

Literature Reviews:

Effectiveness of Environmental Strategies on the Prevention of Prescription Drug, Marijuana, Alcohol and Tobacco Use

Prepared by:

Wake Forest School of Medicine

Kimberly Wagoner, DrPH, MPH

Melinda Pankratz, PhD

Mark Wolfson, PhD

East Carolina University

Kathleen Egan, PhD

Global Evaluation Solutions

William Geary, PhD

Andrea de la Flor, MA

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INTRODUCTION

Environmentally focused prevention strategies shift the focus on solving substance use-related problems from the individual to the settings in which the substance is used or obtained. These approaches have the capacity to change attitudes, behaviors, community norms, and consequences.

In an effort to assist the *North Carolina Department of Health and Human Services, Division of Mental Health, Developmental Disabilities and Substance Abuse Services* in identifying effective and/or promising environmental strategies to support in future initiatives, we conducted literature reviews to assess the evidence for environmental strategy implementation for four substances: prescription drugs, marijuana, alcohol, and tobacco. Findings from literature reviews can be extremely valuable for informing practice because they assess the body of research on a specific topic instead of focusing the outcomes of one or two single studies. We hope that the findings presented in this document provide valuable and timely information to inform future prevention efforts across the state of North Carolina.

METHODS

We conducted separate literature searches for each substance using PubMed. The focus of the literature reviews was limited to primary prevention outcomes; therefore, harm reduction strategies were not included in these reviews. Due to the existing evidence for the effectiveness of environmental strategies on alcohol and tobacco use, the searches used existing documents as the foundation for the review and conducted searches of peer-reviewed articles from 2008 to present to update the existing evidence (please see the sections of *Alcohol* and *Tobacco* for more information on the search details). Because no such documentation existed for prescription drugs or illicit drugs, a more extensive search was conducted of peer-reviewed articles from 2000 to present. Search terms were identified for each literature review and exclusion criteria were applied to identify the articles for the final list of articles. Specifically, articles were included if they 1) described the strategy used; 2) identified output measures to evaluate

the strategy; 3) evaluated the effectiveness of the strategy at reducing substance use; and 4) used a strategy that could be implemented or supported by prevention providers in North Carolina. More detail about each literature review is included in the respective section.

Each article included was reviewed to abstract the following information:

- Title, authors, date published
- Type of literature reviewed
- Brief description
- Study design
- Sample size
- Strategy used (Availability; Price; Marketing/Advertising, Mass Communication Campaigns; Other)
- Population studied
- Standardization of Intervention
- Dose measurements
- Use of reliable and valid instruments
- Setting
- Replication study
- Outcomes and findings

After the reviews were completed, the team completed a collective review of the evidence for each substance, using the abstracted data (listed above). We adapted the North Carolina Practice Improvement Collaborative's (PIC) *Application for an Evidence-Based Practice Review* to develop a matrix of *Levels of Evidence* (see Table 1). Using the operational criteria definitions listed on page 3, the team determined if the strategy was **1) evidenced-based; 2) promising; or an 3) insufficient / non evidence-based practice.**

DETERMINING LEVEL OF EFFECTIVENESS

Operational Criteria Definitions

Transparency: Both the criteria (e.g., how to find evidence, what qualifies as evidence, how to judge quality of evidence) and the process (e.g., who reviews the evidence) of review should be open for observation by public description. For example, results should be published in peer reviewed journal.

Research: Accumulated scientific evidence based on randomized controlled trials, quasi-experimental studies, and in some cases less rigorously controlled studies. Research should be published in appropriate peer reviewed journals and available for review.

Standardization: An intervention must be standardized so that it can be reliably replicated elsewhere by others. Standardization typically involves a description that clearly defines the essential elements of the practice, as evidenced in a manual or toolkit.

Replication: Replication of research findings means that more than one study and more than one group of researchers have found similar positive effects resulting from the practice.

Fidelity Scale: A fidelity scale is used to verify that an intervention is being implemented in a manner consistent with the treatment model – or the research that produced the practice. The scale has been shown to be reliable and valid.

Meaningful Outcomes: Effective interventions must show that they can help consumers to achieve important goals or outcomes related to impairments and/or risk factors.

Table 1. Matrix of Level of Effectiveness

Level	Transparency	Research	Standardization	Replication	Fidelity Scale	Meaningful Outcomes
Evidence-based Strategies	Yes	≥3 studies in peer reviewed journals. Minimum of one study is based on a randomized control trial; OR Listed as a recommended strategy in CDC Community Guide.	Yes	Yes	Yes	Yes
	Yes	≥3 studies in peer reviewed journals. Studies are at least quasi-experimental; OR Listed as a recommended strategy in CDC Community Guide.	Yes	Yes	In development or no	Yes
	Yes	≥3 studies in peer reviewed journals. Less rigorously controlled studies considered*.	Yes	Yes	No	Yes
Promising Strategies	Yes	1 or 2 studies in peer reviewed journals. Some rigor in design*.	Unknown	Unknown	Unknown	Yes
Insufficient Evidence/ Non-Evidence Based Strategies	Yes	No rigor in design.	Unknown	Unknown	Unknown	Yes
	No	No	No	No	No	No

*Evidence-based or promising strategies must have a comparison group or some other level of control in the study design.

PRESCRIPTION DRUGS

Brief Introduction

Nonmedical prescription drug use (NMPDU), the use without a prescription or for the experience and feeling the drugs cause, is the second most common illicit drug use behavior in the United States (Center for Behavioral Health Statistics and Quality, 2015). In 2013, 7.64% of individuals 12 years of age and older reported past 12-month NMPDU (SAMHSA, 2014). Deaths from NMPDU have exceeded the number of deaths due to illicit drugs (NIDA, 2015) and motor vehicles (Jones, 2015). Other adverse consequences of NMPDU include emergency department visits (SAMHSA, 2013; Warner, Hedegaard, & Chen, 2014), dependence and addiction (Compton et al., 2006), infectious diseases (Bruneau, Roy, Arruda, Zang, & Jutras-Aswad, 2012; Conrad et al., 2015; Zibbell et al., 2015), and community consequences (Berning, Compton, & Wochinger, 2015; Goodnough, 2010). The total economic burden of NMPDU and associated consequences is estimated to exceed \$78.5 billion (Florence, Zhou, Luo, & Xu, 2016).

There is a clear need to identify and implement evidence-based strategies to address NMPDU and associated consequences (Levl, Segal, & Miller, 2013; ONDCP, 2011; Ulan, Davison, & Perron, 2013), and there have been several calls to action to do so. One of the first calls to action, entitled “*Epidemic: Responding to America’s Prescription Drug Abuse Crisis*,” was made in 2011 by the Office of National Drug Control Policy (ONDCP, 2011). This plan called for a comprehensive approach that included education of the general public and medical professionals, appropriate prescribing and use of prescription drug monitoring programs and encouraging proper storage and disposal of unused medications. The effectiveness of these prevention strategies needs to be assessed to ensure the use of the most promising strategies to prevent and reduce NMPDU by community organizations.

Methods

Data Sources and Searches

We followed a predefined protocol to identify and select peer-reviewed manuscripts to include in this literature review. We searched the online database PubMed for peer-reviewed articles that examined environmental strategies to address nonmedical prescription drug use. Our search included articles that were published between January 1, 2000 and August 31, 2018. Individual searches were conducted for each intervention (see Table P1). All searches, with the exception of searches pertaining to medication disposal, included the following string: (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR adhd OR benzodiazepine). “Medication*” was added to the search string for medication disposal after we discovered that manuscripts related to disposal were not being captured.

Table P1.

Intervention	Search Strategy	Articles Identified (#)	Articles Selected (#)
Prescribing & Dispensing Guidelines	<p><i>Prescribing:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND (prescribing guideline*)</p> <p><i>Dispensing:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND dispensing AND pharma*</p>	133 250	7
Prescription Drug Monitoring Programs (PDMP)	(Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND (pdmp* OR "prescription drug monitoring program*" OR "monitoring program*")	312	40
Pill Mill Policies	(Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND ("pain clinic law" OR "pain clinic ordinance" OR "pain clinic policy" OR "pill mill law" OR "pill mill policy" OR "pill mill ordinance")	134	8
Medicaid Lock-In	(Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND ("lock-in" OR "lock in")	12	6
Academic Detailing	(Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine*) AND ("academic detailing" OR "provider detailing" OR detailing)	133	3
Medication Disposal	<p><i>Take-Back Events:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine* OR medication*) AND ("take-back event*" OR "take-back" OR "take back event" OR "take back")</p>	49	14

	<p><i>Drop-Boxes:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine* OR medication*) AND (drop-box* OR dropbox OR "drop box")</p> <p><i>Deactivation Devices:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine* OR medication*) AND ("deactivation device" OR "deactivation pouch" OR Deterra OR "Dispose RX")</p> <p><i>Local ordinances:</i> (Prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine* OR medication*) AND ((dispos* AND law) OR (dispos* AND ordinance) OR (dispos* AND policy))</p>	6	
		5	
		156	
Communication Campaigns	(prescription drug* OR opioid* OR opiate* OR tranquilizer* OR sedative* OR stimulant* OR benzodiazepine) AND campaign*	293	3

Study Selection

All titles and abstracts were independently screened by 1 of 2 investigators (KE or MM). Articles that were considered relevant advanced to full-text review. In order to be eligible, an intervention had to be implemented and the intervention must have been implemented in the United States. If the search identified a review (systematic, scoping, etc.) the individual manuscripts within the manuscript were reviewed separately and the systematic review was not included as a separate manuscript. Commentary and policy statements were not included. Table P1 includes the number of relevant manuscripts for each intervention.

Data Extraction and Quality Assessment

Two researchers (KE or MM) independently read selected articles. Using a standardized article assessment form, they captured data on study design (including type of study, whether or not the study was a replication study, use of reliable and valid instruments, and measurement of intervention dose), standardization of the intervention, population studied, setting, and sample size. A brief description and overview of findings were documented. Additionally, the investigators coded the type of intervention (e.g., medication disposal, academic detailing, etc.) and environmental strategy (e.g., availability/access, price, promotion, etc.).

Four investigators (MW, KW, KE, and MM) reviewed and discussed all the articles that underwent full-text review and data extraction in order to assess the evidence for each intervention using the operational definitions and *Matrix of Level of Effectiveness*, described in this report's Introduction. The interventions were identified as: **evidence-based, promising, or insufficient evidence / not evidence-based**. Results are presented below.

Results

Prescribing & Dispensing Guidelines

Evidence Level	Promising <i>Rationale:</i> All seven studies found varying degrees in the reduction of opioid prescribing following the implementation of prescribing guidelines. The studies varied in the guidelines, type of clinics, and patient populations. The investigators of several studies discussed possible limitations of contamination but their study designs (interrupted time series) suggested that the guidelines impacted prescribing patterns. It is unknown if changes in prescribing impact nonmedical opioid use or mortality.
Transparency	8 peer-reviewed articles
Research	No experimental and 4 quasi-experimental studies
Standardization	All were standardized
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Primary outcomes were focused on the quantity and frequency of opioid prescriptions following implementation of opioid prescribing guidelines that aimed to decrease high-risk prescribing.
References 1. Al Achkar, M., Grannis, S., Revere, D., MacKie, P., Howard, M., & Gupta, S. (2018). The effects of state rules on opioid prescribing in Indiana. <i>BMC health services research</i> , 18(1), 29.	

2. Chen, J. H., Hom, J., Richman, I., Asch, S. M., Podchiyska, T., & Johansen, N. A. (2016). Effect of opioid prescribing guidelines in primary care. *Medicine*, 95(35), e4760. <https://doi.org/10.1097/MD.0000000000004760>
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Prescription Drug Monitoring Programs (PDMPs)

Evidence Level	Promising <i>Rationale:</i> There were 37 original studies that examined the impact of PDMPs. The rigor and focal outcomes of the studies varied as well as the findings. Most of the studies reported findings that support PDMPs as a promising strategy. There were several studies that reported null or negative findings. The studies that reported negative findings examined PDMPs that had been implemented prior to- or in the early stages of the opioid epidemic and the most recent outcome data was around 2011. While these are still valid studies, it is fair to assume that the climate around PDMP use has changed. In fact, several of the studies examined the robustness of the PDMPs and accompanying policy. Majority of these studies found that robust PDMPs have a greater impact. There was variability in controlling for other ongoing interventions such as pain clinic laws or opioid prescribing guidelines. There were mixed findings pertaining to heroin use or associated consequences.
Transparency	40 peer-reviewed articles
Research	Due to the nature of the intervention, random assignment was not a possibility. There were 26 quasi-experimental studies and 3 systematic reviews.
Standardization	Each individual PDMP has some level of standardization. However, there is variability across states and over time in the elements and requirements of the PDMP systems. The information about each PDMP should be available at the state level and various organizations that have been cataloging

	PDMP characteristics.
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	There were a wide variety of outcomes that were examined by the identified outcomes, including, but not limited to, -- number of deaths due to opioid overdoses, ED visits, nonmedical use of opioids or benzodiazepines, and opioid prescribing behaviors. Potential unintentional consequences such as heroin use were also assessed.
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Pill Mill Laws

Evidence Level	<p>Promising</p> <p><i>Rationale:</i> Several studies found that the implementation of pill mill laws was positively associated with behavioral and mortality outcomes. However, these studies were primarily only conducted in two states - Texas and Florida – reducing their generalizability. Additionally, the studies could not disentangle the potential influence of prescription drug monitoring programs from the impact of pill mill laws.</p>
Transparency	8 peer-reviewed articles
Research	No experimental and 7 quasi-experimental studies
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes were focused on closure of pain clinics, controlled medication (primarily opioids) prescriptions and morphine equivalent doses per transaction, diversion, and opioid overdose deaths.
<p>References</p> <ol style="list-style-type: none"> 1. Chang, H. Y., Murimi, I., Faul, M., Rutkow, L., & Alexander, G. C. (2018). Impact of Florida's prescription drug monitoring program and pill mill law on high-risk patients: A comparative interrupted time series analysis. <i>Pharmacoepidemiology and drug safety</i>, 27(4), 422-429. 2. Chang, H. Y., Lyapustina, T., Rutkow, L., Daubresse, M., Richey, M., Faul, M., ... & Alexander, G. C. (2016). Impact of prescription drug monitoring programs 	

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Medicaid Lock-in

Evidence Level	Promising <i>Rationale:</i> Although several peer-reviewed studies found reductions in the number of pharmacies and doctors visited and number of controlled medication prescriptions, there were inconsistencies regarding the number of morphine milligram equivalents prescribed and an increase in out-of-pocket payments which may indicate that patients are circumventing the policy to obtain opioid prescriptions.
Transparency	6 peer-reviewed articles
Research	No experimental and 5 quasi-experimental study
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes were focused on the number of pharmacies and doctors visited, controlled medications and morphine milligram equivalents prescribed, and payment source.
References <ol style="list-style-type: none">1. Dreyer, T. R., Michalski, T., & Williams, B. C. (2015). Patient outcomes in a Medicaid managed care lock-in program. <i>Journal of managed care & specialty pharmacy</i>, 21(11), 1006-1012.2. Naumann, R. B., Marshall, S. W., Lund, J. L., Gottfredson, N. C., Ringwalt, C. L., & Skinner, A. C. (2018). Evaluating short-and long-term impacts of a Medicaid “lock-in” program on opioid and benzodiazepine prescriptions dispensed to beneficiaries. <i>Drug and alcohol dependence</i>, 182, 112-119.	

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Academic Detailing

Evidence Level	Evidence-based <i>Rationale:</i> Three research studies with rigorous designs found that academic detailing on existing prescribing guidelines and prescription drug monitoring programs positively impacted opioid prescribing behaviors and reductions in opioid related mortality.
Transparency	3 peer-reviewed articles
Research	1 experimental and 2 quasi-experimental studies
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes were focused on use of PDMP, adhering to prescribing guidelines, reduction in opioid prescriptions and morphine milligram equivalents, and reductions in overdose.
References <ol style="list-style-type: none">1. Cochella, S., & Bateman, K. (2011). Provider detailing: an intervention to decrease prescription opioid deaths in Utah. <i>Pain Medicine (Malden, Mass.)</i>, 12 Suppl 2, S73-76. https://doi.org/10.1111/j.1526-4637.2011.01125.x2. Kattan, J. A., Tuazon, E., Paone, D., Dowell, D., Vo, L., Starrels, J. L., ... Kunins, H. V. (2016). Public Health Detailing-A Successful Strategy to Promote Judicious Opioid Analgesic Prescribing. <i>American Journal of Public Health</i>, 106(8), 1430–1438. https://doi.org/10.2105/AJPH.2016.3032743. Liebschutz, J. M., Xuan, Z., Shanahan, C. W., LaRochelle, M., Keosaian, J., Beers, D., ... Lasser, K. E. (2017). Improving Adherence to Long-term Opioid Therapy Guidelines to Reduce Opioid Misuse in Primary Care: A Cluster-	

Randomized Clinical Trial. JAMA Internal Medicine, 177(9), 1265–1272.
<https://doi.org/10.1001/jamainternmed.2017.2468>

Medication Disposal

<p>Evidence Level</p>	<p>Promising</p> <p><i>Rationale:</i> While multiple research studies suggest that individuals are disposing of unused prescription drugs via organized disposal interventions (i.e., take-back events and drop-boxes), the evidence on how these interventions impact nonmedical prescription drug use and associated consequences is unclear. Additionally, one study suggested that disposed controlled medications account for less than 1% of medications that are dispensed. This study was conducted prior to regulations pertaining to limits on prescriptions so the findings may change if this study was replicated. Additional research with rigorous study designs that examine the impact of medication disposal programs on nonmedical prescription drug use and associated consequences is needed.</p>
<p>Transparency</p>	<p>14 peer-reviewed articles</p>
<p>Research</p>	<p>No experimental or 1 quasi-experimental studies</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Outcomes were focused on self-reported disposal behavior and quantity and type of medications disposed.</p>
<p>References</p> <ol style="list-style-type: none"> 1. Egan, K. L., Gregory, E., Sparks, M., & Wolfson, M. (2017). From dispensed to disposed: evaluating the effectiveness of disposal programs through a comparison with prescription drug monitoring program data. <i>The American journal of drug and alcohol abuse</i>, 43(1), 69-77. 	

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Administration's Medication Take-Back Events. *American journal of public health*, 105(1), e65-e71.

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14. Yanovitzky, I. (2017). A Multiyear Assessment of Public Response to a Statewide Drug Take-Back and Disposal Campaign, 2010 to 2012. *Health Education & Behavior*, 44(4), 590-597. (The following manuscript presented preliminary findings from the same study: Yanovitzky, I. (2016). The American Medicine Chest Challenge: Evaluation of a drug take-back and disposal campaign. *Journal of studies on alcohol and drugs*, 77(4), 549-555.).

Communication campaigns

<p>Evidence Level</p>	<p>Insufficient evidence</p> <p><i>Rationale:</i> While the three peer-reviewed research studies had promising outcomes, none of the outcomes addressed changes in nonmedical use of prescription drugs or associated consequences with use. Additional research is needed to assess how communication campaigns impact nonmedical prescription drug abuse and associated outcomes. Additionally, future research should control for other ongoing interventions such as prescription drug monitoring programs.</p>
<p>Transparency</p>	<p>3 peer-reviewed articles</p>
<p>Research</p>	<p>No experimental and 2 quasi-experimental studies</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Outcomes were focused on awareness, perception of harm, communication with others about nonmedical prescription drug use, storage and disposal of unused medications, and intentions to engage in nonmedical prescription drug use.</p>
<p>References</p> <ol style="list-style-type: none"> 1. Evans, W., Andrade, E., Goldmeer, S., Smith, M., Snider, J., & Girardo, G. (2017). The Living the Example social media substance use prevention program: A pilot evaluation. <i>JMIR mental health</i>, 4(2). 2. Johnson, E. M., Porucznik, C. A., Anderson, J. W., & Rolfs, R. T. (2011). State-level strategies for reducing prescription drug overdose deaths: Utah's prescription safety program. <i>Pain Medicine</i>, 12(suppl_2), S66-S72. 	

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MARIJUANA

Brief Introduction

As more and more jurisdictions move towards some form of locally legitimate availability for marijuana, science and public health are struggling to keep up. Currently nine states have “legalized” marijuana for recreational use and another 23 states have some form of “medical” marijuana availability. Marijuana stands apart as the only illicit drug that has increased in use since 2007 with almost 20 million users in the United States (about 7.5% of the total population aged 12 and over). The Monitoring the Future (MTF) survey estimates that marijuana is one of the most popular drugs used by high school seniors, eclipsing tobacco and alcohol. However, the MTF also notes that marijuana use has not increased significantly during the current legalization phase. Having said that, it is important to note that some states where marijuana is legal are not included in the MTF survey.

Research on prevention of marijuana use can be complex due to several factors including the mixed legal status of marijuana across the country and the instability of its status as an illicit drug. In addition, the drug’s status as a Schedule I substance precluded almost all legitimate, U.S.-based research on its effects, its impact on communities, and subsequently, strategies for prevention. Much of the research on this topic includes assertions that, in many ways, marijuana is similar to alcohol and tobacco in terms of its relationship to community distribution mechanisms. This approach advocates for utilizing proven strategies for tobacco and alcohol to control a legitimized marijuana marketplace. At this stage controlled, experimental research on the efficacy of environmental strategies for marijuana use is sparse. This research indicates that specific, targeted, appropriately messaged communication campaigns can be effective at reducing use, as well as school policies that include strong enforcement and in-school punishments and counseling for use.

Methods

Data Sources and Searches

We followed a predefined protocol to identify and select peer-reviewed manuscripts to include in this literature review. We searched EBSCO for peer-reviewed articles that examined environmental strategies to address marijuana use. Our search included articles that were published between January 1, 2008 and August 31, 2018. Individual searches were conducted for each intervention (see Table M1). Searches were limited to peer-reviewed, scholarly articles from the United States.

Table M1.

Intervention	Search Strategy	Articles Identified (#)	Articles Selected (#)
Communication Campaigns	("Marijuana") AND ("Media" OR "Communication Campaign" OR "Information Campaign" OR "Above The Influence") AND ("Youth") NOT ("Presidential") NOT ("Obama") NOT ("Election")	37	3
School Policies	("Marijuana") AND ("School Policies") AND ("Adolescence" OR "12 to 17") AND ("Prevention")	82	1

Study Selection

All titles and abstracts were independently screened and articles that were considered relevant advanced to full-text review. This included those articles directly pertaining to environmental strategies relating to marijuana in the United States. Table M1 includes the number of relevant manuscripts for each intervention.

Data Extraction and Quality Assessment

One researcher (WG) independently read selected articles. Using a standardized article assessment form, WG captured data on study design (including type of study, whether or not the study was a replication study, use of reliable and valid instruments, and measurement of intervention dose), standardization of the intervention, population studied, setting, and sample size. A brief description and overview of findings were documented. Additionally, the investigators coded the type of intervention and environmental strategy.

Three investigators (WG, MW, and KW) reviewed and discussed all the articles that underwent full-text review and data extraction in order to assess the evidence for each intervention using the operational definitions and *Matrix of Level of Effectiveness*, described in this report's Introduction. The interventions were identified as: **evidence-based, promising, or insufficient evidence / not evidence-based**. Results are presented below.

Results

Communication Campaigns

Evidence Level	Evidence-based <i>Rationale:</i> While all three articles are peer-reviewed, the two articles testing “Above the Influence” have the most significant findings, with thousands of subjects and national samples.
Transparency	3 peer-reviewed articles
Research	3 experimental
Standardization	Unknown
Replication	Yes
Fidelity Scale	Unknown
Meaningful Outcomes	These studies reflect that various types of communication campaigns are effective at either reducing marijuana initiation and use. Specifically, “Above the Influence” decreased marijuana use and impacted youth attitudes about marijuana use. However, focusing on the “gateway drug” aspect of marijuana appears to increase marijuana use. Messages should focus on elements of the theory of reasoned action (TRA), persuasion theory, and the health belief model.
References Scheier, L. M., Grenard, J. L., & Holtz, K. D. (2011). An empirical assessment of the Above the Influence advertising campaign. <i>Journal of Drug Education</i> , 41(4), 431–461. https://doi.org/10.2190/DE.41.4.f Slater, M. D., Kelly, K. J., Lawrence, F. R., Stanley, L. R., & Comello, M. L. G. (2011).	

Assessing media campaigns linking marijuana non-use with autonomy and aspirations: “Be Under Your Own Influence” and ONDCP’s “Above the Influence.” *Prevention Science*, 12(1), 12–22. <https://doi.org/10.1007/s11121-010-0194-1>

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School Policies

Evidence Level	Promising <i>Rationale:</i> While the article discusses policies in both the U.S. and Australia, the sample size is large and has a strong experimental design.
Transparency	1 peer-reviewed articles
Research	1 experimental and no quasi-experimental studies
Standardization	UNK
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Research describes elements of school policies that are associated with increased or decreased marijuana use. Interestingly, evidence supports the idea that out-of-school suspension was associated with increased marijuana use. Recommended policies include enforcing nonuse policies and remedial (as opposed to punitive) sanctions for violations.
References Evans-Whipp, T. J., Plenty, S. M., Catalano, R. F., Herrenkohl, T. I., & Toumbourou, J. W. (2015). RESEARCH AND PRACTICE. Longitudinal Effects of School Drug Policies on Student Marijuana Use in Washington State and Victoria, Australia. <i>American Journal of Public Health, 105</i> (5), 994–1000. https://doi.org/10.2105/AJPH.2014.302421	

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ALCOHOL

Brief Introduction

Alcohol continues to be the most widely used substance by both adults and youth in the United States. In fact, 2015 statistics from the National Survey on Drug Use and Health (NSDUH) report that 86% of adults have drunk alcohol in their lifetime. When asked about the past year, that number drops to 70%, but is still the majority of adults. Just over half of adults say they drank in the last month. Most of these adult drinkers however, drink modest amounts and experience little to no health impacts for their drinking. A smaller percentage, approximately 27% of adults are binge drinkers and it is this behavior that is driving around three-quarters of the total costs related to alcohol misuse in this country which in 2010 amounted to a stark \$249 billion. Some of these binge drinkers become heavy drinkers or meet the criteria for an Alcohol Use Disorder (AUD). In fact, it is estimated that 15 million adults had AUD in 2015. Alcohol misuse is related to unintentional injury and death; it is the third leading preventable cause of death in this country, and many are losing their lives to the consequences of alcohol-impaired driving (represents 31% of all driving fatalities). In addition, heavy alcohol use places a significant burden on our healthcare system. Almost half of all liver disease and cirrhosis deaths are attributable to excessive and continued use of alcohol and alcohol increases one's risk of certain types of cancer (e.g. pharynx, breast, mouth, esophagus). Unborn children are impacted by alcohol misuse at a growing rate since the late 1990's which can be seen in the prevalence of Fetal Alcohol Syndrome (NIAAA, 2018)

In addition, alcohol is typically the first substance that young people try in their teenage years. These same 2015 NSDUH statistics found that around 20% of youth between the ages of 12 and 20 years-old drank alcohol in the past month and approximately 13% engaged in binge drinking. Youth alcohol use is particularly concerning given what we now know about the human brain, which is not fully developed until the mid-twenties. Research suggests that the earlier a person begins using alcohol, the more likely they

are to develop alcohol problems later in life. In addition, young people put themselves at risk for a variety of negative consequences associated with drinking such as drinking and driving, accidents, and they are more likely to be the victim of a physical or sexual assault (or engage in one as the perpetrator).

A wealth of research on the prevention of alcohol has been conducted over the past couple of decades and while prevention science has advanced in many ways, “what works” hasn’t changed significantly over the years. Many successful strategies have focused on limiting the amount of alcohol available in the environment, enforcing existing laws against sales to minors, increasing the consequences associated with excessive alcohol use, and increasing the price of alcohol. The research is clear that reduced access to alcohol for both adults and youth results in less drinking and alcohol related problems. Also, people tend to be price-sensitive (as the price of alcohol goes up, excessive drinking tends to go down). Some strategies have aimed to change the community norms associated with excessive alcohol use and underage drinking. A significant focus has been placed on minimizing risk factors and increasing protective factors as they relate to youth. Regardless of the strategies a community decides to implement, communities must consider their unique qualities and ensure that they are carrying out data-driven plans that address a variety of factors simultaneously (Harding, et al., 2016).

Methods

Data Sources and Searches

We followed a predefined protocol to identify and select peer-reviewed manuscripts to include in this literature review. We began our search by identifying resources for systematic reviews on this topic. Given that there are several existing systematic reviews on the topic, we used them as a starting point from which to build our search efforts. We selected the following two sources for this purpose: (1) *The Guide to Community Preventive Services* (The Community Guide), and (2), the *County Health*

Roadmaps. This particular topic area is titled “Excessive Alcohol Consumption” in The Community Guide, which includes underage drinking, and “Alcohol and Drug Use” in the County Health Roadmaps. The following is a brief description of each of these resources.

The Guide to Community Preventive Services (The Community Guide)

Established in 1996 by the U.S Department of Health and Human Services (HHS), The Guide to Community Preventive Services is a collection of systematic reviews and recommendations on evidence-based interventions to improve public health. This work, which is ever-expanding (a topic prioritization process is conducted every five years), is overseen by The Community Preventive Services Task Force (CPSTF), a group of 15 nonfederal experts in public health and prevention research, practice and policy, appointed by the Director of the Centers for Disease Control and Prevention (CDC). A group of staff members based at the CDC provide the scientific, technical and administrative support needed to carry out this work to include coordinating systematic review teams, maintaining adherence to the approved review methods, writing and publishing findings, and disseminating the recommendations to audiences who can use them to improve public health policy and practice. High quality systematic reviews like the ones conducted by the CPSTF provide a reliable source of evidence to guide program, practice and policy. The reason is that they are guided by a specific protocol for finding relevant research articles, determining whether or not to include them in the analysis of findings, and eliminating reviewer bias by involving a minimum of two people in the systematic review process. Systematic review findings can be extremely valuable for informing practice because they do not focus on the components, settings, target audiences and outcomes of one single study. Instead, they take the body of research on a particular program or intervention and determine whether or not it is likely to produce a benefit even if it is executed in slightly different ways in a community.

The Community Guide findings are reported in the following three categories:

(1) Recommended: Strong or sufficient evidence that the intervention is effective

- (2) Recommended Against: Strong or sufficient evidence that the intervention is harmful or not effective.
- (3) Insufficient Evidence: The available studies do not provide sufficient evidence to determine if the intervention is, or is not, effective. More research is necessary before a recommendation can be made.

The County Health Roadmaps

A collaboration between the Robert Wood Johnson foundation and the University of Wisconsin's Population Health Institute, the County Health Roadmaps serve as a guide for groups working to improve community health to prioritize efforts. Programs and policies are given a rating based on the amount and type of evidence on the topic, and the quality of that evidence. Systematic reviews such as those published by the Community Preventive Services Taskforce (CPST) and high quality peer-reviewed studies with designs that demonstrate causality as it pertains to specified outcomes and are given the most "weight" in this process. In addition, grey literature (not formally or commercially published) is incorporated into the search, selection, and assessment process. There are six rating categories designated by two analysts' assessments of each strategy. Community members are encouraged to prioritize strategies with the strongest evidence of effectiveness before selecting those with insufficient or mixed evidence, and to avoid those with evidence of ineffectiveness. Guidance is also provided on how to consider innovation and community context when implementing strategies, and various "tools for action" are made available to help communities succeed with their work.

The rating categories are as follows:

- (1) Scientifically Supported: Strategies with this rating are most likely to make a difference. These strategies have been tested in multiple robust studies with consistently favorable results.

- (2) Some Evidence: Strategies with this rating are likely to work, but further research is needed to confirm effects. These strategies have been tested more than once and results trend favorable overall.
- (3) Expert Opinion: Strategies with this rating are recommended by credible, impartial experts but have limited research documenting effects; further research, often with stronger designs, is needed to confirm effects.
- (4) Insufficient Evidence: Strategies with this rating have limited research documenting effects. These strategies need further research, often with stronger designs, to confirm effects.
- (5) Mixed Evidence: Strategies with this rating have been tested more than once and results are inconsistent; further research is needed to confirm effects.
- (6) Evidence of Ineffectiveness: Strategies with this rating are not good investments. These strategies have been tested in multiple studies with consistently unfavorable or harmful results.

Rather than attempt to recreate these efforts, our review committee integrated them into our process. First, we reviewed *The Community Guide* and determined that any environmental strategy identified as “recommended” in *The Community Guide* was designated as “evidence-based” in our review, unless new literature was identified that provided evidence against the strategy. Next, we reviewed the *County Health Roadmaps*, which included updated reviews on all of the interventions reported in the *The Community Guide*. For example, the evidence cited for *Responsible Beverage Server Training* in the *County Health Roadmaps* included the findings from *The Community Guide* in addition to various studies published through August 2015 (*The Community Guide* review of this intervention ended in October 2010). Because their review methodology was quite similar to ours, we determined that any environmental strategy identified as “scientifically supported” in the *County Health Roadmaps* was designated as “evidence-based” in our review, unless new literature was identified that provided evidence against the strategy.

We searched the peer-reviewed literature on the topic since *The Community Guide* or

the *County Health Roadmaps* completed their systematic review to identify any new research. The results of this search method are reflected in Table A1 below. Although there are a small number of articles reported in the review, this only reflects the articles in the protracted time period. Please keep in mind that there are multiple studies within the systematic reviews reported in both *The Community Guide* and *County Health Roadmaps*. Thus, this review is an update to these two systematic reviews.

After reviewing all *The Community Guide* and the *County Health Roadmaps*, we conducted a broad literature search to identify any additional strategies to reduce alcohol use and underage drinking that were not included in either *The Community Guide* and the *County Health Roadmaps*. For that search, we searched for articles that were published over the last 10 years (August 1, 2008 through August 31, 2018).

Table A1 presents the search periods corresponding to each intervention included in *The Community Guide* and the *County Health Roadmaps*:

Table A1. Search Dates for Interventions Listed in <i>The Community Guide</i> and/or <i>County Health Roadmaps</i>	
Dates	Intervention
August 1, 2008 through August 31, 2018	<ul style="list-style-type: none"> • Social Host Laws • Mass Media Campaigns Against Underage & Binge Drinking
January 1, 2014 – August 31, 2018	<ul style="list-style-type: none"> • Responsible Beverage Service Training • Social Norms Media Campaigns • Restrictions on Drink Promotions • Publicized Sobriety Checkpoint Programs • Alcohol Outlet Density Restrictions
August 1, 2014 – August 31, 2018	<ul style="list-style-type: none"> • Dram Shop Liability Laws • Retailer Compliance Checks • Advertising and Marketing Restrictions

August 1, 2015 – August 31, 2018	<ul style="list-style-type: none"> • Keg Registration Laws
March 1, 2017 – August 31, 2018	<ul style="list-style-type: none"> • Privatization of Off-Premises Retail Alcohol Sales
May 1, 2017 – August 31, 2018	<ul style="list-style-type: none"> • Restrictions on Hours and Days of Sale • Campus Alcohol Bans

All searches were conducted electronically using PubMed. Searches were limited to peer-reviewed, scholarly articles and we did not include research studies conducted in settings outside of the United States. In addition, all searches included the following string: ("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking"). All searches incorporated the following filters in PubMed: clinical study, journal article, meta-analysis, observational study, Randomized Controlled Trial, Review, Systematic Reviews; Species Humans; title/abstract (search fields). Table A2 provides the number of relevant manuscripts found for each search by intervention type. The number of articles selected for review is also provided. Please note that if an existing systematic review was used in the assessment, it is listed along with the number of articles included in the respective review.

Table A2. Search Results			
Intervention	Search Strategy	Articles Identified (#)	Articles Selected (#)
Responsible Beverage Service Training	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("alcohol server" OR "responsible beverage service" OR "RBS" OR "server-intervention" OR "retailer")	17	4 + <i>County Health Roadmaps</i> (7)
Social Norms	("alcohol consumption" OR "drinking" OR		

Media Campaigns	"alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("media campaign" OR "information campaign" OR "social norms" OR "norming" OR "social marketing") AND ("prevention" OR "intervention" OR "community-based" OR "educational")	74	1 + <i>County Health Roadmaps</i> (2)
Restrictions on Drink Promotions	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("happy hour" OR "price" OR "promotion" OR "marketing" OR "purchase" OR "two-for-one" OR "free drinks" or "drink specials" OR "price reduction" or "unlimited beverages") AND ("prevention" OR "intervention" OR "strategy" OR "implementation" OR "community-based")	262	1 + <i>County Health Roadmaps</i> (15)
Publicized Sobriety Checkpoint Programs	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("sobriety checkpoint" OR "sobriety checkpoints" OR "DUI checkpoints")	14	1 + <i>The Community Guide</i> (6) + <i>County Health Roadmaps</i> (5)
Restrictions on Hours and Days of Sale	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("days of sale" OR "hours of sale")	17	0 + <i>The Community Guide</i> (3) + <i>County Health Roadmaps</i> (4)

Social Host Laws	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("social host" or "social host liability" or "social host ordinance")	13	2+ <i>County Health Roadmaps</i> (2)
Dram Shop Liability Laws	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking") AND ("dram shop liability" OR "criminal liability" OR "civil liability" OR "dram shop laws" OR "liability" OR "commercial host") AND ("prevention" OR "intervention" OR "strategy" OR "implementation" OR "policy")	8	0+ <i>The Community Guide</i> (11) + <i>County Health Roadmaps</i> (2)
Retailer Compliance Checks	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("retailer compliance" OR "purchase survey" OR "compliance check")	1	1 + <i>The Community Guide</i> (1)
Retailer Mystery Shop Programs	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("servers and clerks" OR "alcohol outlets" OR "retail mystery shop")	99	1
Use of ID Scanners for Retailers	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("fake ID" OR "false ID" OR "scanner")	40	1
Alcohol Outlet Density	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking	148	2 + <i>The Community</i>

Restrictions	alcoholic beverages" OR "binge drinking") AND ("alcohol outlet" OR "density" OR "liquor stores" OR "outlets") AND ("prevention" OR "intervention" OR "strategy" OR "implementation" OR "community-level)		<i>Guide (19) + County Health Roadmaps (5)</i>
Privatization of Off-Premises Retail Alcohol Sales	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("alcohol retail privatization" OR "retail alcohol sales" OR "private alcohol sales")	8	0 + <i>The Community Guide (14) + County Health Roadmaps (4)</i>
Advertising and Marketing Restrictions	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("alcohol advertising" OR "alcohol marketing" OR "media exposure" OR "advertising ban" OR "advertising restriction")	84	0 + <i>County Health Roadmaps (5)</i>
Mass Media Campaigns Against Underage & Binge Drinking	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR "underage drinking") AND ("communication campaign" OR "information campaign" OR "media campaign" OR "youth drinking prevention campaign" OR "underage drinking prevention campaign" OR "parents who host" OR "talk they hear you" OR "social media campaign")	32	3 + County Health Roadmaps (1)
Keg Registration Laws	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR "alcohol use" OR "drinking alcoholic beverages" OR "binge drinking" OR	0	0 + <i>County</i>

	“underage drinking”) AND (“keg registration” OR “identification tags” OR “beer kegs”)		<i>Health Roadmaps (7)</i>
Campus Alcohol Bans	("alcohol consumption" OR "drinking" OR "alcohol abuse" OR “alcohol use” OR "drinking alcoholic beverages" OR "binge drinking" OR “underage drinking”) AND ("campus alcohol bans" OR "alcohol policies" OR "university alcohol policy" OR "alcohol ban" OR "dry campus")	15	0 + <i>County Health Roadmaps (3)</i>

Study Selection

All titles and abstracts were independently screened by 1 of 2 investigators (AD or WG). Articles that were considered relevant advanced to full-text review. In order to be eligible, an intervention must have been implemented in the United States. Commentary and policy statements were not included. Table A2, above, includes the number of relevant manuscripts for each intervention. We focused on environmental-level as opposed to individual-level strategies with meaningful outcomes related to drinking behavior, associated risk factors, and related consequences for both adults and youth. We focused on strategies that coalitions in North Carolina can successfully impact at the local-level. Given this, we decided not to include blood alcohol concentration (BAC) laws, alcohol taxes or minimum legal drinking age (MLDA) laws in this review.

Data Extraction and Quality Assessment

One of 2 researchers (AD or WG) independently read selected articles. Using the standardized article assessment form, the following data was captured: study design (including type of study, whether or not the study was a replication study, use of reliable and valid instruments, and measurement of intervention dose), standardization of the intervention, population studied, setting, and sample size. A brief description and

overview of findings were documented. Additionally, the investigators coded the type of intervention (e.g., alcohol outlet density restrictions, responsible beverage service training, etc.) and environmental strategy (e.g., availability/access, price, promotion, etc.).

Four investigators (AD, BG, MW, and KW) reviewed and discussed all the articles that underwent full-text review and data extraction in order to assess the evidence for each intervention using the operational definitions and *Matrix of Level of Effectiveness*, described in this report's Introduction. The interventions were identified as: **evidence-based, promising, or insufficient evidence / not evidence-based.**

Results

Responsible Beverage Service Training (RBST)

Evidence Level	Evidence-based <i>Rationale:</i> RBST is most effective if part of a broader strategy for reducing alcohol use. There is minimal information on the reduction of underage drinking, but the data indicates a positive impact on youth drinking behavior. In addition, RBST improves risk factors associated with underage drinking such as retail availability and decreases alcohol related consequences such as impaired driving.
Transparency	4 peer-reviewed articles + County Health Roadmaps
Research	4 experimental + 1 systematic review
Standardization	2 standardized; 2 unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	There are multiple outcomes reported including ID checks, serving intoxicated patrons, intra-store communication about best practices, changes in store signage and changes in store policies.
References	
<ol style="list-style-type: none"> 1. Danaher, B.G, Dresser, J., Shaw, T., Severson, H.H., Tyler, M.S., Maxwell, E.D. & Christiansen, S.M. (2012). Development and process evaluation of a web-based responsible beverage service training program. <i>Substance Abuse Treatment, Prevention and Policy</i>, 7(41). https://doi.org/10.1186/1747-597X-7-41. 	

2. Fell, J.C., Fisher, D.A., Yao, J. & McKnight, A.S. (2017). Evaluation of a responsible beverage service and enforcement program: Effects on bar patron intoxication and potential impaired driving by young adults. *Traffic Injury Prevention*, 18(6), 557-565. <https://doi.org/10.1080/15389588.2017.1285401>
3. Lenk, K.M., Erickson, D.J., Nelson, T.F, Horvath, K.J, Nederhoff, D.M, Hunt, S.L, Ecklund, A.M & Toomey, T.L. (2018). Changes in alcohol policies and practices in bars and restaurants after completion of manager-focused responsible service training. *Drug and Alcohol Review*, 37(3), 356-364. <https://doi.org/10.1111/dar.12629>
4. Wolff, L.S., El Ayadi, A.M, Lyons, J.N., Herr-Zaya, K., Noll, D., Perfas, F, & Rots, G. (2010). Improving the alcohol retail environment to reduce youth access: A randomized community trial of best practices toolkit intervention. *Journal of Community Health*, 36(3), 357-366. <https://doi.org/10.1007/s10900-010-9316-8>

Reviews

5. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Responsible Beverage Server Training. (2015). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/responsible-beverage-server-training-rbsrbst>

Social Norms Media Campaigns

Evidence Level	Promising <i>Rationale:</i> The research is mixed. Some data indicates positive impacts while other do not. In addition, most of this research applies to college students who are underage as opposed to younger (15-18 year old's). The evidence is stronger on student perceptions than actual use, but with the right conditions it appears this can be effective for youth drinking.
Transparency	1 peer reviewed article + County Health Roadmaps
Research	1 quasi-experimental + 1 systematic review
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	In general, the types of campaigns can be effective. However, it is important to select the right campaign (both in terms of content and delivery methodology) for the right audience. Abstinence based messaging, in general, showed the greatest impact on attitudes and behavior.
<p>References</p> <p>1. Glassman, T.J., Sloan Kruger, J., Deakins, B.A., Paprzycki, P., Blavos, A.A., Hutzelman, E.N. & Diehr, A. (2016). Abstinence, social norms, and drink responsibly messages: A comparison study. <i>Journal of Alcohol and Drug Education</i>, 60(2), 72-90.</p> <p><u>Reviews</u></p>	

2. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). School-based social norming: Alcohol Consumption. (2014). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/school-based-social-norming-alcohol-consumption>

Restrictions on Drink Promotions

Evidence Level	Evidence-Based <i>Rationale:</i> Studies have found associations between discounted alcohol prices (e.g. two-for-one specials, happy hours, free or unlimited drinks) and increased excessive alcohol consumption. However, underage drinking outcomes tend to focus on the college student population (i.e. 18-20 years-old). With that said, coalitions serving communities with college campuses may benefit from assessing and limiting drink promotions. Additional research is needed to determine if there are any effects for high school-aged youth.
Transparency	1 peer reviewed + County Health Roadmaps
Research	1 quasi-experimental + 1 systematic review
Standardization	No
Replication	No
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes are focused on impacts among the older underage drinker population and individuals at or above the Minimum Legal Drinking Age (MLDA). In addition, to findings related to reduced alcohol consumption, there is some evidence indicating that lower prices increased the amount of drinking a person plans to do. There is also an association between increased alcohol prices and decreased alcohol-related motor vehicle accidents, traffic offenses and other negative health effects.

References

1. Baldwin, J.M., Stogner, J.M. & Miller, B.L. (2014). It's five o'clock somewhere: An examination of the association between happy hour drinking and negative consequences. *Substance Abuse Treatment, Prevention, and Policy*. 597(x), 9-17. <https://doi.org/10.1186/1747-597X-9-17>

Reviews

2. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Drink Special Restrictions. (2014). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/drink-special-restrictions>

Publicized Sobriety Checkpoint Programs

Evidence Level	<p>Evidence-Based</p> <p><i>Rationale:</i> While the research is unable to link sobriety checkpoints with underage drinking, well-publicized programs can increase the perception or risk associated with alcohol-impaired driving. They are recommended as part of a comprehensive strategy. They appear to be more effective when they are conducted on a regular basis (at least monthly) and include mass media campaigns to promote awareness. High media coverage with lower frequency checkpoints is more effective than checkpoints on their own.</p>
Transparency	1 peer-reviewed study + 1 peer-reviewed systematic review (The Community Guide) + County Health Roadmaps
Research	1 quasi-experimental study + 2 systematic reviews
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes focused on decreasing drinking, decreasing impaired driving, and decreasing traffic injuries.
<p>References</p> <p>1. Browning, S., & Thompson, K. (2016). Specific deterrence and the infrequent use of sobriety checkpoints. <i>Security Journal</i>, 29, 340-351. https://doi.org/10.1057/sj.2013.31</p> <p><u>Reviews</u></p>	

2. Bergen, G., Pitan, A., Qu, S., Shults, R.A., Chattopadhyay, S.K., Elder, R.W., Sleet, D.A., Coleman, H.L., Compton, R.P., Nichols, J.L., Clymer, J.M., & Calvert, W.B. (2014). Publicized sobriety checkpoint programs: a community guide systematic review. *American Journal of Preventive Medicine*, 46(5), 529-539. <https://doi.org/10.1016/j.amepre.2014.01.018>

3. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Breath Testing Checkpoints. (2014). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/breath-testing-checkpoints>

Restrictions on Hours and Days of Sale

Evidence Level	<p>Promising</p> <p><i>Rationale:</i> While these studies focus primarily on adult use the resulting decreasing in adult drinking and drinking consequences are directly related to retail availability which is a key risk factor for youth.</p>
Transparency	2 peer-reviewed systematic reviews (The Community Guide) + County Health Roadmaps
Research	3 systematic reviews
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	<p>Most significant outcomes relate to decreased drinking and behaviors associated with drinking including and assaults, impaired driving. While there were no youth outcomes measured, the decreasing of retail availability (described elsewhere) is an important strategy for reducing underage drinking.</p>
<p><u>Reviews</u></p> <ol style="list-style-type: none"> 1. Hahn, R. A., Kuzara, J. ., Elder, R., Brewer, R., Chattopadhyay, S., Fielding, J., Naimi, T.S., Toomey, T., Middleton, J.C., Lawrence, B., & the Task Force on Community Preventive Services. (2010). Effectiveness of policies restricting hours of alcohol sales in preventing excessive alcohol consumption and related harms. <i>American Journal of Preventive Medicine</i>, 39(6), 590–604. https://doi.org/10.1016/j.amepre.2010.09.016 2. Middleton, J.C., Hahn, R.A., Kuzara, J.L, Elder, R., Brewer, R., Chattopadhyay, S., Fielding, J., Naimi, T.S., Toomey, T., Laurence B. & the Task Force on 	

Community Preventive Services. (2010). Effectiveness of policies maintaining or restricting days of alcohol sales on excessive consumption and related harms. *American Journal of Preventive Medicine*, 39(6):575–589.

<https://doi.org/10.1016/j.amepre.2010.09.015>

3. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Alcohol days of sale restrictions. (2017). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/alcohol-days-of-sale-restrictions>

Dram Shop Liability Laws

Evidence Level	Evidence-Based <i>Rationale:</i> There are two systematic reviews described here. While there are some associations for adult binge drinking behaviors, this is limited by mixed findings on some risk factors. There is no discussion on the impact of youth initiation, or drinking behavior and very little on youth risk factors.
Transparency	1 peer-reviewed systematic review (The Community Guide) + County Health Roadmaps
Research	2 systematic reviews
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	These laws have the most significant impact on those who binge drink in retail establishments. While these may be an important part of a comprehensive community strategy, there is little known about the anticipated impact on youth drinking behavior.
<p><u>Reviews</u></p> <ol style="list-style-type: none"> 1. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Dram Shop Liability Laws. (2014). Retrieved from: http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/dram-shop-liability-laws 2. Rammohan, V., Hahn, R.A., Elder, R., Brewer, R., Fielding, J, Naimi, T.S., Toomey, T.L., Chattopadhyay, S.K., Zometa, C. & Task Force on Community Preventive Services. (2011). Effects of dram shop liability and enhanced 	

overservice law enforcement initiatives on excessive alcohol consumption and related harms. *American Journal of Preventive Medicine*, 41(3), 334-343.
<https://doi.org/10.1016/j.amepre.2011.06.027>

Retailer Compliance Checks

<p>Evidence Level</p>	<p>Evidence-Based</p> <p><i>Rationale:</i> While there is limited research linking retailer compliance checks with youth drinking behaviors, this intervention is strongly associated with a decrease in alcohol sales to both “decoys” (individuals judged to appear under the age of 21) and actual underage purchasers. Therefore, this intervention is likely to benefit communities that identify retail purchases at off-premises establishments as significant access points for youth. It is important to note that effective compliance check programs are conducted on a regular schedule due to the effects decaying over time, and include publicity efforts.</p>
<p>Transparency</p>	<p>1 peer-reviewed + The Community Guide</p>
<p>Research</p>	<p>1 quasi-experimental study +1 systematic review</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Yes</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Outcomes were focused on how many agencies that conduct compliance checks use optimal methods-including checking all establishments in the jurisdiction, conducting checks at least 3 to 4 times per year, conducting follow-up checks within 3 months, and penalizing the licensee (not only the server/clerk) for failing a compliance check, and (iii) characteristics of the agencies that conduct compliance checks.</p>

References

1. Erickson, D. J., Smolenski, D. J., Toomey, T. L., Carlin, B. P., & Wagenaar, A. C. (2013). Do alcohol compliance checks decrease underage sales at neighboring establishments? *Journal of Studies on Alcohol and Drugs*, 74, 852–858. <https://doi.org/10.15288/jsad.2013.74.852>

Reviews

2. Elder RW, Lawrence BA, Janes G, Brewer RD, Toomey TL, Hingson RW, Naimi TS, Wing S, Fielding J. Enhanced enforcement of laws prohibiting sale of alcohol to minors: Systematic review of effectiveness for reducing sales and underage drinking. *Transportation Research Circular*. 2007;2007(E-C123):181–188.

<http://www.preussergroup.com/trbanb50/ec123.pdf#page=187%20>.

Retailer Mystery Shop Programs

Evidence Level	Promising <i>Rationale:</i> This research describes an approach that parallels compliance checks except for the involvement of law enforcement and ensuring that all decoys are actually legal purchasers. Only one study could be found and it has positive results.
Transparency	1 peer reviewed
Research	1 experimental
Standardization	Yes
Replication	No
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes are focused on decreases of alcohol-related driving fatalities, alcohol consumption, alcohol-related violence, and alcohol-related diseases. Decreased ratio of drinking to nondrinking drivers under age 21 involved in fatal crashes.
<ol style="list-style-type: none"> References Grube, JW, DeJong, W, DeJong, M, Lipperman-Kreda, S, Krevor & Brad S. (2018). Effects of a responsible retailing mystery shop intervention on age verification by servers and clerks in alcohol outlets: A cluster randomised cross-over trial. <i>Drug and Alcohol Review</i>, 37,774-781. https://doi.org/10.1111/dar.12839 	

Use of ID Scanners

Evidence Level	Promising <i>Rationale:</i> Although there is only one study that considers this approach, the desing was rigorous and considered meaningful outcomes. More research is needed on this topic to move it to an evidence-based practice.
Transparency	1 peer reviewed article
Research	1 experimental
Standardization	Unknown
Replication	No
Fidelity Scale	Unknown
Meaningful Outcomes	Found that the false ID laws with scanner provision significantly reduce underage drinking, including up to a 0.22 drink decrease in the average number of drinks consumed by underage youth per day. This effect is observed particularly in the short-run and more pronounced for non-college students and those who are relatively younger.
References	
<ol style="list-style-type: none"> 1. Baris, Y.K. (2014). Can technology help to reduce underage drinking? Evidence from the false ID laws with scanner provision. <i>Journal of Health Economics</i>, 36, 33-46. https://doi.org/10.1016/j.jhealeco.2014.03.004 	

Alcohol Outlet Density

Evidence Level	Evidence-Based <i>Rationale:</i> There is strong evidence that this approach is important for reducing underage drinking by decreasing retail access for adults and youth.
Transparency	2 peer-reviewed + 1 peer-reviewed systematic review (The Community Guide) + County Health Roadmaps
Research	2 systematic reviews + 1 experimental + 1 quasi-experimental
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Research clearly describes that outlet density is associated with high levels of drinking and binge drinking for adults, college underage drinking, and younger drinking. The general research findings is that reducing alcohol outlet density will decrease underage drinking.
References	
<ol style="list-style-type: none"> 1. Scribner, R., Mason, K., Theall, K., Simonsen, N., Schneider, S. K., Towvim, L. G., & DeJong, W. (2008). The contextual role of alcohol outlet density in college drinking. <i>Journal of Studies on Alcohol and Drugs</i>, 69(1), 112-120. 2. Tanumihardjo, J., Shoff, SM.S., Koenings, M., Zhang, Z. & Lai, H.J. (2015). Association between alcohol use among college students and alcohol outlet proximity and densities. <i>Wisconsin Medical Journal</i>, 114(4), 143-147. 	

Reviews

3. Campbell CA, Hahn RA, Elder R, et al. The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol consumption and alcohol-related harms. *American Journal of Preventive Medicine*. 2009;37(6):556–69.
4. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Alcohol Outlet Density Restrictions. (2014). Retrieved from: <http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/alcohol-outlet-density-restrictions>

Privatization of Off-Premises Retail Alcohol Sales

Evidence Level	Evidence-Based <i>Rationale:</i> While local communities can rarely impact this area the research presented here is clear that privatization significantly increases all types of drinking and negative consequences associated with drinking.
Transparency	1 peer-reviewed systematic review (The Community Guide) + County Health Rankings
Research	2 systematic reviews
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Privatization requires strong counter-measures and can significantly impact both adult and youth drinking behavior. Privatization is associated with increased outlet density and increased retail outlets, both of which increase negative drinking behaviors. It may be important for coalitions in privatized states to understand how privatization leads to increased drinking so they can plan counter strategies appropriately.
<p><u>Reviews</u></p> <ol style="list-style-type: none"> 1. County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Retail Alcohol Sale Privatization. (2017). Retrieved from: http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/retail-alcohol-sale-privatization 2. Hahn, R.A, Middleton, J.C, Elder, R., Brewer, R et al. (2012). Effects of alcohol retail privatization on excessive alcohol consumption and related harms: A 	

community guide systematic review. American Journal of Preventive Medicine, 42(4), 418-427.

Advertising and Marketing Restrictions

Evidence Level	Insufficient Evidence <i>Rationale:</i> There is some evidence that exposure to alcohol advertising and marketing through various communications mediums has an impact on youth alcohol related beliefs (of varying types). Numerous studies look at the kinds of marketing and advertising messages aimed at youth and how they may differ by geographical area. Very little research provides a link between advertising and drinking behavior and numerous studies were published internationally and not part of our review. We saw no studies looking at the effects of an intervention aimed at restricting advertising and marketing as a single strategy.
Transparency	County Health Roadmaps
Research	1 systematic review
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outcomes focused on changes in alcohol-related beliefs among youth and adults, impacts on alcohol brand preferences, and the kinds of messaging alcohol companies are directing toward youth.
<u>Reviews</u> County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Alcohol Advertising Restrictions. (2014). Retrieved from: http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/alcohol-advertising-restrictions	

Keg Registration Laws

<p>Evidence Level</p>	<p>Insufficient Evidence <i>Rationale:</i> The County Health Rankings Roadmap classifies keg registration laws as “insufficient evidence”. Studies do not indicate that keg registration laws have no direct relationship to underage drinking. In addition, many of the studies measure the outcome of underage drinking (as opposed to drinking).</p>
<p>Transparency</p>	<p>County Health Roadmaps</p>
<p>Research</p>	<p>1 systematic review</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Keg registration has been recognized as potentially beneficial in part of a multi-component approach to reduce impaired driving. However, there is also evidence demonstrating that keg registration alone is not related to beer consumption, binge drinking, or impaired driving. In fact, some research indicates a negative impact resulting in increases in impaired driving and binge drinking.</p>
<p><u>Reviews</u> County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Keg registration laws. (2015). Retrieved from: http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/keg-registration-laws</p>	

Campus Alcohol Bans

<p>Evidence Level</p>	<p>Insufficient Evidence <i>Rationale:</i> According to the County Health Rankings Roadmap there is very little evidence to support the relationship between campus alcohol bans and decreased use of alcohol. In fact, the research indicates no significant relationship between underage drinking and campus alcohol bans.</p>
<p>Transparency</p>	<p>County Health Roadmaps</p>
<p>Research</p>	<p>1 systematic review</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>It is estimated that about 34% of four year colleges and universities have some sort of campus alcohol ban. Research demonstrates small decreases in frequency of alcohol use, but no impact on binge drinking.</p>
<p><u>Reviews</u> County Health Rankings & Roadmaps. What works for health (Alcohol and Drug Use). Campus alcohol bans. (2014). Retrieved from: http://www.countyhealthrankings.org/take-action-to-improve-health/what-works-for-health/policies/campus-alcohol-bans</p>	

Social Host Laws

<p>Evidence Level</p>	<p>Promising</p> <p><i>Rationale:</i> The research here shows some impact on group drinking behavior and group binge drinking with less impact on overall drinking for youth. It also appears that different kinds of social host laws have differing impacts on youth drinking behavior. The research cited here focuses on laws that deter underage drinking parties which hold the individuals who control the property accountable for underage drinking that occurs on the premises, irrespective of who provided it.</p>
<p>Transparency</p>	<p>2 peer-reviewed + County Health Roadmaps</p>
<p>Research</p>	<p>2 experimental + 1 systematic review</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Social host laws appear to be most effective for creating extra barriers for youth drinking by decreasing the amount of youth drinking in large groups in private homes. It is unclear how this impacts overall drinking and initiation, but some evidence suggests it can reduce drinking for those who have already started drinking. Local social host policies that include strict liability and civil penalties that are imposed administratively may be associated with less frequent underage drinking in private settings</p>
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TOBACCO

Brief Introduction

According to the Centers for Disease Control (CDC), smoking is the most common form of preventable disease and death in the United States. Every year, 480,000 people (or 1 in every 5 deaths in the U.S.) is directly attributable to cigarette smoking. While youth and adult smoking has declined since 2005, currently about 15% of the adult population currently smokes. In addition, about 8% of high school seniors report 30-day use of cigarettes. While smoking has decreased over the past 10 years, smoking still poses severe health consequences. Smoking negatively impacts “nearly every organ of the body” and has been identified as a direct cause of life-threatening diseases such as cancer, heart disease, lung diseases, diabetes, chronic obstructive pulmonary disease (COPD) and more. (Centers for Disease Control and Prevention, 2014).

In addition, smoking dramatically increases the likelihood of other illnesses such as tuberculosis, immune system disorders, rheumatoid arthritis, and erectile dysfunction. Despite the recent long-term trends of declining cigarette use, challenges for prevention remain and may lead to increases in cigarette use over the next decade. CDC data indicates that while rates of use have declined over the past 15 years, that rate has slowed significantly over the past 3 years. In addition, the popularity of “e-cigarettes” has dramatically increased in the past seven years showing a dramatic 680% increase since 2011 (Centers for Disease Control and Prevention, 2014)

In addition, the tobacco industry still spends almost \$10 billion per year promoting smoked and smokeless tobacco. Finally, the use of these products differs significantly between different demographic populations. Those with less education, lower levels of income, minority status, psychological distress, living in the Midwest and the Southern regions of the U.S. report the highest levels of tobacco use, including cigarettes. While most current smokers indicate a preference for cessation, the public health field has identified broad, macro-level approaches that can significantly reduce both adult

and youth use. Reports by the CDC and the Surgeon General's Office have elaborated extensively on the current state of research pertaining to environmental strategies that have demonstrated significant change. In addition, the CDC maintains an up-to-date website that consistently monitors these (and other) programs (Centers for Disease Control and Prevention, 2014). This section outlines some of the more recent research trends on effective prevention for cigarette use. While one article does include information on e-cigarettes, it is important to note the relative paucity of e-cigarette and smoke-free tobacco when compared to cigarettes.

Methods

Data Sources and Searches

We followed a predefined protocol to identify and select peer-reviewed manuscripts to include in this literature review. We searched PubMed for peer-reviewed articles that examined environmental strategies to address youth use of tobacco products. Our search included articles that were published between January 1, 2013 and August 31, 2018. That cut-off date was determined by the publication date of the Center for Disease Control's Community Guide (2015) review of tobacco strategies which followed the 2014 Surgeon General's Report (Health Consequences of Smoking- 50 Years of Progress). Individual searches were conducted for each intervention (see Table T1). Search terms for tobacco included, "tobacco", "chew", "chewing tobacco", "snuff", "cigarettes", "e-cigarettes", and "vape". Searches were limited to peer-reviewed, scholarly articles involving youth in the United States.

Table T1. Search Results			
Intervention	Search Strategy	Articles Identified (#)	Articles Selected (#)
Communication Campaigns	("Tobacco" OR "chew" OR "chewing tobacco" OR "snuff" OR "cigarettes" OR "e-cigarettes" OR "vape") AND ("Media" OR "Communication Campaign" OR "Information Campaign") AND ("Youth"))	154	4 + Surgeon General 2014 (35) + CDC Guide (64)
Outlet Density	("Tobacco" OR "cigarettes" OR "e-cigarettes") AND ("Outlet Density")	573	3
School Policies	("Tobacco") AND ("School Policies") AND ("Adolescence") AND ("12 to 17")	272	2 (one meta-review comprised 31 studies)
Smoke Free and Clean Air Policies	("Tobacco") AND ("Smoke Free" OR "Clean Air") AND ("Youth") AND ("Prevention")	217	2 + Surgeon General 2014 (21) + CDC (132)
Enforcement	("Tobacco") AND ("Enforcement" OR "Compliance") AND ("Youth") AND ("Prevention")	71	3 + 2012 Surgeon General (20)
Merchant Education	("Tobacco") AND ("Merchant Education") AND ("Youth")	7	1 + Community Guide (N=8)

Study Selection

All titles and abstracts were independently screened by 1 investigator (WG). Articles that were considered relevant advanced to full-text review. This included those articles directly pertaining to environmental strategies relating to communication campaigns in the United States. Table T1 includes the number of relevant manuscripts for each intervention.

Data Extraction and Quality Assessment

One researcher (WG) independently read selected articles. Using a standardized article assessment form, WG captured data on study design (including type of study, whether or not the study was a replication study, use of reliable and valid instruments, and measurement of intervention dose), standardization of the intervention, population studied, setting, and sample size. A brief description and overview of findings were documented. Additionally, the investigators coded the type of intervention and environmental strategy.

Two additional investigators (MW, KW) reviewed and discussed all the articles that underwent full-text review and data extraction in order to assess the evidence for each intervention. The interventions were identified as insufficient evidence, promising, evidence-based as determined by examining transparency (e.g., peer-reviewed manuscripts on intervention), research (e.g., accumulated peer-reviewed manuscripts based on randomized controlled trials, quasi-experimental studies, and in some cases less rigorously controlled studies), standardization (e.g., essential elements of the intervention are clearly documented as evidenced in a manual or toolkit), replication (e.g., more than one peer-reviewed study with similar findings), fidelity (e.g., intervention is being implemented in a consistent manner), and meaningful outcomes (e.g., interventions result in meaningful outcomes).

Results

Communication Campaigns

Evidence Level	Evidence-based <i>Rationale:</i> There is a lot of strong evidence for this approach. Multiple research reviews and meta-analyses combine with the newer research outlined here all speak to the measured impact of Communication Campaigns on youth smoking. While the evidence suggests communication campaigns have a significant impact, that impact is more powerful when campaigns are part of a comprehensive approach.
Transparency	4 peer-reviewed articles
Research	3 experimental and 1 quasi-experimental studies and 1 meta-analysis + Surgeon General (2014) Report (N=35) + CDC Best Practices (2014)(N=64)
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	These studies reflect that various types of communication campaigns are effective at either reducing smoking rates, reducing positive attitudes towards smoking or both. While these 5 studies focus on the isolated impact of anti-smoking communication campaigns, the CDC and Surgeon General (2014) both support communication campaign effectiveness as part of a comprehensive approach towards reducing youth smoking. Research also indicates campaigns are most effective if they target specific audiences.

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Communication, 21(11), 1153–1160.

<https://doi.org/10.1080/10810730.2016.1233307>

Retail Outlet Density

Evidence Level	Evidence-Based <i>Rationale:</i> While one article found that outlet density is less important than smoke-free policies, these articles have significant power with thousands of subjects across multiple cities.
Transparency	3 peer-reviewed articles
Research	2 experimental and 1 quasi-experimental studies
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Outlet density within 1 mile of residence and/or school increased both initiation and 30 day use of tobacco.
References	
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School Policies

Evidence Level	<p>Promising</p> <p><i>Rationale:</i> While these articles focus on school policies, and show support for this approach, their impact may be due to high levels of enforcement and using policy in addition to communication campaigns in the school. The Meta-review involved both U.S. and international studies (N=31: Galanti et al).</p>
Transparency	2 peer-reviewed articles
Research	1 experimental & 1 meta-analysis
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	In general, there is support for tobacco free school-based policies, but tobacco free zones alone do not appear to be effective. Policies that are strictly enforced and communicated are most effective.
<p>References</p> <ol style="list-style-type: none"> Galanti, M. R., Coppo, A., Jonsson, E., Bremberg, S., & Faggiano, F. (2014). Anti-tobacco policy in schools: upcoming preventive strategy or prevention myth? A review of 31 studies. <i>Tobacco Control</i>, 23(4), 295–301. https://doi.org/10.1136/tobaccocontrol-2012-050846 Paek, H.-J., Hove, T., & Oh, H. J. (2013). Multilevel Analysis of the Impact of School-Level Tobacco Policies on Adolescent Smoking: The Case of Michigan. <i>Journal of School Health</i>, 83(10), 679–689. https://doi.org/10.1111/josh.12081 	

Smoke Free and Clean Air

Evidence Level	Evidence-based <i>Rationale:</i> The research noted here reflects 190 articles with a variety of experimental and quasi-experimental designs with strong agreement that smoke-free and clean air policies decrease youth tobacco use.
Transparency	2 peer-reviewed articles
Research	1 experimental and 1 systematic review (26 studies) and Surgeon General Report (31) and CDC Community Guide (132)
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Clean air and smoke-free laws are effective at preventing initiation and supporting cessation. Also, including e-cigarettes in these policies is effective at decreasing tobacco smoking and e-cigarette use among youth.
References <ol style="list-style-type: none"> 1. Abouk, R., & Adams, S. (2017). Bans on electronic cigarette sales to minors and smoking among high school students. <i>Journal of Health Economics</i>, 54, 17–24. https://doi.org/10.1016/j.jhealeco.2017.03.003 2. Klein, E. G., Forster, J. L., & Erickson, D. J. (2013). Longitudinal Predictors of Stopping Smoking in Young Adulthood. <i>Journal of Adolescent Health</i>, 53(3), 363–367. https://doi.org/10.1016/j.jadohealth.2013.04.012 3. U.S. Department of Health and Human Services. <i>E-Cigarette Use Among Youth and Young Adults (2016). A Report of the Surgeon General.</i> Atlanta, GA: 	

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<https://doi.org/10.3390/ijerph15071386>

Enforcement/SYNAR

Evidence Level	Evidence-Based <i>Rationale:</i> The research includes long term (8 years) research and strong experimental and quasi-experimental design. In addition, the meta-review (also cited elsewhere) supports over 17 years of data. The data is strong and consistent.
Transparency	4 peer-reviewed articles
Research	2 experimental and 1 quasi-experimental and 1 meta-analysis (N=26 studies)
Standardization	Unknown
Replication	Unknown
Fidelity Scale	Unknown
Meaningful Outcomes	Strict enforcement is a critical piece for success of tobacco policies to impact youth behavior and access to tobacco products.
References <ol style="list-style-type: none">1. Glanz, K., Jarrette, A. D., Wilson, E. A., O’Riordan, D. L., & Arriola, K. R. J. (2007). Reducing minors’ access to tobacco: Eight years’ experience in Hawaii. <i>Preventive Medicine: An International Journal Devoted to Practice and Theory</i>, 44(1), 55–58. https://doi.org/10.1016/j.yjpm.2006.08.0212. Ickes, M. J., Rayens, M. K., Wiggins, A. T., & Hahn, E. J. (2015). A Tobacco-Free Campus Ambassador Program and Policy Compliance. <i>Journal of American College Health</i>, 63(2), 126–133. https://doi.org/10.1080/07448481.2014.9909723. Lipperman-Kreda, S., Grube, J. W., Friend, K. B., & Mair, C. (2016). Tobacco	

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Merchant Education

<p>Evidence Level</p>	<p>Insufficient evidence <i>Rationale:</i> Using our search criteria results in only 1 research study which is a review of the literature. In that review, only 1 study is referenced applying to the U.S. (others are international). The author concludes that merchant education is not effective. In addition, <i>the Community Guide</i> lists merchant education as insufficient evidence since “no studies qualified for the review”.</p>
<p>Transparency</p>	<p>1 peer-reviewed articles + Community Guide</p>
<p>Research</p>	<p>1 meta-analysis</p>
<p>Standardization</p>	<p>Unknown</p>
<p>Replication</p>	<p>Unknown</p>
<p>Fidelity Scale</p>	<p>Unknown</p>
<p>Meaningful Outcomes</p>	<p>Merchant education for tobacco as a stand-alone is not effective at decreasing tobacco use for youth. Research indicates it is best used as part of a broader, comprehensive set of policies that includes strict enforcement.</p>
<p>References DiFranza, J. R. (2012). Which interventions against the sale of tobacco to minors can be expected to reduce smoking? <i>Tobacco Control</i>, 21(4), 436–442.</p>	

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