theoretical antecedents of attitude toward methamphetamine (meth) use. College students in Montana ($N = 403$) were surveyed about their exposure to MMP ads and communication about meth in conversation. Structural equation modeling showed that the data fit the specified model well. Significant parameters indicated that only beliefs about the negative relational outcomes of meth use, and not about personal well-being or physical appearance, were related to attitude. Attention, rather than encoded exposure, to MMP ads related to each belief about meth use. Conversation frequency related to engagement with MMP ads, and a conversational partner's conveyed attitude toward meth use related to personal and physical beliefs as well as attitudes. Theoretical and practical implications of the findings are discussed.

The Montana Meth Project (MMP) is a highly publicized campaign designed to prevent methamphetamine (meth) use in the state of Montana. The campaign was initiated in 2005 to combat the prevalence of meth in the state (Siebel & Mange, 2009) by targeting beliefs and attitudes about negative outcomes associated with the drug's use (Montana Meth Project, 2008). Due to its proclaimed success in Montana (Siebel & Mange), the campaign was adopted in six additional states (Kramer, 2009). With the campaign's growing popularity came critical attention. Opponents of the MMP empirically argue that it has little to no effect on decreasing meth use in Montana (Anderson, 2010; Erceg-Hurn, 2008).

Using the integrative model of behavioral prediction (Fishbein et al., 2002; Fishbein & Yzer, 2003), this investigation provides a detailed analysis of the theoretical propositions made by the MMP campaign's creators by examining the relationships between engagement with campaign media and related interpersonal conversations (see Southwell & Yzer, 2007) and specific beliefs about and attitude toward

meth use. Structural equation models are tested to assess how distal variables predict behavioral beliefs and how those beliefs predict attitude toward meth. Such an analysis provides insight into the efficacy of the MMP as well as into the underlying cognitive process that influences antidrug attitudes.

THE MMP CAMPAIGN

The MMP campaign was developed to increase the perceived risk of, promote dialogue with parents about, and stigmatize use of the meth among teenagers (Siebel & Mange, 2009). Market research was conducted to identify the beliefs that accounted for favorable attitudes toward meth use. After identifying these factors, a "hard-hitting, integrated media campaign" (p. 411) consisting of television, print, and radio advertisements was developed to change attitudes about meth by targeting beliefs associated with the dangers of the drug's use (Montana Department of Justice, 2008). The ads were designed to decrease favorable attitudes associated with meth use by enhancing beliefs about its detrimental impact to one's general well-being, physical appearance, behavioral control, relationships, and community (Siebel

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& Mange, 2009). The graphic ads portray meth users as “unhygienic, dangerous, untrustworthy, and exploitive” (Erceg-Hurn, 2008, p. 256) by depicting scenarios such as a son beating his mother to steal money to buy meth, young girls prostituting themselves in exchange for meth, and a group of meth-addicted teens leaving a friend to die (Siebel & Mange, 2009). From 2005 to 2007, the campaign “sustained a saturation level” of reaching its audience three to five times per week (Siebel & Mange, 2009, p. 412).

Some evidence appears to support the success of the campaign in decreasing meth use in Montana. One campaign-funded survey found that antimeth attitudinal shifts occurred since the inception of the campaign (Montana Meth Project, 2008). Other studies show that meth use in Montana has continued to decline concurrently with the campaign (Montana Department of Justice, 2008; Montana Office of Public Instruction, 2009).

Despite this proclaimed success, questions arose regarding the efficacy of the MMP campaign. Some critical analytic reviews noted that empirical trends do not support the success of the campaign. Erceg-Hurn (2008) showed that the results from various studies conducted by the MMP indicated that even though meth use decreased in Montana since the inception of the MMP, there was no evidence that the reduction was attributable to the campaign. Furthermore, comparison of youth’s attitudes before and after implementation of the campaign showed an increased acceptance and decreased perceived danger of using meth. Another empirical review showed that after accounting for preexisting downward trends in methamphetamine use before implementation of the campaign, the MMP had no discernible effect in reducing the prevalence of meth use in Montana (Anderson, 2010).

The disputed efficacy of the campaign begs a question of what factors in addition to contact with the MMP may account for changes in meth use in Montana. This research investigates how a related communication phenomenon—conversation about meth—may also influence the beliefs that are targeted by the campaign. Scholars have devoted considerable attention to the shared influence that interpersonal communication and media campaigns have on health behaviors (Morgan, 2009; Southwell & Yzer, 2007, 2009), prompting calls for campaign message approaches that deliberately encourage interpersonal communication regarding health issues (Noar, 2006). In this fashion, the MMP claims to have increased meth-related conversation generally in communities (Siebel & Mange, 2009) and specifically between teens and parents (Montana Meth Project, 2008).

The MMP’s theoretical position of beliefs influencing attitudes is consistent with many theories of behavior change. The campaign’s targeting of certain beliefs, as well as its acknowledgment that interpersonal communication, in addition to exposure to the campaign, affects health behaviors, makes it possible to model the campaign’s purported effects on attitude toward meth.

EXPOSURE TO AND INTERPERSONAL COMMUNICATION ABOUT HEALTH CAMPAIGNS

Fishbein and colleagues (2002; Fishbein & Yzer, 2003) proposed an integrative model of behavioral prediction that accounts for the factors preceding behavioral health decisions. The theory was developed to design and assess health behavior interventions. Taking elements from the reasoned action approach (Fishbein & Ajzen, 2010), health belief model (Janz & Becker, 1984), social cognitive theory (Bandura, 1997), and integrative theory of behavior change (Cappella, Fishbein, Hornik, Ahern, & Sayeed, 2001), the model predicts that health behaviors are enacted based on antecedent skills, intentions, and environmental constraints perceived by the individual. Intentions are formed through attitudes, perceived norms, and self-efficacy assessments. Each of these predictors of behavioral intention is formed based on related beliefs. Thus, behavioral beliefs and expected outcomes determine attitudes, normative beliefs and motivation to comply determine perceived norms, and efficacy beliefs determine self-efficacy assessments. The theory proposes that a number of other distal variables (e.g., personality, individual differences, and exposure to media) have indirect effects on behavior by acting on beliefs.

The present study focuses on the direct and indirect theoretical antecedents of attitude toward meth use. Although the MMP was not explicitly designed with the integrative model of behavioral prediction in mind, the campaign’s theoretical rationale and empirical support of changing attitudes through targeting beliefs (Montana Department of Justice, 2008; Siebel & Mange, 2009) allow for the application of the model to the campaign. Further, the MMP is used as an illustrative health campaign for explaining the theoretical components of the integrative model of behavioral prediction (Yzer, 2012). Studying meth-related attitude as an outcome makes sense in this context for three reasons: The MMP was designed to alter attitudes, attitudes strongly predict behavior (Kim & Hunter, 1993), and self-reports of illicit drug use are usually not valid measures of actual usage (Magura & Kang, 1996).

This investigation assessed the MMP’s intended goal of changing attitudes via changing beliefs by testing the relationships between behavioral beliefs targeted by the campaign, relevant distal variables, and attitude toward meth. Due to the campaign’s focus on the distinct outcomes about personal well-being, relationships, and physical appearance, it is hypothesized that each of these behavioral beliefs about the negative outcomes of meth use should independently relate to attitudes toward using the drug.

- H1: (a) Personal, (b) relational, and (c) physical behavioral beliefs about the negative outcomes of meth use will negatively associate with attitude toward meth use.

The integrative model of behavioral prediction (Fishbein & Yzer, 2003) proposes that distal variables such as campaign exposure are ultimately reflected in belief structures that predict behavior. Thus, distal variables are influential in determining how people form behavioral beliefs and subsequent attitudes. Fishbein and Yzer theorized one such distal variable to be exposure to mass media health interventions. Indeed, public health campaign success is contingent on campaign exposure (Hornik, 1997).

Actual exposure to a campaign itself does not guarantee processing of the media content (Clarke & Kline, 1974; Salmon, 1986); it is possible to be in the presence of an advertisement without engaging the message. Instead, encoded exposure—the retrievable memory trace of contact with campaign ads—more appropriately characterizes the type of exposure of interest to campaign evaluators (Southwell, Barmada, Hornik, & Maklan, 2002). Simply put, encoded exposure is a person's recognition of previous engagement with mediated content. Encoded exposure to mediated material significantly predicts beliefs associated with the material (Hwang & Southwell, 2009).

However, encoded exposure may not capture the full extent to which engagement with campaign advertisements influences beliefs. McGuire (2001) noted the conceptual difference between exposure and attention to public campaigns in affecting beliefs. Exposure (i.e., tuning in to the communication) is different from the additional step of attending to the communication, which is also required for persuasion to occur via cognitive processing. Research corroborates this theoretical distinction. Attention and exposure to campaign advertisements independently predicted cognitive effects of campaigns, with attention being the stronger predictor (Chaffee & Schleuder, 1986). Other research shows that media exposure and attention independently influence health-related risk judgments (Slater & Rasinski, 2005).

As distal variables, exposure and attention to MMP advertisements should affect attitudes indirectly through behavioral beliefs. Because the campaign targeted distinct behavioral beliefs, the following hypotheses are forwarded regarding exposure and attention to the ads.

H2: Encoded exposure to MMP advertisements will positively associate with (a) personal, (b) relational, and (c) physical behavioral beliefs about meth use.

H3: Attention to MMP advertisements will positively associate with (a) personal, (b) relational, and (c) physical behavioral beliefs about meth use.

Engagement with campaign advertisements is not a solitary activity. Social networks influence how people process and act upon mediated messages (Hornik, 1989; Southwell, 2005). Anecdotal evidence has been used to suggest that a benefit of the MMP campaign was to increase open discussions about meth (Siebel & Mange, 2009). Survey research concurs that teens in Montana reported engaging in more

discussion with parents since the inception of the campaign (The Montana Meth Project, 2008).

A growing body of research demonstrates that conversations related to health campaigns influence a campaign's effectiveness. The majority of research indicates that interpersonal communication prompted by campaigns enhances knowledge, pro-attitudinal shifts, and positive behavior change (Chatterjee, Bhanot, Frank, Murphy, & Power, 2009; Dunlop, Wakefield, & Kashima, 2008; Southwell & Torres, 2006; van den Putte, Yzer, & Brunsting, 2005). Studies show that the mere presence of campaign-related conversation, regardless of its valence, shifts attitudes, intentions, and actual health behaviors toward a campaign's advocated position (Durkin & Wakefield, 2006; Valente & Saba, 1998; van den Putte, Yzer, Southwell, de Bruijn, & Willemsen, 2011). One study found that conversations prompted by a health campaign still led to positive health outcomes even when those engaging in the conversations had negative reactions to the campaign, suggesting that talk has a neutralizing effect on negative perceptions toward campaign content (Hafstad & Aarø, 1997). Overall, the presence of campaign-related conversations positively predicts attitude and behavior change in conjunction with campaigns. In light of this, a hypothesis is proposed that treats meth-related conversation frequency as a distal predictor of behavioral beliefs about meth use.

H4: Meth-related conversation frequency will positively associate with (a) personal, (b) relational, and (c) physical behavioral beliefs about meth use.

Not all research supports the claim that more frequent campaign-related conversation equates to more desirable attitude change. David, Cappella, and Fishbein (2006) found that discussing antidrug campaigns on the Internet increased promarijuana attitudes and approval of the drug. Other studies conclude that evaluations made by people about campaign advertisements determine whether a subsequent conversation about the campaign advances or inhibits campaigns goals (Helme et al., 2011). That is, when people do not perceive campaigns favorably, conversations are likely to be unfavorable toward campaign message content.

The recognition that conversations can both help or hinder campaigns led to Southwell and Yzer's (2009) call for research to focus on the content and characteristics of conversations, rather than just the frequency with which they occur. Researchers are now looking at content of conversations as mechanisms for interpersonal influence in behavior change. For example, interpersonal pressure stimulated by campaign advertisements (e.g., nagging from others) increased the likelihood with which people quit smoking (Dunlop, Cotter, & Perez, 2011). The sharing of positive opinions and perceived expression of favorability toward vaccination within conversations led to message-advocated attitude change and behavioral intentions (Dunlop, Kashima, & Wakefield, 2010). Indeed, the nature of conversations is likely an important predictor of beliefs and attitudes toward

meth use. Erceg-Hurn (2008) pointed out that though the MMP appeared to spur conversations between parents and children about meth, the possibility exists that “parents and teens could be discussing how the MMP’s advertisements exaggerate the risks of methamphetamine use” (p. 260). Determining how conversational content about meth affects beliefs about the outcomes of the drug’s use is important.

Thus, the current investigation sought to determine how a communicator’s attitude in recent conversation influences behavioral beliefs and subsequent attitudes. In light of the aforementioned research, another’s attitude toward meth use conveyed in a recent conversation serves as a viable predictor of perceptions toward meth. Thus, the attitude communicated by another in conversation should serve as a distal variable that ultimately affects behavioral beliefs associated with meth use. It also seems plausible that communicated attitudes bypass internalization into behavioral beliefs by directly relating with one’s attitude. With this in mind, consider the following hypotheses:

- H5: A recent conversational partner’s conveyed attitude toward meth will positively associate with (a) personal, (b) relational, and (c) physical behavioral beliefs about meth use.
- H6: A recent conversational partner’s conveyed attitude toward meth will directly and positively associate with attitude toward meth use.

The final area of interest in this investigation is the role of conversation frequency in predicting engagement with MMP advertisements and conveyed attitudes toward meth in conversation. Evidence suggests that campaign-related conversations sensitize people to future engagement with the campaign. Southwell (2005) found that individuals who report more conversation about drugs also report greater encoded exposure to antidrug campaign advertisements. Following McGuire’s (2001) information processing model, the closely related concept of attention should also be influenced by conversation frequency.

Given the evidence that shows discussing campaign relevant topics increases persuasion in the direction advocated by campaigns, the frequency with which conversations occur about meth likely influences the content of those conversations. Since people who more frequently talk are more likely to align their attitudes and behaviors with those of a campaign (see H4), the content of their conversations (as a behavior) is also likely to align with campaign content. Thus, individuals not only communicate a negative attitude toward meth, but confirm their beliefs by talking with others who share similar attitudes. In light of the preceding analysis, three hypotheses are proposed:

- H7: Conversation frequency positively associates with encoded exposure to MMP advertisements.
- H8: Conversation frequency positively associates with attention to MMP advertisements.

- H9: Conversation frequency negatively associates with attitude toward meth conveyed by a partner in recent conversation.

METH USE AMONG COLLEGE STUDENTS

Although the MMP campaign targeted youth between the ages of 12 and 17 (Seibel & Mange, 2009), there is precedent to study relationships between campaign contact, interpersonal communication, and cognitions about meth among college students. At the time of data collection, the average age for first-time meth use was 19 years (SAMHSA, 2009), 2 years older than the oldest age group targeted by the MMP. Multiple studies showed that meth use increased among college students in the years preceding the initiation of the MMP (Johnston, O’Malley, Bachman, & Schulenberg, 2005; SAMHSA, 2006). Although some reports generally suggest that current enrollment in college serves as a protective factor for past-year meth use (Herman-Stahl, Krebs, Kroutil, & Heller, 2007), others found college education to be a risk factor for people who graduated from high school (Durell, Kroutil, Crits-Christoph, Barchha, & Van Brunt, 2008). Durell and colleagues found that (1) among high school graduates, current meth use increased with more undergraduate education; (2) people with some college were significantly more likely to use meth compared to those without high school degrees; and (3) among 18- to 25-year-olds, there was no significant difference between students and nonstudents in lifetime use. Clearly, college students are not unaffected by meth.

Scholars note the potential for increased risk of illegal stimulant use, including meth, among youth when transitioning to college (Teter et al., 2003). The director of the MMP at the time these data were collected acknowledged the need for research about meth use among college-aged populations, citing anecdotal reports of meth being available on campuses throughout Montana (Redden, 2006). For these reasons, this investigation assessed hypotheses within a sample of college students in Montana.

METHOD

Participants and Procedure

Participants ($N = 437$) were recruited from a general education communication course at a large university in Montana during late October and early November in 2007. People were offered a small amount of extra credit to complete a survey. Of the participants completing the survey, 34 (7.7%) reported never having a conversation about meth, and their data were excluded from analysis. This case-wise deletion was necessary to test the specified model that included structural paths relating to idiographic conversations about meth

(H5, H6, and H9), but it is possible that the small number of removed cases process MMP ads differently from the typical respondent and these effects are not represent in analysis. The final sample consisted of 403 participants comprised mainly of teenagers ($M = 19.66$, $SD = 2.65$). Most participants (60.8%) were in their first semester of college. Males made up 51.4% of the sample. The majority of participants identified as Caucasian (95.8%), with less than 2% in any remaining ethnic group. Most reported being Montana residents ($n = 244$, 60.5%).

Institutional review board (IRB) approval was obtained at the university where participants were enrolled. After providing information consent, participants completed a questionnaire designed to measure their engagement with the MMP campaign, as well as their attitudes, beliefs, and interpersonal communication about meth. Responses remained anonymous and confidential.

Measures¹

Meth-related conversation frequency. Six items used in media effects research (Eveland & Thomson, 2006) assessed the frequency with which people talked about meth with others in the recent past (“In the past 6 months, how often have you talked about methamphetamine with: neighbors, coworkers, friends, acquaintances, family, and classmates”). People indicated the amount of discussion on an ordinal scale from 0 (*none in the last 6 months*) to 7 (*50 times or more*) ($M = 1.05$, $SD = 0.93$, $\alpha = .80$).

Encoded exposure to the MMP. Three questions used to assess media effects (Eveland & Thomson, 2006) measured the frequency with which participants encountered MMP advertisements. Items assessed the number of days in the previous week that participants watched an MMP ad on television, read an MMP ad in print (i.e., on a billboard or in a newspaper), or heard an MMP ad on the radio (“How many days in the past week did you watch/read/hear a Montana Meth Project advertisement on the television/on billboards or in newspapers/on the radio?”; 0 = *no days* to 7 = *7 days*; $M = 1.84$, $SD = 1.51$, $\alpha = .69$).

Attention to MMP. Three items assessed the amount of attention paid to MMP advertisements on television, in print, and on the radio (“How much attention do you pay to Montana Meth Project advertisements on television/on billboards or in newspapers/on the radio?”) on a scale from 0 (*very little attention*) to 10 (*close attention*) ($M = 5.13$, $SD = 2.44$, $\alpha = .81$). This scale has been used in numerous studies of media effects (Chaffee & Schleuder, 1986; Eveland & Thomson, 2006).

¹Principal component analyses were conducted among the items that represented each scale. Initial eigenvalue results indicated that all scales represented unidimensional constructs.

Other's recent conveyed attitude toward meth. Participants were asked to recall the most recent conversation they had about meth and answer questions about the conversational partner's attitude toward meth as well as when the conversation occurred. Three items were measured on a 1 (*not at all true*) to 5 (*very true*) Likert-type scale (e.g., “He or she conveyed that occasional meth use was okay for fun” and “He or she conveyed that it is okay to experiment with meth”) ($M = 1.44$, $SD = 0.81$, $\alpha = .74$).

Behavioral beliefs. Three types of behavioral beliefs targeted by the MMP assessed people's perceived negative outcomes association with meth use. All items were measured on a on a 1 (*definitely disagree*) to 6 (*definitely agree*) Likert-type scale. *Personal* beliefs referred to general beliefs about how meth would affect one's future. Five items (e.g., “If I took methamphetamine, I would be okay” [reverse coded] and “If I took methamphetamine, nothing bad would happen to me” [reverse coded]) were used such that higher values corresponded with perceptions of more negative personal outcomes associated with meth use ($M = 5.30$, $SD = 0.82$, $\alpha = .72$). *Relational* beliefs referred to beliefs about how one's relationships would be harmed after using meth. Three items (e.g., “If I took methamphetamine, my relationships could suffer” and “If I took methamphetamine, I could hurt someone close to me”) were measured such that higher values corresponded with perceptions of more negative relational outcomes associated with meth use ($M = 5.54$, $SD = 0.81$, $\alpha = .69$). Finally, *physical outcome beliefs* referred to beliefs about how meth use will detrimentally affect one's health and bodily appearance. Three items (e.g., “If I took methamphetamine, I could experience tooth decay” and “If I took methamphetamine, I could develop sores on my skin”) were measured such that higher values corresponded with greater perceptions of negative physical outcomes related to meth use ($M = 5.30$, $SD = 0.95$, $\alpha = .79$). Information about the specific physical consequences of meth use was taken from the MMP website.

Attitude toward meth use. Four items measured attitude toward meth use (e.g., “Taking Meth is not that big of a deal”) on a 1 (*definitely disagree*) to 6 (*definitely agree*) scale ($M = 1.15$, $SD = 0.45$, $\alpha = .88$). Higher scores reflected a more positive attitude toward meth use.

RESULTS

Descriptive Results

Bivariate correlations among latent variables are found in Table 1.

Frequency of conversation about meth. Within the previous six-month period, most participants had discussed meth at least once with a friend (84.6%), classmate (64.0%),

TABLE 1
Interconstruct Correlations Among Meth-Related Cognitions and Communication

	1	2	3	4	5	6	7
1. Attitude	—						
2. Personal beliefs	-.29***	—					
3. Relational beliefs	-.43***	.53***	—				
4. Physical beliefs	-.31***	.33***	.60***	—			
5. Other's conveyed attitude	.21***	-.16***	-.08	-.13**	—		
6. MMP encoded exposure	-.03	-.02	.06	.15**	.00	—	
7. MMP attention	-.08	.19***	.18***	.16***	.00	.33***	—
8. Conversation frequency	.02	-.09*	-.05	.00	.01	.21***	.20***

Note. Significance indicated by: *** $p < .001$, ** $p < .01$, * $p < .05$.

or family member (53.6%). Conversation about meth was also prevalent in other relationships, though to a lesser extent: People reported discussing meth at least once with an acquaintance (34.8%), coworker (34.2%), or neighbor (14.5%).

Frequency of exposure to the MMP. Most people reported encountering an MMP television (59.1%), print (76.7%), or radio (60.3%) advertisement at least once in the previous week. Only 11% of people surveyed reported no exposure to an MMP ad within the previous week.

Recency of latest conversation about meth. Forty-four percent of the sample reported having a conversation about meth within the previous week (i.e., ≤ 7 days), 61% reported having a conversation within the previous 2 weeks (i.e., ≤ 14 days), and 90% reported having a conversation within the previous 2 months (i.e., ≤ 60 days).

Analysis

Structural equation modeling (SEM) was used to assess hypothesized relationships between distal predictors (i.e., encoded exposure to MMP ads, attention to MMP ads, conversation frequency, and other's conveyed attitude toward meth), behavioral beliefs, and attitude toward meth use. LISREL 8.80 software was utilized to test the structural models with full information maximum likelihood estimation. Hu and Bentler's (1999) recommendations—the root mean squared error of approximation (RMSEA) being less than or equal to .06 for excellent parsimonious fit and the standardized root mean square residual (SRMR) being less than or equal to .09 for excellent absolute fit—were used to assess model fit.

Model Construction

Measured variables served as indicators for latent factors. For each factor, one indicator was fixed to 1 to provide scale. Three measurement error covariances were added between the encoded exposure and the attention items that referenced

the same medium (e.g., the measurement errors of encoded exposure to television ads and attention paid to television ads were allowed to covary). Conversation frequency was exogenous to the two MMP engagement factors (i.e., encoded exposure and attention), and the latter two factors were allowed to covary. Other's conveyed attitude toward meth use in recent conversation was also predicted by conversation frequency. These four factors each predicted personal, relational, and physical behavioral beliefs. The three belief factors were allowed to covary. Finally, attitude toward meth use was predicted by the three belief factors as well as other's attitude toward meth use in recent conversation.

Multigroup analysis. Since data were collected from both Montana residents and residents of other states, it was possible that the model would function differently for these two groups. Residents of Montana likely experienced more exposure to the MMP, given the reported "saturation level" of the campaign in Montana in the years preceding data collection (Seibel & Mange, 2009, p. 412). Thus, a test was conducted to determine whether the model predicting attitudes toward meth would differ for people not previously exposed to the campaign as teenagers. A multigroup analysis was performed to determine whether the model functioned differently for these two groups. Multigroup analysis is a method of testing between group differences by constraining measurement and structural coefficients to be equal across groups (Bentler, 1995). Structural equation models were assessed to determine whether parameters in the specified model significantly differed between Montana residents ($n = 244$) and residents of other states ($n = 159$).

The multigroup analysis consisted of three steps (Byrne, 1998). First, confirmatory factor analysis (CFA) and structural models were tested for each group individually and assessed for goodness of fit. The CFA model fit well for Montana residents, $\chi^2(374) = 634.43, p < .01, RMSEA = .050, 90\% CI = (.043, .058), SRMR = .067$, as did the structural model, $\chi^2(379) = 636.05, p < .01, RMSEA = .050, 90\% CI = (.042, .057), SRMR = .068$. The CFA model was acceptable for residents of other states, $\chi^2(374) = 646.61,$

$p < .01$, RMSEA = .059, 90% CI = (.049, .068), SRMR = .085, as was the structural model, $\chi^2(379) = 649.46$, $p < .01$, RMSEA = .058, 90% CI = (.048, .067), SRMR = .087. Thus, the CFA and structural models appeared as sufficiently fitting models to explain each groups' data separately.

Second, the measurement model was assessed for each group simultaneously, with all model parameters—except for measurement error variances and the variance of the exogenous variable (i.e., conversation frequency)—constrained to be equal across groups. The initial CFA resulted in acceptable fit, $\chi^2(805) = 1423.79$, $p < .01$, RMSEA = .058, 90% CI = (.052, .063), SRMR = .10. Modification indices were consulted to determine whether paths in the measurement model should be unconstrained due to significant differences between groups. The between-groups constraint was released for the parameter that accounted for the greatest significant difference in χ^2 , and the CFA model was rerun. This iterative process was repeated until no significant differences in measurement paths remained between groups. The method resulted in four measurement paths being freed across groups; constraints were released for the paths between, in order, one attitude indicator, one personal belief indicator, one relational belief indicator, and one conversation frequency indicator and their respective latent factors. After these modifications, the final multigroup CFA showed good fit, $\chi^2(801) = 1390.67$, $p < .01$, RMSEA = .054, 90% CI = (.049, .060), SRMR = .098.

Finally, the structural model—with all theoretical paths constrained to be equal across groups—was tested for each group simultaneously while retaining the released constraints in the measurement model. If groups significantly differed in certain parameters, modification indices would indicate which constraint should be released across groups to significantly decrease the model χ^2 . Any significantly different theoretical paths would show that the specified model operates differently for Montanans and residents of other states. The multi-group structural model resulted in good fit, $\chi^2(806) = 1377.49$, $p < .01$, RMSEA = .055, 90% CI = (.049, .060), SRMR = .097. Iterative consultations of modification indices suggested the release of two parameters—covariances between the behavioral belief factors (i.e., first, personal and relational beliefs, and then relational and physical beliefs). After unconstraining these covariances, the model exhibited good fit, $\chi^2(804) = 1357.11$, $p < .01$, RMSEA = .053, 90% CI = (.047, .059), SRMR = .096. Montana residents and residents of other states significantly differed in the strength of covariances between the belief factors. In particular, the covariance between personal beliefs and relational beliefs was significantly greater for Montanans (standardized $\sigma = .69$) than for residents of other states ($\sigma = .27$), whereas the covariance between relational beliefs and physical beliefs was significantly greater for residents of other states ($\sigma = .61$) than for Montanans ($\sigma = .47$). Montanans and residents of other states did not significantly differ in any hypothesized theoretical paths.

Final model. Because the multigroup analysis did not result in significant differences between Montanans or residents of other states in theorized causal paths, the data of these two groups were combined and analyzed as one sample irrespective of residency status. Hypotheses were tested according to this model. The CFA indicated good fit for the measurement model, $\chi^2(374) = 786.86$, $p < .01$, RMSEA = .051, 90% CI = (.046, .057), SRMR = .063. The structural model exhibited excellent model fit, $\chi^2(379) = 792.16$, $p < .01$, RMSEA = .051, 90% CI = (.046, .056), SRMR = .065, and appears in Figure 1.

Hypotheses Testing

H1 stated that three distinct behavioral beliefs about the negative outcomes of meth use that were targeted by the MMP would relate to attitude toward meth use. As Figure 1 indicates, only relational beliefs significantly associated with attitudes toward meth (standardized $\beta = -.35$, $p < .001$); as people's beliefs increased about the negative relational consequences of meth use, their attitude toward meth use became more negative. Personal and physical beliefs did not significantly associate with attitude toward meth use. H1 was partially supported.

H2 and H3 proposed that engagement with campaign advertisements in the form of encoded exposure and attention would relate to behavioral beliefs. Although attention to MMP ads positively associated with personal ($\beta = .24$, $p < .01$), relational ($\beta = .20$, $p < .01$), and physical ($\beta = .14$, $p < .05$) beliefs, encoded exposure did not significantly relate to any behavioral beliefs (see Figure 1). On the one hand, people who reported paying more attention to MMP media experienced increased beliefs regarding the negative outcomes of meth use. On the other hand, the frequency with which people reported encountering MMP ads had no direct relationship with their behavioral beliefs of meth use. Thus, H2 was rejected and H3 was supported.

Frequency of meth-related conversation was predicted to relate to behavioral beliefs (H4). Figure 1 shows that conversation frequency did not significantly relate to behavioral beliefs associated with meth use. H4 was rejected.

A partner's conveyed attitude toward meth in recent conversation was hypothesized to relate to behavioral beliefs (H5) and attitude toward meth use (H6). As shown in Figure 1, other's conveyed attitude negatively associated with personal ($\beta = -.16$, $p < .01$) and physical ($\beta = -.13$, $p < .05$) beliefs, but not relational beliefs ($\beta = -.08$, *ns*). The more favorable another's conveyed attitude toward meth, the lower were the beliefs in the negative personal and physical outcomes of meth use. H5 was partially supported. A partner's conveyed attitude positively associated with attitude toward meth use ($\beta = .17$, $p < .01$). The more favorable another's conveyed attitude toward meth use in recent conversation, the more favorable was one's own attitude toward meth use. H6 was supported.

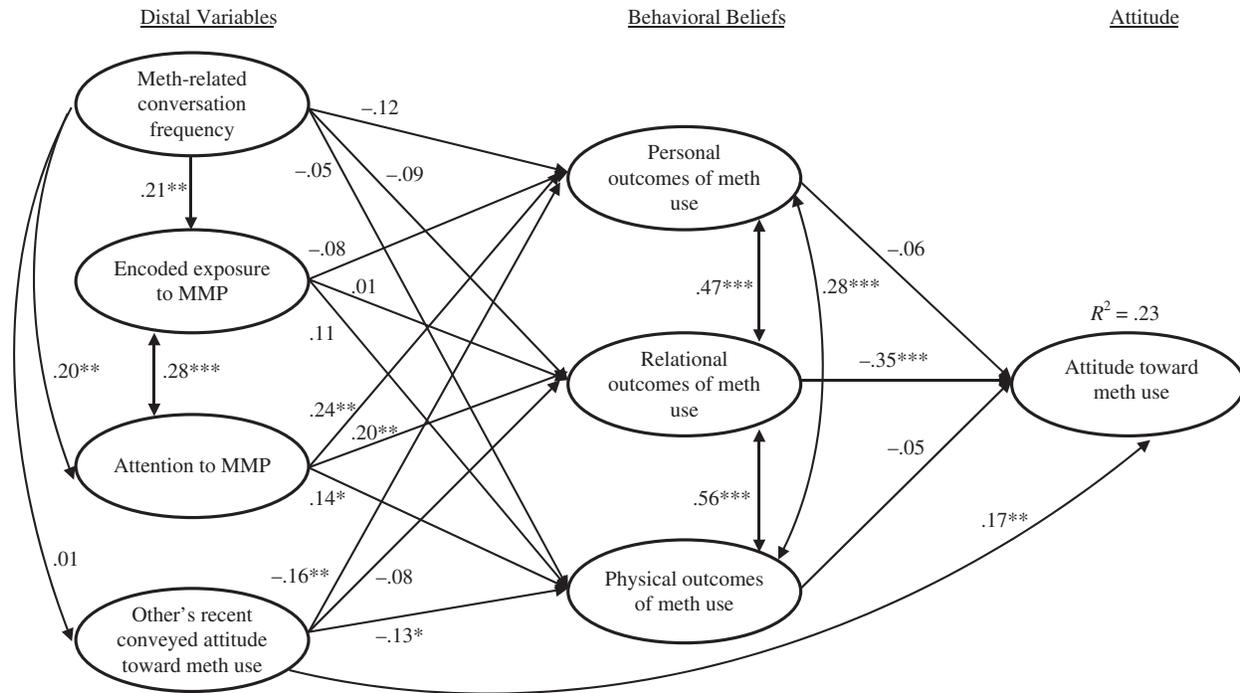


FIGURE 1 Final model predicting attitude toward methamphetamine with distal variables and behavioral beliefs. All parameter estimates are standardized. Significance indicated by: **p* < .05, ***p* < .01, ****p* < .001.

The last three hypotheses referred to the relationship between meth-related conversation frequency and encoded exposure to the MMP, attention to the MMP, and a partner's conveyed attitude toward meth use. Conversation frequency associated with encoded exposure ($\beta = .21, p < .01$) and attention ($\beta = .20, p < .01$) to MMP advertisements (see Figure 1). People who discussed meth more frequently also reported more encounters with and paying more attention to MMP ads. These results support H7 and H8. Contrary to expectations, conversation frequency did not share a significant association with other's conveyed attitude toward meth use in recent conversation. H9 was rejected.

DISCUSSION

This investigation examined the relationships between engagement with the MMP campaign, conversations about meth, and beliefs about and attitude toward meth use. Of the behavioral beliefs targeted by the MMP that were measured here, only those about the relational consequences of meth use associated with attitude toward the drug. Attention to MMP ads, rather than encoded exposure, related to beliefs about meth use. One characteristic of recent conversation—the attitude toward meth use conveyed by a conversational partner—associated with beliefs about negative personal and physical outcomes of meth use as well as attitude toward meth use. Finally, meth-related conversation frequency significantly related to encoded exposure and attention to MMP

ads, but not a recent conversational partner's attitude toward meth. The results reported here provide information about the MMP campaign as well as the theoretical antecedents of beliefs and attitudes of meth use.

Theoretical Implications

Utilizing the causal sequence suggested by the integrative model of behavioral prediction (Fishbein et al., 2002), a model was proposed to test the cognitive and experiential antecedents to attitudes toward illicit drug use. Based on research that integrates media campaign engagement and related interpersonal communication, an argument was made to suggest that, in addition to exposure to a campaign, conversation variables (here, conversation frequency and other's conveyed attitude in recent conversation) serve as distal predictors of behavioral beliefs. Results support and extend elements of the integrative model of behavioral prediction and research about campaigns and conversation in a number of ways.

First, this study suggests the need to model relationships between multiple behavioral beliefs and attitude when interventions target multiple but distinct beliefs. It is not enough to assume that "the more one believes that performing the behavior in question will lead to 'good' outcomes and prevent 'bad' outcomes, the more favorable one's attitude should be toward performing the behavior" (Fishbein & Yzer, 2003, p. 168). Instead, it is possible that some outcome-specific beliefs are connected with attitudes while

others are not. This study showed that beliefs about the negative relational outcomes of meth use relate to attitude, but beliefs about personal and physical outcomes do not.

Campaign developers emphasize the need to identify relevant attitudinal considerations for an audience before implementing an intervention (Cappella et al., 2001). The MMP's preliminary research led to the identification of beliefs that appeared to affect attitudes toward meth (e.g., beliefs about one's personal well-being, relationships, and physical appearance), and the campaign was designed to target these beliefs. This study supports the idea that health messages designed to target behavioral beliefs can successfully alter these beliefs and still not elicit expected changes in health related outcomes (Yzer, 2012). Thus, theoretical evaluations of attitudes should measure relevant behavioral beliefs separately to assess their independent effects.

Second, these results clearly show that campaign exposure and attention operate as separate constructs. Though McGuire (2001) identified this conceptual distinction, little research has investigated the mutual roles of exposure and attention to campaign outcomes. Although encoded exposure implies some degree of attention—a retrievable memory of a stimulus cannot be made unless the stimulus first enters into one's awareness—this study showed that while encoded exposure and attention covary, only attention to the campaign directly associated with beliefs. This finding corroborates previous research that demonstrated attention's stronger influence on beliefs and perceived risks compared to encoded exposure (Chaffee & Schleuder, 1986; Slater & Rasinski, 2005). Attention to campaigns, separate from campaign exposure, appears to function in concert with beliefs.

Finally, this study demonstrates that interpersonal communication plays an important role in the success of health messages. Conversations about drugs can directly and indirectly relate to behavioral beliefs about outcomes associated with drug use. Contrary to previous findings (Durkin, Wakefield, Kashima, 2008; van den Putte, Yzer, & Brunsting, 2005), conversation frequency did not directly relate to cognitions associated with behavior change. However, conversation frequency significantly associated with encoded exposure and attention to MMP advertisements, and attention to MMP ads significantly associated with behavioral beliefs about meth use. Thus, for the MMP campaign, the possibility remains that conversation frequency may indirectly relate to behavioral beliefs through mediated channels. These results support previous findings regarding the effects of conversation in motivating subsequent engagement with campaign content (Southwell, 2005). The process by which conversation frequency affects behavior needs continued investigation; in particular, psychological mechanisms that mediate the role of conversation on subsequent attitudes, like increased attention to related media, should be explored.

This study is one of the few that examines the relationships between conversational characteristics and health

beliefs and attitudes. Results showed that a conversational partner's conveyed attitude toward meth use significantly associated with personal and physical beliefs as well as attitude toward meth use. This pattern suggests that the favorability toward health behaviors communicated in conversation (Dunlop, 2011; Helme et al., 2011), rather than solely the frequency with which the conversations occur, may be an important determinant of beliefs. Continued exploration into interpersonal communication as a distal antecedent to beliefs that ultimately predict intentions to engage in behaviors would be fruitful research.

This study provided support for the integrative model of behavioral prediction as a theoretical approach to test the relationships between campaign contact, interpersonal communication, and cognitions about meth use in Montana. Nevertheless, the success of this model does not eliminate the possibility that other models better explain these cross-sectional data. For example, a model whereby attitude toward meth is exogenous to other variables makes sense, as it is feasible that one's position about meth can motivate consumption of MMP ads, communication about the drug, and beliefs about its effects. Indeed, SEM procedures indicated this model² also adequately fitted the data, $\chi^2(391) = 828.05$, $p < .01$, RMSEA = .052, 90% CI = (.047, .057), SRMR = .074. However, model comparison using Akaike's information criterion (Akaike, 1974) demonstrated that the structure implied by the integrative model of behavioral prediction was notably lower (AIC = 942.43) than a model with attitude acting exogenously to other constructs (AIC = 962.24), and therefore should be considered as superior. Although the hypothesized model might continue to withstand alternative explanations, it is possible that another untested model better describes relationships among these variables. Still, the theoretical foundation on which the integrative model is based affords confidence in the relationships examined here.

Practical Implications

Although the sample consisted of college students older than the MMP's target audience of twelve to seventeen year olds (Siebel & Mange, 2009), the majority of participants were teenage residents of Montana in their first semester of college at the time of data collection. That is, this sample consisted of individuals who were targeted by the campaign when it was implemented in 2005. This point, along with the risk of meth use among college students (Durell et al., 2008) and the observation that most participants talked about meth and encountered MMP ads on a regular basis, suggests that these data offer valid evaluative insight to the campaign's

²The alternative model treated attitude as exogenous to all other latent factors. This model retained the measurement error and structural covariances that were found in the hypothesized model.

relationships with meth-related cognitions and suggestions for future campaign design. Four particular points are noted.

First, with the exception of Montanans' and residents of other states' differing perceptions regarding the associations between personal, relational, and physical beliefs, the specified model operated alike for both groups. That is, engagement with MMP media and conversing about meth functioned similarly for students who had presumable familiarity with the campaign from growing up in Montana and who were less familiar due to growing up in another state. A number of explanations may account for the lack of differences based on residency status. For one, it is possible that the memory traces (Southwell, 2005) associated with the MMP and meth-related conversation only remain salient for a short period of time, with relatively recent media exposure and interpersonal contact about meth being more salient to relevant cognitions about meth use. Therefore, it is possible that only recent exposure and conversation, rather than long-term exposure and conversation, affect beliefs. If this were the case, previous exposure to the MMP while a teenager could be less important to current attitudes than recent exposure. Thus, because out-of-state students and Montanans both experienced recent exposure, the MMP related to beliefs and attitudes similarly for both groups.

Another explanation for the model's similar explanatory ability for Montanans and residents of other states could be that the model's process (i.e., parameters) functions similarly across groups, but the relative structures of variables (i.e., means) differ between the two groups. For example, Montanans may have both higher conversation frequency and higher encoded exposure than out-of-state students because they were targeted by the campaign, but the relationship between conversation frequency and encoded exposure may be similar for both groups. To test this idea, independent-samples *t*-tests were conducted on composite variables using residency status as the grouping variable. Of the variables used in the model, only encoded exposure, $t(401) = 8.13, p < .001$, and attention, $t(400) = 5.74, p < .001$, to MMP ads significantly differed by group. That is, Montanans reported more recent encounters with ($M = 2.30, SD = 1.50$) and attention to ($M = 5.67, SD = 2.28$) MMP ads than residents of other states ($M = 1.14, SD = 1.22$, and $M = 4.30, SD = 2.46$, respectively). Although people who grew up in Montana reported greater exposure and attention to the campaign compared to people from other states, their processing (i.e., model parameters) was essentially the same.

Second, MMP ads significantly associated with beliefs about the negative outcomes of meth use for people who reported paying more attention to the ads rather than merely recalling encounters with them. If attention, rather than merely exposure, relates to the beliefs targeted by the MMP, then perhaps the "saturation level" goal of exposing audience members to ads three to five times a week (Seibel & Mange, 2009, p. 12) is misguided. Instead of emphasizing amount of exposure, campaign designers might consider shifting

focus to create advertisements that elicit greater attention. For example, it appears not to matter to belief formation whether an ad is encountered once or seven times a week; in cases like this, efforts should be made for ads to be especially attention-getting when they are encountered.

Third, the campaign claims to increase conversations about meth in Montana (Seibel & Mange, 2009). Although this study indicates that the frequency with which people discuss meth does not directly relate to their beliefs regarding the negative outcomes of using the drug, people who talk about meth more frequently also engage with more MMP media, and attention to MMP ads relates to negative beliefs about meth. Thus, it appears that talking about meth indirectly relates to beliefs about meth.

However, the content of conversations encouraged by the MMP is also important to consider (Erceg-Hurn, 2008). Here, talking to others with favorable attitudes toward meth associated with participants' more favorable attitudes and less negative beliefs about the personal and physical outcomes of meth use, but did not associate with beliefs about relational outcomes. Perhaps conversations in Montana focus primarily on personal and physical outcomes of meth use. Since only relational beliefs related to attitude toward meth, the MMP may consider focusing on encouraging conversation about the negative relational implications of using meth, in addition to the detriments to one's own future well-being and appearance.

Finally, and related to the previous point, of the beliefs targeted by the MMP that were assessed here, only beliefs about the relational harms of meth use, and not those about how one's future personal well-being and physical appearance would be damaged, related to attitude toward meth use. This suggests two points of consideration for the MMP. On the one hand, MMP ads might continue to emphasize negative relational implications of meth use because these beliefs appear to relate to attitude toward using the drug. On the other hand, MMP ads might devote more resources to the building of beliefs that meth impairs future personal success and physical well-being since these beliefs do not appear to influence attitude toward meth use. That is, if the campaign intends for these beliefs to affect attitudes, it may be necessary to strengthen the cognitive associations between them, as they appear unrelated in this study. It is also possible that, contrary to what market research discovered before developing the campaign, personal and physical beliefs simply do not function to affect attitudes. Were the latter the case, the MMP would do well to focus more on the relational consequences of meth use at the expense of personal and physical consequences.

As with all research, this study is not without limitations. As mentioned earlier, it is possible that the cognitive patterns found within this sample are different from the younger population who are primarily targeted by the MMP. However, many in this college sample initially fell into the demographic targeted by the MMP, and those that did

not demonstrated no significant difference in relationships between distal variables, beliefs, and attitude toward meth. Still, these participants were all university students, which may limit the study's generalizability.

Finally, although the use of SEM in health communication contexts provides the ability to assess complicated relationships (Stephenson, Holbert, & Zimmerman, 2006), the main limitation to this study was the inability to assess causal relationships while utilizing cross-sectional data. Even though there is recent precedent to test reasoned action models with health-related survey data collected at one point in time (Dillard, 2011; Nabi, Southwell, & Hornik, 2002; Roberto, Krieger, & Katz, 2011), longitudinal data or experimental data would provide a superior assessment of both theory and campaign effectiveness. Researchers must rely on theoretical arguments for assessing relationships among cross-sectional data, and insight into theory can still be gained from such studies (Eveland & Thomson, 2006). The ability of the specified model to fit these data better than a competing model gives some credence to the theoretical relationships reported here. Regardless of any insight into the integrative model of behavioral prediction, the current study is not well positioned to comment unequivocally on the efficacy of the MMP as an intervention, as these data do not assess how contact with the campaign affects people over time or against a control group.

CONCLUSION

The recent adoption of antimeth public campaigns in a number of states demonstrates a need for theoretically grounded investigation of relationships between interpersonal and mediated communication with attitude toward meth use. Using the integrated model of behavioral prediction (Fishbein & Yzer, 2003), this study demonstrated how engagement with the MMP campaign and conversations about meth ultimately relate to beliefs and attitudes targeted by the campaign. Results also indicate that talking about meth relates to engagement with MMP ads, that encoded exposure and attention to the ads function independently in relation to behavioral beliefs, and that the attitude toward meth recently conveyed by a conversational partner relates to some meth-related beliefs and attitude.

This investigation shows how conversations about and engagement with antidrug media have the potential to ultimately affect health behaviors. The findings reported here suggest that conversations appear to influence antidrug attitudes in multiple ways. Frequency of conversations indirectly related to beliefs via increasing attention to antidrug ads, while specific conversations directly related to beliefs and attitudes. Health campaigns can utilize these interpersonal resources by encouraging frequent talk in general, as well as specific discussions with people who are sympathetic to the campaign's cause. This strategic

harnessing of conversation to facilitate attitude change offers a promising avenue for interventions to increase their overall effectiveness.

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Predictors of Exposure From an Antimarijuana Media Campaign: Outcome Research Assessing Sensation Seeking Targeting

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Predictors of Exposure From an Antimarijuana Media Campaign: Outcome Research Assessing Sensation Seeking Targeting

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Using data from a large-scale antimarijuana media campaign, this investigation examined the demographic and psychographic variables associated with exposure to public service announcements designed to target high sensation-seeking adolescents. The literature on sensation seeking indicates that adolescents high in this trait are at

greater risk for substance abuse. Analyses assessed the predictive utility of various risk and protective factors, normative influences, demographic variables, and marijuana-related attitudes, intentions, and behaviors on campaign message exposure. Results confirm that level of sensation seeking was positively associated with greater message exposure. In addition, viewers reporting greater exposure were younger adolescents who indicated that they had poor family relations, promarijuana attitudes, and friends and family who used marijuana. Implications for designing future antimarijuana messages based on these findings are discussed.

The success of a recent drug prevention campaign demonstrates the effectiveness of a theory-based media strategy in changing the target audience's drug-related behaviors. Specifically, three 4-month television-only campaigns preceded a substantial drop in 30-day marijuana use among high sensation-seeking adolescents (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001). The results were replicated in two geographic regions of the United States. From this study, researchers reinforced two primary conclusions: One, contrary to some previous research, a television-only campaign is an efficacious option in drug prevention; and two, the campaign's strategy offers an effective method for future media prevention efforts.

The framework employed in the campaign, called SENTAR (Sensation-Seeking Targeting), primarily involved creating high sensation value (HSV) television spots (those with formal and content audiovisual features that elicit sensory, affective, and arousal responses) to convey the consequences of using marijuana to high sensation seekers (HSS). HSS manifest a need for novelty and stimulation, a trait that may lead them to engage in risky health behaviors, like marijuana use (Zuckerman, 1979, 1994). Consequently, HSS have been targeted because their need for stimulation is also fulfilled by the content and formal features characteristic of HSV messages. Therefore, HSV spots offered a potentially effective vehicle with which to convey the consequences of using marijuana.

The purpose of this study is to perform a detailed examination of the target audience's exposure to the media campaign. Our first objective is to evaluate differences in exposure between HSS and low sensation seekers (LSS). Grounding the campaign in the SENTAR approach should lead to greater campaign exposure among HSS than LSS. Our second objective is to examine other important demographic and psychographic variables, beyond sensation seeking, associated with exposure. Regarding the significance of this research in light of the established behavioral effects, "the effect or outcome is paramount, but you also need to know what happened, how and why which elements worked, and to analyze what should be changed in future programs" (National Institutes of Health, 1992, p. 63). Thus, the knowledge gained from this study is potentially meaningful for two reasons: The research objectives provide an opportunity to evaluate (and refine) the SENTAR framework to campaign design, while determining the predictors of

message exposure renders practical information for conceptualizing and creating future antimarijuana public service announcements (PSAs). We begin by reviewing the advances associated with conceptualizing and developing campaigns for specific target audiences.

OVERVIEW OF TARGETING

Targeting strategies involve tailoring and directing a campaign to a specific audience demographic rather than a generalized mass public. Typically, “the audience [is] segmented into internally homogenous subgroups that may be more at risk than other segments and that can be reached through certain types of messages” (Everett & Palmgreen, 1995, p. 226). Effective audience segmentation strategies became more prevalent after ineffective targeting was cited as one major reason mass media campaigns fail (Flay & Sobel, 1983; Rogers & Storey, 1987). Now, effective targeting is the cornerstone of the social marketing approach to prevention campaign design. Although demographics can provide a rudimentary beginning, any targeting scheme should also segment on the basis of psychographic variables (e.g., attitudes, values, beliefs, personality characteristics) linked both to the behavior of interest (e.g., marijuana use) and to the communication channels and message styles most preferred by target audience members (Backer, Rogers, & Sopory, 1992; Slater, 1996).

Slater (1995) suggested that campaign planners now rarely overlook careful targeting and audience segmentation strategies, noting that “it is second nature to adapt the style and content of our communication to the idiosyncracies of our audience” (p. 186). In addition, we have advanced our knowledge on statistical techniques (such as Q-Sort, cluster analysis, logistic regression) that can be employed in “discovering sensible patterns of needs, wants, desires, and tendencies among groups within a target population” (Albrecht & Bryant, 1996, p. 66). “The crucial point here is that it is more efficient, in terms of maximizing impact with given resources, to identify people who are similar in important respects and tailor one’s communication content and delivery to them” (Slater, 1995, p. 187).

SENTAR

SENTAR is a prevention strategy and framework designed to specifically target members of the population who are high in sensation seeking (Palmgreen & Donohew, in press). HSS are an attractive targeting demographic because of their psychobiological disposition to engage in thrill-seeking behaviors. This drive for novel, complex, and intense sensations and experiences is typically satisfied by a willingness to take more social risks (e.g., impulsive behaviors, sexual promiscuity), physical risks (e.g., skydiving, bungee jumping, driving fast), legal risks (e.g., getting arrested and put in jail), and financial risks (e.g., not paying fines, impulsive

purchases; Zuckerman, 1979, 1994). In contrast, individuals with a low need for sensation are less likely to engage in these behaviors. Health practitioners and campaign planners are typically interested in HSS's tendency to engage in thrill-seeking behaviors, such as risky sex or illicit substances use to fulfill their needs for sensation (Barnea, Teichman, & Rahav, 1992; Clayton, Cattarello, & Walden, 1991; Newcomb & McGee, 1991; Zuckerman, 1979, 1994).

Consistent with their need for novelty and stimulation, HSS report clear and distinct preferences for specific media message characteristics (Donohew, Palmgreen, & Lorch, 1991). After more than a decade of research involving focus groups and laboratory and field experiments with adolescents and young adults, SENTAR emerged as the framework linking the health and media perspectives. Primarily created for the prevention of substance use, this model is summarized by the following principles: (a) Employ the sensation-seeking trait as a major targeting variable, (b) design prevention messages that are high in sensation value to reach HSS, (c) employ formative research with high sensation-seeking members of the target audience, and (d) place prevention messages in HSV contexts. The impetus of SENTAR is that messages designed to appeal specifically to the needs of HSS will be more effective in reaching and ultimately influencing this high-risk group.

Using SENTAR in a mass media campaign. The first evidence for the effectiveness of a SENTAR-based antidrug campaign was generated from a field study involving a televised PSA campaign targeting young adults (Palmgreen et al., 1995). Those results implied that sensation seeking and use status leveraged attention and exposure to the campaign's HSV PSAs.

Most recently, the SENTAR strategy was employed to evaluate the effectiveness of television antidrug campaigns on young adolescents' attitudes toward—and use of—marijuana. Televised PSAs (4 developed specifically for this campaign and 3 from the Partnership for a Drug Free America) targeting high sensation-seeking 8th to 12th graders were aired in a Southeastern metropolitan city from January through April 1997 and January through April 1998. Using a combination of purchased and donated television airtime on broadcast and cable stations, an average of 777 paid spots and 1,160 unpaid spots aired in each campaign (Stephenson et al., 1999). Gross rating point (GRP) data, a measure of audience exposure, revealed that at least 70% of the targeted age group was exposed to a minimum of three campaign ads per week for a sustained period of 4 months. Monthly time series profiles depicted a considerable, statistically significant decrease in 30-day marijuana use among the target audience after the campaigns were broadcast (Palmgreen et al., 2001).

Given these behavioral effects, analyses thus far have not, however, examined the association between sensation seeking and exposure to these campaign messages. Such information would be useful in interpreting the impact on the target audience. Given the observed behavioral changes in adolescent 30-day marijuana

use, we predict that (H1) HSS will report significantly greater message exposure than LSS. In line with the SENTAR emphasis on the stronger need for stimulation by HSS adolescents, we would also predict that (H2) HSS marijuana users and nonusers will report greater campaign message exposure than LSS marijuana users and nonusers. This does not preclude the possibility that LSS were reached, only that HSS are expected to report greater campaign exposure.

Historically, however, researchers have not compared high and low risk groups to determine if changes in drug-related attitudes were markedly different (cf. Sussman et al., 1987). We know that previous antidrug media campaigns (like those from the Partnership for a Drug Free America) have been successful in shifting attitudes in a direction less favorable to drug use (Black, 1991). Nonetheless, a portion of the population still holds favorable attitudes toward marijuana, which in turn, should affect perceptions of antidrug PSAs. Promarijuana attitudes and behaviors suggest high involvement with the PSA message content (e.g., Flora & Maibach, 1990), and therefore, we predict that (H3) exposure rates will be higher among respondents with favorable attitudes toward marijuana use. In addition, (H4) exposure rates will be higher among respondents who report past marijuana use.

An additional persuasive outcome variable typically examined with attitudes and behaviors is one's intent of engaging in a specific behavior, in this case marijuana use. From a prevention perspective, it is particularly important to reach those who have not yet tried marijuana, but believe they may do so in the future. Because attitudes and intention are correlated (Ajzen & Fishbein, 1980; Kim & Hunter, 1993), we would also predict that (H5) exposure will be higher among respondents who intend to use marijuana at least once in the future (excluding those who have already used marijuana).

Other Factors Associated With Campaign Exposure

Although sensation seeking was the primary drug risk factor employed in the campaign, numerous other factors have been identified in the etiology of adolescent drug use.

Risk and protective factors. Newcomb and Felix-Ortiz (1992), among others (see Huba, Wingard, & Bentler, 1980) have stressed the importance of various factors which appear to protect the individual against drug use and abuse, including performance in school (GPA), religiosity, self-acceptance, law-abidance, educational aspirations, deviance, and perceived peer drug use. Likewise, data from the annual Monitoring the Future Survey indicate that those adolescents possessing certain risk factors display the greatest year-to-year shifts in drug use, whereas those with a greater number of protective factors (e.g., religiosity) show the least change (Bachman, Johnson, & O'Malley, 1991).

Such risk and protective factors thus may be important variables that moderate the effectiveness of media drug abuse prevention campaigns. Those high or low on risk and protective factor indexes may vary in their susceptibility to persuasion through media and other channels. Consequently, one goal of this analysis was to determine which risk and protective factors were associated with campaign exposure. Although these risk and protective factors are correlated to some extent with sensation seeking (Newcomb & Felix-Ortiz, 1992), determining which risk and protective factors are associated with exposure provides a richer understanding of the targeted audience. Therefore, we ask Research Question 1 (RQ1): What risk and protective factors, beyond sensation seeking, are associated with campaign exposure?

Normative components. Beyond the aforementioned factors, social relations are often considerable influences on the attitudes and behaviors of adolescents, particularly pertaining to substance use (e.g., Iannotti, Bush, & Weinfurt, 1996; Leventhal, Fleming, & Glynn, 1988). Ajzen and Fishbein's (1980) theory of reasoned action highlights the considerable influence others can have on one's intention to perform a specific behavior, such as smoking marijuana. Studies demonstrated the influence of peers and family members (Botvin, Malgady, Griffin, Scheier, & Epstein, 1998) as well as school and neighborhood environmental factors (Allison et al., 1999). In light of this research, our interest is in the importance attributed to these social factors by campaign viewers. We believe that if social norms do not support substance use, the dissonance created by teens' substance use will cause them to pay greater attention to drug abuse prevention messages. Therefore, we also ask (RQ2): What normative influences were associated with campaign exposure?

Demographic factors. Finally, demographic factors are also interesting and useful in establishing a profile of those exposed to campaign messages. Thus (RQ3): What demographic factors were associated with campaign exposure, and do any demographic factors moderate the relation of the risk and protective, normative, or persuasive outcome variables with exposure?

METHOD

Participants

Participants were 785 adolescents in grades 7 through 12 recruited by telephone from class rolls in a Southeastern metropolitan city. A grade-stratified random sample of approximately 100 participants was recruited each of the four postcampaign months used in this analysis. This sample was 45% boys and 18% non-White. Most participants were in the 9th (18%), 10th (24%), 11th (23%),

and 12th (19%) grade. Some were in the 7th (< 1%) or 8th grade (6%), or had graduated or dropped out (9%).

Procedure

To enlist participants, a parent or guardian was contacted by telephone requesting the child to participate in this study. An interview time was scheduled in the teenager's home only if both the parent and the teen agreed to the adolescent's participation. After consent forms were obtained from parents, the interview was conducted somewhere in the home where nothing could be overheard. Parents signed consent forms and answered a series of demographic questions before leaving the room for the confidential interview. The interview was administered on a laptop computer, with responses to sensitive questions (i.e., drug use) keyed in by the participant. This assisted with confidentiality in that only the participant knew how the questions were answered. This also prevented responses to sensitive questions from being answered aloud. Each interview lasted about 40 min. Adolescent participants received certificates for a free movie rental and a pizza for participating.

Measures

Sensation seeking. Sensation seeking was measured using the 8-item Brief Sensation-Seeking Scale (Hoyle & Stephenson, in press; Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, in press). This scale, which was developed for this line of research with adolescents, was created by adopting items from the sensation seeking scale-form V (SSS-V; Zuckerman, Eysenck, & Eysenck, 1978) and a set of items derived from the SSS-V but tailored for adolescents (Huba, Newcomb, & Bentler, 1981). Items were adapted for use with adolescents and revised to reflect contemporary language (e.g., "swinger" was changed to "party-er"). The four dimensions represented in Zuckerman's SSS-V are equally represented. Because sensation seeking often is used to predict substance use, items that referred to alcohol or drug use were not included in the new scale.

This scale demonstrated good construct validity (Hoyle et al., in press). Specifically, the scale is moderately correlated with multiple lifetime and 30-day substance use measures (including alcohol, tobacco, marijuana, and inhalants, with Pearson r s ranging from 0.22–0.49). In addition, the scale is positively correlated with indexes of drug risk factors (such as deviance, perceived peer use, and perceived family use, with Pearson r s ranging from 0.29–0.41) and negatively correlated with drug protective factors (such as law abidance, family life, and perceived sanctions, with Pearson r s ranging from 0.22–0.40).

Because about half the teenage population are HSS, a median split on the sum of the eight items was used to define HSS and LSS, which follows the procedures employed in most studies of sensation seeking (Zuckerman, 1979). On a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), participants responded to the eight items, such as “I like wild parties,” “I would like to have new and exciting experiences, even if they are illegal,” and “I prefer friends who are excitingly unpredictable.” These measures generated acceptable reliability ($\alpha = .74$).

Total viewing time. Because of expected differences in total time viewing television on weekdays and on weekends, total viewing time was assessed with two separate questions. Participants responded to “How many hours of TV do you watch per weekday, not including videotapes that you have rented or bought?” and “On a typical Saturday or Sunday, how many hours of TV do you watch per day, not including videotapes that you have rented or bought?” Because the reliability of this type of measure has been questioned in certain lines of media research (e.g., Hirsch, 1980; Potter, 1993; Shoemaker & Reese, 1990), a check of the internal consistency was justified, even though the items were treated separately in analyses. The reliability results suggest participants are generally answering the question consistently ($\alpha = .74$).

Risk and protective factors. Participants responded to a series of items designed to assess their standing on a variety of risk and protective factors for drug use and other problem behaviors (e.g., Newcomb & Felix-Ortiz, 1992; Newcomb, Maddahian, & Bentler, 1986). Participants responded to measures of religiosity (e.g., “I believe/do not believe in religion” and “I feel that prayers are answered/praying is a waste”; $\alpha = .82$), self acceptance (e.g., “I regard myself as a failure/regard myself as a success” and “I like/dislike myself for who I am”; $\alpha = .78$), and family relations (e.g., “My family is very close/not very close” and “There is a lot/not much happiness in my family”; $\alpha = .79$). Participants also reported their GPA which was measured on a scale ranging from 1 (*all Fs*) to 10 (*all As*).

Normative factors. In single-item measures, participants indicated their perceptions of marijuana use by their friends (e.g., “Among your friends, how many use marijuana?”), family (e.g., “Among the people in your family, including parents, brothers, sisters, grandparents, aunts, uncles, and cousins, how many use marijuana?”), and community (e.g., “Among the people you know in your community—for example, people in your neighborhood, members of your church—NOT including your family and friends, how many use marijuana?”). Participants also responded to single-item measures of their family, friend, and community’s approval of their own use of marijuana, as well as perceived friend and parental reaction to finding out they used marijuana.

Attitudes. Participants responded to seven items (e.g., “Occasional use of marijuana is okay”; $\alpha = .91$) about occasional use of marijuana on a scale ranging from 1 (*disagree strongly*) to 4 (*agree strongly*).

Intentions. Participants indicated their intent to engage in experimental marijuana use (e.g., “In the future do you think you will try marijuana at least once?”) and regular marijuana use (e.g., “In the future, do you think you will use marijuana regularly?”) on a scale ranging from 1 (*definitely will not*) to 4 (*definitely will*). Both were treated as single-item measures.

Behavior. Participants reported their lifetime marijuana use (e.g., “Have you ever used marijuana?”). By answering yes or no to this question, participants were asked to report their 30-day marijuana use (e.g., “Please type in the number of days between 0 and 30 that you have used marijuana in the last 30 days”). Both were treated as single-item measures.

Demographics. Participants indicated their sex, grade in school, and ethnicity.

Exposure to antimarijuana PSAs. To assess whether participants had been exposed to the messages, adolescents read a four-sentence description of each of the four campaign PSAs. Participants indicated their certainty in viewing each PSA on a scale ranging from 1 (*very certain I did not see it*) to 4 (*very certain I saw it*). Exposure scores were summed across the four PSAs to create the dependent variable (exposure) for these analyses. Individuals were generally consistent in their responses to certainty of exposure ($\alpha = .74$; however, alpha could be somewhat attenuated as individuals may actually have seen some ads and not seen others, producing variation in responses that would be calculated as instability by alpha).¹

¹To assess the accuracy of the measure, exposure to the messages was assessed at least 1 month prior to airing each PSA. For each PSA, the percentage of respondents who were very certain they had viewed the PSA was minimal before it aired, although substantially higher the month it first aired, as well as 1 month after it first aired. PSA1: 4% 1 month before, 54% month of first airing, 67% 1 month after first airing; PSA2: 4% 1 month before, 52% month of first airing, 56% 1 month after; PSA3: 3% 1 month before, 24% month of first airing (midmonth start), 53% 1 month after; PSA4: 4% 1 month before, 19% month of first airing (midmonth start), 58% 1 month after. Exposure certainty typically peaked between 70% to 75% in the ensuing months. Illustrations in Palmgreen et al. (2001) indicated large increases in exposure as GRPs mount in all campaigns. We also continuously measured exposure in a control city where the campaign was not broadcast. The percentage of control-county respondents who were very certain they had viewed the PSA was also very small, averaging only 2% over the 4-month campaign period. Naturally, as is demonstrated, a small portion of respondents reported seeing the PSAs due to errors in memory or social desirability.

Although exposure has historically been used as a dependent variable, we employ it here with the caveat that exposure is not equivalent to learning (Robinson & Levy, 1986), retention (Lemert, Wanta, & Lee, 1999), or attention (Chaffee & Schleuder, 1986) in regard to the content of the messages. The issue is generally framed in terms of one's active or passive use of the media. Research has demonstrated, however, that exposure measures are associated with attitude change. Price and Zaller (1993) found that, in some cases, exposure predicted recall of news content, noting that "it is at least conceivable that simple exposure to news media ... is sufficient to produce various attitudinal effects that interest communication researchers" (p. 159). Bartels (1993) argued and demonstrated that media exposure effects, although admittedly modest, are often attenuated by measurement error. In evaluating media exposure and opinion change during the 1980 presidential election, Bartel reported that "attention to the effects of measurement error significantly increased the apparent impact of media exposure on opinion change" (p. 274). We highlight these viewpoints simply to emphasize that the conclusions of this research are based solely on exposure to these messages.

Method of Analysis

Two media campaigns (January to April 1997 and January to April 1998) preceded the data employed in subsequent analyses. The data are from adolescent responses given by participants over the 4-month periods following two media campaigns (approximately 100 interviews per month in May to August 1997 and May to August 1998). Factorial analysis of variance was used to evaluate H1 and H2. Multiple regression was used to assess H3 through H5 and RQ1 through RQ3, where two variables accounting for total TV viewing time on weekdays and weekends were entered first to control for their influence on the dependent variable.

RESULTS

H1 and H2

In support of H1, a significant main effect for sensation seeking was detected on exposure, $F(1, 777) = 6.02, p = .01, \eta^2 = .01$, where HSS ($M = 3.22$) reported viewing greater exposure than LSS ($M = 3.06$). No other main effects or interactions were significant. In addition, the results to H2 demonstrated a significant main effect for sensation seeking on message exposure, $F(3, 754) = 3.90, p = .009, \eta^2 = .02$. This hypothesis, however, is only partially supported, as multiple comparison tests revealed the only significant difference ($p < .05$) to be HSS nonusers ($M = 3.24$) reporting greater exposure than LSS nonusers ($M = 3.02$). HSS users ($M = 3.16$) also

reported greater exposure than LSS nonusers, but the difference was only marginally significant ($p = .09$).

H3 and H4

Controlling for weekday and weekend television viewing time, results indicate that individuals with more favorable attitudes about marijuana were more likely to see the antimarijuana PSAs ($\beta = .15, p < .01, R^2 = .02$; see Table 1). Similarly, these viewers were likely to have used at least some marijuana in the past 30-days ($\beta = -.08, p < .05, R^2 = .01$). Therefore, these hypotheses were supported.

H5

After removing those who had previously used marijuana and controlling for television viewing time, one’s intention to try marijuana at least once in the future was a significant predictor of campaign message exposure. Specifically, individuals more likely to try marijuana at least once were more likely to report exposure to campaign messages ($\beta = .12, p < .01, R^2 = .02$; see Table 2). Intent to use marijuana regularly in the future was not a significant predictor of exposure, although as might be expected, there was little variance to be explained in this variable. This hypothesis is partially supported.

RQ1

Beyond sensation seeking, only family relations was a significant predictor of campaign exposure. Specifically, individuals with strained family relations indicated greater certainty in seeing the message than those with good family relations ($\beta = -.10, p < .05, R^2 = .01$; see Table 3).

TABLE 1
Regression Coefficients of Attitudes and Use on Message Exposure

<i>Step</i>	<i>Predictors</i>	β	<i>sr</i>	ΔR^2
1	Weekday TV viewing	.07	.06	.03***
	Weekend TV viewing	.13**	.10	
	Block R^2			
2	Attitude toward marijuana	.15**	.14	.02***
	Days used marijuana past month	-.08*	-.07	
	Block R^2			
	Total R^2			.05***

Note. $N = 785$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

TABLE 2
Regression Coefficients of Intentions on Message Exposure

Step	Predictors	β	<i>sr</i>	ΔR^2
1	Weekday TV viewing	.06	.05	
	Weekend TV viewing	.16**	.13	
	Block R^2			.04***
2	Intent to try marijuana once	.12**	.11	
	Intent to use marijuana regularly	-.02	-.02	
	Block R^2			.01*
	Total R^2			.05***

Note. $N = 502$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

TABLE 3
Regression Coefficients of Risk and Protective Factors on Message Exposure

Step	Predictors	β	<i>sr</i>	ΔR^2
1	Weekday TV viewing	.07	.06	
	Weekend TV viewing	.13**	.10	
	Block R^2			.03***
2	Sensation seeking	.16***	.16	
	Block R^2			.03***
3	Self acceptance	.02	.02	
	Family relations	-.10*	-.08	
	Religiosity	.02	.02	
	GPA	.06	.05	
	Block R^2			.01
	Total R^2			.07***

Note. $N = 785$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

RQ2

After television viewing covariates, results indicate that several normative influence variables were predictors of exposure to the antidrug PSAs ($R^2 = .06$; see Table 4). Specifically, adolescents who perceived that more of their friends ($\beta = .13$, $p < .05$) and family members ($\beta = .12$, $p < .01$) used marijuana were more likely to report message exposure. Likewise, these individuals generally believed their friends would not react adversely to their own use of marijuana. However, those reporting greater exposure also perceived less community approval ($\beta = -.09$, $p < .05$) and less peer approval ($\beta = -.13$, $p < .01$) of marijuana use. Thus, although peers generally might not approve, those most likely to re-

port exposure did not feel that their friends would do anything to discourage them from using it ($\beta = .17, p < .01$).

RQ3

After controlling for television viewing time, age and lifetime marijuana use were significant predictors of message exposure ($R^2 = .01$; see Table 5). Specifically, younger adolescents were more likely to report exposure to campaign messages ($\beta = -.09, p < .05$), as were individuals who had used marijuana at least once in their lifetime ($\beta = .08, p < .05$). Gender was not a significant predictor.

DISCUSSION

The overarching goal here was to perform outcome research on a recently completed antimarijuana campaign targeting high sensation-seeking adolescents. We examined and evaluated the relation between sensation seeking, marijuana use, time spent viewing television, and campaign message exposure. In addition, we examined the risk, protective, and normative factors (beyond sensation seeking) associated with campaign exposure, with the understanding that some might enhance message design strategies in future campaigns. Because the latter is a particularly new contribution to this literature, we begin with a review of the variables associated with message exposure as explored in H3 through H5 and RQ1 through RQ3 before turning to a discussion on SENTAR-based outcomes.

TABLE 4
Regression Coefficients of Normative Factors on Message Exposure

<i>Step</i>	<i>Predictors</i>	β	<i>sr</i>	ΔR^2
1	Weekday TV viewing	.07	.06	
	Weekend TV viewing	.13**	.10	
	Block R^2			.03***
2	Perceived community use	.01	.00	
	Perceived friend use	.13*	.09	
	Perceived family use	.12**	.11	
	Perceived community approval	-.09*	-.08	
	Perceived friend approval	-.13**	-.09	
	Perceived family approval	-.02	-.02	
	Perceived friend reaction	.17***	.15	
	Perceived parent reaction	-.03	-.03	
	Block R^2			.06***
Total R^2			.09***	

Note. $N = 785$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

TABLE 5
Regression Coefficients of Gender, Lifetime Marijuana Use, and Age
on Message Exposure

Step	Predictors	β	<i>sr</i>	ΔR^2
1	Weekday TV viewing	.06	.05	
	Weekend TV viewing	.14**	.11	
	Block R^2			.03***
2	Gender	.01	.01	
	Lifetime marijuana use	.08*	.06	
	Age	-.09*	-.07	
	Block R^2			.01*
	Total R^2			.04***

Note. $N = 783$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Associations With Campaign Exposure

Risk, protective, and normative factors. A series of variables beyond sensation seeking provides useful information about who reported viewing campaign messages. Specifically, individuals who reported experiencing poor family relations were more likely to report message exposure. Although sensation seeking is correlated with poor family relations ($r = .27$), the size of the correlation suggests that this risk factor is a subset of individuals somewhat distinct from HSS (i.e., sharing only about 10% of the variance with sensation seeking; see Table 6). Furthermore, the antimarijuana campaign was salient to the behavior of individuals high in this risk factor, as lifetime marijuana use was positively associated with poor family relations ($r = .28$). Consequently, this campaign appears to have reached at-risk viewers who are not necessarily HSS, but who do exhibit some risk in using marijuana.

Normative components and campaign exposure. Several normative components were also associated with campaign message exposure. Viewers apparently perceived some marijuana use by family members (broadly defined) despite general perceptions that community standards were not favorable toward marijuana. Although none of the campaign PSAs singled out the family unit, the consequences of using marijuana were depicted in the PSAs as being harmful to friends and significant others. Again, it appears that the salience of messages about marijuana may be driving higher rates of exposure among adolescents who are at higher risk.

Adolescents indicating greater exposure also perceived an association between friendship and their own marijuana use. Specifically, those more likely to see the PSAs generally believed that their friends used some marijuana. These viewers

also believed that their friendships would not be jeopardized (i.e., quit being friends, get turned in to the police) by their own use of marijuana. These findings portray reciprocal relationships between viewers and their friends: Some of their friends use marijuana and those friendships will be maintained if the viewer uses marijuana as well.

A third result pertaining to friends is less consistent. Adolescents indicating greater message exposure indicated that their friends would not approve of their (the respondents') own marijuana use. This finding is puzzling in light of the previous two significant predictors of viewing. On one hand, perhaps this finding is consistent with the idea that expected disapproval made the message more salient. On the other hand, it is also possible that this is a methodological issue, where survey questions inquiring about respondents' friends were worded inconsistently, leaving participants unable to distinguish between *close friends* and *peers*. Whereas close friendships might be tolerant and perhaps even supportive of marijuana use, respondents may have felt less certain about the approval of *casual friendships* (other peers and classmates, but not close friends). Because it is generally believed that individuals cultivate friendships with those who have similar interests (including marijuana use), it seems reasonable to speculate that those most likely to be exposed to the campaign PSAs had some marijuana-using friends, which in turn, allowed the partici-

TABLE 6
Correlations of Variables With Sensation Seeking, Lifetime Marijuana Use, 30-Day Marijuana Use, and Message Exposure

	<i>Sensation Seeking</i>	<i>Message Exposure</i>	<i>Lifetime Marijuana Use</i>	<i>30-Day Marijuana Use</i>
Perceived community use	.17	.06	.31	.31
Perceived friend use	.35	.12	.51	.47
Perceived family use	.18	.14	.33	.34
Perceived community approval	.08	-.05	.21	.21
Perceived friend approval	.35	.04	.52	.44
Perceived family approval	.14	.00	.28	.26
Reaction friend	-.30	-.13	-.39	-.26
Reaction parent	.10	.00	.19	-.21
Try once	.42	.12	.57	.45
Use marijuana regularly	.25	.07	.45	.67
Religiosity	-.20	-.05	-.27	-.29
Self-acceptance	-.16	-.04	-.18	-.14
Family relations	-.19	-.10	-.28	-.19
Attitudes	.46	.10	.60	.42
Age	-.01	-.08	.26	.12
GPA	-.15	-.02	-.32	-.23

Note. Ns range from 783 to 785; rs greater than ±.07 are statistically significant at $p < .05$.

pants to infer that these friendships would not be jeopardized by their own use of marijuana. Perhaps respondents were feeling some dissonance when they also reported that their friends might not approve of their own marijuana use. Obviously to untangle these inconsistencies, further research is warranted.

Attitudes, intentions, demographic factors, and campaign viewing. Individuals with favorable attitudes toward marijuana reported greater exposure to campaign messages. In addition, even after excluding previous marijuana users, those indicating their intent to try marijuana at least once in the future were also more likely to have viewed the PSAs. Conceivably, the promarijuana attitudes and intentions to use may have increased the salience of the campaign messages for those who report being exposed to them, whereas those who already had a negative attitude toward marijuana or had no intention of using marijuana tuned them out. These results are particularly interesting and encouraging from a prevention perspective, in that the messages were viewed by a critically important promarijuana subpopulation in a drug prevention campaign such as this one.

Finally, some of our results suggest that younger viewers remembered viewing the antidrug messages, consistent with the notion that older teenagers may be more involved in school activities, have more homework assignments, and be more independently mobile with their own transportation. Also, younger viewers may be in the process of forming their attitudes toward marijuana and thus may have found antimarijuana messages more relevant. Gender did not predict campaign viewing.

Sensation Seeking and Television

Consistent with our expectations and previous research, H1 revealed that HSS indicated significantly greater exposure than their LSS counterparts. We learn in more detail from H2 that HSS nonusers (and to some extent, HSS users) indicated greater exposure than LSS nonusers. From a prevention perspective, this finding is interesting because HSS nonusers generally are more predisposed to begin using marijuana than are LSS nonusers. Given the cross-sectional nature of the longitudinal behavioral data, however, it is not entirely clear whether the observed reduction in 30-day marijuana use among HSS occurred among existing users, those experimenting for the first time, or some combination of the two. With the results to both hypotheses indicating exposure rates were generally greater among HSS than LSS, we see that the targeting strategies (e.g., purchasing airtime and placing messages in preferred television programming) employed in the campaign in combination with the salience of the PSA content increased the chances that HSS would be exposed to the antidrug information. The results, however, should be interpreted cautiously in light of the admittedly unimpressive effect size associated with these results.

Time spent watching television, interestingly, is probably not a viable explanation for why HSS reported more exposure. Although LSS adolescents viewed slightly more television than HSS adolescents both on weekdays (LSS = 2.75 hr, HSS = 2.57 hr) and weekends (LSS = 2.84 hr, HSS = 2.64 hr), the differences between HSS and LSS were not statistically significant. These nonsignificant differences, however, should not overshadow the important implication for campaign targeting—that there is roughly a 2-hr window of time each day to reach HSS through television messages. This reaffirms the need advocated by SENTAR to purchase specific advertising time and strategically place antidrug messages in television programming most viewed by HSS. Beyond this, however, is the implication that other media, such as radio or the Internet, may need to be included in campaigns directed at adolescents.

SENTAR Campaign and Message Design

This SENTAR-based campaign strategy appears useful given that a SENTAR-designed campaign preceded a substantial decrease in 30-day marijuana use among HSS. The SENTAR approach also values message placement and the purchase of advertising time. For adolescents, these principles are important given that these results indicate that most adolescents watch television only a few hours a day (although it is unclear whether even this viewing is active or passive). In this antimarijuana campaign, planners employed the services of a media buyer who consulted television ratings to determine which programs were most viewed by the target audience. The ratings were cross-validated with the responses from the 100 adolescents interviewed each month. With channel diversification and limited free air time, message placement and purchased advertising time are important factors to consider in reaching the target audience.

The results of this study provide useful information about campaign viewers that could be incorporated into the content of HSV messages. For example, regarding viewers with poor family relations, an antimarijuana message could depict a teenager turning to marijuana to cope with his or her feelings after a quarrel with parents, or alternatively, being ignored by parents or siblings. As the teenager leaves the house to light up a marijuana joint, a friend comes along and encourages other ways to blow off the stress. The message could then depict quick cuts from activity to activity offering alternatives to smoking marijuana. This example is similar to a PSA called “Common” and used in our previous campaign in the early 1990s. Common featured heavy metal music and quick action cuts from one high-sensation activity to another. The spot included a voice-over that stated, “The one thing all these people have in common? They don’t need drugs.”

Targeting viewer characteristics increases message identification, which in turn increases the chances of having an impact on attitudes and behaviors. Of course,

messages should conform to established principles of reaching high sensation-seeking youth in addition to targeting specific factors affecting message exposure.

Limitations

Although we feel the results are useful and make some contribution to the health campaigns literature, we temper our results in light of the low effect sizes in some of the analyses. The possibility exists that some of the significant results would not emerge with a smaller sample size. In addition, as we noted, our measures of television viewing time and campaign exposure do not provide what might be the best information available from these measures.

CONCLUSIONS

The results of this analysis suggest that those most likely to have been exposed to the antimarijuana campaign, other than reporting higher levels of sensation seeking, experienced poor family relations, perceived their friends and some family members to use marijuana, generally maintained favorable attitudes toward marijuana, may be likely to use marijuana at least once in the future, and were likely to be younger adolescents. Future formative research with HSS would benefit by investigating these characteristics. Specifically, how salient are these risk factors in the lives of adolescent HSS? How does the use of marijuana facilitate or inhibit the prevalence of these factors? In addition, how can antimarijuana campaign messages effectively address these risks associated with marijuana use?

In general, these results also affirm the campaign design principles advocated by SENTAR: HSS indicated more campaign exposure than LSS. These results reinforce the usefulness of strategically purchasing advertising time and placing messages in shows most viewed by the intended target audience, HSS. We also attribute greater campaign exposure among HSS to the HSV content which depicts activities and behaviors that appeal to the target audience, or to featuring message content consistent with their lifestyle. This, in combination with the additional information on normative, attitudinal, and demographic data offers new information for future drug prevention message design.

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Reduced Substance Use as a Secondary Benefit of an Indicated Cognitive-Behavioral Adolescent Depression Prevention Program

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Abstract

Our first aim was to test whether a group cognitive-behavioral (CB) depression prevention program reduces substance use escalation over 2-year follow-up relative to two active comparison interventions and a brochure assessment control. Our second aim examined whether reductions in depressive symptoms mediate intervention effects, as posited by the affect-regulation model of substance use. In this indicated prevention trial, 341 high school adolescents at risk for depression due to the presence of elevated depressive symptoms were randomized to a group CB intervention, group supportive-expressive intervention, CB bibliotherapy, or educational brochure control condition. Participants in group CB had significantly lower rates of substance use compared to brochure control participants at both 1- and 2-year follow-up and lower substance use at 2-year follow-up relative to bibliotherapy participants; no other condition differences were significant. Mediation analyses suggested that reductions in depressive symptoms from baseline to post-test accounted for changes in substance use over two years for participants in group CB relative to brochure control participants but did not mediate effects relative to those receiving bibliotherapy. Results suggest that a secondary benefit of this CB group indicated depression prevention program is lower rates of long-term substance use. Findings supported the hypothesis that, relative to a non-active comparison condition, reductions in depressive symptoms mediated the effects of group CB prevention on substance use escalation.

Keywords

depression; prevention; adolescents; substance use; mediation; secondary benefits

Adolescence is the peak risk period for substance use initiation and escalation, with first use of alcohol, tobacco, and other drugs typically occurring during this period (Johnston, O'Malley, Bachman, & Schulenberg, 2008). Alcohol and other drug use negatively impacts physical development and family relationships and is associated with school failure, criminality, unwanted pregnancy, sexually-transmitted infections, accidents, homicide, and

suicide (Chassin, Pitts, & Prost, 2002; Chassin, Ritter, Trim, & King, 2003). Tobacco use is the leading preventable cause of death in the United States (U.S. Department of Health and Human Services, 2004).

Negative mood states have been theorized to increase the risk for substance use (Wills, Sandy, Shinar, & Yaeger, 1999) and clinicians have suggested that some depressed individuals “self-medicate,” consuming psychoactive substances as a coping mechanism to reduce negative affect (e.g., Khantzian, 1985; Swendsen et al., 2000). Consistent with this affect-regulation model, depressive symptoms and major depressive disorder (MDD) increase the risk for substance use onset in adolescents (e.g., Kuo, Gardner, Kendler, & Prescott, 2006; Measelle, Stice, & Hogansen, 2006; Sihvola et al., 2008), although this effect has not emerged in all studies (e.g., Degenhardt, Hall, & Lynskey, 2003; Hallfors, Waller, Bauer, Ford, & Halpern, 2006). Studies with null findings either focused on depression predicting initial use of a single substance (e.g., cannabis) or examined whether a brief measure of current depressive symptoms predicted substance use one year later, which suggests that the impact of depressed mood on future substance use applies to a broader range of substances or requires a comprehensive assessment of depression.

Also consistent with the affect-regulation model, cognitive-behavioral (CB) treatments for depression have been associated with reduced substance use for depressed adults in addiction treatment (Brown, Evans, Miller, Burgess, & Mueller, 1997; Patten et al., 1998), and antidepressant therapies tend to achieve significant, albeit modest, reductions in both depression and substance use for adults with comorbid depression and substance use disorders, especially for nicotine dependence and alcohol use disorders (Nunes & Levin, 2004; Torrens, Fonseca, Mateu, & Farre, 2005). Trials with adolescents, however, have found that neither psychosocial (Rohde, Clarke, Mace, Jorgensen, & Seeley, 2004) nor pharmacological (Cornelius et al., 2009; Riggs et al., 2007) treatments for depression significantly reduce substance use, suggesting that depression plays a more potent maintenance role for substance use during adulthood than adolescence.

Few randomized trials have tested whether reducing depression reduces risk for escalation in substance use, an objective for which adolescent depression prevention (as opposed to treatment) programs seem well suited. We first examined this question using an indicated CB depression prevention program with older adolescent ($M_{age} = 18.6$ years) young women with elevated depressive symptoms (Burton, Stice, Bearman, & Rohde, 2007). Although the group CB intervention significantly reduced depressive symptoms relative to assessment-only controls, there were no intervention effects on future substance use.

A second trial evaluated the CB depression prevention program in a younger sample ($M_{age} = 15.6$ years) of both female and male adolescents (Stice, Rohde, Seeley, & Gau, 2008). This trial evaluated the efficacy of an indicated group CB depression prevention program relative to both an educational brochure control condition and two active dismantling comparison conditions that provided the two components of the CB group: CB bibliotherapy and supportive-expressive group treatment. CB group participants showed significantly greater reductions in depressive symptoms compared to supportive-expressive, bibliotherapy, and brochure control participants at post-test (6 weeks after baseline), although only the difference relative to brochure controls remained significant at 6-month follow-up. Consistent with the affect-regulation model, CB participants showed significantly lower substance use at post-test than either brochure control or bibliotherapy participants, and lower substance use than participants in all three alternative conditions by 6-month follow-up. Supportive-expressive group participants also had lower substance use relative to brochure controls at 6-month follow-up but not at post-test; bibliotherapy participants did not differ from brochure controls on substance use at either assessment point. We recently

completed the 2-year follow-up of this study and reported effects for depression outcomes in Stice, Rohde, Gau, and Wade (2010). Group CB participants showed greater reductions in depressive symptoms than bibliotherapy and brochure control participants at the 1-year follow-up and significantly or marginally greater reductions by 2-year follow-up.

The primary aim of this report is to examine the degree to which lower substance use for group CB participants relative to the three other intervention conditions detected at 6-month follow-up persists through 2-year follow-up. Our second aim is to test whether reductions in depressive symptoms mediate the effects of CB group depression prevention on any long-term effects on substance use detected in Aim 1, using latent growth curve models in which growth in the mediator and outcome are modeled (MacKinnon, 2008). This long-term mediational model (Stice, Marti, Rohde, & Shaw, 2011) posited that change in depressive symptoms would fully or partially mediate the effects of group CB relative to comparison conditions on escalation in future substance use. Using a randomized controlled trial to test whether interventions that reduce depression also reduce the risk for substance use escalation provides an evaluation of the affect-regulation hypothesis that complements the conclusions that can be drawn from prospective risk factor studies (Hinshaw, 2002).

Methods

Participants

Participants were 341 high school students (56% female) who ranged in age from 14 to 19 years ($M = 15.6$; $SD = 1.2$) at baseline. The sample was composed of 2% Asians, 9% African Americans, 46% Caucasians, 33% Hispanics, and 10% who specified “other” or mixed heritage, which was somewhat more ethnically diverse than the greater Austin area (7% African American, 18% Hispanic, 65% Caucasian). Educational attainment of parents was 26% high school graduate or less; 17% some college; 35% college graduate; 18% graduate degree, which was somewhat higher than the adult population from which we sampled (34% high school graduate or less; 25% some college; 26% college graduate; 15% graduate degree).

Procedures

Participants were recruited using mass mailings, leaflets, and posters that invited students experiencing sadness to participate in a trial of interventions designed to improve current and future mood. Interested students were given a depression screener (the Center for Epidemiologic Studies-Depression scale [CES-D]; Radloff, 1977) and a consent form by mail, which described the study conditions, randomization, and assessment procedures. Parents provided written consent and adolescents provided written assent. Adolescents who returned a signed consent form and scored 20 or above on the CES-D were invited to complete a baseline assessment. We selected this cutoff because an epidemiologic study (Roberts, Lewinsohn, & Seeley, 1991) found that 31% of community-dwelling adolescents scored above 20 on the CES-D and this cutoff maximized sensitivity for detecting youth at risk for major depression. Students who met diagnostic criteria for current major depression were excluded and given treatment referrals.

Participants were recruited at six schools between 2004 and 2007 and were randomly assigned by the project coordinator using computer-generated random numbers to one of four conditions: (1) CB group ($n = 89$), (2) supportive-expressive group ($n = 88$), (3) CB bibliotherapy ($n = 80$), or (4) an educational brochure control condition ($n = 84$).

CB and supportive-expressive group interventions consisted of six weekly 1-hour sessions. Groups were facilitated by a clinical psychology graduate student and co-facilitated by an undergraduate psychology student. If a participant missed a session, a brief (10-15 minute)

meeting was conducted with the youth to review missed material when possible. Detailed manuals for both group interventions contained a theoretical rationale for the program, general facilitator guidelines, material needed for each session, and outlines for all sessions (session topics, points to cover in each section, anticipated time requirements for each section, home practice assignments for the CB condition). The first author rated session recordings for adherence and competence using scales adapted from prior trials (Rohde et al., 2004). Two sessions from the first group for each facilitator and one from each subsequent group were randomly selected for ratings (27% total). Adherence was measured using session-specific checklists for the concepts, skills, and exercises detailed in the scripts. Each item was rated for full, partial, or minimal presentation. General facilitator competence was rated using 18 3-point items that assessed the various indicators of a competent therapist (e.g., leader fosters supportive group process, allocates time fairly across group members). Regarding treatment fidelity, 96% of the CB components and 100% of the supportive-expressive components were rated as full adherence. Regarding leader competence, 94% of the items in the CB sessions were rated at good competence (5% at partial, 1% at poor) and 94% of the items in the supportive-expressive sessions were rated at good competence (6% at partial, 0% at poor).

Participants completed a survey and diagnostic interview at baseline, post-test, 6-month, 1-year, and 2-year follow-ups. They received \$20 for completing each assessment. Assessors, who were blinded to condition, had at least a bachelor's degree in psychology and received 40 hours of training in the use of the semi-structured interviews. Assessors were required to show a minimum kappa agreement of .80 for diagnosis with expert raters before starting data collection and to maintain this throughout the study (assessed in a randomly selected 10% of taped interviews). Assessments and groups were conducted at the high schools after classes. The University of Texas at Austin research ethics board approved this study. Previous reports of this trial (Stice et al., 2008; 2010) provide additional study details.

Group CB Depression Prevention Intervention

Our brief CB program drew upon the Clarke et al. (1995) program, general CB concepts for the prevention and treatment of depression, and our experience with the design of eating disorder prevention programs. Sessions focused on building group rapport, increasing pleasant activities, learning and practicing cognitive restructuring techniques, and the development of response plans for future life stressors. In-session exercises require youth to apply the skills taught in the intervention. We used homework to reinforce the skills taught in the sessions and help participants learn how to apply the skills to their daily life. We also used motivational enhancement exercises to maximize willingness to use the new skills, behavioral techniques to reinforce use of the new skills, and group activities to foster feelings of social support and group cohesion.

Group Supportive-Expressive Intervention

The goals of this condition were to establish and maintain rapport, provide support, and help participants identify and express feelings; this group did not cover any specific skills from the CB conditions. Sessions provided a forum to discuss feelings in a safe environment based on the rationale, which was presented to group members, that sharing feelings with another person reduces stress and improves our mood, listening to others helps us realize we are not alone, and it's more helpful to listen than tell others what to do. Participants were encouraged to discuss changes in their experiences, as well as any emerging problems or worries. No direct advice was given. Participants and facilitators actively supported and responded to each another.

Bibliotherapy Intervention

Participants in the bibliotherapy condition were given copies of *Feeling Good* (Burns, 1980), which provides relevant and practical CB techniques for preventing and reducing negative moods. Participants were told, “This book has been shown to be helpful to some individuals who are feeling sad or depressed. This copy is yours to keep, so feel free to write or highlight in it as you read. We encourage you to use this as a self-help resource.”

Educational Brochure Control Condition

At baseline, participants were given an NIMH brochure that describes major depression and recommends treatment for depressed youth (“Let’s Talk About Depression” NIH Pub. 01-4162), as well as information about local treatment options. They completed the same assessments as those in the other conditions, which allowed us to monitor depression and suicidal ideation, and to contact parents and provide treatment referrals as necessary.

Measures

Substance use—Substance use was measured with 10 items from Stice and Barrera (1995). Adolescents reported the frequency and quantity of intake of beer/wine/wine coolers and hard liquor, frequency and quantity of cigarettes (number of smoking days, number of cigarettes per smoking day), and frequency of marijuana, stimulants, downers, inhalants, and hallucinogen use during the past month. Frequency items used 7-point response scales (never = 0; a few times = 1; less than monthly = 2; 1-3 times a month = 3; 1-2 times a week = 4; 3-4 times a week = 5; 5-7 times a week = 6). Based on the polysubstance use reported in our sample and consistent with other studies that have predicted overall substance use composite scores (e.g., Chassin, Curran, Hussong, & Colder, 1996; Coley, Votruba-Drzal, & Schindler, 2008; Hussong & Chassin, 1997; Wills, Vaccaro, & McNamara, 1994), items were averaged to form an overall substance use measure, which was then normalized with a square-root transformation. This scale has shown internal consistency ($\alpha = .87$), 1-year test-retest reliability ($r = .50$), and predictive validity for changes in parenting (Stice & Barrera, 1995). In the current study the scale showed adequate internal consistency ($\alpha = .79$) and good 6-week test-retest reliability for brochure controls ($r = .71$).

Depressive symptoms—Sixteen items assessing DSM-IV major depression symptoms were adapted from the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Kaufman, Birmaher, Brent, Rao, & Ryan, 1996), a semi-structured diagnostic interview. Participants reported the peak severity of each symptom over the past month using an expanded response format (response options: 1 = *not at all* to 4 = *severe symptoms* [ratings of 3 and 4 reflecting diagnostic levels]). Severity ratings for each symptom were averaged to form a continuous depressive symptom composite. The depressive symptom severity score has shown 1-week test-retest reliability ($r = .93$), inter-rater agreement ($r = .85$), internal consistency ($\alpha = .75$), predictive validity (Nolen-Hoeksema, Stice, Wade, & Bohon, 2007), and sensitivity to detecting intervention effects (Stice et al., 2008).

Data Analysis

Preliminary analyses examined the comparability of participants across conditions. Next, linear mixed effects models (Fitzmaurice, Laird, & Ware, 2004; Hedeker & Gibbons, 2006) with random intercepts and slopes, an unstructured covariance structure, individual time scores measured in months from baseline assessment, and baseline depression scores as a covariate tested whether there were differential changes between the prevention intervention conditions in substance use from baseline to 1- and 2-year follow-up assessments. These models use all available data, thereby accommodating participants with incomplete data.

Models with a quadratic term were considered, but based on the Akaike information criteria (AIC) and Bayesian information criteria (BIC) fit statistics, the linear only model (AIC = 1480, BIC = 1495) showed superior fit to the linear and quadratic model (AIC = 1515, BIC = 1542). Because mixed effects models do not provide standardized regression coefficients, partial correlation coefficients, computed on the basis of *t* values and degrees of freedom (Rosenthal & Rubin, 2003) were computed for effect sizes. Partial correlation coefficients were converted to a *d*-statistic using the formula provided by Rosenthal (1991).

For contrasts where the impact of CB group prevention on reducing substance use persisted through 2-year follow-up, we tested whether depressive symptoms mediated substance use outcomes for CB group relative to the alternative condition. Mediation was examined using latent growth curve (LGC) models in a structural equation modeling framework (SEM) in which parallel growth in the mediator and the outcome variables was modeled (MacKinnon, 2008). Mediation models were constructed with the Mplus software (Muthén & Muthén, 2010) using direct maximum likelihood estimation, which makes use of all available data. We tested whether (1) the initial variable (i.e., group CB condition relative to the control condition) predicts the outcome (i.e., substance use; path c), (2) the initial variable predicts change in the mediator (depressive symptoms; path a), (3) change in the mediator predicts change in the outcome (path b), and (4) the relations between the initial variable and the outcome is reduced to zero if the mediator is included in the model (path c'), which demonstrates full mediation or evidence of a significant reduction, which would suggest partial mediation. Paths a, b, and c' are estimated in a model in which we tested the indirect effect from condition variable to the substance use variable through depressive symptoms with bias corrected bootstrap estimates that test the null hypothesis that the relation between condition and substance use does not depend on the mediator (i.e., the product of the a and b paths is 0). In the event that models did not show acceptable model fit, we identified theoretically viable changes to the models based on the modification indices.

Prior to the constructing parallel growth models, we tested for multivariate normality, an assumption of SEM. Change in the growth patterns were examined for both the mediator and outcome variables to assess the best model of longitudinal change. We visually examined growth plots of change in the depressive symptoms and substance use, and examined models of static, linear, and quadratic change. In the event of nonlinear change, we evaluated transformations, which linearize nonlinear relations, and piecewise models, which account for distinctly different periods of change (Bollen & Curran, 2006). The LGC models were comprised of factors that represent initial status and growth rate. We assessed the fit of various models of change across time by comparing AIC values of models, using the criteria that decreases of greater than 2 in AIC indicate improved model fit (Burnham, & Anderson, 2002). Mediation in the growth models was assessed following the parallel growth model suggested by MacKinnon (2008). Change in the mediator was regressed on the initial status of the mediator and the intervention condition. Change in the outcome was regressed on the initial status of the outcome, change in the mediator, and intervention condition. Tucker-Lewis Index (TLI > .90), Confirmatory Fit Index (CFI > .90), and Root Mean Square Error of Approximation (RMSEA) (< .08) were used to assess model fit.

Results

Sample Description

Participants assigned to the four conditions did not differ on demographic factors, treatment services received for emotional/behavior problems during the past year, or substance use, although as previously reported (Stice et al., 2008), intervention condition was associated with differences in baseline depressive symptoms ($F[3,334] = 4.80$; $p = .003$; $\eta^2 = .04$); bibliotherapy participants had significantly lower baseline depressive symptoms than group

CB and supportive- expressive participants, but not brochure controls. Thus, all analyses controlled for baseline depressive symptoms. Participants assigned to the various conditions did not show significant differences in treatment expectancy, group attendance, treatment fidelity and competence, or attrition (Stice et al., 2008). The percentage of participants who did not provide data was 3% at post-test, 9% at 6-month follow-up, 15% at 1-year follow-up, and 22% at 2-year follow-up.

Attendance was similar across groups, 52% of CB participants attended all 6 sessions compared to 47% of supportive-expressive participants; 89% of CB participants and 85% of supportive-expressive participants attended at least 3 of the 6 sessions. Among bibliotherapy participants, 41% indicated they read at least half the book, 37% read less than a quarter, and 22% did not read any of the book.

At baseline, 50% of participants reported having used alcohol at least once, 26% reported some cigarette use, 28% reported some marijuana use, and 8% reported some use of other drugs. These rates are similar to national norms for this age group (e.g., 2010 annual prevalence rates of 10th graders for alcohol, marijuana, and other illicit drugs = 52%, 28%, and 12%, respectively; lifetime prevalence of smoking = 33%; Johnston, O'Malley, Bachman, & Schulenberg, 2011). Baseline substance use did not significantly differ ($p > .05$) by intervention condition for any of these substances. Participants who completed all five assessment waves ($n = 230$) were compared to those who did not ($n = 109$) on baseline substance use; attrition use was not significantly related to either baseline substance use ($\beta = -0.12$, $SE = 0.17$, $p = .479$) or the interaction of condition by baseline substance use ($\beta = -0.07$, $SE = 0.35$, $p = .676$).

Substance use during the follow-up consisted almost exclusively of polysubstance use or alcohol use only: of the 148 participants who reported any substance use at the last assessment, 59% reported use of more than one drug category; of the remaining participants, 33% reported alcohol use only, 5% reported cigarette use only, and 3% reported marijuana use only; none reported use of only other drugs; of the participants who reported any substance, 90% used alcohol. The pattern of substance consumption corroborated our use of a single composite measure of substance use. Substance use scores by condition at the five assessment points are shown in Table 1.

Substance Use Outcomes in the 1- and 2-Year Follow-Up Periods

Results from the linear mixed effects models testing for differential changes in substance use across intervention condition from baseline to 1- and 2-year are shown in Table 2. Group CB participants showed significantly smaller increases in substance use compared to brochure controls from baseline through both 1- and 2-year follow-ups ($d = .45$ [$p = .004$] and $.32$ [$p = .033$], respectively). They also showed significantly smaller increases in substance use relative to bibliotherapy participants from baseline through 2-year follow-up ($d = .43$ [$p = .006$]), a difference that reached the level of a trend at 1-year follow-up ($d = .28$ [$p = .067$]). None of the remaining contrasts were statistically significant at either longer-term follow-up point. A visual depiction of the changes in substance use by condition, derived from estimated marginal means, is shown in Figure 1.

Impact of Treatment Compliance

We also examined whether treatment compliance impacted the pattern of findings. These analyses were restricted to the participants who attended all six CB sessions ($n = 46$; 52% of CB participants), all 6 supportive-expressive sessions ($n = 41$; 47% of supportive-expressive participants) or read at least 50% of the bibliotherapy book ($n = 31$; 41% of bibliotherapy participants), comparing them to the 84 brochure control participants. Re-running the linear

mixed effects models testing for differential changes in substance use across conditions from baseline to 1- and 2-year indicated the same pattern of results, with one exception: whereas the intent-to-treat results found a significant condition by time interaction in substance use for the group CB vs. bibliotherapy participants at 2-year follow-up, this difference fell to the level of the trend when analyses were restricted to compliers ($Estimate = .008$; $SE = .005$; $t\text{-value} = 1.84$; $p = .067$; $d = .43$). Group CB participants continued to show significantly smaller increases in substance use compared to brochure controls from baseline through both 1- and 2-year follow-ups ($d = .49$ and $.41$, respectively), and none of the remaining contrasts were statistically significant at either longer-term follow-up point.

Test of Whether Depressive Symptoms Mediate Substance Use Outcomes

Variables included in the model failed to demonstrate multivariate normality (Doornik-Hansen test $\chi^2(20) = 200.58$, $p < .001$), and therefore we used bias corrected bootstrapping to assess statistical significance. Visual examination of depressive symptoms and substance use suggested a piecewise model for depression, which decreased sharply between baseline and post-test for participants in group CB, then exhibited a slow decline from post-test to the 2-year follow-up (e.g., mean depressive symptoms for CB group participants at baseline, post-test, and 2-year follow-up = 1.88, 1.52, and 1.48, respectively; comparable scores for brochure control participants = 1.81, 1.69, and 1.55; Stice et al., 2010). The change in AIC between a linear model and a piecewise model that modeled change for two distinct time segments (baseline to post-test vs. post-test to the 2-year follow-up) was 58.3, which indicated a superior fit for the piecewise model of depression change. We also examined transformations of month from baseline, as depressive symptoms appeared to decrease following post-test, but level off after 6 months. A log transformation of months improved the model fit: AIC decreased by 7.4. We also considered a piecewise model of substance use but AIC increased, suggesting that the piecewise model did not improve fit relative to the linear model. The AIC for the linear model of substance use change was equivalent to the log transformed months models and we therefore selected the log-transformed model to keep it on the same scale as depressive symptoms.

We first tested the mediation model for the group CB condition versus brochure control. This model (Figure 2) demonstrated acceptable fit (TLI = .966; CFI = .973; RMSEA = .049).¹ Prevention condition significantly predicted the baseline to post-test change in depressive symptoms growth factor (-0.35 , 95% CI = -0.60 , -0.20 , $\beta = -.62$) but not post-test to 24-month change (0.03 , 95% CI = -0.01 , 0.08 , $\beta = .22$), indicating that condition predicted immediate change in the mediator. Baseline to post-test change in depressive symptoms growth factor significantly predicted the substance use growth factor (0.25 , 95% CI = 0.03 , 1.99 , $\beta = .51$), indicating that change in the mediator predicted change in the outcome. The direct effect of prevention condition significantly predicted the substance use growth factor (-0.07 , 95% CI = -0.12 , -0.03 , $\beta = -.25$), but after controlling for change in depressive symptoms from baseline to post-test, the direct path from condition to the substance use growth factor became nonsignificant (0.01 , 95% CI = -0.10 , 0.59 , $\beta = .05$). The indirect path from intervention condition to the baseline to post-test change in depressive symptoms to growth in substance use was significant (-0.09 , 95% CI = -0.85 , -0.01 , $\beta = -.32$). In summary, the results supported a model in which change in depressive symptoms fully mediated the impact of CB group versus brochure control in reducing future substance use.

We next tested the mediation model for CB group condition versus bibliotherapy. This model (also Figure 2) demonstrated acceptable fit (TLI = .962; CFI = .954; RMSEA = .060).

¹Baseline and post-test residuals were allowed to co-vary based on the modification indices.

² Prevention condition significantly predicted baseline to post-test change in the depressive symptoms growth factor (-0.55 , 95% CI = -1.19 , -0.28 , $\beta = -1.13$). However, the second criterion of mediation (i.e., that change in the mediator predict change in the outcome) was not supported: baseline to post-test change in depressive symptoms growth factor did not significantly predict the substance use growth factor (0.02 , 95% CI = -0.17 , 0.86 , $\beta = .06$). Controlling for change in depressive symptoms, the direct path from prevention condition to the substance use growth factor was nonsignificant (0.06 , 95% CI = -0.16 , 0.16 , $\beta = -.27$), whereas the direct effect of condition on the substance use growth factor had been significant (-0.06 , 95% CI = -0.12 , -0.03 , $\beta = -.35$) in a model that did not include the mediator as a predictor of substance use slope. Finally, the indirect path from intervention condition to the baseline to post-test change in depressive symptoms to growth in substance use was nonsignificant (-0.01 , 95% CI = -0.30 , 0.10 , $\beta = -.13$). In summary, three of the five criteria for the mediation of CB group versus bibliotherapy by change in depressive symptoms were satisfied in the models.

Discussion

The present study extends the intriguing short-term findings from our previous report (Stice et al., 2008) regarding the apparent secondary benefit of an indicated CB group depression prevention in reducing the normative escalation of substance use over time in adolescents who have subclinical depressive symptoms. The impact of three active depression prevention interventions on future substance use suggested a complex and, we believe, potentially important set of findings that warranted targeted follow-up examination and the evaluation of a key mediational model, namely the affect-regulation hypothesis. Participants in the CB prevention group showed significantly lower rates of substance use relative to brochure controls at both 1- and 2-year follow-up assessments. In addition, group CB participants showed significantly lower increases in substance use relative to adolescents in a bibliotherapy condition at 2-year follow-up, an effect that was at the level of a trend one year post-intervention. Differences between CB group participants and supportive-expressive group participants in substance use escalation at both long-term assessment points were nonsignificant; the possible implications of this nonsignificant finding are discussed below. The significant effects for substance use were in the moderate range ($d = .32$ to $.45$; mean $d = .40$), representing meaningful intervention benefits that were detectable up to two years post-intervention. Cuijpers (2002) noted that although well-designed prevention programs directly targeting substance use have reduced substance use during the intervention phase, effects have tended to not persist (e.g., mean overall effect size at 1-year follow-up was $d = .10$). The durability of substance use effects in the present study is noteworthy given that the CB group intervention consisted of six weekly 1-hour group sessions aimed at reducing depression. The present findings are consistent with a meta-analytic study of school-based substance use prevention programs (Gottfredson & Wilson, 2003) which found that effective school-based substance use prevention programs need not be lengthy.

The second aim of this study was to test the hypothesis that reductions in depression mediated the effects of the CB depression prevention program on substance use, relative to bibliotherapy and brochure control participants. Results provided full support for the affect-regulation model when participants in group CB were compared to brochure controls but not to those receiving bibliotherapy. In the mediation model comparing group CB to brochure control, CB group participation predicted greater reductions in substance use at 2-year follow-up and significant reductions in depressive symptoms by post-test (although not 2-

²The residual variance for the baseline to post-test change in depressive symptoms was negative in the original model and was thus constrained to zero to avoid non-positive definite matrices.

year follow-up). In addition, overall change in baseline to post-test change in depressive symptoms predicted long-term change in substance use. Controlling for change in depressive symptoms reduced the impact of the group CB condition to nonsignificance and the indirect path from intervention condition to change in depressive symptoms to growth in substance use was significant, indicating support for full mediation.

In the mediation model comparing the group CB and bibliotherapy conditions, only some of the criteria for mediation were supported. CB group participation predicted greater reductions in substance use at 2-year follow-up and significant reductions in depressive symptoms by post-test (but not 2-year follow-up) relative to bibliotherapy participation. In addition, controlling for change in depressive symptoms reduced the impact of group CB, relative to bibliotherapy, on substance use to nonsignificance. However, baseline to post-test change in depressive symptoms failed to predict long-term change in substance use and the indirect path from intervention condition to depressive change to growth in substance use was not significant. The pattern of mediational findings comparing group CB to bibliotherapy suggest that aspects of the group CB intervention other than reductions in depressive levels account for its apparent effect on substance use escalation.

While present results provided support for the mediational thesis, it should be noted that the affect-regulation model conceptually implies that depressed individuals misuse substances to cope with current negative mood states rather than influencing their future substance use. In the present study, we found the reductions in depression occurring during a 6-week CB group intervention did not result in simultaneous reductions in substance use but rather predicted reduced substance use out to two years after the intervention. Our growth curve analyses revealed a clear nonlinear pattern in that depressive symptoms in the CB group condition substantially decreased during the intervention period and then leveled off, in contrast to the pattern of change in substance use, which exhibited a fairly constant rate of increase over follow-up. Although there was little evidence that change in depressive symptoms occurred at the same time as change in substance use, results did provide crucial evidence that change in a mediator should temporally precede change in the outcome (Stice, Presnell, Gau, & Shaw, 2007).

An alternative explanation for the effect of CB group on substance use is its group modality. Although group CB was more effective than both bibliotherapy and brochure control conditions, it was not more effective than the other group intervention condition; supportive-expressive group. Further, although supportive-expressive group did not result in significantly lower rates of long-term substance use compared to brochure controls, we previously reported (Stice et al., 2008) that it reduced substance use relative to brochure controls at the 6-month follow-up ($p = .035$; $d = .21$) and there was a trend-level effect in the present study at 1-year follow-up ($p = .078$; $d = .28$). Given the weaker but near-significant effects on substance use for expressive-supportive group versus brochure controls, a provisional hypothesis is that group interventions with marginally depressed adolescents are preventive of future substance use experimentation and escalation. Whereas cognitive restructuring, which was present in both CB conditions but particularly strong in CB bibliotherapy, may be a key mechanism for long-term depression prevention (Stice et al., 2010), nonspecific therapeutic factors common to both group interventions aimed at preventing depression (e.g., normalization of depression, provision of hope and therapist support, modeling and reinforcement of positive coping, interactions with a prosocial peer group) may have the secondary benefit of reducing future substance use.

Although the present findings appear to be long-lasting and clinically meaningful, we are not implying that CB group depression prevention interventions will reduce the rate at which substance use develops in *all* adolescents; adolescents in the present study were selected on

the basis of elevated depression symptomatology. Whereas depressive symptoms and disorder are known to increase risk for substance use disorders (e.g., Armstrong & Costello, 2002; Swendsen et al., 2010), they are not the most robust or consistent risk factors. Other, more potent risk factors for adolescent substance use and abuse include externalizing disorders, previous substance use, parent-child conflict and associated family factors, drug-using peers, and a family history of substance use disorder (e.g., Armstrong & Costello, 2002; Brook, Brook, Zhang, & Cohen, 2009; Swendsen et al., 2010). A simulation study using data from the National Comorbidity Survey-Replication suggested that preventing depression or anxiety disorders would not be a particularly cost effective method of preventing substance use disorders because a large number of internalizing disorders would need to be prevented to reduce the number of subsequent substance use disorders (Glantz et al., 2008). Rather than a primary goal of intervention, Glantz and colleagues suggested that any reductions in future substance use or abuse be conceptualized as important secondary benefits of preventing internalizing disorders. Our assumption is that subthreshold depression represents one risk factor for future substance use that applies to a subset of the adolescent population who will develop substance abuse problems.

Several limitations of this study should be noted. First, substance use was assessed with a brief survey that primarily focused on use in the previous 30 days, and no data were obtained regarding lifetime substance use or the symptoms of substance abuse or dependence. On a related note, we examined an overall substance use composite rather than using separate scales to measure use of alcohol and the various illicit drugs. This was done because the majority of participants who reported any substance use used multiple substances. However, alcohol use was almost synonymous with substance use in the sample (90% of participants who reported any substance use at the last follow-up assessment reported alcohol use, with or without other drugs) and the pattern of findings may be applicable primarily to alcohol use. Future research evaluating the secondary benefits of depression prevention interventions should assess substance use outcomes in much greater detail, including diagnostic interview and, if possible, examine associations with specific psychoactive substance use categories. Second, we examined only one potential mediator, based on the affect-regulation model, and additional mediators should be examined, if this secondary benefit finding is replicated. Third, the attrition rate by 2-year follow-up may have impacted findings, although attrition was not associated with intervention condition or initial levels of substance use.

Evaluating the etiology of any problem behavior is challenging and randomized prevention trials provide a unique opportunity to evaluate whether changes in a putative risk factor translates into change in future pathology (Hinshaw, 2002). Cross-sectional and naturalistic longitudinal designs are unable to rule out the possibility that emerging associations are due to unknown third variables. By randomizing participants in this study to the group CB prevention intervention or the alternative control conditions, we reduced the likelihood that the effects for substance use prevention are due to unmeasured third variables. Clinically, the present trial suggests that a fairly brief indicated CB group intervention aimed at reducing and preventing depression in adolescents at elevated risk for depression has the added benefit of delaying or preventing the onset and escalation of substance use in a subset of adolescents who are at elevated risk for substance use disorders. The apparent dual effects of group CB for depression and substance use are encouraging because prevention programs that produce effects for more than one psychiatric problem have greater public health utility and cost effectiveness than those that produce effects for only one condition. Given the high prevalence of substance use and abuse in adolescents in conjunction with evidence that adolescent substance abuse is not easily preventable (e.g., Tobler et al., 2000; White & Pitts, 1998), that less than 25% of youth with substance use disorders receive treatment (Newman et al., 1996), and that substance abuse treatment often fails to result in lasting remission

(Brown, D'Amico, McCarthy, & Tapert, 2001), a better understanding of various methods that may reduce substance use and abuse for at-risk adolescents is valuable.

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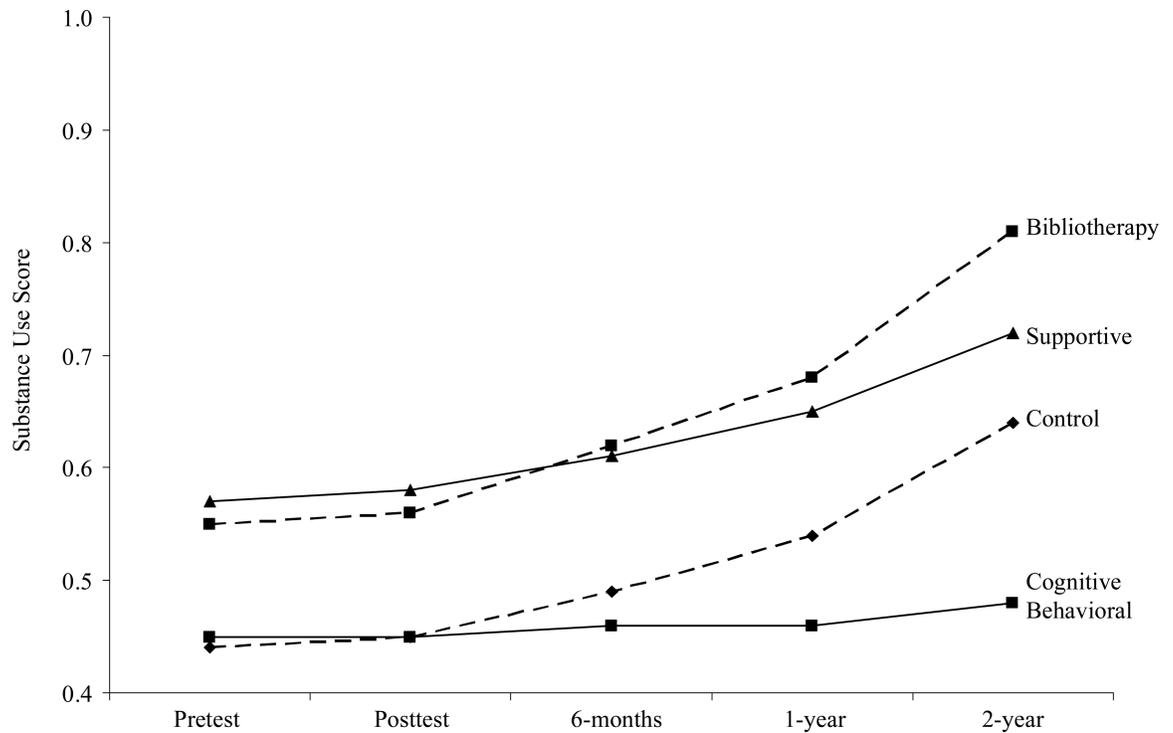


Figure 1.

Model implied substance use trajectories by intervention condition. Model based on all observed substance use score from baseline through the 2-year follow-up. Effect size estimates for mean differences at baseline are: Cognitive-Behavioral vs. Control ($d = .04$), Cognitive-behavioral vs. Supportive ($d = .23$), Cognitive-Behavioral vs. Bibliotherapy ($d = .19$), Control vs. Supportive ($d = .26$), Control vs. Bibliotherapy ($d = .22$), and Supportive vs. Bibliotherapy ($d = .04$).

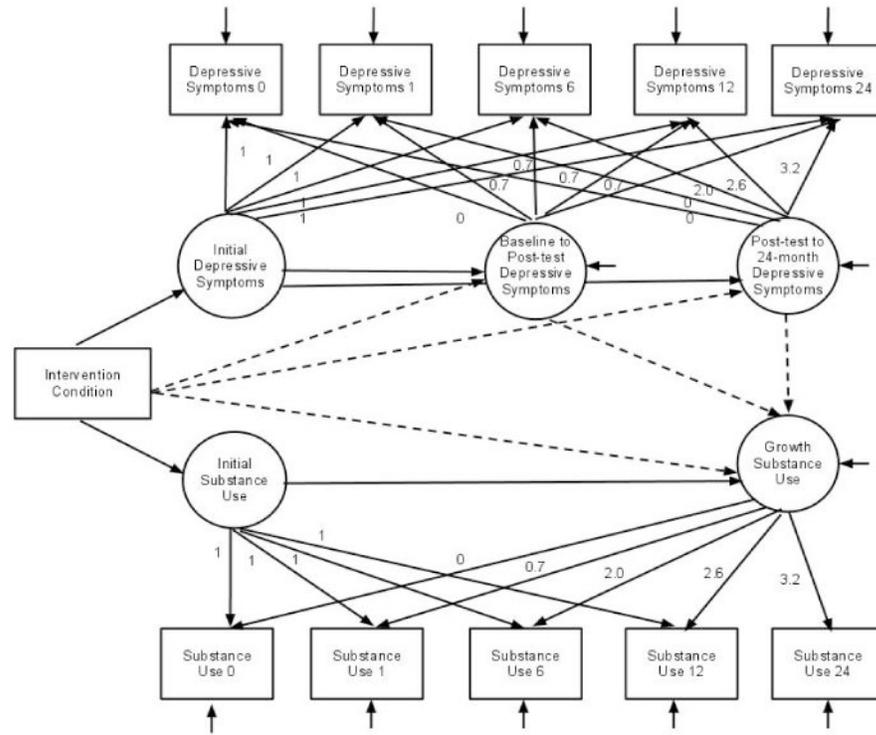


Figure 2. Parallel growth model of depressive symptoms and substance use. Dashed lined indicate mediation paths.

Table 1
Observed Substance Use Descriptive Statistics by Intervention Condition at the Various Assessment Points

Substance Use	CB n = 89			Supportive n = 88			Bibliotherapy n = 80			Control n = 84		
	M	SD	Max	M	SD	Max	M	SD	Max	M	SD	Max
Baseline	0.48	0.53	2.00	0.60	0.75	3.30	0.58	0.68	2.80	0.39	0.60	2.80
Post-test	0.40	0.58	2.70	0.65	0.88	3.30	0.64	0.77	3.00	0.38	0.52	2.00
6-month follow-up	0.39	0.65	3.30	0.62	0.86	3.70	0.73	1.01	5.40	0.61	0.84	3.10
1-year follow-up	0.47	0.64	3.10	0.74	0.85	3.50	0.77	0.93	3.60	0.62	0.76	2.90
2-year follow-up	0.58	0.77	3.10	0.84	0.95	4.30	0.93	0.93	3.30	0.66	0.87	3.50

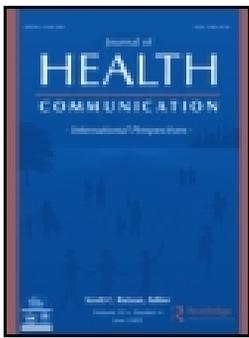
Note: CB = Cognitive-behavioral prevention group; M = mean, SD = standard deviation, Min = minimum, Max = maximum

Table 2
Time × Condition Interactions Assessing Change in the Substance Use by Both Longer-Term Follow-up Assessments

	Estimate	SE	t-value	p-value	d
Baseline to 1-Year Follow-up					
CB vs. Supportive-expressive	.006	.005	1.18	.237	.18
CB vs. Bibliotherapy	.010	.006	1.84	.067	.28
CB vs. Control	.016	.005	2.94	.004	.45
Bibliotherapy vs. Supportive-expressive	-.004	.006	-0.72	.471	.12
Bibliotherapy vs. Control	.005	.006	0.95	.345	.14
Supportive-expressive vs. Control	.009	.005	1.76	.078	.26
Baseline to 2-Year Follow-up					
CB vs. Supportive-expressive	.005	.003	1.56	.118	.24
CB vs. Bibliotherapy	.010	.004	2.79	.006	.43
CB vs. Control	.007	.003	2.15	.033	.32
Bibliotherapy vs. Supportive-expressive	-.005	.004	-1.31	.191	.20
Bibliotherapy vs. Control	-.003	.004	-0.74	.460	.12
Supportive-expressive vs. Control	.002	.003	0.59	.533	.10

CB = cognitive-behavioral; SE = standard error; d = effect size statistic

Note: Baseline to 1-year follow-up slope estimates are: CB -.001, supportive-expressive .005, bibliotherapy .011, and control .015; Baseline to 2-year follow-up slope estimates are: CB .001, supportive-expressive .006, bibliotherapy .011, and control .008



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Articles

Influence of a Nationwide Social Marketing Campaign on Adolescent Drug Use

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In this study, we examined whether awareness (recall) of the National Youth Anti-Drug Media Campaign (NYADMC) benefited youth by attenuating their drug use. Data were obtained from the National Survey of Parents and Youth (NSPY), an evaluative survey tool designed to monitor campaign progress over 4 years. A growth modeling strategy was used to examine whether change in message recall or campaign brand awareness was related to declining patterns of drug use. Two distinct growth trajectories were modeled to account for growth among younger (12 to 14) versus older (15 to 18) youth. Growth trajectories indicated steady and positive increases in alcohol, cigarette, and marijuana use over time. During the early portion of adolescence, youth reported more “brand” awareness, remembered more of the video clips depicting campaign messages, recalled more media stories about youth and drugs and more antitobacco ads, and reported more radio listening and less television watching. When they were older, these same youth reported declines in these same awareness categories except for specifically recalling campaign ads and radio listening. Models positing simultaneous growth in drug use and campaign awareness indicated mixed findings for the campaign. Overall early levels of campaign awareness had a limited influence on rates of growth, and in a few cases higher levels were associated with quicker acquisition of drug use behaviors. When they were younger, these youth accelerated their drug use and reported increasing amounts of campaign awareness. When they were older, increasing awareness was associated with declines in binge drinking and cigarette smoking. No effects for marijuana were significant but trended in the direction of increased awareness associated with declining drug use. The findings are discussed in terms of how they depart from previous reports of campaign efficacy and the potential efficacy of social marketing campaigns to reach a large and impressionable youthful audience with strategically placed advertisements.

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The National Youth Anti-Drug Media Campaign (NYADMC) is a concerted response by the federal government to deter adolescent drug use. The campaign targets youth in the early part of adolescence, when they are most vulnerable to drug initiation proffering a bevy of media communication strategies showcasing the personal and social pitfalls of drug use. Prior reports of campaign efficacy suggest that awareness of campaign messages was associated with higher drug use among teens, underscoring a “boomerang” or iatrogenic effect (Hornik, 2006; Hornik, Maklan, Cadell, et al., 2003; Orwin et al., 2006). This can be disappointing, especially since evidence is accruing that social marketing campaigns designed around persuasive health messages may be effective tools to obtain behavior change (e.g., Brown & Einsiedel, 1990; Flay & Burton, 1990; Pechmann & Reibling, 2000; Zucker et al., 2000). In this article, we explore several limitations with previous analyses that may mask or hide campaign efficacy. We then present a brief overview of the campaign history including discussion of its theoretical background. This is followed by presentation of new campaign evaluation findings using alternative modeling strategies that capture the dynamic interplay of campaign exposure and its influence on youth drug use.

The National Youth Antidrug Media Campaign

The campaign ran in its initial format as “The Anti-Drug” from 1999 to 2004 and incorporated state-of-the-art social marketing technology aimed at reducing adolescent initiation of drug use and to curtail use among those already engaged.¹ In the period leading up to implementation of the campaign, various drug surveillance systems pointed to consistently high drug prevalence rates among our nation’s secondary school students (Johnston, O’Malley, Bachman, & Schulenberg, 2007) as did data from a nationally representative household survey (Substance Use and Mental Health Services Administration, 2007). This surveillance information coupled with the increasing number of new initiates to drug use sounded an alarm for Congress to institute more powerful, sustainable, broad-brush prevention campaigns. In 1998 Congress appropriated funds to conduct a scientifically rigorous and independent evaluation of the NYADMC. A signature event of the campaign included implementation of a new nationally representative, household-based survey, the National Survey of Parents and

¹Historically speaking, much of the “technology” of social marketing is based on the work of Lazarsfeld and Merton (1949) and Wiebe (1951–1952) and later refined by Kotler and Zaltman (1971; Kotler & Roberto, 1989). Social marketing campaigns use “brand” merchandising to sell or market social behavior change in a similar fashion as product marketing. In brand marketing schemes, information about a product is transmitted with the goal of changing behavior and increasing product consumption. Social marketing represents a variant of brand or commodity marketing, with the goal of persuasively changing behavior through value or attitudinal change. Standard campaign applications of these ideas generally have relied on public service announcements (PSAs) and ancillary communication strategies (e.g., television, radio, print media, billboards) to inform the public with a goal of changing beliefs, attitudes, and eventually behaviors. If diffusion of information about a product through merchandising will increase buying behavior, then transmission of information about social values may very well encourage people to change their behaviors. Examples of mass media interventions include campaigns to reduce cigarette smoking among youth (Flynn et al., 1992; Murray, Prokhorou, & Harty, 1994; Popham et al., 1994; Siegel & Bierner, 2000), reduce sexual risk, HIV and AIDS (e.g., Farr, Witte, Jarato, & Menard, 2005; McCombie, Hornik, & Arnarfi, 2002), child abuse (e.g., Stannard & Young), heart disease (Belicha & McGrath, 1990), and nutrition (Chew, Palmer, & Kim, 1998), to name a few.

Youth (NSPY), which could be used to assess youths' awareness of the campaign messages and monitor any corresponding changes in drug use trends.

Detailed information on the phased staging of the campaign and the pro-bono match conducted with the entertainment industry can be found in various reports issued by the Office of National Drug Control Policy (ONDCP, 1998) and the evaluation contractor (Orwin et al., 2005).² From a conceptual point of view, the campaign messages were fairly broad and inclusive for all ages; however, the evaluation component emphasized tracking responses in youths between 11 and 14 years of age. These are the critical years when drug influences by peers are most active and also reflect the formative years of identity formation when youth are most vulnerable to certain risk behaviors (Hawkins, Catalano, & Miller, 1992). In the latter stages of the campaign, owing to nationwide upturns in marijuana use, the Marijuana Initiative was put into motion. The Initiative shifted the target group from 11 to 14 years of age over to 14 to 16 years as the primary audience. With this change in emphasis, almost 99% of the campaign ads focused exclusively on the negative and damaging social, legal, economic, health, and academic consequences of marijuana use.

Theoretical Background for the Media Campaign

To place the campaign in perspective, the main thrust of the campaign advertising emphasizes that most youth do not use drugs (prevalence themes), that drugs interfere with life's ambitions, and have deleterious effects on social status impeding success in life (consequence themes). Drugs are depicted as a bad choice that interferes with normal role socialization, disrupts social relations, and encourages risky behavior and deviant adaptations. Many of the campaign PSAs and radio commercials depict drug-using youth as "loners" and disenfranchised from mainstream conventional institutions (school, family, peers). Youth are encouraged to refuse drug offers (again emphasizing marijuana in most of the advertisements) and are reminded how effective these skills are to offset a wide range of negative social influences. Behavior change is guided by the Theory of Reasoned Action (TRA: Ajzen & Fishbein, 1973, 1977) and draws also from social persuasion (McGuire, 1961, 1966, 1968) and communication theories (Hovland, Janis, & Kelley, 1953). According to the TRA, the influence of attitudes (i.e., subjective evaluations of behavior consequences) and beliefs (subjective norms and behavioral outcomes or expectancies) on behavior is mediated through intentions (i.e., future intent to engage the behavior). In other words, youth form impressions of whether drugs are good or bad, and they combine this information with normative beliefs (whether their close friends approve of drug use) and behavioral expectations (perceived benefits and negative consequences of drug use) toward drug use. These steps are necessary but not sufficient conditions, as the final decision to use drugs is guided by their behavioral willingness or intentions.

Modeling Developmental Change Using Growth Curve Analysis

To date, analyses of the media campaign efficacy have used traditional linear regression or correlation techniques to examine campaign effects. While this tactic

²Detailed information on the scope of the media campaign, funding sources, and evaluation can be obtained at www.whitehousedrugpolicy.gov, <http://www.drugabuse.gov/DESPR/Westat/> and through the ONDCP site <http://www.mediacampaign.org/publications/index.html>

has been useful to delineate the basic statistical associations between campaign awareness and drug use, a major weakness of this approach is that it fails to provide a developmental perspective and incorporate systematic features of change in either awareness or drug use. A cornerstone feature of the campaign's success would suggest that increasing amounts of exposure to campaign messages (assessed through measures of awareness and recall) attenuates drug use in those already using and possibly curtails experimentation in novice users. Theoretically speaking, the bevy of campaign messages from various media sources (e.g., television, radio, print media) should have the effect of stifling the desire to use drugs because youth come to realize that drug use is not normative, valued by their peers or society, and can have catastrophic personal effects.

A program evaluation that can appreciate the importance of dose-response relationships (i.e., cumulative exposure to and awareness of the campaign messages over a prolonged period of time reduces drug use) requires analysis of variances and covariances (both within- and between-wave covariance matrix information) in addition to explicit modeling of the mean structure of the data. This analytic framework provides a means to identify features of development from one point in time to another and examine factors associated with the underlying process of "change." Growth modeling is clearly a more definitive way to address the question of change and increasingly has been advocated as a means to assess prevention effects that unfold over time (Brown, Catalano, Fleming, Haggerty, & Abbott, 2005; Mason, Kosterman, Hawkins, Haggerty, & Spoth, 2003; Park et al., 2000; Taylor, Graham, Cumsille, & Hansen, 2000). A growing literature specialized in analysis of change highlights distinct strengths of this approach with respect to modeling development (Duncan & Duncan, 1995; Mehta & West, 2000; Rogosa & Willett, 1985; Willett & Sayer, 1994) and to better understand drug etiology (Duncan & Duncan, 1996; Wills & Cleary, 1999), including studies of alcohol (Curran, Stice, & Chassin, 1997; Scheier, Botvin, Griffin, & Diaz, 2000), cigarettes (Simons-Morton, Chen, Abroms, & Haynie, 2004), and marijuana (Brook, Whiteman, Finch, Morojele, & Cohen, 2000).

There are several distinct features associated with growth modeling that apply to the NSPY data. For one thing, the NSPY collected data from youth ages 12 to 18 (data from youth ages 9 to 11 are excluded from the current study) at each of four rounds. Thus a youth who was 12 in Round 1 was followed three more times through age 15 using follow-up assessments scheduled anywhere from 6 months to 1 year later. Given the purposeful sampling strategy to ensure adequate representation of youths in the critical and vulnerable years (12 to 15), Round 1 of the NSPY evaluation data includes some youth who are 12, some 13, some 14, and so forth through age 18. A natural attrition mechanism was imposed so that youths older than 18 were not tracked longitudinally (for cost efficiency and coinciding with the campaign's focus on the critical formative years of drug initiation). Thus, at each successive round there would be youth anywhere between 12 and 18; however, youth older than age 18 are considered ineligible and therefore not refiled in subsequent waves of data collections (recruitment of new youth at each successive round was also minimized).

The age mixture within each round makes it imperative to estimate growth using age-cohort models (Mehta & West, 2000; Muthén, 2000) to offset the age-based heterogeneity that may arise in the data from true individual differences in the focal constructs. In other words, there may be some variability in drug use (both initial status and rate of growth) and likewise in measures of campaign awareness that arguably

arises from differences in the ages of the respondents within each data collection point. To illustrate this point, younger non-drug-using youth may benefit from the campaign differently from older drug-using youth, for whom the messages have little traction. Technically speaking, where a youth starts in the process (with respect to either drug use or awareness) and how fast they grow is age dependent. From an analytic point of view, the underlying heterogeneity of age requires developing model parameters that reflect the individual vectors of growth in addition to accounting for population or aggregate trends (i.e., the random effects portion of the model that posits a between-persons effect of age). Using an age-cohort approach with time-structured data, we then can ask more specific questions about how each of the various age groups fared with respect to their campaign awareness, and not restrict ourselves to asking whether all youth in general responded to the campaign messages.

There are several ways to parameterize a model of this nature (see, for example, Duncan, Duncan, & Strycker, 2006); however, in the model we propose, age replaces a measure of time as the main chronometric consideration, and the various components of the growth model become conditioned on age rather than being focused on time (the successive rounds). With this rescaling of time in terms of age, the model now addresses how change in awareness influences change in drug use as if all the youth were present at each of the ages sampled. That is, if a youth was 13 at Round 1 and did not start the study at age 12, his or her missing data for age 12 is treated as missing at random and augmented using full information maximum likelihood estimation procedures (Dempster, Laird, & Rubin, 1977; Graham, Hofer, & MacKinnon, 1996; Muthén, 2000). In this situation, the mechanisms behind the missing data are design based rather than being a function of observed covariates or outcomes (i.e., drug use). Even though the data are not available for each individual at the age at which they possibly could be eligible for participation in the study, the programmatic features of an age-cohort model rearrange the data based on age rather than on round or data collection cycle.

A second distinct feature of a growth model is its ability to monitor how change in one construct influences change in another. This type of “bivariate” growth model can single out the influence of one slope function or aggregate measure of change on another slope function. In the present study our focus emphasizes whether change in campaign awareness assessed by various recall measures influences trajectories of self-reported drug use. A third feature rests with the specific model parameterization that is used. The standard approach includes an intercept term that captures the reference point before growth is estimated, and this can be realistically used as a baseline status indicator (characterizing the group as a whole). A second growth function, the slope term, is an aggregate profile of all the individual growth trajectories across time. A structural path from the campaign awareness intercept to the slope term for drug use (also called a “lagged” effect) tests whether early recall of campaign messages influenced trajectories of drug use (and corresponds to a true “program” effect). A structural path from the drug use intercept to the slope of campaign awareness captures the effect of early levels of drug use on growth in recall of campaign messages. This would represent a “consequence” effect underscoring that perhaps drug use interferes with receptivity of campaign messages or limits somehow use of the various media channels. In the event this structural component is significant, it could be used to argue that youth who already have experimented with drugs during the early phases of the campaign may not benefit from the campaign messages, a possibility that was not identified before in previous analyses.

One other item that surfaces within the context of the campaign suggests that awareness or recall is not the endpoint or dependent variable as explained above, but it should take shape as a manipulation or independent variable.³ Testing this conceptualization requires a slightly different model parameterization in which campaign awareness is treated as a time-varying covariate that influences drug use. This model specifies a “fixed effect” of awareness for each cohort year (age 12, age 13, age 14, . . . 18) on drug use, controlling for the underlying growth in drug use. The model in this analysis asks whether awareness exerts an influence at a particular age even though the underlying trend in drug use may change over time. Even though a randomized prevention trial was not used to assess media campaign effects, we still identified whether manipulating campaign exposure influenced drug use.

Importance of the Present Study

It is clear from this brief overview of the various strengths of growth modeling that the absence of any formal means to test developmental features of the data in terms of age and time may lead to erroneous conclusions regarding campaign effects. In the present study, we explore relations between campaign awareness and three types of drug use that were the principal focus of the media campaign evaluation (alcohol, cigarettes, and marijuana). The inclusion of effects for cigarette and alcohol even with the advent of the marijuana initiative is done simply for two reasons. The gateway hypothesis suggests that early stage drug use follows a progression from alcohol to cigarettes and then to harder illicit drugs like marijuana in an unwavering hierarchical sequence (e.g., Kandel, 2002; Kandel & Faust, 1975; Kandel, Yamaguchi, & Chen, 1992; Newcomb & Bentler, 1986). There is tremendous support for this observation to the extent that most school-based, drug prevention programs emphasize gateway substances as their principal focus (Botvin & Griffin, 2005; Griffin & Botvin, 2009). Because of the closely intertwined nature of drug use experiences in these early stages, it is possible that campaign effects intended for marijuana “spill over” to other drugs. Support for this argument also derives from the close association of the risk factors that prompt drug use at this age (i.e., peer social influences instigate early stage drug use as opposed to psychological problems), and how these influences can become bundled together etiologically (Hawkins et al., 1992; Scheier, 2001).

³We are deeply grateful to the scholarly review that helped shape the contents of this article. Of the many points raised, one compelling one was the differences between treating awareness as a dependent measure and mapping changes in this measure to concurrent changes in drug use as opposed to treating awareness as if it was a manipulation. The different conceptualizations really attribute to whether we think of the campaign as a randomized trial in which there is a manipulation given equally to every participant. It is conceivable, for instance, that we think of the amount of recall each individual reports as the “manipulation” (reflecting their overall exposure), and this was assessed in the NSPY using industry standards as Gross Rating Points (GRPs). At an aggregate (zip code) level, we could measure the effect of GRPs on both recall and drug use, although there was little variation in the amount of campaign shown across the United States. The way we structured our analyses reinforces that the ultimate goal of the media campaign is to test whether the infusion of PSAs and antidrug messages shown through various media channels increases youth awareness that drugs will interfere with normal development and have negative consequences. Toward this end, the growth models express this emphasis by showing whether the trajectories of campaign awareness influence normative drug use trends. The models with awareness as a time-varying covariate express a slightly different and perhaps more experimental view.

Second, an argument can be made that even though the Marijuana Initiative instituted in 2002 (which corresponds to the later part of the campaign evaluation) encouraged youth to refrain from marijuana use, the campaign's original directive fell under the broad catchall of "antidrug" and was not marijuana specific. This is quite pertinent to the evaluation tool, which asked questions about recall of "generic" antidrug messages. The inclusion of nonspecific antidrug messages encouraging youth to avoid drugs and develop drug refusal skills makes it worthwhile to inspect whether campaign messages, even those instituted after 2002, dampened a broad spectrum of youth drug use rather than focusing exclusively on marijuana. Evidence of a broad-brush effect would support social marketing campaigns like the NYADMC, which then can possibly reach a wider audience with concerted antidrug messages.

Method

Overview of the Sample Design

Youth were between the ages of 9 and 18 when they were contacted for participation in the NSPY. Details on the sampling and survey design can be found in several published reports (e.g., Hornik et al., 2003; Orwin et al., 2006). The initial recruitment waves 1–3 comprise Round 1, waves 4 and 5 comprise Round 2 (first follow-up), waves 6 and 7 comprise Round 3 (second follow-up) and waves 8 and 9 comprise Round 4 (third follow-up). Children between the ages of 9 and 11 received a slightly different survey and therefore are not included in the present study. As mentioned previously, ineligible youth older than 18 were flagged and deleted from the panel sample.

Derivation of Sampling and Correction Weights

Individual weighting factors adjusted for the complex sampling design including nonresponse and selection factors. In addition, counterfactual projection (CPF) weights provided adjustments for variables that may be confounded with campaign awareness and were created using a propensity scoring method derived from logistic regression models. Propensity scores help adjust or correct statistical relations when randomization is absent, but the goal is to make causal inference about effects of some treatment or intervention (Indurkha, Mitra, & Schrag, 2006). The statistical corrections help balance groups for any systematic differences or confounding background characteristics (i.e., exposure differences) that might introduce bias and create a threat to internal validity (D'Agostino, 1998). A group of confounding covariates is modeled using multivariable regression techniques with the end result being a "function" or single propensity score that discriminates membership in an intervention or treatment group (Rosenbaum & Rubin, 1983; Rubin, 1979).⁴

⁴Variables modeled to obtain adjusted propensity scores included prior round measures that predict exposure (divided into quintiles) including school attendance, current grade level, academic performance (i.e., grades), participation in extracurricular activities, future plans, family functioning, antisocial behavior, association with antisocial peers, marijuana use by close friends, sensation seeking, self-reported tobacco or alcohol use of a long-standing nature, and amount of television viewing and radio listening. Inclusion of the television and radio measures in derivation of the CFP weight forced us to use nonresponse and selection weights in analyses of these exposure measures only.

Replicate weights provided poststratification adjustments for the complex survey design and to adjust for clustering of respondents. The method used to adjust variance estimators is based on the original work of Fay (1984, 1989) and subsequently refined by Rizzo and Judkins (2004; Judkins, 1990).⁵ Growth models estimated with the campaign awareness variables used the full sample CFP weights. Growth models with measures assessing television and radio used the multiround longitudinal selection weights, and attrition analyses used the replicate variance weights. To our knowledge no existing commercial software program that estimates growth models handles replicate weights to produce consistent unbiased parameter estimates with a linearization or Taylor series approximation method (L. Muthén, personal communication, 2008).

Measures

Campaign Awareness

Campaign brand awareness included four questions probing awareness of newsprint antidrug ads (“In recent months, about how often have you seen such anti-drug ads in newspapers or magazines?”), with response categories ranging from “Not at all” (1) through “More than one time a day” (6); ads shown in movie theaters (“In recent months, about how often have you see such anti-drug ads in the movie theaters or on rental videos?”) with response categories ranging from “Haven’t gone to movies or rented videos in recent months” (0) through “More than 1 time a day” (6); public viewing (“In recent months, about how often have you seen anti-drug billboards or other public anti-drug ads such as on buses, in malls, or at sports in events?”) with response categories ranging from “Not at all” (1) through “More than 1 time a day” (6); and awareness through television or radio (“In recent months, about how often have you seen such anti-drug ads on TV, or heard them on the radio?”), with response categories ranging from “Not at all” (1) through “More than 1 time a day” (6). A total awareness composite score then was created ranging from 9 to 180, with imputation for respondents who were asked separate television and radio questions in waves 1 to 4 (Round 1). This measure then was transformed to a four-level ordinal measure grouping awareness into “less than once per month” (1), “1 to 3 times per month” (2), “4 to 11 times per month” (3), and “12 or more times per month” (4).

As part of the in-home survey, youth were shown digitized versions of various ads shown during the previous 60-day period in their area. The ads were shown to the general public in “flights” or grouped themes tied to the campaign goals. Each year included four flights with 10–12 weeks of exposure time. Two to three ads grouped thematically were shown in any one flight. Survey questions probed recall of these video clips based on ever seen (“Have you ever seen or heard this ad?”), with responses coded as “yes” or “no,” and number of times seen (“In recent months, how many times have you seen or heard this ad?”), with responses coded “Not at all” (1), “Once” (2), “2 to 4 times,” “5 to 10 times,” and “More than 10 times.” As a validity check, youth also were queried whether they had seen a “ringer” ad that had not aired during the designated time period (but were not calculated as part of

⁵The adjustment or correction to variance estimators included replicate-specific poststratification factors. These were $h_k = 2.57$ for $k = 1, 2, \dots, 60$ replicate weights and $h_k = 0.06$ for $k = 61, 62, \dots, 100$ replicate weights. Calculation of the variance and standard deviation estimates is based on the formula: $SE(\hat{y}) = \sqrt{\sum_{k=1}^{100} h_k (\hat{y}_k - \hat{y})^2}$.

their overall recall score). Scores then were statistically adjusted through imputation to correct for the disproportionate number of ads shown to minorities (African American and bilingual Hispanic youth were shown more ads as part of the campaigns efforts to target these youth). The resultant imputed scores then were summed across all eligible ads in order to obtain a measure of total recall for campaign-based ads. A corresponding weighting algorithm was applied to a matrix of the two recall questions (ever seen the ad and how many times) with increasing valence applied to greater recall. This score then was scaled to a four-point measure ranging from “Less than one time per month” (0), “One to less than 4 times per month” (1), “4 to less than 12 times per month” (2), and “12 or more times per month” (3).

Additional measures of campaign awareness included an assessment of antitobacco ad recall (“How often did you see or hear anti-tobacco TV/radio ads in the last 6 months?”) with responses ranging from “Not at all” (1) to “More than one time a day” (6), a dichotomous (yes/no) measure assessing recall of stories in the media depicting youth and drugs. The measure was derived from five media types including television/radio, movies, talk shows, movies/videos, and magazines; a measure averaging the number of ads recalled in the past 60-day period (averaging across the total number of ads recalled when shown to the youth as part of their specific recall-aided awareness measure); a measure averaging the number of hours watching television on weekends and during the weekday; and a measure averaging hours spent listening to the radio combining weekend and weekday hours.

Alcohol and Drug Use

Assessment of alcohol and drug use relied on an Anonymous Computer Assisted Self-report Interview (ACASI). Two alcohol use items⁶ assessed being drunk or high (“How many times were you drunk or very high from alcohol in the last 12 months?”) with response categories ranging from “I don’t use alcohol” (0) through “40 or more occasions” (7); and heavy alcohol use based on a measure of binge drinking (“How many days have you had five or more drinks in the last 30 days?”) with response categories ranging from “I don’t drink” (0) through “10 or more times” (6). Cigarette use was assessed with a single item (“How many cigarettes smoked a day during the last 30 days?”) with response categories ranging from “None” (0) through “More than 35 per day, about 2 packs or more” (7). A single frequency item assessed marijuana involvement (“How many times have you used marijuana in the last 12 months?”) with response categories ranging from “I have never used marijuana” (0) through “40 or more occasions” (6).

Analyses and Model Testing Strategy

We first tested a basic “univariate” growth model for each of the three drug use measures and then followed this procedure with tests of growth for the individual

⁶The ACASI instrument was set up to include skip patterns for youth responding “No” to the drug experience questions (e.g., “Have you ever drank alcohol?”). Use of skip patterns resulted in many youth not responding to items tapping frequency or intensity of use. In order to include more youth in the analyses and examine variation attributed to nonuse, we added categories reflecting responses of “I never used . . .” to each question in the skip pattern. Adding these youth back into the analyses allowed us to estimate growth relations that consider the addition of youth transitioning from nonuse to use over time. (Otherwise, they would have been excluded from subsequent rounds and not analyzed.)

measures of campaign awareness. We specified piecewise linear growth models for the drug and awareness models (Chou, Yang, Pentz, & Hser, 2004; Li, Duncan, & Hops, 2001). The piecewise model incorporated different slopes for when these youth were younger versus older (using S_1 to capture growth from 12 to 14 and S_2 from 14 to 18). Rather than assuming the growth trends would be homogeneous for the different age groups, we hypothesized that the trajectory for the high school years would be qualitatively different in shape and form compared with when these youth were in junior high school. In the case of drug use there are substantial age-related peer and social influence factors that could cause this differentiation, and in the case of awareness, different patterns of utilization (e.g., with increasing age youth may cut back on television for school work or employment) might influence the course of growth.

After estimation of the respective univariate growth models, we then posited a combined bivariate growth model. The bivariate model addresses the core theoretical issues of the media campaign: whether increasing campaign awareness over time is associated with concomitant decreases in drug use. In addition, the bivariate model also produces lagged effect parameters, which estimate the association between early campaign awareness and growth in drug use, and conversely between early drug use and growth in awareness (as a direct test of drug consequences and their disruptive influence). Following these models, then we estimated a model positing the different measures of recall and awareness as “time-varying” covariates estimating their independent effects on drug use, controlling for the underlying growth.

Results

Sample Description

The sample was 52% male, and this remained consistent across all four rounds. The sampling strategies employed to ensure the dataset was nationally representative of the major racial groups resulted in two-thirds (67.3%) being White (only Round 1 data presented), 13.8% Black, 15.1% Hispanic, and 3.8% other (non-Hispanic). Among Hispanic youth, 8% reported their origin as Mexican, 1% Puerto Rican, 0.4% Cuban, and 2% other Hispanic origin. Numbers of youth in each age cohort across the four Rounds are shown in Table 1. Based on sampling protocols, very few new youth were recruited in each successive round, and youth older than 18 were not tracked longitudinally.

Table 1. Sample sizes by round and age cohort

Age	Round of data collection			
	1	2	3	4
12	920	23		
13	850	565	15	
14	475	903	560	19
15	262	592	906	568
16	8	383	604	872
17		49	388	619
18			42	437
Total	2515	2515	2515	2515

Patterns of Drug Use Across the Four Rounds

Table 2 shows the prevalence rates for each age cohort from 12 to 18 years of age. As expected, with increasing age a greater number of youth reported some drug experience. At the age of 12 only about 1% or 2% of youth reported any use, but by the time they were 18, 44% reported alcohol use, 27% binge drinking in the past 30 days, 25% using cigarettes, and 30% having tried marijuana. Consistent with the campaign goals of targeting youth in the most vulnerable years, there was an apparent major developmental inflection appearing between 14 and 15 years of age, with precipitous rises in the numbers of youth saying they had tried all three drugs. Notably, the rates are still somewhat lower than comparable rates for the national youth surveys for the same historical period (e.g., Johnston et al., 2007).

Panel Attrition Analyses

Attrition analyses were structured to determine whether certain factors operate systematically to cause dropout from the study. Proportional analyses using the χ^2 test were used for cross tabulation of binary measures and logistic regression modeling to examine the optimal predictors of retention (coded "1" stay and "0" dropout). We used the WesVar software program to estimate logistic regression models of panel attrition. This statistical modeling program enables us to adjust (through poststratification) the sample variance estimators for the undersampling of primary sampling units and correct any bias in parameter estimates related directly to the complex sampling design (using replicate variance estimators to adjust standard errors for design effects).

Proportional tests indicated that panel youth were significantly more likely to be female, smoke more cigarettes, drink alcohol, and smoke marijuana (all χ^2 proportional tests significant at the $p \leq .0001$) compared with dropout youth. Given the large number of variables possibly related to retention status, logistic models were run separately for five individual domains (demographics, campaign awareness, drug use, school-related factors, and psychosocial risk).⁷ Following tests of the individual domains, we culled only significant predictors and tested these in a combined model predicting retention. The final model indicated that retained youth were less at risk for marijuana use (unstandardized $b = -3.51$, $p \leq .0001$, OR = .03), engaged in more antisocial behavior (evidencing suppression: [$b = .23$, $p \leq .0001$, OR = 1.26]), spent fewer hours listening to the radio on a daily basis ($b = -.09$, $p \leq .01$, OR = .91), and were more likely to have attended school in the past year ($b = 1.05$, $p \leq .01$, OR = 2.87) compared with their dropout counterparts. Using the Cox-Snell likelihood pseudo- R^2 statistic, the model accounted for 12% of the variance in retention status, $F(14,87) = 12.127$, $p \leq .0001$.

⁷Predictors in the attrition analyses included demographic and background measures (gender, dummy coded measures of race to contrast White, Black, and Hispanic versus all other ethnic groups, respectively, and a measure of religious service attendance); drug use measures (alcohol, cigarettes, and marijuana); campaign awareness (brand awareness and specific recall-aided exposure, television and radio exposure to antidrug messages, and television viewing and radio listening behavior), school-related factors (grades, absenteeism, educational plans, a summed index of extracurricular school activities, and whether the respondent attended school in the past 12 months); and measures of psychosocial risk (antisocial behavior and a regression-derived measure of risk for marijuana use).

Table 2. Prevalence of drug use by age group

Age (years)	Alcohol (past 12 months)	Binge (past 30 days)	Cigarettes (past 30 days)	Marijuana (past year)
12	.02	.01	.02	.01
13	.05	.02	.03	.04
14	.11	.05	.06	.09
15	.21	.11	.11	.16
16	.32	.16	.17	.22
17	.39	.22	.21	.28
18	.44	.27	.25	.30

Results of the Growth Modeling

Figure 1 graphically shows the two-factor unconditioned growth model for the cohort analysis. This model parameterization serves as a basic template on which all models were tested for linear growth. Basis points or loadings for the intercept growth factor centered the structured means at age 12 as the initial status or reference point. Equally spaced basis points were used to specify linear growth for each of the two respective slope growth factors, one capturing growth from age 12 to 14 and the second trend designating growth from ages 14 to 18.

Table 3 shows the fit indices and model parameters for all of the univariate models tested. A careful inspection of this table shows that most of the estimated growth models fit the sample data. With the exception of the model for marijuana, the Comparative Fit Indices (CFI: Bentler, 1990) for each model is relatively large and exceeds the .90 benchmark (at least 90% of the model-implied means and covariances fit the observed sample means and covariances: Hu & Bentler, 1998). The root mean square error of approximation (RMSEA: Browne & Cudeck, 1993; MacCallum, Browne, & Sugawara, 1996) and standardized root mean square residual (SRMR) are used to indicate lack of fit. In general, smaller values (<.05) indicate congruence between the off-diagonal elements of the sample and population

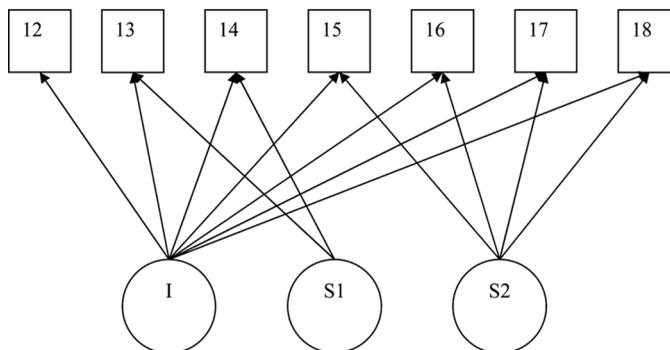


Figure 1. Univariate piecewise growth model. I = Intercept; S1 = Slope 1; S2 = Slope 2; 12 = measure at age 12. Equal interval basis loadings for slope factor indicates linear growth form (0, 1, 2, 3). Not shown for purposes of clarity are curved lines with two-headed arrows representing associations between initial status (intercept) and rate of growth (slope).

Table 3. Fit statistics for univariate growth models

Variable name	Parameter estimates													
	Model fit indices				Means				Variances				Correlations	
	χ^2	CFI	RMSEA	SRMR	I	S ₁	S ₂	I	S ₁	S ₂	I,S ₁	I,S ₂	S ₁ ,S ₂	
Alcohol Use	69.719 (13)***	.919	.042	.091	.003	.071***	.274***	.015	.070***	.163***	-.006	-.008	.011	
Binge Drinking	24.567 (13)*	.959	.019	.064	.002	.042***	.161***	-.003	.026**	.066***	.002	.002	.003	
Cigarettes Use	71.545 (13)***	.930	.043	.109	.011	.095***	.288***	.131	.174**	.312***	-.020	-.022	.061*	
Marijuana Use ¹	58.338 (12)***	.883	.039	.150	.004	.081***	.262***	.003	.088**	.187***	.011	-.025	.040	
Media Stories	8.621 (13)	1.000	.000	.040	.920***	.023***	-.002	.028**	.007*	.000	-.012*	-.002	.001	
Brand	22.931 (13)*	.980	.018	.030	2.089***	.124***	-.071***	.441***	.146*	.044*	-.170**	-.033	-.011	
Specific Recall ²	20.192 (15)	.985	.012	.053	1.145***	.198***	.084***	.234***	.000	.014*	NA	-.023*	NA	
Anti-Tobacco Ads ³	38.162 (16)**	.958	.024	.068	3.108***	.113**	-.133***	.742***	.000	.083***	NA	-.120***	NA	
Television Watching	37.897 (13)***	.984	.028	.052	3.872***	-.020	-.198***	1.436***	.133	.105***	.002	-.146	-.023	
Radio Listening	46.078 (13)***	.967	.032	.051	2.074***	.371***	.047**	1.629***	.454***	.156***	-.242	-.261	-.002	

¹The mean was freely estimated for Marijuana Use at age 18 for to improve the model fit.

²The mean was freely estimated for Specific Recall at age 18, and the variance for slope 1 was fixed at zero for proper model convergence.

³The variance for slope 1 was fixed at zero for Anti-Tobacco ads.

* $p < .05$; ** $p < .01$; *** $p < .001$.

I = intercept; S₁ = slope 1; S₂ = slope 2; NA = not applicable due to fixed variance.

covariance matrices. There appears to be some tension in the way growth was specified for the cigarette and marijuana models, but the remaining models show relatively small RMSEA and SRMR fit statistics indicating there is adequate fit between the sample and implied population model.

Slope terms were all positive, indicating steady increases in drug use when these youth were younger (S_1) and as they matured to the latter part of adolescence (S_2). Interestingly, a comparison of slope terms for the younger years to the later years shows the growth trends are somewhat steeper (larger in magnitude) for the S_2 parameter, indicating faster growth during the high school years. Turning to the campaign awareness parameters, we see two findings worth noting. First, growth in campaign awareness is positive for the earlier years (12 to 14), except for television viewing behavior, which had a slope not significantly different from zero. As these youth became older (14 to 18), their awareness declined for every media venue except specific recall (videos shown on laptops) and radio listening behavior. Also, the magnitude of the slope terms were considerably larger at the younger age for recall of stories about drugs and youth, brand awareness, specific recall, and radio listening but larger in magnitude for television (declining) as these youth transitioned to high school.

The far-right-hand section of Table 3 shows the relationships between the intercepts and slope terms and also the association between the two slope terms. The two columns containing the associations between the intercept and slope terms indicate how fast awareness grew among these youth. A negative relationship indicates that youth with lower levels of campaign awareness at age 12 grew fastest over time (or declined slower if the awareness slope was negative). This was the case for recall of stories in the media about drugs and youth ($r = -.012$, $p \leq .05$) and general brand awareness ($r = -.170$, $p \leq .01$) during the early portion of adolescence. In the latter portion of adolescence this negative relationship included specific recall of the video clips ($r = -.023$, $p \leq .05$) and antitobacco ads ($r = -.120$, $p < .001$).

Results of the Bivariate Growth Models

Figure 2 graphically presents a generic template for testing the bivariate cohort growth models. Again, two slope trends are posited to capture the different rates of growth for youth when they were younger versus when they were older, and this is repeated for both drug use (D) and awareness (A) measures. Table 4 contains the results of the bivariate growth models. In general, these were all well-fitting models with CFI $> .90$, small residual variances expressed by the RMSEA and SRMR and optimal ratio of χ^2/df . Of interest in this table are the parameters indicating (1) effects of early campaign awareness on growth in drug use ($AI \rightarrow DS_1$ and $AI \rightarrow DS_2$); (2) effects of early drug use on growth in campaign awareness ($DI \rightarrow AS_1$ and $DI \rightarrow AS_2$); and (3) the slope-to-slope correlations (DS_1, AS_1 and DS_2, AS_2), the latter parameter capturing a major campaign effect. Turning first to effects of early campaign awareness on growth in drug use, we see there are only two significant lagged effects for youth when they were younger ($AI \rightarrow DS_1$), and they are both positive (binge alcohol use with both radio listening: $\beta = .163$, $p \leq .05$ and recalling stories about youth and drug use: $\beta = .109$, $p \leq .01$). The positive relationship indicates youth with appreciably higher levels of awareness when they were younger grew faster in drug use during the years between 12 and 14. The column to the immediate right in Table 4, which captures the same effect when these youth are older

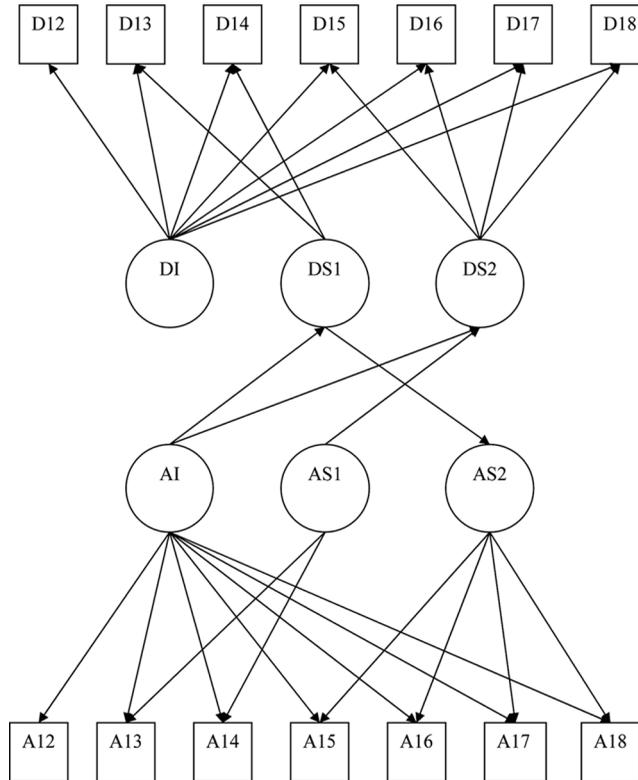


Figure 2. Bivariate piecewise growth model. The variance of intercept was fixed at zero for all of the drug use variables, and thus there are no regression lines depicted on the drug use intercept. Residuals are not shown in this figure. D = drug use variable; A = Awareness (recall) variable. Also not shown for purposes of clarity are curved lines denoting correlations between DI and DS1 and DI and DS2.

(AI→DS2), also shows there are seven significant and positive lagged effects. Thus, even at the different age periods, those youth with initially higher levels of campaign awareness grew faster in their drug use (there were three effects for alcohol, one for cigarettes, and three for marijuana).

A second concern is whether drug use interferes with campaign awareness. Unfortunately, we were unable to robustly estimate the full range of possible consequence effects because of variance estimation problems with the drug use intercept. Estimation of correlations between drug intercept and other model parameters was prevented because of offending estimates (often called “Heywood” cases: Dillon, Kumar, & Mulani, 1987) that prevent model convergence. This occurs when a variance is trivially small or negative, usually resulting from extremely skewed measures, which we encountered with the self-reported drug use for younger age youth (age 12).

The one piece of information that we were able to obtain and that addresses consequences is under the column labeled DS₁→AS₂. This parameter captures the effect of growth in drug use when the participants were younger on their growth in campaign awareness when they were older. Here, if we treat awareness not as a

Table 4. Fit statistics for bivariate growth models

Drug Use	Awareness	χ^2	CFI	RMSEA	SRMR	DI→AS ₁ Std Est	DI→AS ₂ Std Est	DS ₁ →AS ₂ Std Est	AI→AS ₂ Std Est	AI→DS ₁ Std Est	AI→DS ₂ Std Est	AS ₁ →DS ₂ Std Est	DI, AI Std Est	DS ₁ , AS ₁ Std Est	DS ₂ , AS ₂ Std Est
Alcohol ¹	Brand	221.874 (63)***	.907	.033	.072	NA	NA	NA	-.254	.031	.199	-.016	NA	.035	.109
Alcohol ¹	Recall ²	217.364 (66)***	.905	.030	.079	NA	NA	NA	-.163	.020	.038	NA	NA	NA	.051
Alcohol ¹	Tobacco Ads ³	255.403 (67)***	.898	.034	.081	NA	NA	NA	-.258	.098	.084	NA	NA	NA	.051
Alcohol ¹	Television	227.209 (63)***	.940	.032	.078	NA	NA	NA	.271*	-.040	.036	-.126	NA	-.074	-.259*
Alcohol ¹	Radio	224.078 (63)***	.927	.032	.073	NA	NA	NA	-.318*	.101	.99	.107	NA	.204**	.116
Alcohol ¹	Media Stories	177.193 (63)***	.908	.027	.066	NA	NA	NA	-.516	.055	.431***	.292*	NA	.051**	.010
Binge ¹	Brand	78.568 (63)	.983	.010	.052	NA	NA	NA	-.068	-.085	.291*	-.042	NA	-.001	.085
Binge ¹	Recall ²	101.874 (66)**	.956	.015	.059	NA	NA	NA	-.094	-.021	.009	NA	NA	NA	.181
Binge ¹	Tobacco Ads	94.533 (63)**	.967	.014	.062	NA	NA	NA	-.205	.012	.348	-.542	NA	.005	.135
Binge ¹	Television	245.673 (63)***	.933	.035	.103	NA	NA	NA	.250	-.086	-.877	.922	NA	.161	-.143
Binge ¹	Radio	127.503 (63)***	.958	.020	.060	NA	NA	NA	-.578***	.163*	-.003	.121	NA	.199*	.574***
Binge ¹	Media Stories	61.183 (63)	1.000	.000	.047	NA	NA	NA	-.660	.109**	.343*	.269	NA	.029	.146
Cig Use ¹	Brand	243.003 (63)***	.904	.035	.069	NA	NA	NA	-.039	.112	.088	-.227	NA	-.075	.070
Cig Use ¹	Recall ²	202.807 (66)***	.922	.029	.089	NA	NA	NA	.036	-.042	.034	NA	NA	NA	.304
Cig Use ¹	Tobacco Ads	266.399 (63)***	.906	.037	.100	NA	NA	NA	-.077	.101	.541	-.853	NA	-.127	.030
Cig Use ¹	Television	129.793 (63)***	.965	.021	.068	NA	NA	NA	.256	-.029	.041	.038	NA	-.143	-.305*
Cig Use ¹	Radio	240.672 (63)***	.930	.034	.102	NA	NA	NA	-.233*	.171	.183	.124	NA	.288**	.277**
Cig Use ¹	Media Stories	207.437 (63)***	.913	.031	.089	NA	NA	NA	.039	.015	.310*	.328	NA	.019	-.711
Marijuana ¹	Brand	210.828 (63)***	.900	.031	.092	NA	NA	NA	-.077	.080	.261*	-.022	NA	-.007	-.010
Marijuana ¹	Recall ¹	164.215 (66)***	.930	.024	.086	NA	NA	NA	.229	-.022	.144*	NA	NA	NA	-.207
Marijuana ¹	Tobacco Ads	222.535 (63)***	.896	.033	.099	NA	NA	NA	.038	.067	.459	-.699	NA	-.222	-.017
Marijuana ¹	Television	181.353 (63)***	.940	.027	.096	NA	NA	NA	.134	.019	.801	-.826	NA	-.197	-.179
Marijuana ¹	Radio	168.786 (63)***	.936	.026	.092	NA	NA	NA	-.161	.054	.122	.089	NA	.221**	.194
Marijuana ^{1,4}	Media Stories	179.550 (62)***	.890	.028	.090	NA	NA	NA	-.445	.042	.293**	.171	NA	.036	-.152

¹The variance was fixed at zero for the intercept (age 12) of the drug use variables.

²For Binge-Recall the mean at age 18 for Recall was freely estimated and the variance of slope 1 was fixed at zero.

³For Alcohol Use-Anti-Tobacco Ads, the variance of slope 1 for Anti-Tobacco Ads was fixed at zero.

⁴For Marijuana-Media Stories, the mean was freely estimated at age 18 for Marijuana.

* $p < .05$; ** $p < .01$; *** $p < .001$.

DI = drug use intercept; DS = drug use slope; AI = awareness intercept; AS = awareness slope; NA = not applicable due to fixed variance.

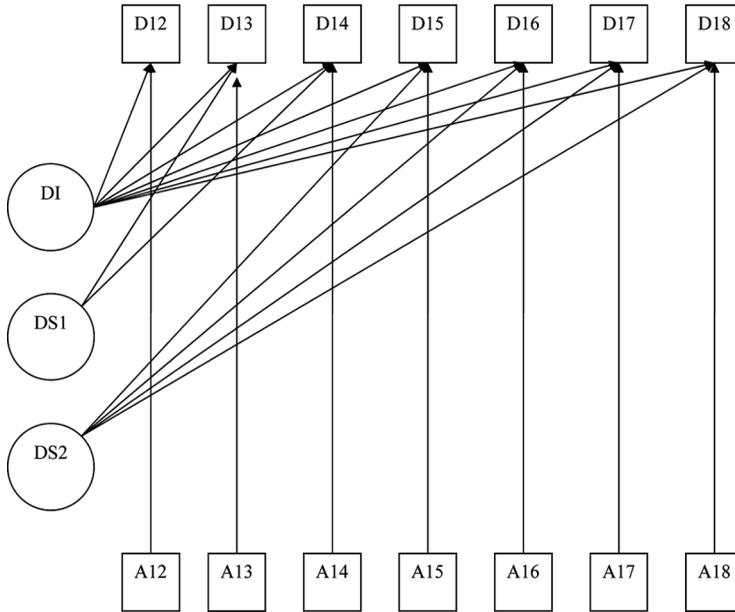


Figure 3. Piecewise drug use growth model with time varying covariates of campaign awareness. D12 to D18 represent measured drug use variables and A12 to A18 is the corresponding campaign awareness exposure measure.

measure of actual viewing of the commercials and PSAs but rather as a measure of recall (how much youth recall seeing the campaign ads on television or listening to them on the radio), then this particular parameter expresses whether growth in drug use interferes with recall. Four of these relations were significant (alcohol and television: $\beta = .271, p \leq .05$, alcohol use and radio listening: $\beta = -.318, p \leq .05$, heavy alcohol use and radio: $\beta = -.578, p \leq .001$, and cigarette use and radio: $\beta = -.233, p \leq .05$). Three of these (negative effects) indicate that increasing amounts of drug use were associated with poor recall, whereas the fourth positive relation indicates that there is a stimulation of television viewing from increases in binge drinking.

Another analytic focus concerns the slope-to-slope correlations (the two far-right columns in Table 4), which captures a major program effect. The question posed by the slope correlations addresses whether increasing amounts of campaign exposure (awareness) is in any way related to downturns in their drug use. The question is posed separately for when these youth were younger (DS_1, AS_1) and older (DS_2, AS_2). Of the 24 possible models tested for the younger period, five had significant slope relations and all were positive. This indicates that increasing awareness and recall of campaign messages was associated with increasing levels of drug use. A total of eight of the 24 models tested were negative (supporting positive campaign effects), but none of these inverse relations achieved significance. Turning to the period when these youth were older, there was evidence of positive campaign effects in the model for television watching and alcohol use ($r = -.259, p \leq .05$) and likewise in the model for television watching and cigarette use ($r = -.305, p \leq .05$). The remaining two slope correlations were both positive, supporting an iatrogenic or boomerang effect (radio and heavy alcohol use: $r = .574, p \leq .001$ and radio and

Table 5. Media Exposure as Time Varying Covariate

Drug Use ^a	Awareness	χ^2	CFI	RMSEA	SRMR	A12→D12		A13→D13		A14→D14		A15→D15		A16→D16		A17→D17		A18→D18	
						Std Est													
Alcohol	Brand	135.499 (32)***	.915	.037	.063	-.017	-.038	.029	-.023	-.011	-.043	-.018	-.018	-.011	-.043	-.018	-.018	-.018	-.018
Alcohol	Recall	122.130 (32)**	.927	.034	.063	.066	.027	.064**	.005	.016	-.001	.028	.028	.016	-.001	.028	.028	.028	.028
Alcohol	Tobacco Ads	145.739 (32)***	.914	.038	.063	.059	-.042	.012	-.039**	-.022	-.061*	-.038	-.038	-.022	-.061*	-.038	-.038	-.038	-.038
Alcohol	Television	53.815 (32)**	.956	.017	.041	.072*	-.051	-.054	-.062*	-.043	-.046	-.059	-.059	-.043	-.046	-.059	-.059	-.059	-.059
Alcohol	Radio	131.453 (32)**	.918	.035	.055	-.027	.016	.105**	.026	.006	-.016	-.002	-.002	.006	-.016	-.002	-.002	-.002	-.002
Alcohol	Media Stories	138.476 (13)***	.922	.037	.059	.029**	-.027	.000	-.016	-.006	-.020	-.006	-.006	-.006	-.020	-.006	-.006	-.006	-.006
Binge	Brand	135.499 (32)***	.912	.037	.063	-.017	-.038	.029	-.023	-.011	-.043	-.018	-.018	-.011	-.043	-.018	-.018	-.018	-.018
Binge	Recall	48.256 (32)*	.967	.014	.042	.092*	-.023	-.018	-.019	.001	.006	.020	.020	.001	.006	.020	.020	.020	.020
Binge	Tobacco Ads	32.990 (32)	.998	.004	.042	.048	.000	.021	-.006	.008	-.001	-.005	-.005	.008	-.001	-.005	-.005	-.005	-.005
Binge	Television	53.815 (32)**	.956	.017	.041	.072*	-.051	-.054	-.062*	-.043	-.046	-.059	-.059	-.043	-.046	-.059	-.059	-.059	-.059
Binge	Radio	53.583 (32)**	.958	.016	.043	.135*	.099*	.132**	.040	.000	-.019	-.049	-.049	.000	-.019	-.049	-.049	-.049	-.049
Binge	Media Stories	40.510 (32)	.984	.010	.039	.021	-.031	-.026	-.018	-.001	.002	.008	.008	-.001	.002	.008	.008	.008	.008
Cig Use	Brand	163.016 (32)***	.906	.042	.085	.005	-.039	-.010	-.018	.004	.008	.023	.023	.004	.008	.023	.023	.023	.023
Cig Use	Recall	117.286 (32)**	.938	.033	.075	.042	.014	.020	.026	.045**	.032	.039	.039	.045**	.032	.039	.039	.039	.039
Cig Use	Tobacco Ads	170.980 (32)***	.915	.042	.089	-.042	.010	.051	-.003	-.005	-.014	-.018	-.018	-.005	-.014	-.018	-.018	-.018	-.018
Cig Use	Television	142.637 (32)***	.925	.037	.087	-.040	-.062	-.027	-.041	-.016	-.029	-.026	-.026	-.016	-.029	-.026	-.026	-.026	-.026
Cig Use	Radio	152.280 (32)**	.922	.039	.087	.106*	.057	.081*	.055**	.072**	.043	.045	.045	.072**	.043	.045	.045	.045	.045
Cig Use	Media Stories	178.025 (32)***	.922	.043	.086	.013	-.035*	-.019	-.016	-.001	.003	.007	.007	-.001	.003	.007	.007	.007	.007
Marijuana	Brand	129.624 (32)***	.905	.036	.085	.008	-.043	.011	-.019	-.004	-.008	-.029	-.029	-.004	-.008	-.029	-.029	-.029	-.029
Marijuana	Recall	98.539 (32)**	.937	.029	.077	.036	.008	.049	.006	.019	.016	.008	.008	.019	.016	.008	.008	.008	.008
Marijuana	Tobacco Ads	132.926 (32)***	.904	.036	.087	.001	-.005	-.016	-.009	-.016	-.027	-.081	-.081	-.016	-.027	-.081	-.081	-.081	-.081
Marijuana	Television	87.413 (32)**	.934	.026	.077	.034	-.039	.003	-.032	-.017	-.019	-.051	-.051	-.017	-.019	-.051	-.051	-.051	-.051
Marijuana	Radio	87.199 (32)**	.934	.026	.079	-.002	-.017	.075	.020	.005	-.001	-.073	-.073	.005	-.001	-.073	-.073	-.073	-.073
Marijuana	Media Stories	140.505 (32)***	.900	.037	.087	.021*	-.031	-.003	-.007	.001	.004	-.004	-.004	.001	.004	-.004	-.004	-.004	-.004

^aThe variance was fixed at zero for the intercept (age 12) of the drug use variables.

A = Awareness; D = Drug Use; A12→D12 = Drug use for the cohort beginning at age 12 regressed on awareness (recall) at age 12.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

cigarette use: $r = .277, p \leq .01$).⁸ Interestingly, and with the exception of radio listening, all of the marijuana models were negative, albeit none were significant. This does indicate, however, that over time, as these youth reported increasingly more awareness and recalled increasingly more campaign messages, there was a concomitant decrease in their reported levels of marijuana use.

Manipulating Media Awareness

As we explained previously, there is another way to address the campaign effects that consider awareness as a manipulated or treatment measure. In other words, rather than identifying the measures of awareness as recall, they can be conceivably thought of as measures of “exposure” to the campaign. This would be consistent with a randomized field trial where exposure levels were manipulated (increased or decreased) comparatively between a treatment and control condition. Figure 3 graphically depicts that awareness is modeled as a time-varying covariate and its influence estimated on the measures of drug use at each respective age. As the figure shows, we are modeling a direct regression of the drug use measures (alcohol, cigarettes, and marijuana) on awareness for each age after controlling for the underlying growth in drug use over time. The results of this model are contained in Table 5. Again, the far left side of the table indicates each of the models fit well and that there is good congruence between the sample and implied population model (means and covariances). In fact, some of the problems previously encountered with the marijuana models are no longer apparent. The various standardized estimates indicate whether awareness influences drug use growth beginning at that age for that cohort (each age period is treated independently). As we can see, there are seven positive estimates for the 12-year-old cohort, one positive and one negative for the 13-year-old cohort (cigarette use and recall of stories about youth and drugs: $\beta = -.035, p \leq .05$), four positive effects for 14 year olds, one positive effect and three negative effects for 15 year olds (alcohol and anti-tobacco ads: $\beta = -.039, p \leq .01$; alcohol and television viewing: $\beta = -.062, p \leq .05$; and binge alcohol use and television watching: $\beta = -.062, p \leq .05$), two positive effects for 16 year olds, one negative effect for 17 year olds (alcohol and recalling antitobacco ads: $\beta = -.061, p \leq .05$), and none that were significant for the 18-year-old group. Overall, the combination of these effects demonstrates that awareness is related in some cases to less drug use, supporting the intended positive campaign effect.

Discussion

This article examined effects of the NYADMC using a cohort-based growth framework to detect whether increased viewing and recall of campaign messages is associated with declines in drug use. A growth framework that can account for the process linking campaign awareness and drug use had not been previously tested bringing into question whether reported “boomerang” or iatrogenic effects might

⁸The column labeled $AS_1 \rightarrow DS_2$ that is contained in Table 3 reflects a “regression” of the slope for drug use (when the youth were older) on growth in campaign awareness when they were younger. This is another way to ask whether growth in awareness of campaign themes was protective and exerted an influence for younger youth as they matured. Only one relation is significant ($r = .292, p \leq .05$) for alcohol and recalling seeing ads about youth and drugs. Nine of the 24 models tested did produce an inverse relation; however, these did not achieve statistical significance.

be specious to the analytic framework. The improvements with modeling growth potentially could uncover positive campaign effects that might endorse mass media communication campaigns like the NYADMC as suitable for the population in question. In order to systematize the quite extensive analyses presented here, we divide the discussion into four sections owing to how they shape our understanding of campaign efficacy: (1) the nature of growth for drug use and campaign awareness, (2) the different age-graded effects, (3) discussion of iatrogenic effects, and (4) whether there was support for positive campaign effects. We also discuss possible theoretical and conceptual refinements to the campaign strategy that arise from this study.

Trajectories of Growth in Drug Use

The piecewise or discontinuous models specifying growth in drug use suggest that compared with their early years, youth accelerated their drug use more quickly in the later portion of their teenage years (14 to 18). There is behavioral information (not reported here) that supports this acceleration. For instance, even though rounds are not the true “marker” of progress but rather age is, we know that the proportion of youth reporting having tried drugs grew precipitously at each round. This was clearly indicated by the addition of new users; the numbers of youth who transitioned from nonuse to use at each age, and increased frequency and intensity of use among those already experimenting with drugs (i.e., greater numbers of cigarettes smoked and more heavy drinking).

It is worth noting that prevalence rates for this sample deviated somewhat from national rates, with the NSPY sample reporting somewhat lower rates of use at the younger ages and higher rates of use as the sample matured. There are several factors that may precipitate these noted discrepancies. First, the differences may be an artifact of different data collection methodologies, particularly survey versus in-home computerized interviews (Fendrich & Johnson, 2001). Moreover, the actual wording of drug use questions was not identical with national surveillance surveys, which may rule out any direct comparisons between rates of use. Self-report bias and the possibility of under-reporting in the initial stages of the NSPY also might account for the gross differences in reported prevalence rates. That is, youth in the NSPY sample are initially uncomfortable with the use of computers in their home, thinking their parents will still see their answers. This is not the case with anonymous paper-and-pencil surveys in schools that avoid connecting personal identification with a youth's answer. As the NSPY youth mature and gain some familiarity with computerized data collection methods, their reporting becomes more veridical, resulting in larger estimates of reported drug use, exceeding those reported in national surveys.

To check this, we obtained estimates of use from other longitudinal panel samples and compared these with the NSPY and MTF numbers. One source of data was obtained from a cohort-sequential study of alcohol and drug etiology,⁹ while another was obtained from a school-based drug abuse prevention program¹⁰ (untreated

⁹Oregon Youth Substance Use Project (OYSUP), Funded by the National Institute on Drug Abuse (DA10767) with data collection running between 1999 and 2005, Principal Investigator Judy Andrews, Ph.D., Oregon Research Institute.

¹⁰Drug Abuse and Violence Prevention with Minority Youth, Funded by the National Institute on Drug Abuse (DA08905) with data collection running between 1998 and 2002, Principal Investigator, Gilbert J. Botvin, Ph.D., Weill Medical College of Cornell University, Institute for Prevention Research.

control students only). We matched the ages of these youth as closely to the NSPY participants as permitted, and the period of data collection overlapped between the respective studies (to rule out historical influences). In the cohort-sequential longitudinal study, which used in-home interviews combined with self-report questionnaires, combining across five separate 12-year-old cohorts prevalence rates for alcohol across 6 years were 6%, 14%, 21%, 31%, 32%, and 41% through 17 years of age, respectively. Prevalence rates for past 30-day cigarette smoking were 2%, 4%, 9%, 13%, 19%, and 24%. Rates of past 30-day marijuana use were 1%, 4%, 9%, 14%, 18%, and 21%.

In the school-based drug abuse prevention program, which used confidential, self-report, paper-and-pencil questionnaires, prevalence rates for the control youth from sixth to tenth grades were 15%, 20%, 28%, 38.5%, and 45%, respectively, for alcohol; 3.5%, 11%, 14%, 18%, and 20% for cigarettes; and 1%, 5%, 7%, 14%, and 18.5% for marijuana. This brief comparative analysis shows that when participants mature in a longitudinal study, there emerges a pattern of consolidated drug use with greater numbers of youth engaging in drugs over time. We might expect there to be a consolidation of drug use behaviors as the NSPY sample matures, particularly since entry into the college years traditionally has been marked by a rapid increase in drug use including binge drinking, an expansion of drugs used, and new personal freedoms (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Chen & Kandel, 1995; Rutledge & Sher, 2001).

Trajectories of Growth for Campaign Awareness

The picture of growth for campaign awareness measures differed markedly from what was observed for drug use. In the early years, growth in campaign awareness was mostly linear and positive for the different types of messaging themes with the exception of television watching, which had a relatively flat trajectory. With increasing age, however, the pattern reversed and growth mostly was characterized by downward trajectories, with the exception of listening to the radio and specific recall of campaign videos (themes), which increased. In some cases, the trajectories seemed to be stronger in the early years (brand awareness) and then less steep in later years. We also found that brand recognition and specific recall of video clips accelerated more steeply in the younger years. This bodes well for the campaign, showing that the PSAs and commercials are more tractable at younger ages, which are the critical and vulnerable years. The ability to isolate age-graded effects for the slope terms is important because it helps elucidate the respective success of different campaign strategies to reach the target audience (ages 12 to 15 seems critical for drug use initiation). The age-graded effect also extended to television viewing behavior, which declined more steeply as the sample matured. The declining utilization of television may reflect maturation and increasing demands from school and extracurricular activities including sports, work, and family responsibility. Television and radio represent the two most important, and highly utilized venues for mass media interventions. In the present study, however, we get mixed findings as to the utility of these outlets, given that there was declining utilization of television throughout, increasing radio listening in the early portion of adolescence, and then reduced growth in this medium with increasing age. In terms of growth for the remaining venues, recall of stories about youth and drugs and antitobacco ads were relatively unchanged across the time span.

Age-Graded Effects

The various age-graded effects mainly are concerned with whether campaign awareness was informative about drug use when youth were younger as opposed to older and whether similar patterns held up for drug use consequences on campaign awareness. These effects are elucidated in the relations between intercept and slope terms in the univariate models and the regression parameters corresponding to the lagged effects in the combined bivariate models. Turning first to the univariate case, we see that there was relatively little information gained from knowing a youth's initial level with regard to how fast they grow in drug use or campaign awareness, and this held for whether they were younger or older. The 20 models tested revealed that only four were significant, and, in all cases, youth who reporting initially lower levels grew the fastest (two each at the different age periods). All four of these models involved awareness, suggesting that barraging these youth with messages in the early portion of adolescence will stimulate them to recall them later on and perhaps inundate them with the appropriate antidrug notions.

The bivariate lagged effects paint a completely different picture and support age-graded relations between awareness and drug use. This raises the specter that the campaign effects were different in the early portion of adolescence compared with the latter portion, where we suspect some behaviors are more entrenched. For instance, awareness in the early portion of adolescence was associated with only two effects for binge alcohol use, but the sheer number of effects rose to six when these youth reached later adolescence. Admittedly, all these relations support iatrogenic campaign effects. In the other age-graded effects, increasing alcohol use in the early portion of adolescence was associated with decreasing radio listening behavior in later adolescence, binge alcohol use was associated with decreasing radio listening, and increasing cigarette use was associated with less radio listening, all three supporting negative consequences from early drug use.

There are several angles from which to better appreciate the role of negative consequences or reverse causation in the campaign effects. Drugs can influence recall and awareness in myriad ways, including their soporific pharmacological effect, loss of memory from prolonged use, reduced cognitive abilities, and neuropsychological deficits. Regardless of the precise underlying mechanism, if youth are immersed in a drug culture or just "turning off" to the message content, the campaign diminishes in importance and fails to reach these troubled youth. Alternative channels may be required to reach hardened drug-using youth, addressing, in particular, their limited media exposure arising from disaffection in school and from other conventional institutions where media messages are delivered or discussed (i.e., school-based drug programs).

The Nature of Iatrogenic Effects

It should be clear by now that the numbers of iatrogenic effects certainly outweigh positive campaign effects. There are several factors that may help us to better understand what produces iatrogenic effects. First, it is imperative that we learn more about youths' perceptions of the campaign messages, particularly because we do not know what precipitates their "awareness," whether certain features of the campaign messages are more salient, or whether their awareness of a campaign's themes is calibrated depending on drug use status. In fact, this type of "conditioning" effect

that links prior existing risk with program outcomes has been a staple part of drug prevention research. Evaluations of school-based drug prevention programs, for instance, show different program effects for experienced drug using versus inexperienced or nonusing youth (Donaldson, Graham, & Hansen, 1994; Ellickson, Bell, & Harrison, 1993; MacKinnon, Weber, & Pentz, 1989). Moreover, the campaign may have to consider that with such a broad-brush effect served ubiquitously to all youth across America, we just do not have the rigorous controls we need to determine if the messages reach nonusing youth in the same manner as drug-using youth and convey the same content that is intended. This also points toward the need for controlled laboratory studies that can experimentally manipulate message content and determine whether the campaign's efficacy reaches across different groups of youth in a similar manner (Terry-McElrath et al., 2005).

Does Growth in Campaign Awareness Influence Drug Use?

A different picture emerges when we put the different pieces of the growth trajectories together. In the early stages when these youth are between 12 and 14 years of age, there is not much support for positive campaign effects; in fact, all of the significant relations between slopes reinforce iatrogenic effects as previously has been reported (Orwin et al., 2006). When we look at these same effects corresponding to the latter portion of adolescence (14 to 18), however, there are two pieces of evidence that suggest campaign messages are getting across and supporting the desired positive outcomes. This occurs with alcohol-using youth and those smoking cigarettes, behaviors that diminished in conjunction with growth in television watching. Even though they reported increasing their television watching behavior, we cannot be sure they were exposed to campaign messages, but we do know that there is something protective about this behavior. Interestingly, we did not get any supportive campaign effects for marijuana despite the content emphasis of the Marijuana Initiative. That is not to say the data do not support a positive campaign effect with marijuana, because all of the slope-to-slope relations were negative, just not significant.

When we piece all of these findings together, there are at least two possibilities that may interfere with the effectiveness of the initiative. First, youth just may not believe the campaign message themes. In particular, they may doubt the veracity of the proposed negative health outcomes or damaging social and personal consequences that are portrayed in the campaign PSAs. Second, there may be an element of "meta-messaging," in the form of heightened sensitivity to the drug problem responsible for the increase in drug use following exposure to the campaign. This phenomenon arises because the message content tells youth that drug use is widespread among their peers or at least normatively prescribed. Moreover, when youth are taught that drugs can cause irreparable harm, but they also are told that drugs are widely used, they form a "disbelief" in the information content of the messages. Alternatively, psychological reactance theory (Brehm, 1966; Ringold, 2002) has been used to account for the unexpected effects. In this view, youth react to the imposition of dogmatic rules and behavioral conduct expectations that are expressed through campaign messages at a time when rebellion against established institutions is widespread and formative in their thinking. When robbed of their freedom to make independent behavioral choices (i.e., perceived threat), youth rebel by using drugs as a statement of autonomy. Both explanations are theoretically plausible but must be tested in future analyses.

We also can employ micro-analysis of the campaign effects pitting brand recognition or awareness against the other forms of recall. Brand recognition was measured as a collage of questions asking participants whether they recollected hearing antidrug ads on the radio, viewing them on television, or seeing ads for the campaign in papers or magazines, in movies (trailers), or on publically displayed billboards. These represent general ways in which a youth can catch a glimpse of the campaign, but also represent the strongest element of the campaign where the most effort was spent to showcase campaign messages. Interestingly, there was an association between lower initial levels of brand awareness and faster growth in heavy alcohol use, albeit this relationship was not significant. It does suggest, however, that a modicum of messaging is getting across and that increasing awareness suppresses acceleration of alcohol use. Only further moderator analyses that entail comparisons of nonusers versus more experienced users can tease apart whether the campaign achieved its goals of keeping youth from initiating drug use at all.

Is the Campaign Theory Wrong?

Consistent with the underlying theoretical premise outlined in the TRA, the goal of the campaign is to get youth to cognitively evaluate their choices and realize that most of their peers and even adults do not positively value drugs, that drugs interfere with achieving positive life goals, and they do not create positive outcomes as anticipated. This was the heart and soul of the campaign messaging content and should deter youths' "behavioral willingness" to use drugs. So why, then, did the campaign not get the type of effects originally intended (particularly for marijuana) and what additional work needs to be done to uncover these effects should they exist? Two possible scenarios come to mind. One suggests that third-variable alternatives are needed to account for the effects of the campaign, variables that instigate drug use and also account for some variation in campaign awareness. Many of the third-variable alternatives that we might have modeled were removed in the service of equilibrating groups to create the specter of randomization. Propensity scoring offers a means to statistically control for measures that may confound awareness-drug relations but at the same time removes important sources of variation that are involved in processes we wish to detect. In the current study, the propensity scores contained sources of influence that might relate to acquisition of marijuana behavior (i.e., marijuana use by close friends) and also account for some variation in campaign awareness (truant or delinquent youth hang out and smoke together while listening to the radio).

A second concern is that the Marijuana Initiative took place at the tail end of the campaign (2002) and did not have sufficient time to work its magic using the current follow-up timeline. In other words, using a growth framework would not be the proper technique to detect a change in campaign effects over time. Rather, a time series framework would be needed to detect the place in time when the maximal effect was achieved given the change in campaign content emphasis. This goes back to our original point that "gateway spillover" effects are driving the few significant positive campaign effects we obtained. Is this good for the campaign? This is difficult to answer in a simple and straightforward manner. On the one hand the campaign took shape as a broad-brush social marketing health persuasion campaign to deter youth from using drugs. Use at this age refers mostly to initiation or experimental use. The argument posed by gateway theorists is that most use begins with alcohol

and progresses in an invariant sequence to include cigarettes, pills, marijuana, and then more progressively harder illicit drugs (e.g., cocaine). Why then did the campaign target primarily marijuana in the media content and insist that the initial focus be on youth ages 11 to 14 and then with the initiative shift this emphasis to 12 to 15? This does not make sense given that youth in this age group, if they are tempted by pressures to use drugs, drink alcohol or smoke cigarettes first before using marijuana.

If a social marketing campaign wants to be successful, it should choose to remediate behaviors that are less intransigent to change. Why focus almost exclusively on marijuana, which surely is being used by the most deviant and hard-to-reach youth? Brand awareness may not persuade these youth to give up their marijuana use given they are intransigent to messages from the establishment. More than likely these youth have rejected school and cast aside its conventional outlook, and they have lost touch with many other important social institutions. In other words, why not focus on earlier forms of the behavior like alcohol or cigarettes where there is sufficient empirical support for positive campaign effects obtained from other mass media interventions (Farrelly et al., 2002; Flynn et al., 1994; Murray et al., 1994)? In these few instances, there are notable changes in attitudes, beliefs and even behavior following exposure to mass media interventions to reduce tobacco use among youth.

This point was further reinforced when we examined whether campaign awareness acted like an independent measure and exerted a “static” influence on drug use, using a growth model specifying time-varying covariates. In this framework, the effect of awareness was identified at each age as though manipulated in an experimental design. Although this approach is not consistent with the actual design of the study, it provides a means to examine a different angle on whether the awareness-drug use relation is affected by youths’ age. These models also reinforced that there is a mixture of iatrogenic effects coupled with evidence of some positive campaign effects (15 iatrogenic and 5 favoring the campaign). The only pattern that emerged is that most of the supportive campaign effects involved alcohol (one cigarette model) and none marijuana, again supporting the contention that the campaign may want to consider reshaping its focus on a different set of outcomes.

General Limitations and Future Directions

Even with the expressed advantages to modeling developmental features of the campaign, there are several limitations to the present study worth noting. First, there are in fact numerous ways to conceptualize campaign effects that go much deeper than the simplified growth models we tested. Any discussion of these conceptual models has to consider the numerous problems associated with a naturalistic study lacking complete randomization. In short, there was no “intervention” to speak of, but rather the campaign took shape as a naturalistic observational study conducted at a particular point in time with no clear demarcation from various historical influences that could affect patterns of reported drug use. This leads to one of several uncertainties that we cannot attribute causation to the statistical relations despite using longitudinal data. At some point, a decision will have to be made to recruit the national media into a nationwide campaign that requires random assignment of defined regions or tractable census units with observations based on individual

youth behavior. The hierarchically structured data then can be subject to rigorous scrutiny in an effort to see if the campaign affords any protection above and beyond the normal fare of prevention resources offered in schools and communities (see Flay, 2000; Flay & Burton, 1990).

It also is true that we cannot rule out additional “uncertainties” that have to do with the method of data collection (self-report ACASI methods) for both drug use and exposure measures. We really do not have a “true” measure of exposure other than asking individual participants if they recall campaign themes at a general level or more specifically whether they recall (with visual prompting) seeing a specific advertisement played for them using a laptop. Even with inclusion of ringer ads that help tease out fabricated recall, we cannot be certain that youth recall campaign themes in a consistent fashion. The absence of any confirming methods could contribute to the irregular pattern of positive and negative findings obtained in this study. We do not know whether “drug” was the key operative term in the Marijuana Initiative or whether the emphasis on marijuana would be responsible for alteration of behavior. Likewise, we cannot be sure that the effects intended on marijuana and that were observed with alcohol and cigarettes resulted from spillover or subjective interpretations by youth regarding the potential harm from drugs. These concerns, combined with the absence of both randomization and a rigorous means to track exposure at the individual level, may lead to false conclusions regarding the stability and surety of findings. In this regard, more rigorous measures of exposure with greater reliability and validity could improve the quality of a media campaign evaluation in general.

There also are alternative theoretical conceptualizations to consider regarding the operative mechanisms of the campaign. For instance, the Elaboration Likelihood Model (ELM: Petty & Cacioppo, 1986) suggests that persuasion involves cognitive elaboration (i.e., attitude change) that can enhance persuasive value (see also Slater & Rouner, 2002). In this respect, we did not test the various belief and cognitive structures that are principal targets of the campaign messages. In fact, we tested very simplified models that purport that more awareness and recall of campaign themes would be associated with declines in drug use. None of the models we tested attribute to the specific theoretical framework of TRA, where cognitions are the driving force in behavior change.

Others have suggested that youth are embedded in a social network (Hornik, 2006) and that effects should be considered with respect to changes in prevailing norms involving perceived drug use by friends (Gunthar, Bolt, Borzekowski, Liebhart, & Dillard, 2006). There are concerns regarding message receptivity and characteristics of the recipient matching features of the message (Santa & Cochran, 2008). In other words, we do not know which features of the campaign messages are persuasive and whether perceivers are vigilant to the different features of campaign messages or whether they attend to information about normative behavior, consequences of drug use, or general indications that drugs are unhealthy. These concerns fall under the concept of “engagement” and are a large part of the ELM. Likewise, we have very little information on whether youth rely on central as opposed to peripheral route processing in decoding campaign messages.

Some laboratory-based work has been done in this regard (Czyzewska & Ginsburg, 2007; Harrington et al., 2003), but dissection of the campaigns “active ingredients” and analysis of message design strategies and message processing is

relatively new. The Activation Model of Information Exposure (Donohew, Palmgreen, & Duncan, 1980; Donohew, Palmgreen, & Lorch, 1994) suggests that attentional features of the individual message recipient must be factored into the message content in order to boost the effectiveness of health persuasion strategies. Again, this would incorporate the absence of any effects on marijuana and the observed positive campaign effects for alcohol and cigarettes only. To put it one way, the engagement value of the marijuana ads was low and did not tap into the self-interests of these youth. There also is evidence that certain individual personality characteristics like sensation seeking may moderate campaign effectiveness (Palmgreen et al., 2001). Certain message features are more palatable to high sensation seeking youth, owing to the cognitive involvement required to decode messages. The message sensation value has to be considered in light of the different campaign modalities (television, radio, print, billboards, movie trailers, to name a few), which may differentially attract viewers as we observed in their respective trajectories of use over time.

Other factors to consider include the heightened public sensitivity to the drug problem, which has the effect of exposing youth to a wide range of messages that extend beyond the reach of the campaign. That is, other school-based and communitywide efforts may make it hard for youth to distinguish what is “campaign” related compared with what is part of the constant background noise of prevention and antidrug activities. In this respect, the campaign might benefit from including questions not only about involvement in outside prevention activities but also probing counterarguments and cognitive elaboration that are part of mainstream marketing studies. With this approach, we can find out whether the messages are persuasive, whether youth are receptive to message content, and from an information processing point of view, whether youth use the message content to alter their beliefs and behavior. This would provide a more formal test of the campaign and go beyond merely asking youth whether they recall the campaign based on brand recognition or visual recall of video segments.

Finally, we are uncertain whether broad-brush analyses like those suggested here represent the best analytic framework to test the campaign’s success. More micro-analytic approaches that dissect the underlying behavioral heterogeneity might be required. One possibility is to use latent class analysis to dissect heterogeneity in awareness and better understand the different patterns of media usage. Coupled with this is the underlying variability in drug use and then linking the two to determine whether there are latent “classes” of youth who diverge on their receptivity to campaign themes. Growth mixture models then can be used to estimate whether different latent classes (based on recall) have different developmental trajectories for drug use. In addition, despite the wealth of information we obtain from modeling growth, there is the observation that we do not know if campaign messages shown early in the early portion of the campaign stretched their impact over time. Were PSAs broadcast during Round 1 more “potent” than messages shown in later Rounds? In this respect, we cannot know exactly where we get the “biggest bang for the buck” and assume with a growth model that there was a steady dose–response relationship across time. Interrupted time series and other statistical methods that can dissect the point of greatest impact would help address this concern. All told, however, we need to be able to make finer and finer discrimination in evaluating the efficacy of the campaign in order to make sure that we are not throwing out the baby with the bath water.

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**AN EMPIRICAL ASSESSMENT OF THE
ABOVE THE INFLUENCE ADVERTISING CAMPAIGN***

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ABSTRACT

This study evaluated the efficacy of *Above the Influence* (ATI), a national media-based health persuasion campaign to deter youth drug use. The campaign uses public service anti-drug prevention messages and targets youth between the ages of 14 and 16, a period of heightened susceptibility to peer influences. The evaluation utilized mall intercepts from geographically dispersed regions of the country. Theoretical impetus for the campaign combines elements of the theory of reasoned action (TRA), persuasion theory, and the health belief model. A series of structural equation models were tested with four randomly drawn cross-validation samples ($N = 3,000$). Findings suggest that awareness of ATI is associated with greater anti-drug beliefs, fewer drug use intentions, and less marijuana use. Congruent with the

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TRA, changes in beliefs and intentions are intermediate steps linking campaign awareness with behavior. This study provides further evidence of positive campaign effects and may strengthen reliance on mass media health persuasion campaigns as a useful adjunct to other programs targeting youth.

INTRODUCTION

The National Youth Anti-Drug Media Campaign (NYADMC) goes on record as the largest ever government funded, health persuasion media campaign. Taking place in its earliest form from 1999 through 2004, the campaign reflected the urgent need to shape and enact a public health agenda targeting youth drug use. Even with the massive outlays of funding to jumpstart the media campaign, evaluations have produced mixed reviews. Some have suggested the media campaign produced “boomerang” effects (Hornik, 2000; Hornik, Jacobsohn, Orwin, Piesse, & Kalton, 2008; Hornik, Maklan, Cadell, Barmada, Jacobsohn, Henderson, et al., 2003; Orwin, Cadell, Chu, Kalton, Maklan, Morin, et al., 2005), while more recent evaluations modeling developmental trajectories over time indicate specious but positive effects (Scheier & Grenard, 2010). Given the large financial outlay and the tremendous effort put into dissemination of the campaign messages it is prudent to search for additional evidence of media campaign efficacy.

This article examines one such evaluation effort using mall intercepts conducted in geographically diverse regions of the country. Mall intercepts are commonly used marketing strategies to acquire additional insight into consumer behavior and represent an important tool for shoppers to express their opinions on product marketing and consumer preferences. As we explain below, the media campaign targeted a specific audience and mall intercepts represent one of several strategies to learn more about the breadth and reach of the campaign. This article briefly reviews historical information on the campaign, addresses the theoretical foundations of the campaign, highlights the utility of mall intercepts, and then describes an evaluation of the campaign using mall intercepts.

Historical Background of the Media Campaign

In 1998, and in response to the public health mandate to suppress youth drug use, the U.S. Congress authorized expenditures for the National Youth Anti-Drug Media Campaign (NYADMC). These expenditures were part of the National Drug Control Policy, and oversight for the project was provided by the Office of National Drug Control Policy (ONDCP, 1998). The NYADMC uses paid media and public service communication to reach youth between the ages of 14 and 16 with drug prevention messages to discourage initiation as well as encouraging occasional users to stop their use of illicit drugs. The media campaign was developed in concert with a panel of experts who made sure the messages were

evidence-based and supported by the latest scientific research in behavior modification, communication, and prevention. Campaign materials go through extensive theory-based “copy testing” including experimental field trials contrasting beliefs and attitudes of youth viewing ads (DraftFCB, 2005; Fishbein, Hall-Jamieson, Zimmer, von Haefen, & Nabi, 2002) and must show no negative effects before reaching the public.

The early media campaign, running from 1999 through 2004, was branded “*My Anti-Drug*” and focused, in part, on the perceived negative social, academic, psychological, and health consequences of drug use, particularly marijuana use. Other various message platforms for the campaign included resistance skills and self-efficacy (enhancing personal and social skills and promoting drug resistance skills), normative education (correcting misperceptions about how many youth really use drugs), and teaching youth they can intervene with friends who may be using drugs. Evaluation of the *My Anti-Drug* campaign using a nationally representative household survey (The National Survey of Parents and Youth) of youth and their parents suggested that *My Anti-Drug* did not produce positive effects on youths’ marijuana use, attitudes, perceived social norms regarding marijuana use, or resistance skills (Hornik et al., 2003). Spurred by consideration that campaign effects may be specious (Hornik et al., 2008), subsequent and more fine-grained analyses of the *My Anti-Drug* campaign found that messages emphasizing negative consequences of marijuana use, running from October 2002 through June 2003, significantly reduced favorable marijuana beliefs, attitudes, and lowered drug use in high sensation seeking youth (Palmgren, Lorch, Stephenson, Hoyle, & Donohew, 2007).

The introduction in 2005 of a rebranded *Above the Influence* (ATI) campaign signaled a strategic shift to include messages appealing to personal autonomy and aspirations and greater balance between the perceived negative consequences of drug use and positive results from avoiding drugs. To guard against any normalizing of drug use, a narrower focus on older teens, ages 14-16, that were more likely to have direct experience with drug use compared to younger age youth, became the target of advertising. In addition, the message content focused almost exclusively on marijuana use. Extensive research shows the campaign has high levels of reach and frequency (Longshore, Ghosh-Dastidar, & Ellickson, 2006; Orwin et al., 2005) reaching 97% of youth 95 times per year from 2005 through 2008 (average exposure of 2.5 ads per week).

Theoretical Background for the Media Campaign

Theoretically speaking, the largest influence shaping the direct content of campaign messages comes from the theory of reasoned action (TRA) (Ajzen & Fishbein, 1973, 1977, 1980). Briefly, TRA outlines a model of overt behavioral action using attitudes and beliefs as predictors of intentions to act. Attitudes are formulated as favorable or unfavorable subjective evaluations of a specific

behavior (e.g., staying drug-free should help me achieve my personal goals) and were conceived as learned predispositions to act in a certain way toward an object or behavior (Ajzen & Fishbein, 1970). Youth learn about drugs either through vicarious observation or direct role modeling and use this information to evaluate whether smoking marijuana is good or bad, important or unimportant, and pleasant or unpleasant.

Beliefs, on the other hand, involve subjective norms regarding approval or disapproval of a behavior by important referent others. In other words, beliefs reflect social expectations from peers or significant others of what an individual “should do” or how they “should perform” in a given situation (should I smoke to look cool and is it acceptable?). Beliefs also entail the anticipated positive or negative consequences from engaging in the behavior. Youth then piece together subjective evaluations with their belief in whether the behavior is sanctioned by their friends or parents (socially normative beliefs).¹ The two cognitive pieces form an expectancy regarding the anticipated effects of smoking marijuana (smoking will make me look cool and gain friends).

The theory of reasoned action also posits that intentions mediate the influence of subjective evaluations (i.e., attitudes) and normative proscriptions on behavior. Intentions represent a willingness to engage in the behavior in question and provide an index of “effort” or how hard someone is willing to try in performing a behavior. From a messaging standpoint, behavioral intentions entail the desire to smoke marijuana, to accept offers to use drugs, to hang out with peers who use drugs, or not avoid situations where drugs may be prevalent. According to TRA, neither attitude nor beliefs directly influences behavior, but rather both “*prime*” the individual to act indirectly through intentions or willingness to engage behavior. The different pieces of TRA fall neatly into value expectancy or subjective expected utility framework where the instrumental importance of the act (i.e., maximizing gain and minimizing loss) guides behavior (Edwards, 1954; Feather, 1959a).

Another prominent feature of campaign messaging accentuates the Health Belief Model (HBM) (Becker, 1974; Becker, Drachman, & Kirscht, 1974; Becker & Maiman, 1983; Maiman & Becker, 1974; Rosenstock, 1974). A cornerstone feature of the HBM involves weaving together subjective expected utility (e.g., Edwards, 1954, 1955) and related expectancy-value theories (Feather, 1959b) to build a behavioral decision making model based on perceived utility and incentive

¹An additional component of TRA involves the motivation to comply with the norm (the latter component algebraically multiplied by beliefs in the formula predicting behavior). Motivation to comply involves a measure of the strength of the social sanctions to commit the act in question (i.e., the norms governing the behavior and the desire to conform to these norms). This component generally evidences a high association with belief and in many cases does not contribute unique variance to the prediction of behavior. For the present study, no measure of motivation to comply was included.

evaluation. The HBM highlights an individual's appraisal of threat, their own perceived susceptibility, and how this influences behavioral choice. In the case where an individual is faced with a choice that can conceivably eliminate pain or reduce severity of harm, and alternatives are valued as attractive, the likely outcome conveys reinforcing properties through the incentive valuation or benefits associated with reduced harm. In the present context, youth are told that drugs increase their risk of failure, particularly emphasizing loss of friends, damage to their family life, and disruption of their life's goals. In short, the emphasis on personal autonomy and being "Above the Influence" means lowering one's susceptibility to problems from smoking marijuana by making good choices, engaging pro-social behaviors, and staying away from negative peer influences that convey harm.

Utilizing the Mall Intercept

Shopping mall intercepts have been used since the inception of the campaign to collect ongoing tracking data monitoring the impact of the campaign messages on the target audience. This assessment arm is distinct from the in-home national evaluation mentioned above. Mall intercepts are recognized industry-wide as a useful and cost-effective means of data collection for product marketing and have a long history in consumer merchandising (Bush & Hair, 1985; Gates & Solomon, 1982). Mall intercepts quickly became a viable tool for marketing studies following the proliferation of suburban shopping malls in the 1980s (Frost-Norton, 2005). Usually mall intercepts are staged around selection of the n^{th} individual who crosses an imaginary physical boundary or some other quasi-random means of selection to assure demographic representation (i.e., quota sampling techniques). Until the advent of the Internet, mall intercepts were second only to phone surveys in usage by marketing research practitioners (Lehmann, 1989). They are primarily used to gather information on taste or product preferences, shopping experiences (Michon, Yu, Smith, & Chebat, 2007), with extensions of this approach to studies of consumer well-being (Sirgy, Lee, Grzeskowiak, Chebat, Johar, Hermann, et al., 2008). Even with their wide utility, intercept studies are not without criticisms owing to problems assuring a representative (probability) sample, frequency or "coverage" bias at some retail locations, and other drawbacks that may contribute to sampling estimate differences between traditional telephone, mail, or in-home survey methods (Black, Zastowny, Green, Adams, & Lawton, 1994; Bush & Parasuraman, 1985; Cowan, 1989; Nowell & Stanley, 1991).

Despite these concerns, the complete anonymity of mall intercepts may promote more truthful responding where confidentiality is at issue. This is particularly true with self-report drug use data where youth may be wary if their parents or some other authority can examine their answers. In mall intercepts, the subject is not asked any personally identifying questions, thus assuring

complete anonymity. Furthermore, in many cases mall intercepts use computers or television screens, providing a means to test visual products like those used in the media campaign. This vehicle provides a means to test copy recognition for campaign ads, establishing reach by recall of the campaign logo images, internet banner ads, and website homepages. This was part of the rationale used by Black and colleagues (1994) for using mall intercepts to learn more about how strongly public service ads resonated among youth (ages 13 to 17) during the early stages of the media campaign.

METHOD

Overview of the Mall Study

A total of 25 malls participated in the data collection, which was spearheaded by Millward Brown, an international, full-service, research company with expertise conducting mall intercepts. Large malls with available market research facilities were selected with recruitment quotas set to match ethnicity, age, and gender requirements (50% for male and female participants). The intercept facilities were evenly distributed throughout the country geographically, with five located in the northeast, eight located in the south, five in the Midwest, and seven in the west. Regional sample quotas were set to census data: 19% in the Northeast, 23% in the Midwest, 36% in the South, and 22% in the West. Ethnic quotas, again matching census information, were set to 69% other (including White, not Hispanic, American Indian, or Alaskan Native), 13% African American, 14% Hispanic, and 4% Asian. Data for this study were collected between November 2005 and January 2008 based on a rolling recruitment strategy with the goal of achieving 100 youth per week between the ages of 14 and 16 over a 1-year period. Youth were offered a monetary incentive of \$3.00 for their participation, which took on average 15 minutes to complete.

The study was vetted through a federally approved commercial IRB and received a waiver of written consent. The waiver was based on minimal risk, absence of intrusive questions, the practicality of conducting such a large national study with written consent, and provision of full disclosure and information sheets to all participants and their parents. Consent and assent was obtained verbally and information sheets were provided to all youth that explained the study protocols. In the event a youth was accompanied by a parent or guardian, the parent was asked to provide verbal consent for their child's participation, which was voluntary. Once youth agreed to participate they were escorted to a research facility inside the mall where they were given access to a touch-screen computer that presented to them a series of questions. Data collection was strictly anonymous and only a few basic demographic items were asked at the end of the survey (i.e., age, last completed grade, racial self-identification, family living situation, gender, type of school attended, and their residential zip code).

Measures

Media Campaign Awareness and Exposure

The media campaign used a wide range of media outlets to disseminate the public health message including television, radio, newspapers, magazines, billboards, transit ads, bus shelters, movie theaters (trailers), video rentals, Internet sites, Channel One broadcasts conducted in schools, and other venues. To capture these various outlets, four dichotomously coded “yes/no” items were summed to create a unit-weighted measure of general media campaign awareness. The items were identical to those used in the in-home computer-assisted household survey (NSPY) and tapped “brand” awareness, asking youth if they remember seeing any anti-drug advertising, that specifically mentions not acceding to peer pressures to use drugs, that mentions the “anti-drug,” or mentions “Above the Influence” (range 0 to 4). Separately, a measure of specific recall was based on participants viewing still pictures from media campaign television ads presented on the computer monitor. Presentation order for five ads was randomized and respondents indicated whether they had seen the ad (“1”) or not (“0”). These were then summed to create a specific recall score (range 0 to 5). This measure comports with the specific recall-aided exposure measure used in the NSPY and allows us to make direct comparisons to that methodology (Orwin, Cadell, Chu, Kalton, Maklan, Morin, et al., 2006).

A single derived variable was used to indicate exposure. This measure was computed as the difference between the current Julian date when the mall intercept occurred and the date when the campaign became available to the general public viewed as public service announcements, radio commercials, and so forth. This measure essentially captures how much of the campaign messages an individual could have potentially seen. While there is some imprecision in this measure, it is useful to control for time-varying individual differences in viewing time frames in a cross-sectional model. Failure to include such a measure would suppose that all exposure was equal and subject to a monotonic dose-response relationship.

Beliefs

Four multi-item composites were used to reflect a latent construct of “Beliefs.” The four indicators tapped negative beliefs (outcome expectancies), positive beliefs, perceived normative expectations regarding the prevalence and social acceptability of marijuana use, and perceived risk associated with using marijuana. All of these measures have been a staple part of the Partnership for a Drug-Free America Attitude Tracking Survey and have high reliability and validity (Black et al., 1994; Black, Morwitz, Putsis, & Sen, 2002). Moreover, detailing the perceived risks of drug use and correcting misperceptions regarding the social prevalence of drug use (i.e., normative education) are common features of school-based drug prevention programs (e.g., McNeal, Hansen,

Harrington, & Giles, 2004) and often used to assess beneficial program effects (Botvin, Dusenbury, Baker, James-Ortiz, Botvin, & Kerner, 1992; Hansen, Derzon, Dusenbury, Bishop, Campbell, & Alford, 2010).

Negative beliefs consisted of five items tapping the perceived negative outcomes from marijuana use. Sample items include “Kids who smoke marijuana will let other people down” and “Using weed can cause you to lose interest in things that you care about.” Positive beliefs consisted of five items assessing the perceived positive outcomes derived from resisting pressures to use marijuana. Sample items include, “It’s important to stand up for yourself against influences that could bring you down” and “Choosing to be Above the Influence can help you overcome negative influences that you face.” Subjective norms consisted of six items assessing the perceived social climate surrounding marijuana use. Sample items included “A lot of teens today are deciding to resist the influence to use marijuana” and “Teens can make the choice to be above negative influences rather than give in to them.” All of the belief items used the same 10-point scale ranging from (0) *totally disagree* to (10) *totally agree* (with 5 as the midpoint). Seven items were used to form an indicator assessing beliefs in the perceived risk of using marijuana. A stem read “What is the risk of [insert statement] if someone tries marijuana even once or twice?” with sample items including “getting in trouble with the law,” “losing control of themselves,” and “seriously upsetting friends or family.” Response formats ranged from (1) *no risk at all* to (5) *extreme risk*. An average of all five items was formed into a single composite with higher scores indicating more perceived risk associated with marijuana use.

Marijuana Intentions

Four items were used to reflect intentions to engage in marijuana use. A single item probed behavioral willingness to use marijuana in the next year (“At any time during the next year, do you think you will smoke marijuana?”) with response formats including (1) *definitely yes* (2) *probably yes*, (3) *probably not*, (4) *definitely not*, and (5) *skipped question*, the latter which was recoded to missing. A second item asked, “If one of your close friends were to offer you marijuana, would you smoke it?” and used the same response format. A third item included the stem “If you were faced with a choice, how likely do you think it is that you . . .” and two questions followed asking “will be above the influences that could bring you down” and “will take a stand against being influenced to do things like smoking weed?” Response formats for these latter items ranged from (0) *extremely unlikely* to (10) *extremely likely*. The four items were then averaged to form a composite score reflecting youths’ intentions to engage in drug use.

Marijuana Use

A single item assessed “how many times have you used marijuana in the past 30 days?” with response formats ranging from (0) *never* through (5) *20+ times*.

A quick inspection of the distributional characteristics of this measure (skew = 1.63) indicated a large number of non-using youth (68%) with the remainder of youth were divided up between “once” (8.7%), “2-3 times” (7.3%), “4-9 times” (4.5%), “10-19 times” (3.4%), and “20+ times” (8.2%). In light of the irregular shaped distribution, we decided to recode this measure to a dichotomous “yes/no” response.

Model Testing Strategy

Model testing proceeded using the Mplus software program with maximum likelihood estimation (Muthén & Muthén, 2006). Models were tested in two distinct phases (Anderson & Gerbing, 1988), the first step involving specification of a confirmatory factor analysis to assess the statistical reliability of a hypothesized latent construct of Beliefs. Following, we tested a series of structural equation models depicting the theoretically driven effects of the campaign on marijuana use. This included testing the TRA using a mediation framework with exposure influencing beliefs, which in turn influence intentions and finally behavior. By contrast, the campaign can affect behavior change directly, reflected by a direct path from awareness to marijuana use. Direct learning may come about as a result of youth gaining some knowledge or awareness that there is a campaign to promote alternatives to drug use (i.e., social diffusion). The specific messages incorporated in the campaign are not of essential importance, merely that there is a prevailing norm that becomes socially diffused and alters behavior (this is referred to as a process of accommodation). The latter approach would produce a significant direct path linking awareness with marijuana use without positing intervening indirect paths through any of the cognitive measures. Once a final model was obtained, multiple group models were tested separately for gender, race, and age to determine if the regression effects and factor loadings from the measurement model varied significantly between demographic subgroups. Tests of measurement and structural invariance provide evidence for the validity of effects across meaningful subgroups (Drasgow & Kanfer, 1985; Meredith, 1993). Failure to provide support for different loadings and structural coefficients between groups would imply that the campaign had equivalent effects irrespective of demographic influences.

Power and Sample Size

Given the large mall intercept sample available for the analyses, it is worth noting that there may be excessive statistical power to detect media campaign effects. Because large samples yield stable, efficient estimates, with trivially small standard errors, this increases the likelihood of any model parameter being significant. With SEM, there is the added concern that with relatively large samples test statistics are overly sensitive to model departures (Saris & Satorra, 1993; Tanaka, 1993) undermining efforts to detect true models from those reflecting statistical

artifacts (i.e., sampling error) or chance findings. This occurs because the underlying function or log likelihood used to evaluate model fit minimizes the discrepancy between sample and implied population covariance matrices and computational factors in the sample size (N). To offset concerns with trivially small effects being significant (and making an abundance of Type II decision errors or failing to reject an incorrect model), models were tested with four randomly drawn samples of $n = 3,000$. The first sample served as a calibration sample and the remaining random selections served as validation samples. This method of cross-validation is considered superior to using the single large sample and will likely yield correct interpretation of the model findings (Cudeck & Browne, 1983). Following these tests, factor loadings were constrained to equality across samples followed by similar constraints on the structural regression parameters. The fit of these constrained models was pitted against the maintained or less restrictive model and evaluated using the nested likelihood ratio difference test.

With this cross-validation framework in mind, power for the SEM is 1.0, setting the Root Mean Square Error of Approximation (RMSEA) to .05 for the null model (better framed as a “close fit”) and .08 for the alternative model framed as a “mediocre fit” (MacCallum, Browne, & Sugawara, 1996). The RMSEA provides an inferential indicator of model fit or lack thereof (with known distributional properties). Even with a modicum of imprecision in point estimates of model fit, confidence intervals can be constructed around the RMSEA. Minimum sample size to achieve power of .80 with these same settings would be 434 and for power of .90 would be 571. With the degrees of freedom set to 8 based on the actual model tested instead of an arbitrarily selected number, achieving power of .80 requires 953 youths and power of .90 requires 1287 youth. Taken together, these power estimates show that, in all cases, the study is appropriately powered to find precise estimates of fit and carry out the planned hypothesis tests (the null stating there is a “poor fit” between the sample data and implied population model).

RESULTS

Sample Description and Recall Patterns

A total of 12,305 youth participated in the mall intercept study. The sample was 50.2% male and racial breakdown indicated 72% were White, 12% Black, 12.5% Hispanic, and 3.9% indicating “Other” for racial self-identification. By design, the sample was evenly distributed with respect to the different age groups with 34% reporting they were 14 years of age, and 33% each respectively in the 15- and 16-year-old groups. The sample on average was 15 years of age ($SD = .82$). Looking first at the main brand awareness and recall measures, 73% of the sample said they had seen or heard advertising against drug use, 65% said they had seen or heard advertising about resisting peer pressure, 66% said they had seen advertising mentioning the “Anti-drug,” 65% said they had seen

advertising about “Above the Influence,” the latter two items reinforcing relatively high levels of brand awareness. Slightly more than one-half (56%) of the youth remembered the “My Anti-Drug” logo and 65% said they remembered the “Above the Influence” logo. There were no gender differences in the proportion of males or females remembering the “Above the Influence” logo, viewing anti-drug advertising, or remembering ads highlighting the “Anti-drug.” Females were more likely to recall ads emphasizing resistance and peer pressure, $\chi^2(1) = 11.49$, $p = .001$ (51% vs. 49% for females and males, respectively), and likewise seeing the “My Anti-Drug” logo, $\chi^2(1) = 11.78$, $p = .001$ (52% vs. 48% for females and males). Older youth were more likely to recall seeing anti-drug ads, $\chi^2(2) = 15.42$, $p = .001$ (75%, 72%, and 72% for 16-, 15-, and 14-year-old youth, respectively), more likely to have seen ads about peer pressure or resistance skills, $\chi^2(2) = 18.29$, $p = .001$ (67%, 64%, and 64% for 16-, 15-, and 14-year-old youth), more likely to recall “anti-drug” advertising, $\chi^2(2) = 28.05$, $p = .001$ (66%, 64%, and 63% for 16-, 15-, and 14-year-old youth), and more likely to recall ads with the “My Anti-Drug” logo, $\chi^2(2) = 51.42$, $p = .001$ (59%, 56%, and 52% for 16-, 15-, and 14-year-old youth).

Proportional analyses also showed that there were considerable racial differences in patterns of recall. White and Black youth were more likely to recall seeing anti-drug ads, $\chi^2(3) = 81.85$, $p = .001$ (75%, 74%, 64%, 68%, 64% for White, Black, Hispanic, and Other youth, respectively), ads mentioning the “Anti-Drug,” $\chi^2(3) = 118.46$, $p = .001$ (69%, 61%, 57%, 57% for White, Black, Hispanic, and Other youth), ads with “Above the Influence,” $\chi^2(3) = 57.79$, $p = .001$ (67%, 60%, 59%, 58% for White, Black, Hispanic, and Other youth), the “My Anti-Drug” logo, $\chi^2(3) = 43.19$, $p = .001$ (57%, 53%, 49%, 51% for White, Black, Hispanic, and Other youth), and the “Above the Influence” logo, $\chi^2(3) = 116.19$, $p = .001$ (67%, 62%, 55%, 55% for White, Black, Hispanic, and Other youth). Hispanic youth were least likely to recall seeing ads dealing with peer resistance, $\chi^2(3) = 60.70$, $p = .001$ (66%, 66%, 57%, 61% for White, Black, Hispanic, and Other youth).

Patterns of Consumption

For the total sample, 69% of the youth reported they had never used marijuana in the past 30 days (66%, 69%, and 67% in the three validation samples). Using the calibration sample to illustrate patterns of consumption among users, 9% said they used once, 7% said 2-3 times, 4% said 4-9 times, 3% said 10-19 times, and 8% said more than 20 times. Comparatively speaking, females were more likely to say they never used marijuana or report using at much lower consumption levels, $\chi^2(5) = 70.70$, $p = .001$, and males were more likely to report use at higher levels of consumption (e.g., 62% vs. 38% for males and females at 20+ times past month). Younger youth were more likely to report no use of marijuana, and the two older age groups (15 and 16) were more likely to report greater volume

of consumption in the past 30-day period, $\chi^2(10) = 91.36, p < .001$. Racial comparisons indicated that White and Other race groups were more likely to report not using marijuana in the past 30 days, whereas the higher levels of consumption were reported by Hispanic youth, $\chi^2(15) = 38.07, p < .001$.

Tables 1a-c contain the sample means and group difference for all of the measures used in the model. We only examined main effects for age, gender, and race given that there is no definitive reason to explore higher-order interactions. Overall, seven of the nine comparisons were significant for age and gender and five were significant for race. The multiple group models testing factor and regression parameter constraints based on race, gender, and age provide a more powerful test compared to using covariate-adjustment for demographic factors in the SEM. This approach allows us to inspect whether the respective groups differ in the theoretical processes themselves rather than merely adjust for differences in mean levels.

Psychometric Model

Prior to testing the full structural model, we tested a confirmatory measurement model with the four indicators used to reflect a latent construct of Beliefs. This model ascertains whether the latent construct is statistically reliable and psychometrically sound. As stated previously, the model was tested in four randomly drawn samples with approximately 3,000 youth in each. The CFA model indicated the four loadings were all highly significant ($p < .0001$) and relatively large in magnitude across all four samples ($\lambda_1 = .918$ to $.929$ NEG; $\lambda_2 = .937$ to $.947$ POS; $\lambda_3 = .908$ to $.915$ SOC; and $\lambda_4 = .712$ to $.748$ RISK). Using the Werts, Linn, and Jöreskog (1974) formula for structural composites, reliability for the factor loadings were quite high ($\alpha = .997$) in all four samples. The overall fit of the measurement model was adequate using the calibration sample: $\chi^2(N = 3092, 2) = 132.06, p < .0001$, Comparative Fit Index (CFI) (Bentler, 1990) = $.989$, Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993; MacCallum et al., 1996) = $.14$, Standardized Root Mean Square Residual (SRMR) = $.01$. Taken together, the fit indices reinforce that the implied population model adequately replicated the sample data (model fit statistics for the remaining validation samples were similar and can be obtained from the first author). Although some of the fit indices exceed the desired benchmarks, it is essential to recognize that model fit is dependent on sample size and with relatively large samples ($N > 500$) trivial deviations will be significant (Mulaik, James, Alstine, Bennett, Lind, & Stilwell, 1989).

A model constraining the latent construct (Beliefs) factor loadings across the four validation samples provided an adequate fit, $\chi^2(26) = 676.80, p < .0001$, CFI = $.972$, RMSEA = $.09$, and SRMR = $.03$. Differences in the magnitude of the standardized loadings were trivially small and relaxing any of the constraints would not provide sufficient improvement to the overall model fit (the

Table 1a. Mean Comparisons by Age

Variable	Female(a)		Male(b)		Mean comparison*
	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	
Use MJ last 30 days	0.30	0.46	0.34	0.47	a<b
General awareness	2.71	1.42	2.66	1.41	a>b
Specific recall aided awareness	2.64	1.69	2.65	1.68	
Intention	5.66	1.62	5.50	1.68	a>b
Positive beliefs	8.62	2.36	8.21	2.54	a>b
Social expectations	7.62	1.92	7.39	2.04	a>b
Negative beliefs	8.21	2.52	7.88	2.67	a>b
Perceived risk	3.82	0.99	3.67	1.06	a>b
Number of weeks elapsed since ATI launch ¹	3.85	0.94	3.85	0.95	

Note: *Comparisons significant at the 0.05 level. ¹Variable logarithmically transformed. Multiple comparison tests adjusted using the Bonferroni procedure to control for experimentwise error rates.

Table 1b. Mean Comparisons by Gender

Variable	14(a)		15(b)		16(c)		Mean comparison*
	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	
Use MJ last 30 days	0.27	0.45	0.34	0.47	0.35	0.48	a<b, a<c
General awareness	2.62	1.44	2.67	1.43	2.78	1.38	a<b, b<c, a<c
Specific recall aided awareness	2.61	1.70	2.66	1.68	2.66	1.67	
Intention	5.73	1.61	5.50	1.68	5.50	1.66	a>b, a>c
Positive beliefs	8.57	2.43	8.28	2.51	8.39	2.44	a>b, a>c
Social expectations	7.64	1.98	7.40	2.03	7.47	1.94	a>b, a>c
Negative beliefs	8.32	2.53	7.89	2.65	7.91	2.60	a>b, a>c
Perceived risk	3.87	0.99	3.71	1.03	3.66	1.04	a>b, a>c
Number of weeks elapsed since ATI launch ¹	3.86	0.94	3.85	0.95	3.86	0.94	

Note: *Comparisons significant at the 0.05 level. ¹Variable logarithmically transformed. Multiple comparison tests adjusted using the Bonferroni procedure to control for experimentwise error rates.

Table 1c. Mean Comparisons by Race

Variable	Black(a)		Hispanic(b)		White(c)		Other(d)		Mean comparisons*
	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	<i>M'</i>	<i>SD</i>	
Use MJ last 30 days	0.34	0.47	0.35	0.48	0.31	0.46	0.33	0.47	
General awareness	2.61	1.36	2.37	1.56	2.77	1.39	2.44	1.56	c>a, c>b, c>d, a>b, a>d
Specific recall aided measure	2.59	1.64	2.40	1.69	2.71	1.69	2.31	1.69	c>a, c>b, c>d, a>b, a>d
Marijuana intentions	5.50	1.61	5.48	1.69	5.61	1.65	5.54	1.59	c>b
Positive beliefs	8.42	2.48	8.31	2.61	8.44	2.44	8.36	2.31	
Social expectations	7.48	1.99	7.41	2.17	7.53	1.96	7.42	1.89	
Negative beliefs	8.00	2.56	8.08	2.70	8.05	2.59	8.02	2.48	
Perceived risk	3.80	0.98	3.81	1.06	3.73	1.03	3.66	0.96	b>c, b>d
Number of weeks elapsed since ATI launch ¹	3.84	0.99	3.84	0.96	3.86	0.93	3.82	0.99	

Note: *Comparisons significant at the 0.05 level. ¹Variable logarithmically transformed. Multiple comparison tests adjusted using the Bonferroni procedure to control for experimentwise error rates.

magnitude of loadings differed to a slight degree only in the third place to the right of the decimal point). These findings collectively suggest the latent construct of “Beliefs” had the same basic underlying psychometric structure in each of the validation samples.

Results of the Structural Equation Modeling

Figure 1 shows the results of the direct effects structural model depicting the influence of all the measures on a dichotomous measure of past 30-day marijuana use. The model includes the three observed campaign exposure measures, the latent factor of Beliefs, and intentions all specified as direct predictors of marijuana use. As depicted (for the calibration sample only), with the exception of exposure ($\beta = .014$, *ns*) and specific recall ($\beta = -.019$, *ns*), the remaining exogenous predictors were related significantly to marijuana use (general awareness: $\beta = .054$, $p < .05$; Beliefs: $\beta = -.373$, $p < .001$; and intentions: $\beta = -.374$, $p < .001$). The direct effect model fit adequately, $\chi^2(8) = 113.82$, $p < .001$; CFI = .954, RMSEA = .065, Weighted Root Mean Square Residual (WRMSR) = .805 (the latter model fit statistic and weighted least squares estimation is used when modeling a dichotomous outcome). Table 2 contains the correlations among the exogenous measures (presented for the calibration sample only). Among the more sizable associations, exposure and recall were moderately associated ($r = .30$, $p < .001$), as were awareness (brand) and recall ($r = .46$, $p < .001$). The latent construct of “Beliefs” capturing the cognitive elements of perceived risks, normative perceptions, and social facilitation was moderately associated with intentions to not use marijuana ($r = .75$, $p < .001$).

The direct effect model is an essential step in the modeling process to ascertain whether the exogenous measures can account for any variation in the endpoint (while statistically controlling for each other). The next step involved a re-specification of the direct effect model to reflect the theoretical processes outlined by TRA. This model posited awareness, specific recall, and exposure as exogenous predictors, and then included an a priori hypothesized chain of cognitive processes that predicts marijuana use. We first tested a fully saturated and unconstrained model with all possible effects (direct and indirect). While this model is not entirely theoretically consistent with TRA, it provides an initial test to detect any significant paths that may not have been hypothesized. By all indications, the fully saturated and unconstrained mediation model fit well, $\chi^2(33) = 272.02$, $p < .0001$, CFI = .973, SRMR = .05, RMSEA = .03, WRMR = 1.65. Careful inspection of the model parameters and z-critical test statistics indicated several paths were not significant (and were not theoretically consistent). These included all of the direct paths from recall and exposure measures to intentions, and likewise the direct paths from recall and exposure measures to marijuana use.

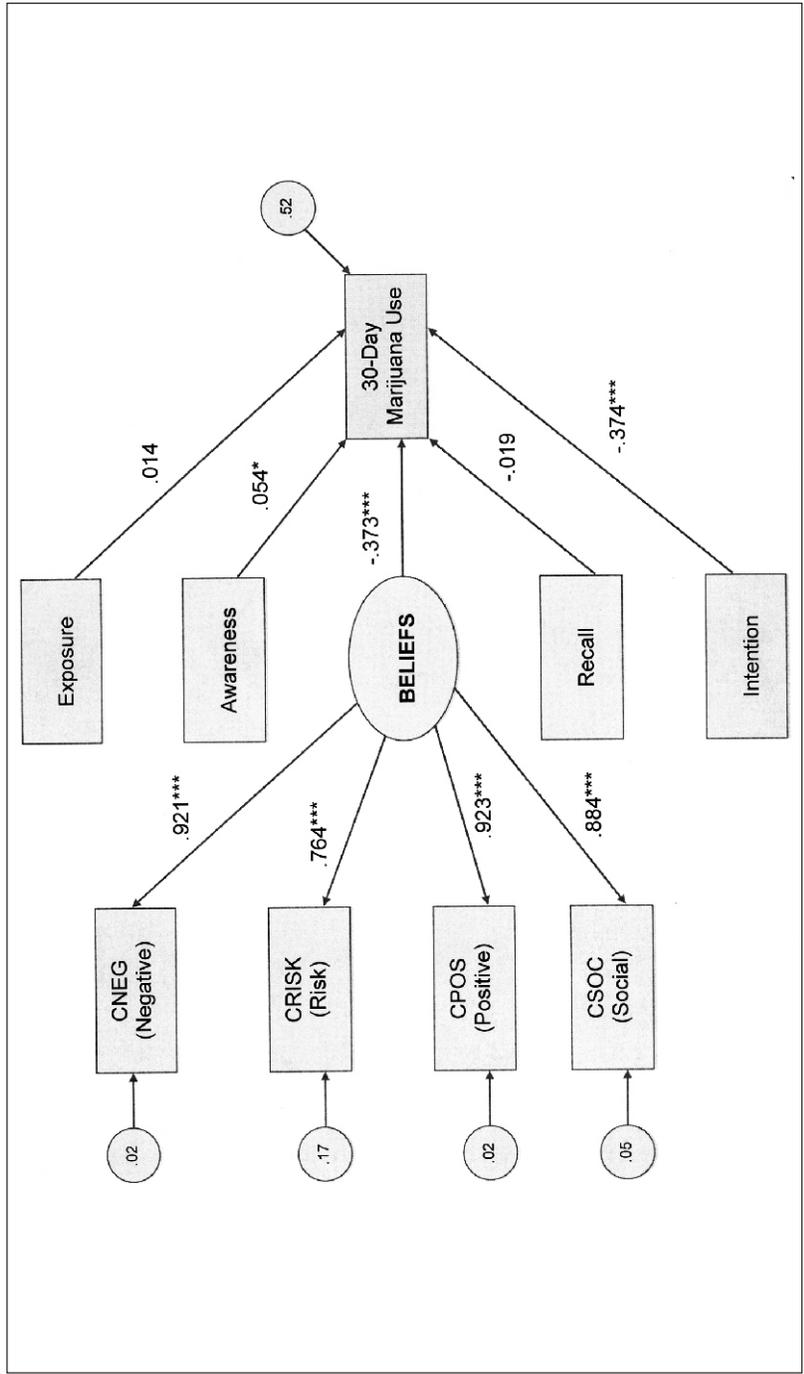


Figure 1. Direct effect model. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Correlations among Exogenous Measures from “Constrained” Direct Effect Structural Model

	V1	V2	F1	V4	V5
Exposure (V1)	1.0	.07***	.00	.30***	.00
Awareness (V2)		1.0	.10***	.46***	.08***
Beliefs (F1)			1.0	.05**	.75***
Specific recall (V4)				1.0	.04**
Intentions to use marijuana (V5)					1.0

p* .05, *p* .01, ****p* .001. Correlations are for “calibration” sample only.

The next step represented the theoretical model that comports with how the campaign is hypothesized to work. This included a mediational chain specifying effects of exposure and both brand awareness (general) and specific recall (recognition of logos and themes) on Beliefs, intentions, and marijuana use as well as effects of both beliefs and intentions on marijuana use. With these slight modifications, the model fit well, $\chi^2(24) = 88.07, p < .001, CFI = .993, RMSEA = .03, WRMR = 1.771$. The upper portion of Table 4 contains the parameters from the unconstrained model depicting the mediation chain and using all four random samples. The largest effects were associated with the paths from Beliefs to intentions, Beliefs to marijuana use, and intentions to marijuana use. Interestingly, the path linking awareness to marijuana use was small and positive and significant in two samples. This path suggests an “inconsistent” mediation effect (MacKinnon, Krull, & Lockwood, 2000). In these instances, the bivariate covariance between awareness and marijuana use is negative, but with successive variance partialling and potential suppression flips to a positive effect. The path from recall (remembering logos and anti-drug themes) to marijuana use was not significant in any case (one-tailed), albeit this path was negative indicating greater recall was associated with less past 30-day marijuana use. The path from exposure to marijuana use was positive and significant in two of the four samples.

The bottom half of Table 4 shows the results from the fully constrained model. In this model, all of the regression parameters were constrained to equality across all four random samples. The model fit indices indicated this constraint was reasonable, $\chi^2(32) = 70.03, p < .0001, CFI = .996, RMSEA = .02$. The nested difference test between the constrained and unconstrained model was not significant, $\chi^2(14) = 6.58, p = .949$, thus we cannot reject the plausibility of the constrained model (i.e., the specified processes operate identically in the four samples). Table 4 also shows that for all four samples, and favoring campaign effects,

Table 3. Parameters from Unconstrained and Constrained Direct Effect Models

Sample	Awareness Use	Exposure Use	Recall Use	Belief Use	Intentions Use
Unconstrained direct effect model parameters					
Random-1	.054*	.014	-.019	-.374***	-.372***
Random-2	.031	.042*	-.016	-3.88***	-.352***
Random-3	.014	.066*	-.006	-.292***	-.425***
Random-4	.054*	.020	-.041*	-.346***	-.410***
Constrained direct effect model parameters					
Random-1	.040***	.035**	-.021*	-.358***	-.389***
Random-2	.039***	.035**	-.021*	-.353***	-.381***
Random-3	.039***	.035**	-.021*	-.349***	-.378***
Random-4	.039***	.035**	-.021*	-.357***	-.395***

* p .05, ** p .01, *** p .001.

awareness was associated with more anti-drug beliefs. Likewise, having more anti-drug beliefs was significantly associated with fewer intentions to use marijuana. Consistent with the mediation chain, more anti-drug beliefs was associated with less recent marijuana use. Awareness had a small significant and positive association with marijuana use (in all four samples). The direct relation between recall and marijuana use was marginal ($p < .06$ one-tailed) in all four samples. As expected, intentions was negatively and significantly associated with marijuana use (less intentions to use associated with less marijuana use) in all four samples.

Figure 2 shows the final structural model trimmed of all the nonsignificant paths (parameters shown are based on the calibration sample). Across all four samples, the proportion of variance accounted for in the complete model was 49%, 47.6%, 46.6%, and 49.4%, respectively. Although not discussed at great length in terms of the four random samples, all of the associations among the exogenous measures were significant and positive (see Figure 2 for calibration sample results).

Decomposition of Effects

Assessing the significance of the full hypothesized mediation chain requires decomposition of the total direct and indirect effects. This provides a more explicit

Table 4. Parameters from Unconstrained and Constrained Mediation Models

Sample	Awareness Beliefs	Beliefs Intentions	Beliefs Use	Awareness Use	Recall Use	Exposure Use	Intentions Use
Unconstrained mediation model parameters							
Random-1	.098***	.766***	-.373***	.063**	-.033	.018	-.373***
Random-2	.104***	.764***	-.387***	.012	.000	.047*	-.351***
Random-3	.124***	.764***	-.293***	.029	-.025	.074*	-.425***
Random-4	.095***	.765***	-.346***	.050*	-.034	.030	-.410***
Constrained mediation model parameters							
Random-1	.103***	.766***	-.355***	.038**	-.022 ^m	.042**	-.391***
Random-2	.107***	.769***	-.351***	.039**	-.022 ^m	.042**	-.384***
Random-3	.106***	.766***	-.347***	.039***	-.023 ^m	.043**	-.381***
Random-4	.102***	.755***	-.355***	.038**	-.022 ^m	.042**	-.396***

* $p < .05$, ** $p < .01$, *** $p < .001$; m = marginal one-tailed ($p < .06$).

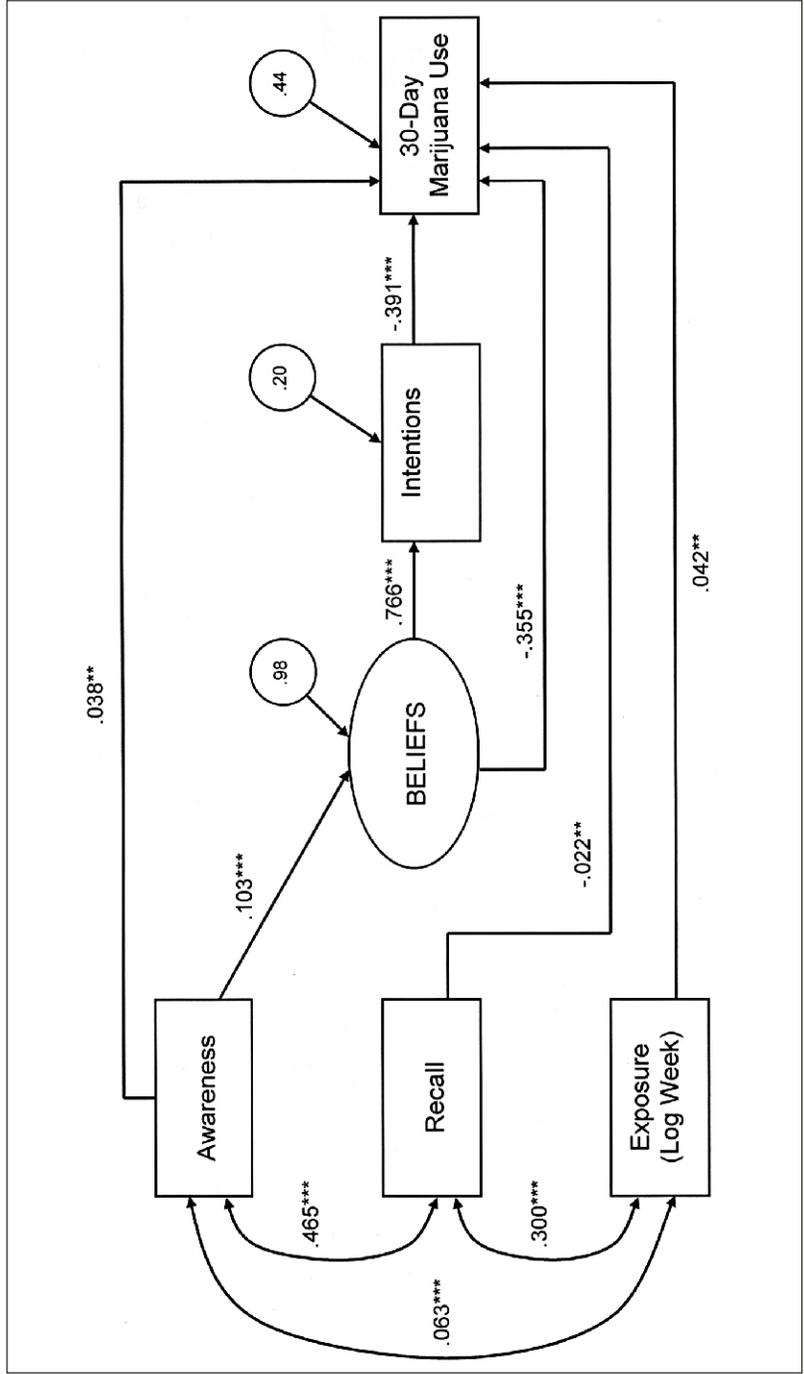


Figure 2. Final structural model, non-significant paths removed. * $p < .05$, ** $p < .01$, *** $p < .001$.

test of the campaign strategy and provides a clearer picture of how much of the effect on marijuana use from awareness is mediated through Beliefs and intentions. The sum of the indirect effect from awareness to marijuana use was significant ($\beta = -.031$, $SE = .003$, $z = 9.568$, $p < .001$), indicating that media campaign awareness was associated with more anti-drug beliefs and with fewer intentions to use marijuana and less actual consumption. Further decomposition showed the effect of awareness on consumption through Beliefs (not specifying intentions in the process) was significant ($\beta = -.029$, $SE = .003$, $z = 10.56$, $p < .001$) and so was the effect of awareness through Beliefs and intentions to marijuana use ($\beta = -.029$, $SE = .003$, $z = 11.07$, $p < .001$), the latter effect gaining some predictive variance because of the additional pathway through intentions.

After controlling for the indirect pathway, the overall direct effect of campaign awareness to marijuana use remains positive ($\beta = .035$, $SE = .008$, $z = 4.24$, $p < .001$). Controlling for campaign exposure, the remaining elements of the model including Beliefs, intentions, and marijuana use formed a perfect three-variable mediation chain and their statistical relations can also be decomposed. This analysis shows the total effect was significant ($\beta = -.532$, $SE = .007$, $z = 78.77$, $p < .001$) and the sum of the indirect effect also was significant ($\beta = -.264$, $SE = .008$, $z = 31.11$, $p < .001$). This leaves the direct effect of Beliefs on marijuana use, which was significant as well ($\beta = -.269$, $SE = .012$, $z = 23.29$, $p < .001$). Computations also show that there is a large proportion of the total effect that is mediated (72%) through the specified cognitive chain. For the three-variable sequence involving Beliefs, intentions and marijuana use, 49.5% of the effect of Beliefs on use is mediated through intentions.

Multiple Group Models

Multiple group comparisons test the equivalence of models across age, gender, and race groups. In conjunction with the means analyses, these analyses provide additional information on the similarity of measurement and structural processes between the different groups. Following conventions for testing factorial invariance, we first examined the fit of the confirmatory factor model across subgroups (Byrne, Shavelson, & Muthen, 1989). This analysis tells us whether the latent factor Beliefs conveys the same meaning for the different subgroups. Following this step we constrained to equivalence the structural parameters from the final mediation model across the different demographic groups.

Turning first to age comparisons, the fit of the multiple group measurement model was adequate, $\chi^2(18) = 880.94$, $p < .0001$, CFI = .981, SRMR = .034, RMSEA = .108 and $\chi^2/df = 48.9$. Modification indices suggested that a slightly improved model fit could be obtained by relaxing the constraint of equivalence for only one indicator across the three groups (perceived social consequences from using marijuana). The modification index (MI) was 14.09 for the younger age group (exceeding 3.84 for 1 *df*) and 22.25 for the older age group. After

freeing this parameter, the resultant loadings for perceived social consequences were $\lambda_{14} = .923$, $\lambda_{15} = .915$, and $\lambda_{16} = .899$, respectively, and there was a significant improvement in model fit, $\chi^2(2) = 24, p = .001$. No further modifications were made given that with relatively large samples any trivial deviation for parameter values will net a significant p -value. The next step involved constraining to equality the structural (regression) parameters across age groups. This model fit well, $\chi^2(92) = 1639.10, p = .0001$, CFI = .974, SRMR = .027, RMSEA = .064 and $\chi^2/df = 18$. None of the MIs indicated any substantive changes to the model parameterization would improve the fit, suggesting that the prediction model worked equally well for the different age groups.

The CFA multiple group measurement model for gender fit well, $\chi^2(10) = 794.22, p = .0001$, CFI = .983, SRMR = .021, RMSEA = .113 and $\chi^2/df = 79$. Only one MI exceeded the critical threshold value (MI = 9.24) for perceived positive consequences of having anti-drug beliefs ($\lambda_M = .949$, $\lambda_F = .935$, respectively). Relaxing this constraint resulted in an improved model, $\chi^2(1) = 9.22, p = .001$. The multiple group structural model for gender fit well, $\chi^2(57) = 1526.69, p = .0001$, CFI = .975, SRMR = .021, RMSEA = .065 and $\chi^2/df = 26.77$. There were some slight differences in parameterization between male and female youth, but none that met the statistical criteria for relaxing an imposed constraint. For males, the effect of awareness on Beliefs was slightly larger ($\lambda_M = .112$ and $\lambda_F = .104$), and all the other parameters were virtually identical in magnitude.

A multiple group measurement model for race (comparing whites versus all other race groups) indicated a good fit, $\chi^2(10) = 846.18, p = .0001$, CFI = .982, SRMR = .044, RMSEA = .117, and $\chi^2/df = 84.6$. The modification indices suggested that relaxing the loadings for perceived risk (MI = 31: $\lambda_W = .738$ and $\lambda_O = .691$, respectively for White vs. Other) and negative consequences (MI > 16: $\lambda_W = .923$ and $\lambda_O = .927$, respectively) would improve the model fit. The final model showed an improved fit, $\chi^2(2) = 49, p = .001$. Again, there is some slight difference in the magnitude of the loadings but nothing to indicate the latent factor of Beliefs behaves differently for the different race groups. The multiple group structural model for race fit well, $\chi^2(57) = 1624.47, p = .0001$, CFI = .974, SRMR = .035, RMSEA = .067, and $\chi^2/df = 28.49$. Several MIs indicated relaxing constrained parameters would improve the overall model fit. In particular, we relaxed the parameter corresponding to the effect of Beliefs on intentions ($\lambda_O = .701$ and $\lambda_W = .764$), general awareness on both marijuana use ($\lambda_O = -.009, p > .05$ and $\lambda_W = .056$) and Beliefs ($\lambda_O = .158$ and $\lambda_W = .086$). With these changes, the model fit improved, $\chi^2(3) = 70, p = .001$.

DISCUSSION

This study yields new insight into the effectiveness of the national youth anti-drug media campaign, providing a fresh angle in the evaluation process. The

analyses emphasized three different ways youth can recognize the campaign ads including “brand” awareness, recall of specific campaign ads, and a more general measure capturing an individual’s overall exposure duration. Data for the study involved youth ages 14 to 16 that participated in mall intercepts conducted across the United States. This target age period coincides with the time when many youth initiate to drug use and represents a period of heightened vulnerability to their peer influences and risk behaviors. There is tremendous cost economy to collecting mall intercept data and this helps evaluators keep a finger on the pulse of the campaign, providing readily accessible information on whether the messages are tractable and working in the manner hypothesized.

Several different pieces from the evaluation are worth noting, including evidence of positive campaign effects, the differential magnitude of effects, their consistency across multiple samples, and congruence with the posited theoretical model. Beginning with the first model tested, we hypothesized a latent construct of “Beliefs” capturing youths’ perception of the harm from marijuana use, positive or enhancing effects, and its perceived social acceptability. These items represent different facets of what TRA suggests captures the “evaluative” or deliberative process many youth engage as they consider whether it is worth using drugs to gain social acceptance or credibility in their peer group. The psychometric soundness of this construct indicates that youth “bundle” their cognitions regarding perceived acceptability, risks, and consequences associated with using drugs. This bodes well for the campaign because it suggests that efforts to modify beliefs may be fruitful given they are accessible to self-report and may work synchronously.

Overall, the direct effect model suggests the measures chosen to reflect campaign awareness relate in the manner hypothesized to the target outcome, with the exception of brand awareness, which had a small positive association. Even though this effect was positive and therefore counterintuitive, it most likely reflected suppression (a reversal of signs from the zero-order relations) in the model.² The remaining relations were consistent with campaign themes and reinforced the value of the various components of TRA in predicting behavior. When the direct effect model was reconfigured to be theoretically consistent

²There is some evidence of suppression in the various effects on marijuana use. For instance, the negative effect from specific recall to marijuana use is significant only one-tailed using the *z*-critical ratio of the unstandardized regression coefficient divided by its standard errors. If this effect is removed, the effect of exposure on marijuana use is positive and significant. However, if the effect of exposure is removed (constrained to zero), the effect of recall is not significant. Likewise, constraining the effect of awareness on marijuana use to zero also renders the effect of recall non-significant. Despite the transitive nature of these effects, we kept them intact because recall and awareness capture uniquely different facets of brand and advertising awareness and both are uniquely different from the measure of exposure, which captures the element of time and dose.

with a value expectancy model it showed that the effect of awareness was primarily meted through drug-related beliefs. Campaign awareness set the stage for protection by stimulating anti-drug beliefs, fewer intentions to use drugs, and less consumption of marijuana. This finding is consistent with those produced by the PDFA in earlier iterations of the campaign; findings which showed that remembering campaign themes was associated with decreased probability of marijuana use (Black et al., 2002).

The SEM captures only a snapshot of a limited set of cognitive elements hypothesized to influence youth drug use, but it reveals that these influences carry substantial weight. In essence, the size of the regression coefficients indicates that even a small association between awareness and cognitive belief structures is associated with a much larger impact on drug use. This observation should factor heavily into the conceptualization of any media campaign with health implications. If you want to change behavior, then you have to choose malleable precursors to the behavior. In the present context these include beliefs about the risks and damaging consequences of marijuana use. Any changes in consumption patterns would appear to be best guided by changing youth's beliefs about the effects of drugs, their utility, and the sanctions imposed by referent groups regarding their normative value or social acceptability. The relatively large association between these youths' beliefs and their drug use intentions also reinforces that once a cognitive expectation of effects from using marijuana is set into motion, it becomes linked with their willingness to use marijuana. Even more important, even though "*intention*" captured future willingness to use marijuana, there was still a close correspondence between intention and behavior regardless of the different time frames. This finding is in keeping with the predictions made from TRA that behavior specific intentions will correlate highly with behavior when there is close temporal proximity.

In contrast to the expected sequence proposed by TRA, beliefs also had a direct and negative association with behavior (bypassing intentions). Even in light of how TRA posits effects on behavior, we also noted that different measures of campaign recollection and brand awareness had small but significant direct effects on marijuana use. While both paths were positive, inferring "iatrogenic" effects, these relations appear to be statistical artifacts resulting from confounding or suppression. Other than social diffusion and heightened awareness, there is no theoretically consistent reason for a direct (and positive) effect. It is possible marijuana users report more awareness of campaign advertising because they are more likely to attend to advertising on a topic already "on their radar screen"—just like someone thinking of buying a car is more likely to notice an automobile advertisement compared to a more disinterested party.

We also posited a mediation sequence specifying that campaign exposure influences belief structures. The total spectrum of findings reinforces that this theoretical model is necessary but not "sufficient" to account for behavior and that other explanatory mechanisms, omitted from the model, are required to account

for behavior. We did not specify elements from any other models, including refinements to the TRA, that involve the role of perceived self-efficacy. This leaves a residual portion of variance in the outcome that might be apportioned to these measures and that are for now captured by the direct effect of awareness. Theoretically informed models with a wider set of predictors might partial this residual portion of variance removing any specter of iatrogenic effects.

Comparative Drug Use Rates

It is also worth asking whether youth participating in mall intercepts are representative of the larger body of youth that provide nationally representative estimates of drug use trends. To accomplish this we compared the 30-day prevalence estimates from the mall sample to the Monitoring the Futures (MTF) (Johnston, O'Malley, Bachman, & Schulenberg, 2007) and National Survey on Drug Use and Health (NSDUH) estimates (Substance Abuse Mental Health Services Administration, 2007). The numbers from the MTF for the corresponding age group (10th grade) indicate that 14% reported past 30-day marijuana use for the year 2006 and the number from the NSDUH indicate that 10.3% (14 years of age), 21% (15 years of age), and 29% (16 years of age) reported ever use. The mall intercept estimate is considerably higher than these other drug surveillance indicators. The lack of precision and direct correspondence may arise from the different methodologies and participant recruitment strategies used (Fendrich & Johnson, 2001). The mall intercept used touch-screen computers in a market research facility located inside malls, whereas the MTF data is obtained using paper-and-pencil questionnaires administered in classroom settings and the NSDUH utilizes in-home computer-assisted interviews. The mall techniques do not have parental or adult supervision, whereas the other approaches might possibly induce some hesitation in youth feeling their behavior could be exposed.

Multiple Group Models

The information obtained from the multiple group models allowed us to assess whether TRA is a useful explanatory framework for the different age, race, and gender groups. Interestingly, loadings for the measure of perceived social consequences of using marijuana varied considerably between demographic groups. This is perhaps indicative of the different relative strength of perceptions youth obtain from their vicarious or direct experiences surrounding drug use. Since youth are likely to mirror certain behavioral beliefs regarding drugs based on their closest friends, it is not surprising that differences crop up based on age, gender, or race group. We also found some evidence suggesting that structural differences exist between demographic groups. For example, the association between brand recognition and anti-drug beliefs was much stronger

for racial minority youth. One caution with the multiple group analyses is the sample size is quite large, and any trivial deviations may reflect statistical artifact more than any practical significance. Still these differences are worth exploring further to determine whether receptivity of the campaign messages is equivalent across meaningful subgroups that may interpret messages differently.

Future Considerations

The ATI campaign was analyzed as a “*stand alone*” advertising campaign without redress to any supplemental activities. Flay (1987, 2000) suggests that ad campaigns should be wedded to community and school-based programs to obtain maximal effectiveness for social psychological based programs. Indeed, there have been favorable findings from campaigns blending both community-based media awareness and school efforts (Slater, Kelly, Edwards, Thurman, Plested, Keefe, et al., 2006). More recently, Slater and colleagues contrasted program evaluation findings from the “Be Under Your Own Influence” campaign, combining community-based media efforts with a school component versus the ONDCP media campaign and did not find significant school-level effects (Slater, Kelly, Lawrence, Stanley, & Comello, 2011). In contrast, Longshore and his colleagues found that the impact of a school-based prevention program was magnified among students that also reported awareness of campaign advertising (Longshore et al., 2006). Perhaps media campaigns such as ATI can serve as boosters to ongoing school-based prevention efforts, reinforce the stated message, and increase the “reach” to wayward youth that are not exposed to an evidence-based drug education program conducted in school (Ringwalt, Vincus, Hanley, Ennett, Bowling, & Rohrbach, 2009). The net benefit of the media campaign is that it does contribute in some fashion or manner to the already existing panoply of messages deterring youth from drug use.

General Study Limitations

Even with the strengths supporting this study there are a number of limitations worth noting. The data reported in this study are cross-sectional and limit the chance to explore trends in consumption or exposure. Thus, care must be taken to address “*effects*” as mere contemporaneous associations, although they can still paint a vivid picture of theoretically consistent relations. In addition, the decision to create random cross-validation samples may result in some loss of precision in parameter estimation. The sample is considerably large and has excessive power; therefore, cross-validation seemed an optimal strategy to avoid making statistically significant findings appear practically meaningful.

Moreover, we did not control for possible confounders and measures that may spuriously cause the association between the different types of exposure, recall, and marijuana use. Risk taking is one such measure that is known to relate to

drug use and characterize vulnerable youth. Work along these lines has shown that campaign messages are dependent on an individual's willingness to engage in risky behaviors (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001; Palmgreen et al., 2007). Consistent with the small size of the models tested, future research should examine a wider range of etiological factors such as propensity toward sensation-seeking that can influence drug use and at the same time alter youths' receptivity to prevention messages. No matter, the linkages between cognitions and behavior fit the proposed TRA framework and show that mass media campaigns are appropriate deterrents for youthful drug use.

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Assessing Media Campaigns Linking Marijuana Non-Use with Autonomy and Aspirations: “Be Under Your Own Influence” and ONDCP’s “Above the Influence”

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Abstract

Two media-based interventions designed to reduce adolescent marijuana use ran concurrently from 2005 to 2009. Both interventions used similar message strategies, emphasizing marijuana’s inconsistency with personal aspirations and autonomy. “Be Under Your Own Influence” was a randomized community and school trial replicating and extending a successful earlier intervention of the same name (Slater et al. *Health Education Research* 21:157–167, 2006). “Above the Influence” is a continuing national television, radio, and print campaign sponsored by the Office of National Drug Control Policy (ONDCP). This study assessed the simultaneous impact of the interventions in the 20 U.S. communities. Results indicate that earlier effects of the “Be Under Your Own Influence” intervention replicated only in part and that the most plausible explanation of the weaker effects is high exposure to the similar but more extensive ONDCP “Above the Influence” national campaign. Self-reported exposure to the ONDCP campaign predicted reduced marijuana use, and analyses partially support indirect effects of the two campaigns via aspirations and autonomy.

Keywords

Marijuana; Media; School intervention; Community intervention; ONDCP

Introduction

Use of substances such as marijuana remains widespread among adolescents in the United States (Johnston et al. 2009). Media-based campaigns are attractive as intervention strategies

given the potential economies of scale associated with media interventions as well as youth involvement with and influence by media (Hornik 1988; Klein et al. 1993; see Green 1977).

The data presented and analyzed here evaluate the impact of a replication and extension of an in-school and community based media intervention, “Be Under Your Own Influence,” found to reduce marijuana uptake trajectories in an earlier randomized community trial (Slater et al. 2006). The planned evaluation was adapted while in the field to incorporate measurement of exposure to the (Office of National Drug Control Policy’s) rebranded national anti-drug media campaign, “Above the Influence,” after it was launched concurrently in 2005. While the unplanned concurrence of these very similar campaigns complicated the original evaluation plans for “Be Under Your Own Influence,” it also represented a unique opportunity to a) provide two simultaneous tests of autonomy and aspiration perceptions as mediators of impact on marijuana use as a consequence of exposure to each of these campaigns, b) conduct the first independent assessment of the ONDCP media campaign, which did not have a formal independent evaluation in place during the years of this study, and c) assess the simultaneous impact of a national campaign and a similar community/in-school effort.

“Be Under Your Own Influence,” Non-use and Youth Aspirations and Autonomy—A Theory of Influence Based on Developmentally Appropriate Goals for Adolescence

“Be Under Your Own Influence” was a media-based substance-use prevention program developed over 5 years of formative research and testing (Kelly et al. 1996, 2000; see also Kelly et al. 2006). The theme was adapted for use in a randomized community trial of an intervention using in-school media and promotional materials combined with community-based efforts, and showed significant intervention reductions in marijuana uptake trajectories (Slater et al. 2006). In the study, eight communities received the in-school and community media, and eight did not. Within each community, two middle schools were recruited, one of which received a classroom-based intervention and one that did not. Main effects and interactions involving the classroom intervention did not reach significance.

The “Be Under Your Own Influence” intervention strategy sought to align messages with developmentally appropriate goals. The campaign positioned non-use as supporting the goals of autonomy and achievement or competence that have been conceptualized as innate psychological needs that persist over the lifespan (Ryan and Deci 2000). The “Be Under Your Own Influence” campaign designed messages that would take into account the salience and unique manifestations of these needs in adolescence. For example, developmentally appropriate drives for adolescents towards autonomy and competence (Peterson 1988) were addressed by emphasizing that substance use would undermine the ability to plan for the future, to achieve goals, to act independently, and to aspire to excellence in sports, creative pursuits, and other activities.

While the results from the experiment and the first intervention supported the developmentally-appropriate behavior influence strategy of the “Be Under Your Own Influence” campaign, several major questions remained that could be addressed only with a replication study. One was whether the intervention was robust enough to provide significant effects upon replication and, if so, if both the community and in-school media components were needed or if either element alone could generate significant effects (see Flay (2000) regarding the importance of disentangling community from school intervention effects). Therefore, in the present intervention, the community component was randomized by community, and the in-school media component was randomized to one of two middle schools within each community. Another research objective was to more fully examine the roles of aspirations and autonomy as possible indirect avenues for campaign effects on substance use behavior.

The ONDCP National Media Campaign: “Above the Influence”

The ONDCP’s National Youth Anti-drug Media Campaign was initiated in 1998 after authorization from Congress. The campaign, initially branded “My Anti-drug,” was on-air during the same years as the initial randomized trial of the “Be Under Your Own Influence” campaign. Creative work on advertisements was overseen by the Partnership for Drug Free America (PDFA) through *pro bono* efforts of leading U.S. advertising agencies.

The ONDCP campaign was initially funded at nearly \$200 million per year, mostly for purchase of advertising time to reach both youth and parents. Media buys were supplemented with a two for one requirement, effectively doubling advertising placement. An evaluation based on a representative national panel of youth and parents, using computer-assisted household interviews over four waves of data collection, found no evidence of effectiveness of the “My Anti-drug” campaign and indeed suggested possible iatrogenic effects (Hornik et al. 2008). A re-analysis of the same data set found evidence supporting possible iatrogenic effects for younger but not older respondents (Scheier and Grenard 2010). Another evaluation effort using a regional field test method suggested positive campaign effects (Palmgreen et al. 2007).

Following public release of the negative findings for the “My Anti-drug” campaign, the ONDCP campaign was rebid and a new advertising firm received the contract. In 2005, a rebranded marijuana prevention campaign, “Above the Influence,”¹ was introduced and ran concurrently with the second trial of “Be Under Your Own Influence” reported here. Funding levels were about half of initial levels. The campaign aimed at parents was eliminated to help maintain levels of campaign exposure to adolescents (Eddy 2006). This national campaign remains ongoing at time of writing.

No formal external evaluation of the rebranded campaign was funded. However, internal rolling cross-sectional surveys conducted weekly over the course of the campaign indicate that while awareness of the “My Anti-drug” campaign had been negatively associated with anti-drug attitudes, awareness of the “Above the Influence” campaign showed significant positive associations with such attitudes (White 2008).

The ONDCP “Above the Influence” campaign also linked substance use with autonomy and aspiration threats. It differed from the “Be Under Your Own Influence” campaign in several respects. The ONDCP campaign involved television advertising produced by leading national advertising agencies placed on broadcast programs frequently watched by teens at levels of exposure comparable to nationally advertised brands. In contrast, the “Be Under Your Own Influence” campaign did not utilize television. The ONDCP campaign effort was supplemented by print advertising, which was the predominant medium used in the “Be Under Your Own Influence” campaign (e.g., posters). Far more creative executions in total were used in the ONDCP campaign effort given the funding levels of that campaign. Creative approaches in print messages generally were similar in concept but somewhat different in execution.

¹The “Be Under Your Own Influence” campaign messaging strategy and preliminary data from its successful randomized trial were presented in 2003 to ONDCP and PDFA senior staff (who provide research briefings to advertising creative staffs) at a meeting of the Behavior Change Expert Panel, a campaign advisory group then chaired by the first author. The recollection of draftfcb creative staff, according to Robert Denniston (personal communication, March 2006), who oversaw the ONDCP campaign, is that draftfcb subsequently but independently came up with the “Above the Influence” approach, launched nationally in 2005, and that while the research on “Be Under Your Own Influence” provided welcome support and direction for their similar approach, draftfcb believes the initial similarity of the campaign strategies was coincidental.

Research Questions and Hypotheses

Given the concurrence of the “Be Under Your Own Influence” and “Above the Influence” campaigns, the close resemblance between the campaign themes, and the parallel mediating mechanisms addressed by both campaigns, effects of the two campaigns must be addressed in tandem. First (RQ1), we assess the extent of exposure to the ONDCP’s “Above the Influence” in treatment and control sites for the “Be Under Your Own Influence” intervention. Second, (RQ2) we examine whether either campaign increases perceptions that marijuana use is inconsistent with aspirations or autonomy. Third (RQ3), we test whether either campaign reduced marijuana uptake, despite the presence of the other campaign, and (RQ4) whether aspirations and autonomy provide an indirect path between the campaigns and marijuana uptake. Finally, (RQ5) we ask whether the presence of the “Be Under Your Own Influence” campaign, a) complements effects (if any) of the ONDCP campaign, (e.g., by reinforcing a similar message); b) interferes with such effects, perhaps by providing a somewhat different presentation of the same message that dilutes the effect of the ONDCP campaign; or, c) has no net impact on effects of the ONDCP campaign.

Methods

Design and Intervention

The study design was a randomized community and school trial with four conditions. Ten communities were randomly assigned to receive the “Be Under Your Own Influence” community-media intervention, which involved a 1-day community-readiness training including training in developing local media materials and working with local press (Slater et al. 2005), provision of media materials including posters, banners, and brochures intended to be used in community settings such as stores, libraries, and recreation centers, and localized press releases about prevention topics, and periodic follow-up. Ten communities did not receive these community-level trainings or materials.

Within each of the 20 communities, two middle schools were recruited and randomized to receive or not receive in-school media including a series of posters for display within the school. Posters included versions pretested for cultural appropriateness for schools with large Hispanic or African-American populations. Banners and promotional materials such as pens, key chains, lanyards, stickers, and t-shirts were also distributed within the school (see Kelly et al. 2006, for details regarding the in-school and community intervention materials). All materials emphasized the link of substance non-use to achieving personal autonomy and aspirations and displayed the campaign slogan “Be Under Your Own Influence.”

To summarize the four experimental conditions: Ten schools were in communities receiving both the community intervention and the in-school media materials, 10 schools received the community intervention without the in-school media, 10 schools received the in-school media and no community intervention, and 10 schools served as controls, receiving no intervention.

Students in all four conditions, of course, were exposed to the nation-wide “Above the Influence” campaign. The re-orientation of the national campaign in 2005 to adopt the same approach as the “Be Under Your Own Influence” intervention was unanticipated and was addressed by adding to the evaluation instrument measurement of exposure to the national campaign.

Four waves of data were collected in each school. The first wave was a pre-intervention baseline in the fall and spring of two school years, beginning in the 7th grade and ending in the 8th grade, followed by data collection at the end of that school year and in the fall and spring of the subsequent year. Schools were recruited based on National Center for

Educational Statistics (NCES) district listings; eligible districts were not in the largest urban category (because of the long delays required to obtain project approval in such districts) and had at least two middle schools of reasonably comparable size. Random assignment used a group-matching procedure: NCES data on community demographics and location were used to generate possible randomization schemes in which major demographics and location were balanced to the degree possible across experimental conditions and one of the acceptable schemes was randomly selected. Two communities were in California, two in Oregon, and two in Texas; three were in Louisiana, one in South Carolina, one in Kentucky, and one in Virginia; two were in Minnesota, one in South Dakota, one in Missouri; two in (northeast) Ohio, one in Pennsylvania, and one in New Jersey. While the intervention took place over a 2-year period, because of the logistic demands of implementation, intervention was staggered across three groups, the first beginning fall 2005, the second in fall of 2006, and the third in fall of 2007, with data collection concluding in spring of 2009.

Participants

3,236 students participated in at least one survey, with 48% males, 52% females and a mean age at baseline of 12.4 years ($SD=0.6$); 75% were European-American, 11.5% African-American, and 13.5% of other racial backgrounds. One-quarter of the youth were of Hispanic ethnicity. Students were recruited using active consent procedures. The average rate of student participation in each school was 32% of total student enrollment, lower than the prior study because of stricter IRB requirements being imposed on recruitment procedures. 57.1% of respondents provided data at all four measurement occasions; 27.2% provided data on three, 9.4% provided data on two and 5.3% provided data on just one of the measurement occasions. Missed surveys appear to be a matter more of absenteeism or slips in getting students to survey sessions, than of panel mortality; 84.5% of participants filled out the wave 1 survey, 86.2% wave 2, 86.1% wave 3, and 81.3% wave 4. Students who responded that they had tried all drugs listed including one that had been invented were considered exaggerators and were excluded from analyses; there were no more than 0.4% of such exaggerators in any given wave of data collection.

Measures

Autonomy and Aspirations Inconsistent With Marijuana Use—Autonomy inconsistent with marijuana use was measured using responses to four items following the phrase “Not using marijuana”: 1) is a way to be true to myself; 2) is an important part of who I am; 3) is a way of being in control of my life; and 4) is a way of showing my own independence, where responses ranged from 1 = *definitely disagree* to 4 = *definitely agree*. Similarly, aspirations inconsistent with marijuana use were measured using the responses to three items following the phrase “Using marijuana would: 1) keep me from doing the things I want to; 2) mess up my plans for when I am older; and 3) get in the way of what is important to me.” Because responses to each scale’s items were heavily skewed, with 82% of respondents selecting “definitely agree” for all aspiration items and 84% of respondents selecting “definitely agree” for all autonomy items, each scale was dichotomized such that a “1” was assigned if all responses to the scale items were “definitely agree” and a “0” otherwise. The Cronbach’s alpha values (Cronbach 1951) for each dichotomized measure were .9 or greater at each of the four waves.

Marijuana Use—Lifetime use of marijuana was measured at each measurement wave using four questions: “How old were you the first time you used marijuana?”, “How often in the last month have you used marijuana?”, “How often in the last 3 months have you used marijuana?”, and “Have you ever tried marijuana? (pot, grass, hash, etc.)?” If a subject responded affirmatively to any one question (or indicated an age when they first used marijuana), lifetime marijuana use was scored a “1”, while an indication of never using

marijuana resulted in a score of “0”. The reliability for the scale was above 0.7 for the first two measurement occasions, .64 on the third occasion, and .69 at the fourth occasion.

Exposure to ONDCP’s “Above the Influence” Campaign and Response to Foils—Exposure to the ONDCP “Above the Influence” campaign was evaluated using the following stem, “Have you seen the following lines in ads or posters about drugs or alcohol?” The lines included two foils or fake campaign slogans, “Use pot and booze, you lose” and “Don’t drink, don’t smoke, don’t croak,” and the ONDCP campaign slogan, “Above the Influence” (see Southwell et al. 2002, re validation of exposure self-reports). This question was asked at measurement occasions 2 through 4 but not at measurement occasion 1. Response options ranged from 1 “definitely have seen” to 3 “definitely have not seen,” with “might have seen” as the middle category. Based on earlier validation research regarding use of foils and recognition measures (Slater and Kelly 2002), only endorsement of “definitely have seen” was regarded as evidence for exposure.² A dichotomous measure for exposure to “Above the Influence” was 1 if the subject reported definitely having seen “Above the Influence” and 0 otherwise. Similarly, a dichotomous variable measuring self-reported exposure to at least one of the foil campaigns was calculated.

Treatment Variables—A dichotomous school-level variable measured whether a school participated in the in-school media effort and a similar community-level variable denoted community-wide participation in the campaign.

Data Analysis

The models used to test the research questions were generalized linear mixed models (Skrondal and Rabe-Hesketh 2004) with binary outcomes. The outcomes were measured within four levels of clustering—multiple occasions within individual within school within community.³ Testing of random effects was accomplished using the likelihood ratio statistic (Goldstein 1990; Snijders and Bosker 1999). In general, the test compares a model under a null hypothesis of no random effect (H_0) at a particular level of clustering against the alternative model containing the effect (H_1).

²Slater and Kelly (2002) found a) “definitely seen” responses were far lower for foils than actual messages in treatment conditions, thus validating foils and b) that “might have seen” responses to foils and actual messages were nearly identical, indicating that a “might have seen” response to an actual message does not evidence exposure to it.

³For the sake of brevity, we illustrate with a two-level model but the expansion to a four-level is straightforward:

$$\pi_{ij} = \{1 + \exp(-[\beta_0 + \beta_1 x_{ij} + u_{0j}])\}^{-1}$$

$$\gamma_{ij} \sim \text{Bin}(\pi_{ij}, n_{ij})$$

$$\text{var}(\gamma_{ij} | \pi_{ij}) = \pi_{ij}(1 - \pi_{ij}) / n_{ij}$$

$$y_{ij} = \pi_{ij} + e_{ij} z_{ij}, z_{ij} = \sqrt{\pi_{ij}(1 - \pi_{ij}) / n_{ij}}, \sigma_e^2 = 1$$

where π_{ij} is the expected value for the ij^{th} unit. Also, per recommendations of Agresti (2002) and Kleinbaum et al. (1998) we use the z – test for examining hypotheses about parameter estimates as those estimates use the maximum likelihood function.

In the analyses reported in this paper, we assumed the missing data mechanism was missing at random (MAR). A violation of this assumption will still result in parameter estimates that exhibit little if any bias if an appropriate method for missing data is applied during the analytic phase (Arbuckle 1996; Wothke 2000). Among the principal methods for addressing MAR is direct maximum likelihood (ML), which we employed.

We assessed our first research question concerning the extent of exposure to the ONDCP's "Above the Influence" campaign in our intervention and control sites using a cross-tabulation showing the proportion of subjects in each of the response categories. Next, we examined the effects of the "Be Under Your Own Influence" campaign on aspirations and autonomy (RQ 2) and on marijuana uptake (RQ 3) by estimating multilevel growth models for three outcome variables—aspirations, autonomy, and marijuana use. Within these models, we looked at both growth trajectories associated with exposure over time as well as post-test comparisons. Multi-level growth models permit assessment of growth trajectories associated with exposure to the campaigns. Growth trajectories have the advantage of utilizing all available measurement occasions to estimate differences in rate-of-growth as a function of cumulative exposure differences, and as such are both conservative and take into account developmental process and cumulative exposure over time. Post-test comparisons look simply at intercepts placed at the last measurement time point, and have the primary advantage of not assuming linearity (a necessary assumption for our trajectory analyses given the number of exposure time points available for both campaigns).

A four-level model was initially estimated (measurement occasion within the individual within a school within a community) for each outcome variable. Random effects were retained if they were significant at the $p < .1$ level. Neither community nor school random effects for intercepts or slopes met this criterion. Parameters for these random intercept and slope effects ranged between $1e^{-8}$ and $1e^{-15}$ (precise parameters are difficult to obtain reliably as the model was difficult to estimate when random effects this close to zero were included in the model).

The fixed effects portion of the model treated each outcome variable as a function of time, school treatment, and community treatment while also controlling for self-reported exposure to the ONDCP message and any foil messages. The fourth research question hypothesized a mediating mechanism through which these media campaigns influence marijuana use via impact on perceptions concerning the relationship of marijuana with aspirations and personal autonomy. Indirect effects were tested using a Taylor series expansion of the Sobel (1982) test that had been previously shown to perform very well in multi-level models (Krull and MacKinnon 2001). The final research question concerned the possibility that the effects of the ONDCP "Above the Influence" campaign might be reinforced or diluted by the similar "Be Under Your Own Influence" intervention. This was tested by adding an interaction term between the intervention treatment effects and the measure of self-reported exposure to the ONDCP campaign to the model used to test RQ 3.

Results

Extent of Exposure to ONDCP Campaign in "Be Under Your Own Influence" Treatment and Control Communities

The extent of exposure to the ONDCP "Above the Influence" campaign (RQ1) was assessed by cross-tabulating the measures of self-reported exposure to this campaign with each of the four treatment/control cells at the fourth wave of data collection, the point by which such exposure would have taken place for all study participants. Of youth in the control community/control school cell, 73% said they definitely had seen the ONDCP "Above the

Influence” campaign. The self-reported exposure to the ONDCP campaign was similar in the three treatment cells (68–79%).

We can be confident that this exposure is in large measure due to actual exposure and not false recognition or youth providing what they may have believed to be a socially desirable response, as the percentage reporting they had definitely seen one of the two foils, or fake campaigns, was much less than the percentage reporting exposure to the ONDCP campaign. For example, in the control cell in which 73% of youth said they’d definitely seen the “Above the Influence” campaign, 14.6% reported definitely seeing one foil and 20.2% claimed they definitely saw the other (false recognition of the two foils was highly correlated—67% of those claiming recognition of the first foil also claimed recognition of the second). Similar differences were found in the other cells. These levels of false recognition are typical in response to survey questions about self-reported exposure that do not include actual images of an advertisement (see Shapiro (1994) for a discussion of false recognition of messages).

Effects of the “Be Under Your Own Influence” and the “Above the Influence” Media Campaigns on Beliefs about the Association of Marijuana with Aspiration and Autonomy

Beliefs about the association of marijuana with personal aspirations and autonomy were proposed as possible proximal effects and a possible mechanism for effects of either or both campaigns (RQ2). Therefore, we first estimated two multilevel growth models, the first using the outcome variable, aspirations, and the second using the outcome variable, autonomy. Tests for growth model random effects at levels 3 and 4, as described above, showed that those effects were not significant. Therefore, they were removed from the model. Because development is not always linear, we recoded time so that the growth model intercept was at the last measurement occasion. Placing the intercept at this location provided a direct test for the treatment on the outcome at the end of the treatment application: If the treatment had an effect by the end of the campaign, experimental groups would differ at this measurement occasion.

The community-level treatment in the “Be Under Your Own Influence” campaign predicted increased perceptions that marijuana use was inconsistent with personal aspirations at the last measurement occasion, controlling for the “Above the Influence” campaign and foil effects ($\beta=0.54, p=0.006$). The school-level treatment did not have a significant effect. The ONDCP “Above the Influence” campaign also exhibited a higher intercept for aspirations at the last measurement occasion ($\beta=1.05, p<0.0005$) but had no detectable effect on the linear rate-of-change (see Table 1).

For autonomy, the community-level treatment resulted in a more positive linear rate-of-change ($\beta=-0.48, p=0.023$) but did not affect post-test scores. The school-level treatment had no significant effect at either the last measurement occasion or on the linear rate-of-change. The “Above the Influence” campaign exhibited a positive effect on autonomy at the last measurement occasion ($\beta=0.599, p<0.0005$) but did not influence the linear rate-of-change (see Table 1).

Effects of the “Be Under Your Own Influence” and the “Above the Influence” Media Campaigns on Marijuana Outcomes

Table 2 presents results for the multilevel growth models that use marijuana use as the outcome variable (RQ3). The positive coefficient for the variable “time” implies that as time progresses, the odds of a positive response to one of the marijuana ever-use indicator variables increases (OR = 3.8: 1, $p<0.005$). The community treatment parameter estimate was significant ($\beta=-0.51, p=0.026$), indicating that community-level treatment lowered the

propensity to use marijuana at the last measurement occasion over and above the effect of the “Above the Influence” campaign. There was no evidence that school-level treatment affected the marijuana use at the last measurement occasion. Neither the community-level nor the school-level treatment for the “Be Under Your Own Influence” campaign provided evidence of an effect on the linear rate-of-change for marijuana use. In other words, while there was evidence of a significant effect of the community-based component of the “Be Under Your Own Influence” campaign on post-test marijuana use, the strong and consistent effects of the prior campaign on both post-tests and reduced linear trajectory of marijuana use were not replicated.

However, there was clear evidence that exposure to the “Above the Influence” campaign, as measured by respondent self-report, predicted reduced marijuana uptake. While controlling for “Be Under Your Own Influence” effects and recognition of foils, exposure to ONDCP’s “Above the Influence” campaign prospectively predicted reduced marijuana use at the last measurement point ($\beta=-1.35, p<0.005$) and a reduced linear rate-of-change of marijuana use ($\beta=0.34, p=0.042$). Expressed in terms of odds ratios, there was a main effect of “Above the Influence” suggesting that, at the last measurement occasion, those who had been exposed to the ONDCP campaign were less likely (OR = 3.85: 1, $p<0.0005$) to use marijuana compared to those not exposed to the campaign.

Indirect Effect Tests: Campaign Effects on Marijuana Use Via Aspirations and Autonomy

One of the aims of the present research was to test the hypothesis that media campaigns such as these might influence substance use behavior by reinforcing beliefs that substance non-use is consistent with youths’ aspirations and autonomy drives (RQ4). We provide inference tests for indirect effects of the campaigns on marijuana use through aspirations and autonomy, using the Taylor-series expansion of the Sobel test.

For the “Be Under Your Own Influence” campaign, we look only at the community-level treatment, for which evidence for statistically-significant effects on marijuana uptake at post-test were found. The path from community-level treatment through aspiration to the marijuana use at post-test was significant ($z=2.58, p<0.01$). No other indirect effect involving the community-level treatment was significant. The indirect effect of the ONDCP campaign on marijuana use as measured at post-test through aspiration was significant ($z=5.2, p<0.005$). The indirect effect of the ONDCP campaign on linear trajectory via aspiration was non-significant ($z=1.31, p=0.19$). The ONDCP campaign also had an indirect effect on marijuana use at post-test through autonomy ($z=3.07, p=0.002$). There was no evidence that autonomy mediated the effect on the rate-of-change for marijuana use ($z=0.58, p=0.56$).

Interaction Effects of Exposure to the Two Campaigns

The simultaneous presence of the two campaigns in our study sites permitted us to test interactions to assess whether the intervention reinforced, interfered with, or had no net effect with respect to ONDCP campaign impacts (RQ5). We found no statistically significant interaction between intervention exposure and ONDCP campaign exposure on marijuana use ($\beta=1.004, p=0.361$).

Discussion

These analyses provide independent evidence that the ONDCP’s revised “Above the Influence” campaign predicted lower marijuana use by the final wave of data collection. These results suggest that the change of campaign theme from the earlier “My Anti-drug”

effort, which was associated with no or perhaps even iatrogenic effects (Hornik et al. 2008), was well-advised.

ONDCP campaign effects on marijuana uptake appeared more robust in examination of post-test results than in tests of effects on linear trajectory, though the latter was statistically significant. Existing data on marijuana uptake over the course of adolescence indicates a non-linear trajectory sharply increasing around ages 14 and 15 (many 8th graders are or turn 14 years old), with initiation increasing by a factor of five over rates from that at ages 12 and 13 (Substance Abuse and Mental Health Administration 2010; see also Tang and Orwin 2009). Finding maximum impact, then, for our respondents who are at the end of 8th grade is consistent with such epidemiological findings. The significant indirect effects indicate that the ONDCP campaign indirectly affected post-test marijuana uptake through both aspirations and autonomy. There was no indirect effect on linear trajectory, perhaps because trajectories are in fact not best modeled as linear, as discussed previously.

With respect to the “Be Under Your Own Influence” community and in-school intervention replication and extension study, the robust effects found in the previous community randomized trial on both post-test and linear trajectory effects replicated only with respect to post-test results. This is not surprising given the study’s control conditions were contaminated by high levels of exposure to the ONDCP “Above the Influence” campaign, which was closely parallel in theme and emphasis to “Be Under Your Own Influence.” Even in the treatment conditions, exposure levels were as high or higher to the “Above the Influence” national campaign as in control conditions, swamping the impact of the intervention. The relative inability of the in-school/community media effort to replicate previous effects in the presence of this very similar national campaign underscores the relative power of national cable and broadcast advertising with high levels of exposure to communicate essentially the same message.

The community component of the “Be Under Your Own Influence” campaign showed evidence for effects in the post-test analysis, while the in-school campaign did not. Under ordinary circumstances, this would be surprising: The level of exposure to campaign content was generally higher in the in-school setting, in which posters and other materials were highly visible, than in the community setting. However, the community effort included media and community coalition activities that were less likely to be redundant with the ONDCP’s national “Above the Influence” campaign. This may explain evidence for community but not in-school treatment effects. Given this anomalous context of a very similar national media campaign in the information environment that was likely to compete more directly with the in-school than the community treatment component, we do not believe our results are informative regarding the question of the comparative effects of an in-school versus community-based prevention effort that we had initially hoped to help answer.

It is worth noting that the presence of a national media campaign *per se* is not the explanation for limited results, as ONDCP’s “My Anti-drug” campaign ran concurrently with the first, clearly successful iteration of the “Be Under Your Own Influence” effort. However, “My Anti-drug” focused on negative consequences, refusal skills, and normative influences (Office of National Drug Control Policy 1998), and had problematic outcomes according to the funded evaluation (Hornik et al. 2008). The overlap of theme and strategy seems the key factor.

The circumstances also permitted a test as to whether combining a national media campaign and an in-school/community media program targeting the same proximal variables would enhance the effects of the national campaign—or, perhaps, undermine them by causing

some confusion of the message with slightly different brands and different creative executions and styles. The lack of interaction effect for exposure to the two campaigns suggests neither happened (or both happened and the effects cancelled one another out). We hasten to note, however, that to therefore infer a national campaign should not consider supplementing efforts through in-school and community media efforts would be premature. It remains quite possible, if an in-school/community effort used exactly the same theme and creative work specifically designed to complement the national campaign, that effects of the national campaign could be measurably increased.

This study has a number of design strengths, including longitudinal data collection in varied communities across the U.S., measurement of mediating variables, and a randomized community trial design for assessment of the “Be Under Your Own Influence” intervention. However, the analyses reported here also have limitations to be taken into account when drawing conclusions from these findings.

Analyses concerning the ONDCP campaign depend on a single-item question concerning exposure to the campaign “Above the Influence” theme. Recognition memory tends to be relatively reliable, although false recognition can be a problem (Shapiro 1994). We controlled for false recognition by incorporating recognition of foil themes consistent with validation analyses from a previous study (Slater and Kelly 2002). The ONDCP exposure item was in the data set for waves 2, 3, and 4 but not in wave 1, as the wave 1 scannable forms had already been printed before the “Above the Influence” campaign had been announced. Having to work with three, rather than four, waves in assessing the predictive power of ONDCP campaign exposure tends to reduce the statistical power to test associations, with a conservative impact on these analyses. It would not have been possible to get a pre-exposure baseline for the ONDCP campaign even if we had been able to get the ONDCP exposure item into all four waves, as wave 1 data were collected after the launch of the “Above the Influence” campaign for nearly all study participants. Therefore, we would be analyzing associations of trajectories even with inclusion of wave 1 data for ONDCP. Another associated limitation is that with three waves we can test only linear relationships and trajectories.

The fundamental limitation of the analyses of the ONDCP campaign rests in the associational, non-experimental nature of these analyses and the resulting uncertainties regarding causation. There are several obvious threats to causal interpretation of this association. The primary threat is social desirability bias—a belief among respondents that claiming recognition of the “Above the Influence” campaign is a way to express socially approved anti-drug norms and values. If responses typically reflected such bias, they might generate spurious associations between claimed recognition and attitudinal and marijuana use uptake outcomes. However, our use of recognition measures of two foils—fake campaign slogans—as controls should largely eliminate this effect: If social desirability is driving affirmative responses to recognition of anti-drug campaigns, they should be more likely to affirm exposure to one or both foils.

It is also possible that those interested in experimentation with marijuana are more likely to remember messages about the product of interest; advertising researchers note that advertisements are best recalled by people interested in using the product advertised (Kokkinaki and Lunt 1999). However, if this is the case, the better recall of the campaign by those interested in marijuana use should lead to negative and not positive associations with anti-drug beliefs and marijuana uptake. Such a bias would therefore render these tests more conservative, and not provide an alternative explanation for results.

Another possibility is that youth who had other protective factors in their lives would be more sympathetic to the aspirational messages, and as a result notice and remember them, producing higher self-reported campaign recognition and spurious positive predictive effects. This explanation, while it cannot be excluded, seems to pose only a modest threat to inference for several reasons. One is that those interested in using a product are more likely to attend to relevant messages, as noted above. Another reason is that evaluation of the prior “My Anti-drug” campaign found at best neutral and often clear tendencies toward negative associations between earlier self-reported recognition measures of the campaign. It is not clear why spurious positive relationships would be found for the aspirational messages in “Above the Influence” and not for the negative consequence, refusal skill, and normative messages found in the “My Anti-drug” effort (Hornik et al. 2008). Even if there was something uniquely protective and compelling about the aspirational theme, this would suggest that the messages were well-targeted, but that the causal process was more complex than captured here, involving reinforcement of existing positive perceptions (Slater 2007). This would qualify but not change the basic findings of these analyses. Finally, the analyses of mediation reported above provide some support for our hypothesized causal processes.

Therefore, despite the uncertainties associated with use of the self-report measure, ONDCP exposure predicting lower uptake and greater association of non-use with personal aspirations and autonomy seems plausible. At minimum, these results provide reason to believe that the possibly iatrogenic effects of the earlier version of the ONDCP campaign are not evident in response to the rebranded campaign. The negative findings from the evaluation of the “My Anti-drug” campaign (Hornik et al. 2008) were also based on self-report and associational data in a panel data set.

The construction of the youth sample is also a limitation. First, while community and school variability is accounted for in these multi-level models, the sample is biased toward smaller towns and suburbs, as it was too difficult to manage logistics of administrative clearances to conduct research such as this efficiently in large metropolitan school districts. In one respect this bias is likely to result in conservative estimates of ONDCP effects. Advertising exposure to the ONDCP campaign was relatively heavier in larger than in smaller media markets, so average exposure of youth in our study communities to the ONDCP campaign was probably at least somewhat less than for typical early adolescents in the U.S. However, it may be that the media campaign is more effective with youth in smaller than large metro communities, perhaps because the larger communities have richer media environments causing more competition with the campaign messages; therefore, likely effects on youth in large metropolitan areas cannot be assessed confidently from these data.

Non-response bias among youth is also an issue. Stricter IRB demands resulted in lower participation rates in the current study compared to the prior project, and appear to have resulted in participants with lower initial use of marijuana. It is possible that this sample under-represents youth at highest risk. Insofar as the media campaigns were both focused on delaying onset among non-users, a bias towards non-users is not necessarily a bad thing, but it does raise questions about effects on users. To the extent that there may be more users in a truly random sample, it is possible that these analyses may overstate average effects overall assuming effects are greater on non-users. As with most longitudinal research, sample attrition also reduces confidence in generalizability of results, although in this study missed surveys seemed due more to erratic patterns of absenteeism or problems at schools early on in getting all students to data collection, rather than actual panel mortality; such missing data points can be adequately managed using the trajectory analyses in a multi-level latent model.

Even granting constraints in inference associated with these limitations, and resulting uncertainties about precise parameter estimates for U.S. younger adolescents as a whole,

these findings provide independent evidence that the ONDCP “Above the Influence” campaign is trending towards positive impacts on attitudes and behavior, and that these effects may be explained in part by impact on perceptions that personal autonomy and aspirations are linked to substance non-use. The autonomy and aspiration messaging approach pioneered in “Be Under Your Own Influence” and adapted by “Above the Influence” continues to have noteworthy potential.

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“Be Under Your Own Influence” (Intervention) and “Above the Influence”(ONDCCP) campaign effects on perceptions that personal aspirations and autonomy are inconsistent with marijuana use: multi-level latent growth model results

Table 1

	Estimate	SE	z. value	Pr(z)	OR
Aspirations					
Intercept	0.912	0.169	5.410	<0.0005	2.489
Community treatment	0.541	0.195	2.772	0.006	1.717
School treatment	0.320	0.197	1.619	0.105	1.376
Time	-0.747	0.160	-4.675	<0.0005	0.474
Foil exposure	0.409	0.142	2.877	0.004	1.506
Above the Influence (AI) Exposure	1.050	0.137	7.648	<0.0005	2.857
School × Community treatment	-0.469	0.279	-1.682	0.093	0.625
Community treatment × time	-0.163	0.188	-0.868	0.386	0.850
School treatment × time	-0.158	0.188	-0.841	0.401	0.854
Foil exposure × time	0.119	0.130	0.920	0.357	1.127
AI Exposure × time	-0.175	0.131	-1.342	0.180	0.839
School × Community × time	-0.318	0.274	-1.162	0.245	0.727
Autonomy					
Intercept	0.510	0.201	2.542	0.011	1.665
Community treatment	0.288	0.229	1.260	0.208	1.334
School treatment	0.166	0.233	0.713	0.476	1.180
Time	-0.899	0.181	-4.961	<0.0005	0.407
Foil exposure	0.497	0.155	3.219	0.001	1.644
Above the Influence (AI) Exposure	0.599	0.158	3.799	<0.0005	1.820
School × Community treatment	-0.128	0.327	-0.390	0.696	0.880
Community treatment × time	-0.483	0.212	-2.281	0.023	0.617
School treatment × time	-0.299	0.212	-1.409	0.159	0.742
Foil exposure × time	-0.005	0.140	-0.036	0.971	0.995
AI Exposure × time	-0.238	0.144	-1.653	0.098	0.788
School × Community × time	0.023	0.307	0.074	0.941	1.023

Participant sample size wave 1 was 2736, wave 2 2789, wave 3 2786, wave 4 2633. There were 20 communities and 40 schools in the study at each wave

“Be Under Your Own Influence” (Intervention) and “Above the Influence”(ONDCCP) campaign effects on marijuana uptake: multi-level latent growth model results

Table 2

	Estimate	SE	z. value	Pr(z)	OR
Marijuana Uptake					
Intercept	-2.308	0.187	-12.346	<0.0005	0.099
Community treatment	-0.511	0.230	-2.223	0.026	0.600
School treatment	-0.251	0.232	-1.081	0.280	0.778
Time	1.325	0.195	6.788	<0.0005	3.760
Foil exposure	-0.306	0.176	-1.738	0.082	0.737
Above the Influence (AI) Exposure	-1.348	0.157	-8.602	<0.0005	0.260
School × Community treatment	0.174	0.334	0.520	0.603	1.190
Community treatment × time	0.365	0.250	1.458	0.145	1.441
School treatment × time	0.385	0.252	1.525	0.127	1.469
Foil exposure × time	0.010	0.182	0.057	0.955	1.010
AI Exposure × time	0.343	0.169	2.031	0.042	1.409
School × Community × time	0.078	0.367	0.214	0.830	1.082

See note to Table 1 re sample sizes

A Multihealth Behavior Intervention Integrating Physical Activity and Substance Use Prevention for Adolescents

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The primary purpose of this study was to test the efficacy of a brief, multi-health behavior intervention integrating physical activity and alcohol use prevention messages for high school-aged adolescents. A total of 604 participants, 335 9th and 269 11th grade students from a suburban high school in northeast Florida participated in this study. A randomized control trial was conducted with participants randomly assigned within grade levels to receive either a brief consultation and prescription with a mailed reinforcing follow-up flyer (Project SPORT) or a minimal intervention control consisting of a wellness brochure provided in school and a pamphlet about teen health and fitness mailed to the home. Differences between intervention groups were evaluated with a series of MANCOVA tests. Project SPORT participants demonstrated significant positive effects at 3-months postintervention for alcohol consumption, alcohol initiation behaviors, alcohol use risk and protective factors, drug use behaviors, and exercise habits, and at 12-months for alcohol use risk and protective factors, cigarette use, and cigarette initiation (p 's < 0.05). A post hoc analysis examining interactions between past 30-day use of marijuana and/or cigarettes by treatment group indicates significant positive effects for drug using adolescents who received Project SPORT on alcohol consumption, drug use behaviors, and drug use initiation at 3-months, and for drug use behaviors and exercise habits at 12-months (p 's < 0.05). A brief, 12-min one-on-one consultation integrating alcohol avoidance messages within those promoting fitness and other positive health behaviors holds promise for influencing adolescent alcohol and cigarette use and other health behaviors at posttreatment and 1 year later. Long-term sustained effects for cigarette and marijuana use, and both vigorous and moderate physical activity, were found among adolescents using marijuana and/or cigarettes prior to intervention.

KEY WORDS: adolescents; prevention; alcohol; physical activity; drug use.

Recent data from the Substance Abuse and Mental Health Services Administration [SAMHSA] (2003) and the National Institute on Alcohol Abuse

and Alcoholism [NIAAA] (2003) indicate that adolescents who drink alcohol are more likely to experience a range of behavioral problems, including delinquent, aggressive and criminal behaviors. In particular, a strong relationship has been found between alcohol consumption and fighting, stealing, driving after drinking, skipping school, being depressed, sexual assault, high-risk sexual behaviors, and deliberately trying to hurt or kill oneself. The prevalence of drinking-related problems increases throughout adolescence, leaving older adolescents at greatest risk for experiencing negative consequences associated with alcohol abuse (NIAAA, 2003; SAMHSA, 2003).

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Although older adolescents in high school are clearly at greater risk for alcohol abuse and problems than younger aged children in middle and elementary school, there is a dearth of preventive interventions targeting adolescents in high school. Furthermore, only one in seven public and private schools in the United States offers science-based prevention programs (Ennett *et al.*, 2003). There is a critical need for research that tests preventive interventions targeting adolescents in high school, if we are to address where the risk for harm most notably exists, as well as span the gap in our scientific knowledge regarding how to efficaciously intervene.

Many health behaviors are established during youth and are interrelated (Grunbaum *et al.*, 2002). For example, research has shown that participation in sports has been associated with decreased use of cigarettes and "other drugs" (Baumert *et al.*, 1998; Melnick *et al.*, 2001; Page *et al.*, 1998), and yet increased use of smokeless tobacco, steroids, and alcohol (Eccles & Barber, 1999; Melnick *et al.*, 2001; Women's Sport Foundation, 2001). Similar results have been reported showing that higher-level exercisers are less likely than lower-level exercisers to use cigarettes and other drugs (Aaron *et al.*, 1995; Field *et al.*, 2001; Pate *et al.*, 1996; Winnail *et al.*, 1995) and more likely to use alcohol (Aaron *et al.*, 1995; Pate *et al.*, 1996; Rainey *et al.*, 1996).

In addition to being interrelated, many adolescent health behaviors share common determinants, (Arthur *et al.*, 2002; Dryfoos, 1991; Durlak, 1998; Kellam *et al.*, 1983) suggesting that interventions addressing multiple adolescent health behaviors simultaneously may be a successful strategy. Unfortunately, to date, most programs focus on a single health behavior, resulting in separate interventions for each behavior. However, a number of recent studies have suggested that universal programs that promote healthy adolescent development can help enhance a range of health behaviors among youth, (Flay, 2003; Roth & Brooks-Gunn, 2003) and may have a greater impact on public health than single behavior programs (Nigg *et al.*, 2002). Interventions that are able to successfully influence a number of adolescent health behaviors will also be more cost-effective and easily adopted by schools, health clinics, and communities than those addressing single behaviors.

The use of fitness as a positive theme for constructing integrative health behavior programs targeting substance abuse prevention is an innovative approach that may have greater appeal for

adolescents than typical substance-focused interventions. Recreational physical activity and exercise has been identified by some as a useful point of entry for facilitating dialogue among adolescents about self-image and problem behavior (Kirkcaldy *et al.*, 2002). In addition, health communication researchers have recently suggested that program planners should yoke targeted negative behaviors (e.g., substance use) to salient productive behaviors (e.g., physical activity), thereby more effectively decreasing the embeddedness of health damaging behaviors (Booth-Butterfield, 2003). Fitness is a core health motivator because it is closely aligned to desired images many youth have for themselves, and because it is arguably associated with multiple health promoting habits, including nutrition, rest, stress management, etc., while simultaneously related to a number of health risk behaviors, such as alcohol, tobacco, and drug use.

Meanwhile, an increasing number of studies have pointed to image as an important factor in the onset and maintenance of substance abuse among adolescents (Amos *et al.*, 1998; Gray *et al.*, 1997; Slovic *et al.*, 2002). The use of appealing images has an empirical foundation in marketing communications and advertising, (Fox *et al.*, 1998; Shimp, 2000) and a conceptual foundation in Social Cognitive Theory (Bandura, 1986). Using adolescent interest in having and presenting to others an appealing image allows for creating an intervention that can address multiple, covarying behaviors in a relatively efficient manner. Using an image appeal that adopts a positive frame which links a target behavior (e.g., alcohol avoidance) with a socially desirable image (e.g., active youth) is consistent with prior research on message framing and health communications (Rothman & Salovey, 1997). Image-based strategies, such as those that emphasize appearance enhancement benefits of health behaviors, have shown promise in a number of recent studies of youth health habits (Mahler *et al.*, 1997, 2003).

Our previous studies indicated that brief, motivational interventions involving structured, one-on-one consultations including print materials were promising as transportable, efficacious prevention technologies (Werch *et al.*, 2000, 2003a,b). The primary purpose of this study was to test the efficacy of a brief consultation intervention targeting multiple health behaviors that integrated physical activity and alcohol use prevention messages for high school-aged adolescents. A two group randomized trial evaluated both short-term (3-month) and long-term

(12-month) outcomes. Participants were randomly assigned to receive either Project SPORT, consisting of a one-on-one fitness consultation with print materials, or to be given a commercial health and fitness print materials as a control. A secondary purpose was to examine the interaction effects of preintervention drug use and intervention exposure on alcohol use, drug consumption, and physical activity behaviors.

METHODS

Participants

In fall 2002, a total of 604 participants, 335 ninth- and 269 eleventh-grade students, from a suburban high school in the northeast Florida region were recruited to participate in this study. Half of participating students were Caucasian (51.0%), one-fifth (21.5%) were African American, and the remaining (27.5%) were from all other ethnic groups combined. The majority of subjects were female (56.0%), with a mean age of 15.24 years ($SD = 1.09$). A little over one tenth (12.7%) of participating students were enrolled in the free or reduced cost lunch program. Over one-third (38.7%) reported having a family member with an alcohol or drug problem, and a majority of fathers (60.3%) and mothers (53.0%) drank alcohol at least a few times a year. Lastly, just over 60 percent (60.9%) reported some alcohol or drug education within the last year.

Design and Procedure

A randomized controlled trial was conducted, with participating students randomly assigned within grade levels (9th and 11th grades) by computer to either the intervention or control group. Baseline data were collected at the beginning of the fall semester 2002, and postintervention data were collected 3-months after the implementation of the program during mid-spring semester 2003 and again 12-months after the baseline data collection during the fall semester 2003. All outcome data were collected from participants, assembled by classroom in the school auditorium, by trained project staff following a standardized protocol. The research protocol was approved by the University of North Florida's institutional review board (lead author's previous employer) prior to implementing the study, and required all students to submit signed parental consents and youth assents prior to participation in the study.

Intervention

The Project SPORT consultation consisted of an in-person health behavior screen, a one-on-one consultation, a take-home fitness prescription targeting adolescent health promoting behaviors and alcohol use risk and protective factors, and a flyer reinforcing key content provided during the consultation mailed to the home. These brief prevention technologies and strategies are based on the Integrative Behavior-Image Model (BIM), which asserts that positive personal and social images, serve as both key motivators for health development, and the glue for unifying health promoting and health risk habits within single interventions. This is accomplished through constructing behavioral couplings which are a conceptual integration of a health promoting behavior (e.g., physical activity) and a health risk behavior (e.g., alcohol use) using personal aspirations. For example, one message in the sport/physical activity section of the consult included "Sports and physical activities are fun, help you look trim and strong, feel good about yourself, give you lots of energy, and can help you do better in school. However, an active lifestyle and alcohol use do not mix. Using too much alcohol can hurt your performance in sports, physical activities, and school. It can also have a negative impact on your health and your relationships with friends and family. "In addition, constructs drawn from multiple contemporary theories and conceptual models including stages of initiation of health behavior from the Multi-Component Motivational Stages (McMOS) model (Werch & DiClemente, 1994), behavioral capability, expectancy beliefs, influenceability, and resistance self-efficacy from Social Cognitive Theory (Bandura, 1986), perceived susceptibility from the Health Belief Model (Becker, 1974), intentions, attitudes, subjective norms, and perceived peer prevalence from the Theory of Planned Behavior (Ajzen, 1991), self-control strategies from the Behavioral Self-Control Theory (Kanfer, 1975), and parental monitoring, parent/adolescent communication, positive parent/adolescent relationship, and value incompatibility from Social Bonding Theory (Hirschi, 1969), were used as themes in designing the alcohol specific messages and are reflected in the risk and protective factor measures. For example, the Health Belief Model construct of perceived susceptibility was measured as a potential mediator and addressed in the consultation with the following statement: "By using alcohol in the last 30 days, you are at risk for embarrassing yourself in front

of your friends, getting into an argument or fight, getting hurt or sick, or getting into trouble with your family, school, or the police due to alcohol misuse.”

The brief, seven-item Health and Fitness Screen was developed to provide tailored feedback on six health behavior related areas, and was administered to participants individually during regularly scheduled school hours just prior to implementing the fitness consultation. The screen consisted primarily of yes/no response items measuring the following behavioral areas: sport and physical activity, exercise, physical activity norms (i.e., social support from family and friends), breakfast and nutrition, sleep and rest, and alcohol initiation and use.

SPORT Fitness consultations were administered using a standardized protocol designed to provide tailored, scripted communications by trained fitness specialists to adolescents one-on-one. Participating students were escorted from regularly scheduled classes to designated, private spaces where consultations were conducted throughout the school day. All interventions were administered within a single class period to reduce coursework and classroom disruption. These prevention communications promoted an active lifestyle, emphasized the conflict between such a lifestyle and consuming alcohol, and portrayed an image of youth as active and fit, with alcohol use as counter productive to achieving this image. Fitness specialists consisted of various types of health care professionals, such as nurses and certified health education specialists, who received a full 2-day training that included demonstrations, role-playing and feedback from project staff on how to implement the screens, consultations and prescriptions, along with a take-home practice assignment in which they tape record a practice session and receive feedback during the second day of training. At the conclusion of the personal consultation, a take-home fitness prescription was provided recommending the adolescent set goals in the areas of sleep, nutrition, physical activity, and alcohol use. Lastly, a one-page flyer was mailed out to participants 1 week after the implementation of the fitness consultations, reinforcing prevention messages provided during the consultation.

Minimal Intervention Control

The minimal intervention control consisted of two commercially prepared generic alcohol prevention and health promotion print materials. The first was a booklet titled: “What Everyone Should Know

ABOUT WELLNESS,” (Channing L. Bete Co. Inc., 1992) which included information about wellness, smoking, alcohol, exercise, nutrition, and stress management. The 15-page booklet with illustrations was administered in a private, secured setting within the participating school. The control intervention was administered simultaneously with fitness consultations. This process involved providing control participants with the reading material, seating them in a quiet space, and providing instruction to carefully read the material at their own pace. Interaction between intervention and control participants was negligible, given all participants were escorted to and from class, they were placed in separate private spaces during treatment implementation, and no intervention materials were distributed to participants to prevent sharing of materials in school. One week after participants were given the control booklets, and corresponding to the mailing of the intervention flyer, control subjects were sent a generic health and fitness pamphlet. The six-panel pamphlet titled: “For Teens Only: Staying Healthy and Fit,” (Masih, 1993) included information about fitness, nutrition, stress management, alcohol and drugs, and changing unhealthy habits.

Measures

The Youth Alcohol and Health Survey (Werch, 2000) was used to collect data on alcohol and drug consumption, risk and protective factors associated with alcohol use, and exercise habits. Slightly different versions of this instrument, along with standardized procedures for implementing the measures, have been used in a number of randomized preventive intervention trials to measure both primary and secondary substance use outcomes (Werch *et al.*, 1996a,b, 2000, 2002, 2003a).

Alcohol consumption was measured by items adapted from previous substance abuse prevention research (Botvin *et al.*, 1984; Eggert *et al.*, 1994; Ellickson & Hays, 1991; Johnson *et al.*, 1990). Measures used for this study’s analysis included items assessing 30-day frequency and quantity of alcohol use; heavy alcohol use, defined as consuming five or more drinks in a row during the last 30 days; 13 items measuring negative consequences (problems) experienced during drinking ($\alpha = 0.99$); and length of time using alcohol (ranging from “I do not drink” and “30 days or less,” to “6 months or more.”) In addition, a measure of the stage of initiation of alcohol use was taken, adopted from previous stage research

and theory (Prochaska & DiClemente, 1983; Werch *et al.*, 1993; Werch & DiClemente, 1994; Werch, 2001). Adaptations of these items have been found to produce robust and replicable categorical classifications of behavioral stages (DiClemente, Schlundt, & Gemmell, 2004; Prochaska & DiClemente, 1983). This item had seven response categories, reflecting recent advances in staging the initiation of alcohol consumption (Werch, 2001), ranging from strong precontemplation stage (will never try alcohol) to a maintenance stage (drinking for longer than 6 months).

Drug use behaviors measured included 30-day frequency of cigarette smoking and marijuana use, paralleling the alcohol frequency measure. Similarly, measures of cigarette and marijuana stage of initiation were taken, which also corresponded to the measure of alcohol use initiation. Measures of moderate and vigorous physical activity were collected, adopted from the Youth Risk Behavior Survey (Centers for Disease Control and Prevention [CDC], 2002). These items measured 7-day participation in *vigorous physical activity* (at least 20 min with sweating and breathing hard) and *moderate physical activity* (at least 30 min with no sweating or breathing hard).

Cognitive, social and environmental risk and protective factors found to mediate alcohol consumption were also measured. These measures re-

flect key constructs from prominent psychosocial theories underpinning Project SPORT discussed earlier. These measures of risk and protective factors have been tested to ensure adequate internal reliability of scales and have been described in detail in prior prevention research reports (Werch *et al.*, 1996a,b, 2000, 2003a,b). Measures of alcohol use risk factors (targeted for reduction) included positive expectancy beliefs (pros), perceived peer prevalence of alcohol use, influenceability, social norms, intentions to use alcohol, and attitudes. Measures of alcohol use protective factors (targeted for increase) included negative expectancy beliefs (cons), behavioral capability, resistance self-efficacy, self-control, perceived susceptibility, parental monitoring, parent/child communication, positive parent/child relationship, and value incompatibility. Lastly, a number of sociodemographic measures were collected and are reported in Table 1.

Even though studies have shown that self-reports by adolescents represent accurate substance use data, (Wallace & Bachman, 1993; Williams *et al.*, 1995; Wills & Cleary, 1997) we used multiple procedures to ensure the most reliable and valid data possible. Trained research staff used standardized protocols to collect data at the targeted school, to ensure continuity in data collection procedures. Second, participants were thoroughly informed regarding issues of confidentiality, including the use of code numbers

Table 1. Characteristics of Participants at Baseline by Group

Characteristic	Total sample (n = 604)		Intervention group (n = 302)		Control group (n = 302)		χ^2	df	p-value
	%	n	%	n	%	n			
Ethnicity									
Black	21.50	130	23.20	70	19.90	60	1.26	2	0.53
White	51.00	308	49.00	148	53.00	160			
Other	27.50	166	27.80	84	27.20	82			
Gender									
Female	56.00	338	59.50	179	53.00	159	2.55	1	0.11
Age (M/SO)	(15.24/1.09)		(15.22/1.11)		(15.25/1.07)		1.75	4	0.78
Free/reduced lunch	12.70	77	15.00	44	11.10	33	1.89	1	0.17
Family alcohol/drug problem	38.70	234	34.90	105	42.70	129	3.89	1	0.05
Alcohol/drug education last year	60.90	368	63.20	191	58.60	177	1.36	1	0.24
Live with parents									
Mother and Father	57.30	346	54.80	164	60.30	182	2.18	3	0.54
Mother	31.60	191	33.80	101	29.80	90			
Father	7.10	43	8.00	24	6.30	19			
Other	3.50	21	3.30	10	3.60	11			
Father drinks	60.30	364	70.40	183	70.40	181	0.00	1	0.99
Mother drinks	53.00	320	56.30	161	55.00	159	0.10	1	0.76
Brother/sister drink	42.90	259	43.00	130	42.70	129	0.01	1	0.93

on survey instruments; that no individual data would be shared with teachers, parents or health care professionals, and that questionnaires would be sealed in boxes upon completion of the data collection and locked in file cabinets. Third, participants were informed that all research staff would be required to sign an affidavit stating that they will not disclose the identity of any of the research participants to anyone outside of the research project. Fourth, participants were asked to place their questionnaires in folders immediately upon completion, to further protect the confidentiality of participant data and to help put participants at ease.

Intervention Fidelity

The mean length of the tailored sport consultation was 12.65 min ($SD = 2.90$). A random sample of audiotaped consultations ($n = 15$) were assessed and scored on seven measures, including accuracy, completeness, interventionist enthusiasm, student responsiveness, smoothness, use of reflective listening and altering tone of voice. These items were measured on a 4-point scale of: 1 = *not at all*, to 4 = *very*, with mean scores ranging from a high of 3.93 ($SD = 0.26$) for completeness in covering the consultation and 3.73 ($SD = 0.462$) for altering tone of voice, to a low of 3.40 ($SD = 0.51$) for accuracy of following the protocol and 3.40 ($SD = 0.74$) for student's responsiveness to the lesson.

Student feedback was collected immediately after the administration of the consultations and control booklets using a 12-item instrument measuring student satisfaction and perceived usefulness. All items were scored on a 4-point scale of: 1 = *not at all*, 2 = *a little*, 3 = *some*, 4 = *a lot*. Average scores ranged from a high of 3.89 ($SD = 0.38$) on "information was easy to understand" and 3.61 ($SD = 0.78$) will "help avoid over-drinking alcohol next month," to a low of 2.80 ($SD = 0.84$) on "new information learned from the Fitness Specialist talk" and "information was meant just for you" 2.90 ($SD = 0.83$). Adolescents receiving the fitness consultation reported significantly more favorable reactions to the consultation than those receiving the generic health and fitness booklet on 11 of 12 evaluation criteria, p 's < 0.05.

Data Analysis

Descriptive statistics including frequencies, percentages, means and standard deviations were gener-

ated to describe the sample. Baseline measures were compared by experimental group using chi-square tests for categorical data, and independent t -tests for continuous scores. Intervention fidelity and attrition analyses were conducted using chi-square and independent samples t -tests. MANCOVAs were used to test the primary objective of examining the efficacy of the intervention at both 3 and 12-months follow-up, with baseline scores serving as covariates, first analyzing alcohol consumption, then risk/protective factors for alcohol use, and lastly, drug use and exercise behaviors. MANCOVA was used due to the multiple health behaviors addressed by the intervention, and because the dependent variables were not perfectly correlated. In such circumstances, MANCOVA creates a new dependent variable that maximizes group differences. It also controls for Type I error resulting from performing individual tests on multiple dependent variables. Repeated measures MANOVAs were then used to examine temporal effects across baseline, 3-month and 12-month data collections, again examining alcohol consumption, followed by alcohol risk/protective factors, and then other drug use and exercise habits. Lastly, factorial MANCOVAs were conducted to test the secondary objective of examining possible interaction effects of prior drug use (past 30-day marijuana and/or cigarette use) and intervention exposure on alcohol use, drug consumption, and exercise behavior measures.

RESULTS

Baseline and Attrition Analyses

Characteristics of participants at baseline by experimental group are shown in Table 1. No differences were found on any of the sociodemographic measures between groups with one exception. A greater proportion of control adolescents (42.7%) reported a family alcohol or drug problem, than intervention adolescents (34.9%), $\chi^2 = 3.89$, 1 df, $p = 0.05$. No differences were found between groups on any of the alcohol and drug consumption or exercise habit measures (p 's > 0.05).

Attrition analyses showed that at 12-month follow-up, 85% of the sample was successfully maintained ($n = 514$), with comparable numbers of missing adolescents equally distributed across the intervention ($n = 42$) and control ($n = 48$) groups. A comparison of participants who dropped from the study in each group at 12-months was conducted

using baseline data. No differences were found between dropouts in the two groups on any of the alcohol and drug consumption measures, or exercise behavior measures. Also, no differences were found between dropouts by group on any of the socio-demographic measures with one exception. A greater percentage of participants who dropped from the control group had mothers who reported drinking at least a few times a year (71.7%) than were among those who dropped from the intervention group (47.4%), $\chi^2 = 5.18$, 1 df, $p = 0.02$.

Outcome Analysis

First, we tested the primary objective of examining the efficacy of the intervention. Table 2 shows the estimated marginal means and standard errors of alcohol consumption, alcohol use risk and protective factors, drug use and exercise behaviors at 3-months and 12-months follow-up by treatment group. Overall MANCOVA tests at 3-months post-intervention were significant for alcohol consumption and initiation behaviors, alcohol use risk and protective factors, drug use behaviors, and exercise habits (p 's < 0.05), with positive effects for those exposed to Project SPORT. Only drug use initiation was not significant at 3-months follow-up.

Univariate analyses showed that among alcohol consumption behaviors, significantly less 30-day frequency, $F(1, 573) = 13.48$, $p = 0.000$, 30-day quantity, $F(1, 573) = 14.35$, $p = 0.000$, and 30-day heavy use, $F(1, 573) = 11.92$, $p = 0.000$, was found for those receiving Project SPORT compared to those receiving the minimal intervention control. Significantly less alcohol use initiation was seen for adolescents exposed to Project SPORT compared to those exposed to the minimal intervention control, on measures of both stage of alcohol initiation, $F(1, 508) = 17.46$, $p = 0.000$, and length of alcohol use, $F(1, 508) = 11.84$, $p = 0.001$. SPORT youth also displayed significantly more protection from alcohol use than control youth on measures of negative expectancy beliefs (cons), $F(1, 324) = 4.16$, $p = 0.042$, behavioral capability, $F(1, 324) = 8.16$, $p = 0.005$, perceived susceptibility, $F(1, 324) = 4.12$, $p = 0.043$, parental monitoring, $F(1, 324) = 4.03$, $p = 0.045$, and parent/child communication, $F(1, 324) = 4.28$, $p = 0.039$. Likewise, SPORT participants showed less risk for alcohol use compared to control participants, on measures of intentions to drink in the future, $F(1, 496) = 6.94$, $p =$

0.009, alcohol attitudes, $F(1, 496) = 6.76$, $p = 0.010$, and influenceability, $F(1, 496) = 6.98$, $p = 0.009$. Lastly, youth exposed to the SPORT intervention engaged in more moderate physical activity, $F(1, 577) = 7.41$, $p = 0.007$, and smoked cigarettes less frequently, $F(1, 580) = 6.18$, $p = 0.013$, than those exposed to the minimal intervention control.

At 12-months follow-up, significant overall MANCOVAs were found for alcohol use risk and protective factors, drug behaviors, and drug use initiation (p 's < 0.05), with positive effects for those exposed to Project SPORT. Although the overall MANCOVA for alcohol initiation was not significant ($p = 0.08$), the univariate analysis for length of alcohol use was significant, with intervention adolescents using alcohol for a briefer period of time than control adolescents, $F(1, 449) = 4.51$, $p = 0.034$. In addition, stage of alcohol initiation approached significance, $F(1, 449) = 3.49$, $p = 0.062$, as did the number of alcohol problems, $F(1, 498) = 3.45$, $p = 0.064$, with intervention youth less advanced in their stage of alcohol initiation and experiencing less alcohol problems than control youth. Univariate tests also showed that Project SPORT provided more alcohol use protection than the minimal intervention control on parent/child communication, $F(1, 284) = 7.84$, $p = 0.005$, and positive parent/child relationship, $F(1, 284) = 3.72$, $p = 0.055$, but less protection on perceived susceptibility, $F(1, 284) = 4.96$, $p = 0.027$. Intervention participants had less alcohol risk than control participants, as measured on intentions to drink in the next 6 months, $F(1, 443) = 3.60$, $p = 0.058$, as well as alcohol attitudes which approached significance, $F(1, 443) = 3.34$, $p = 0.068$. Youth receiving SPORT also smoked cigarettes less frequently than control youth, $F(1, 509) = 8.72$, $p = 0.003$, were less advanced in their stage of initiation cigarette smoking than control youth, $F(1, 423) = 12.39$, $p = 0.000$, and similarly, were less advanced in their stage of initiation of marijuana use than control youth, although this last measure only approached significance, $F(1, 423) = 3.50$, $p = 0.062$.

We then tested the temporal effects of the intervention. Table 3 shows the estimated marginal means and standard errors for measures of alcohol use and initiation behaviors, alcohol risk and protective factors, and drug consumption and exercise habits at baseline, 3-months and 12-months follow-up by group. Significant overall MANOVA interaction effects were found for alcohol consumption and initiation, alcohol risk and protective factors, and drug initiation (p 's < 0.05), with positive effects

Table 2. Estimated Marginal Means of Consumption, Exercise, Risk, and Protective Measures by Group at 3-months and 1-year Postintervention^a

	3 month (n = 584)					1 Year (n = 514)				
	Consultation (n = 292)		Pamphlet (n = 292)		p-value	Consultation (n = 260)		Pamphlet (n = 254)		p-value
	Mean	SE	Mean	SE		Mean	SE	Mean	SE	
Alcohol behaviors	$F = 4.79$; $df = 4, 570$; $p = 0.001$					$F = 1.51$; $df = 4, 495$; $p = 0.19$				
30-Day frequency ^b	0.38	0.04	0.60	0.04	.000	0.60	0.06	0.64	0.06	0.48
30-Day quantity ^c	0.62	0.06	0.98	0.07	.000	0.85	0.08	0.92	0.08	0.55
30-Day heavy use ^d	0.11	0.03	0.25	0.03	.001	0.23	0.04	0.33	0.04	0.10
Alcohol problems ^e	1.68	0.11	1.73	0.11	.74	1.55	0.12	1.90	0.13	0.06
Alcohol initiation	$F = 9.93$; $df = 2, 507$; $p = 0.000$					$F = 2.53$; $df = 2, 448$; $p = 0.08$				
Length of alcohol use ^f	1.80	0.05	2.05	0.05	.001	2.00	0.07	2.21	0.06	0.03
Stage of alcohol initiation ^g	2.97	0.08	3.45	0.08	.000	3.33	0.11	3.61	0.11	0.06
Alcohol protective measures	$F = 2.07$; $df = 9, 316$; $p = 0.03$					$F = 2.86$; $df = 9, 276$; $p = 0.003$				
Expectancy beliefs–Cons	22.33	0.41	23.50	0.40	.04	23.16	0.45	23.05	0.45	0.86
Behavioral capability	3.94	0.20	4.42	0.12	.005	4.11	0.13	4.29	0.13	0.34
Resistance self-efficacy	5.00	0.18	5.16	0.17	.52	4.72	0.19	5.20	0.19	0.07
Self-control	19.16	0.25	19.72	0.25	.11	19.37	0.27	19.32	0.27	0.88
Value incompatibility	2.06	0.08	2.12	0.07	.60	2.13	0.08	2.21	0.08	0.50
Perceived susceptibility	3.53	0.11	3.83	0.10	.04	3.87	0.11	3.52	0.11	0.03
Parental monitoring	3.71	0.14	4.11	0.13	.04	4.27	0.16	4.08	0.16	0.43
Parent/child communication	6.10	0.20	6.70	0.20	.03	5.68	0.23	6.10	0.23	0.006
Positive parent/child relationship	6.30	0.18	6.45	0.17	.56	5.93	0.21	6.50	0.21	0.05
Alcohol risk factor measures	$F = 2.23$; $df = 6, 491$; $p = 0.03$					$F = 2.22$; $df = 6, 438$; $p = 0.04$				
Expectancy beliefs–pros	21.82	0.29	22.21	0.29	.35	23.04	0.33	22.93	0.34	0.81
Subjective norms	7.04	0.10	7.07	0.10	.78	7.35	0.11	7.11	0.11	0.13
Intentions = next 6 months	1.84	0.05	2.04	0.05	.009	1.96	0.06	2.14	0.06	0.05
Attitudes	6.26	0.12	6.71	0.12	.010	6.28	0.13	6.64	0.14	0.06
Perceived peer prevalence	4.80	0.08	4.86	0.08	.62	5.10	0.10	5.09	0.10	0.97
Influenceability	4.91	0.09	5.27	0.09	.009	5.20	0.11	5.25	0.11	0.76
Drug behaviors	$F = 3.69$; $df = 2, 579$; $p = 0.02$					$F = 4.37$; $df = 2, 508$; $p = 0.01$				
30-Day cigarette frequency ^h	0.38	0.05	0.54	0.05	.01	0.42	0.06	0.71	0.07	0.003
30-Day marijuana Frequency ^h	0.31	0.05	0.43	0.05	.08	0.28	0.05	0.37	0.05	0.26
Drug Initiation	$F = 1.96$; $df = 2, 486$; $p = 0.30$					$F = 6.21$; $df = 2, 422$; $p = 0.002$				
Stage of Cigarette initiation ^g	1.59	0.05	1.71	0.06	.19	1.51	0.07	1.88	0.07	0.000
Stage of marijuana initiation ^g	1.79	0.07	1.92	0.07	.21	1.72	0.08	1.94	0.08	0.06
Exercise measures	$F = 3.70$; $df = 2, 576$; $p = 0.02$					$F = 0.643$; $df = 2, 508$; $p = 0.52$				
Vigorous physical activity ⁱ	3.50	0.12	3.72	0.12	.19	4.04	0.14	3.90	0.14	0.46
Moderate physical activity ⁱ	4.10	0.14	4.62	0.14	.007	4.59	0.15	4.68	0.15	0.67

^aHigher mean score = higher risk, Covariates = Baseline measures.

^b1 = 1–2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, 6 = all 30 days.

^c1 = 1 drink, 2 = 2 drinks, 3 = 3 drinks, 4 = 4 drinks, 5 = 5 or more drinks.

^d1 = 1–2 times, 2 = 3–5 times, 3 = 6–9 times, 4 = 10 or more times.

^e0–13 (High score = high risk).

^f1 = I do not drink alcohol, 2 = Thirty (30) days or less, 3 = Less than 6 months, 4 = 6 months or more (High score = high risk).

^g1 = Never will, 2 = not planning to, 3 = not planning in 2–3 years, 4 = will probably try, 5 = plan to try, 6 = started using, 7 = have been using.

^h1 = 1–2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days 5 = 20–29 days, 6 = All 30 days.

ⁱ8 = 0 days, 7 = 1 day, 6 = 2 days, 5 = 3 days, 4 = 4 days, 3 = 5 days, 2 = 6 days, 1 = 7 days.

Table 3. Means of Consumption and Exercise Measures^a at Baseline, 3-months and 1-Year Postintervention by Group

Measure	Fitness consultation (n = 260)						Pamphlet (n = 254)						p-value ^a
	Baseline		3 month		1 year		Baseline		3 month		1 year		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Alcohol behaviors	(F = 1.97; df = 8, 489; p = 0.04)												
30-Day alcohol frequency ^b	0.50	0.07	0.37	0.06	0.55	0.07	0.58	0.07	0.59	0.06	0.66	0.07	0.31
30-Day alcohol quantity ^c	0.78	0.10	0.60	0.09	0.81	0.10	0.82	0.10	0.93	0.09	0.93	0.10	0.04
30-Day alcohol heavy use ^d	0.23	0.04	0.11	0.04	0.21	0.05	0.25	0.04	0.26	0.04	0.35	0.05	0.07
Alcohol problems ^e	1.42	0.16	1.48	0.17	1.46	0.17	1.75	0.16	1.80	0.18	2.01	0.18	0.39
Alcohol initiation	(F = 3.44; df = 4, 428; p = 0.009)												
Length of alcohol use ^f	1.82	0.08	1.79	0.09	1.96	0.09	1.77	0.84	1.99	0.09	2.13	0.09	0.03
Stage of Alcohol Initiation ^g	3.27	0.14	3.02	0.14	3.30	0.14	3.20	0.14	3.36	0.14	3.52	0.14	0.02
Alcohol protective factor measures	(F = 1.83; df = 18, 239; p = 0.02)												
Expectancy beliefs–Cons	22.62	0.52	22.92	0.56	23.36	0.55	22.45	0.52	23.68	0.56	23.17	0.55	0.32
Behavioral capability	4.26	0.17	3.99	0.15	4.10	0.16	4.39	0.17	4.42	0.16	4.33	0.16	0.42
Resistance self-efficacy	4.76	0.24	4.88	0.24	4.70	0.24	5.40	0.24	5.26	0.24	5.43	0.24	0.49
Self-control	19.54	0.31	19.05	0.32	19.41	0.32	19.77	0.31	19.84	0.32	19.46	0.32	0.22
Value incompatibility	1.96	0.10	2.17	0.10	2.19	0.09	2.10	0.10	2.09	0.10	2.27	0.09	0.35
Perceived susceptibility	3.73	0.12	3.60	0.13	4.00	0.13	3.56	0.12	3.81	0.13	3.60	0.13	0.003
Parental monitoring	3.49	0.17	3.60	0.17	4.23	0.20	3.83	0.17	4.14	0.17	4.20	0.20	0.10
Parent/child communication	5.92	0.31	5.66	0.31	5.41	0.31	6.36	0.31	6.74	0.31	6.81	0.31	0.03
Positive parent/child relationship	5.72	0.30	5.83	0.31	5.60	0.29	6.28	0.30	6.64	0.31	6.64	0.29	0.35
Alcohol risk factor measures	(F = 1.86; df = 12, 407; p = 0.03)												
Expectancy beliefs = Pros	21.66	0.42	21.54	0.46	22.74	0.44	22.48	0.44	22.40	0.47	23.13	0.45	0.59
Subjective norms	6.84	0.15	6.93	0.15	7.30	0.15	6.88	0.15	7.10	0.15	7.14	0.16	0.26
Intentions = Next 6 months	1.90	0.10	1.84	0.08	1.92	0.08	1.88	0.08	2.00	0.08	2.20	0.08	0.02
Attitudes	6.43	0.15	6.16	0.16	6.30	0.17	6.45	0.16	6.70	0.16	6.66	0.17	0.07
Perceived peer prevalence	4.61	0.13	4.66	0.13	4.93	0.13	5.01	0.13	4.86	0.14	5.20	0.13	0.45
Influenceability	4.20	0.13	4.85	0.14	5.14	0.14	5.10	0.14	5.24	0.14	5.30	0.14	0.19
Drug behaviors	(F = 1.77; df = 4, 505; p = 0.13)												
30-Day cigarette frequency ^h	0.38	0.08	0.30	0.08	0.36	0.09	0.56	0.08	0.62	0.08	0.77	0.09	0.04
30-Day marijuana frequency ^h	0.24	0.06	0.25	0.06	0.25	0.06	0.32	0.06	0.44	0.06	0.41	0.06	0.45
Drug Initiation	(F = 2.40; df = 4, 403; p = 0.04)												
Stage of cigarette initiation ^g	1.55	0.09	1.48	0.08	1.45	0.09	1.61	0.09	1.66	0.08	1.86	0.09	0.01
Stage of marijuana initiation ^g	1.73	0.10	1.66	0.10	1.71	0.11	1.68	0.10	1.80	0.10	1.89	0.11	0.13
Exercise measures	(F = 1.94; df = 4, 503; p = 0.10)												
Vigorous physical activity ⁱ	3.02	0.14	3.39	0.14	3.92	0.15	3.45	0.14	3.82	0.14	4.01	0.15	0.22
Moderate physical activity ^j	4.37	0.16	4.11	0.16	4.55	0.16	4.40	0.16	4.74	0.16	4.75	0.16	0.07

Note. Higher mean score = higher risk.

^ap-Value's = Time × Assignment.

^b1 = 1–2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, 6 = all 30 days.

^c1 = 1 Drink, 2 = 2 drinks, 3 = 3 drinks, 4 = 4 drinks, 5 = 5 or more drinks.

^d1 = 1–2 times, 2 = 3–5 times, 3 = 6–9 times, 4 = 10 or more times.

^e0–13 (high score = high risk).

^f1 = I do not drink alcohol, 2 = Thirty (30) days or less, 3 = Less than 6 months, 4 = 6 months or more (High score = high risk).

^g1 = Never will, 2 = not planning to, 3 = not planning in 2–3 years, 4 = will probably try, 5 = plan to try, 6 = started using, 7 = have been using.

^h1 = 1–2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, 6 = All 30 days.

ⁱ8 = 0 days, 7 = 1 day, 6 = 2 days, 5 = 3 days, 4 = 4 days, 3 = 5 days, 2 = 6 days, 1 = 7 days.

over time for those exposed to Project SPORT. Univariate ANOVAs were significant for 30-day alcohol quantity, $F(2, 1.94) = 3.32, p = 0.038$, length of alcohol use, $F(2, 1.84) = 3.63, p = 0.030$, and stage of alcohol initiation, $F(2, 1.87) = 4.00, p = 0.021$, with trends indicating intervention youth measures decreasing at

3-months and increasing at 12-months and control youth measures increasing at both 3 and 12-months. Somewhat similar trends were found for the alcohol use protective factor of parent/child communication, $F(2, 1.96) = 3.42, p = 0.037$, as well as the alcohol risk factor of intentions to drink, $F(2, 1.94) = 3.65,$

$p = 0.028$. Lastly, univariate analyses showed significant interactions on 30-day cigarette frequency, $F(2, 1.81) = 3.35$, $p = 0.040$, and cigarette stage of initiation, $F(2, 1.92) = 4.55$, $p = 0.012$, with intervention youth showing less use at 3-months and somewhat of an increase at 12-months, whereas control youth showing increases at 3-months and greater increases at 12-months.

Lastly, we tested the secondary objective of examining interaction effects between prior marijuana and/or cigarette use, and intervention exposure on measured outcomes. Table 4 shows the estimated marginal means and standard errors by preintervention drug use (marijuana and/or cigarettes) and by treatment group at 3- and 12-month follow-up. Overall factorial MANCOVA interaction effects at 3-months postintervention were significant for alcohol consumption behaviors, drug use behaviors, and drug initiation (p 's = 0.000), with more positive effects for drug using adolescents who received Project SPORT.

Univariate analyses showed that at 3-month follow-up, drug users who received the intervention had significantly less 30-day alcohol frequency, $F(1, 571) = 8.62$, $p = 0.003$, 30-day quantity, $F(1, 571) = 8.00$, $p = 0.005$, and 30-day heavy use, $F(1, 571) = 21.07$, $p = 0.000$, than drug users receiving the minimal intervention control. Likewise, drug users exposed to Project SPORT had less 30-day cigarette frequency of consumption, $F(1, 578) = 20.61$, $p = 0.000$, and 30-day marijuana frequency, $F(1, 578) = 13.28$, $p = 0.000$.

At 12-months follow-up, significant overall factorial MANCOVA interactions were found for drug use behaviors, drug initiation, and exercise habits (p 's = 0.05), with more positive effects for drug using adolescents receiving Project SPORT. The univariate analysis for 30-day heavy alcohol use was significant, with drug using youth exposed to the intervention drinking heavily less frequently than drug using control youth, $F(1, 496) = 3.61$, $p = 0.05$. Drug users receiving Project SPORT also used cigarettes less frequently in the past 30-days, $F(1, 507) = 9.09$, $p = 0.003$, and marijuana less frequently in the past month, $F(1, 507) = 8.38$, $p = 0.001$, than drug users receiving the minimal intervention control. Similar findings were seen for cigarette, $F(1, 421) = 13.33$, $p = 0.000$, and marijuana initiation, $F(1, 421) = 17.28$, $p = 0.001$, with drug using adolescents given the intervention having less advanced drug use initiation than drug using adolescents given the control. Lastly, adolescents using drugs and exposed to Project SPORT

engaged in more frequent vigorous physical activity, $F(1, 507) = 5.98$, $p = 0.01$ and moderate physical activity, $F(1, 507) = 5.75$, $p = 0.01$, than those adolescents exposed to the minimal intervention control.

DISCUSSION

These findings indicate that a brief, 12-min one-on-one consultation integrating alcohol avoidance messages within those promoting fitness and other positive health behaviors, along with a mailed flyer recapping key messages, holds promise for reducing alcohol consumption and cigarette use, while increasing exercise habits among high school adolescents in the short-term. Longer term, it appears that this type of brief, tailored intervention resulted in positive effects on the initiation of alcohol use, a number of critical alcohol use risk and protective factors, and the frequency of cigarette smoking and cigarette smoking initiation. These results support a recent previous study suggesting that a brief sport-based screen and consultation tailored to adolescent's health habits may potentially reduce alcohol use, while increasing exercise frequency (Werch *et al.*, 2003a,b). Currently, few studies of brief interventions have reported affecting multiple, comorbid health damaging and health promoting behaviors such as Project SPORT. Given the challenges with implementing typical prevention programs in today's schools which are consumed with standards testing, brief interventions like Project SPORT may provide a more realistic alternative to reaching adolescents with critical prevention interventions than standard full-semester length curricula.

Preventive intervention effects as extensive as these, involving multiple health behaviors and a range of important risk and protective factors, are relatively uncommon in the literature, especially among brief interventions. Given the brevity of Project SPORT, these findings are particularly noteworthy and indicate that these types of personally delivered and integrated health communications are cost-effective. We estimated the total cost of implementing Project SPORT at \$9.25 per participant, including \$3.00 for the cost of materials and postage, and \$6.25 for the cost of consultation time (four consults/hour @ \$25/h). By comparison, the control print materials and postage were estimated to cost around \$5.00/participant if mailed. Given the relatively low cost of implementing Project SPORT, and its transportability to school, clinic, and

Table 4. Estimated Marginal Means by Drug Use (Yes/No) and Group at 3-Months and 1-Year Postintervention

Measure	3 Month						1 Year						Interaction (<i>p</i> value)				
	Yes (<i>n</i> = 118)			No (<i>n</i> = 466)			Yes (<i>n</i> = 104)			No (<i>n</i> = 410)							
	Mean	SE	Interaction (<i>p</i> value)	Mean	SE	Interaction (<i>p</i> value)	Mean	SE	Interaction (<i>p</i> value)	Mean	SE	Interaction (<i>p</i> value)					
Alcohol behaviors																	
30-Day alcohol frequency	0.23	0.11	$F = 6.20; df = 4, 568; p = .000$	0.81	0.10	0.41	0.05	0.54	0.05	0.63	0.15	0.85	0.15	$F = 1.19; df = 4, 493; p = .31$	0.58	0.07	0.35
30-Day alcohol quantity	0.49	0.16		1.36	0.15	0.65	0.07	0.87	0.08	0.80	0.20	1.10	0.20	0.87	0.09	0.88	0.10
30-Day alcohol heavy use	0.04	0.07		0.47	0.07	0.14	0.03	0.19	0.03	0.22	0.10	0.54	0.10	0.24	0.05	0.28	0.05
Alcohol problems	2.13	0.28		1.92	0.26	1.58	0.13	1.69	0.13	1.85	0.32	2.66	0.31	1.48	0.15	1.70	0.15
Alcohol initiation																	
Length of alcohol use	1.98	0.14	$F = 0.08; df = 2, 505; p = .92$	2.18	0.12	1.76	0.06	2.02	0.06	2.24	0.17	2.39	0.16	1.96	0.08	2.16	0.08
Stage of alcohol initiation	3.20	0.22		3.71	0.19	2.93	0.09	3.39	0.09	3.83	0.27	4.08	0.25	3.23	0.12	3.48	0.12
Drug behaviors																	
30-Day cigarette frequency	0.05	0.13	$F = 13.66; df = 2, 577; p = 0.000$	0.79	0.13	0.45	0.05	0.47	0.06	0.43	0.19	1.30	0.19	0.41	0.08	0.56	0.08
30-Day marijuana frequency	0.03	0.14		0.67	0.14	0.37	0.06	0.37	0.06	0.16	0.15	0.44	0.16	0.39	0.07	0.35	0.07
Drug initiation																	
Stage of cigarette initiation	1.60	0.22	$F = 8.64; df = 2, 430; p = 0.000$	2.92	0.24	1.50	0.08	1.71	0.08	1.61	0.18	2.00	0.19	1.59	0.06	1.65	0.07
Stage of marijuana initiation	1.82	0.25		3.11	0.27	1.70	0.09	1.76	0.09	1.67	0.22	2.18	0.24	1.80	0.07	1.87	0.08
Exercise measures																	
Vigorous physical activity	3.01	0.29	$F = 0.75; df = 2, 574; p = 0.47$	3.68	0.26	3.60	0.14	3.73	0.14	3.56	0.32	4.36	0.30	4.16	0.15	3.78	0.16
Moderate physical activity	4.02	0.34		4.81	0.30	4.09	0.16	4.57	0.16	3.96	0.35	5.09	0.33	4.74	0.17	4.58	0.17

Note. Higher mean score = higher risk. Drug Use = Yes to cigarette or marijuana at baseline; *p* value's = Drug use × Group interaction; Covariates = Baseline measures.

community settings, it has the potential to reach very large numbers of adolescents, both as a stand-alone program or as an add-on component to other existing prevention and health promotion programs.

A number of effects approached significance at 12-month follow-up, including alcohol problems and marijuana initiation (p 's = 0.06), whereas others, particularly the initiation and frequency of cigarette smoking, seemed to strengthen over time. These results suggest a slightly longer follow-up period may uncover additional effects as the intervention and control groups diverge over time on variables that occur less frequently (e.g., alcohol problems).

Although a mediation analysis was not conducted for this study, risk and protective factors that appear to have been associated with 3-month alcohol initiation and use included three risk factors (intentions to drink, alcohol attitudes, and influenceability) and five protective factors (negative expectancy beliefs, behavioral capability, perceived susceptibility, parental monitoring, and parent/child communication). Meanwhile, at 12-months, only one risk factor (intentions) and three protective factors (perceived susceptibility, parent/child communication, and positive parent/child relationship) differed significantly between treatment groups, perhaps explaining the lessened impact on alcohol consumption measures at 12-month follow-up, and the need to reinforce these mediator effects to sustain positive gains on alcohol consumption long-term.

The findings also indicate that Project SPORT effects appear to be moderated by pre-intervention adolescent drug use at both 3- and 12-months post-intervention. Specifically, short-term effects were found favoring substance users receiving Project SPORT on alcohol consumption, drug use, and drug initiation, whereas long-term effects favored substance users receiving Project SPORT on drug consumption and improved physical activity. Particularly noteworthy were the strong and sustained effects on reducing marijuana use, and on increasing both moderate and vigorous physical activity long-term among drug using adolescents. These effects were not seen in the analysis with the entire sample, suggesting that Project SPORT may have considerable potential both short and long-term as a selective intervention for drug using adolescents. It may be that drug users have less perceived risk of substance use and therefore were more influenced by positive messages linking alcohol use to benefits derived from being physically active. Further research is also needed to explain why Project SPORT's drug use effects are

largely maintained, and exercise patterns improve over time among drug using adolescents.

The major drawback of Project SPORT appears to be a weakening of alcohol consumption effects between 3-month and 12-month follow-ups. Similarly, positive exercise effects appeared to have decayed over time. The lengthier follow-up period took place after the summer break, suggesting that high school adolescents may experience increased risk for some health behaviors, including alcohol use and exercise habits during summers. Further research is needed to validate this possibility, and if real, booster interventions should be tested for implementation over the summer months to maintain intervention effects. Others have called for further research examining boosters or re-interventions to extend the effects of brief interventions (Connors & Walitzer, 2001; Stanton & Burnes, 2003). Brief intervention strategies other than tailored consultations, such as those targeting parents and peers, should also be examined for their potential to enhance and extend initial effects of brief individual contacts.

A recent systematic review of brief interventions with substance using adolescents (Tait & Hulse, 2003) found that they were effective in reducing alcohol consumption of young people, but had a very small effect in reducing adolescent cigarette smoking. Unlike previous brief interventions that have addressed substance use directly, Project SPORT employed an integrative health behavior model. Such an approach may be particularly useful, even when not addressing a substance directly, if it succeeds in linking a salient and aspired self image (i.e., youth fitness) with a behavior thought to be counterproductive (e.g., cigarette smoking) to reaching the desired image. By framing messages linking socially desirable images of active, fit youth with counterproductive behavior (i.e., alcohol use), it is possible that youth connect these positive images with other behaviors they see as more contradictory to the desired image, namely cigarette smoking.

This study's results must be tempered, however, given the sample was limited to a single suburban high school setting. Future studies should include adolescents from high schools in urban and rural, as well as additional suburban settings. Similarly, studies examining Project SPORT implemented in non-school settings would add to our understanding of the feasibility and efficacy of this and other brief interventions for young people. Another shortcoming of this study was the lack of measures of factors mediating cigarette and marijuana use, as well

as exercise habits, limiting our understanding of the possible mechanisms for change on these behaviors. Additional trials are needed to further examine the mechanisms and processes for change, particularly for cigarette smoking and marijuana use, resulting from Project SPORT. Finally, this study was limited to 3- and 12-month follow-ups, however, as suggested in our earlier discussion, longer-term follow-up might provide additional information regarding the delayed effects of the brief intervention on certain health-related behaviors, such as alcohol problems and other illicit drug use.

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