

Community-based environmental strategies to prevent the non-medical use of marijuana: A review of the literature

Kristen J. Quinlan, Maria Valenti, Linda Barovier, Gisela Rots, & Wayne Harding

Education Development Center, Inc., Waltham, MA, USA

Aims: To summarize published evidence for environmental strategies to prevent the non-medical use of marijuana (NMUM).

Methods: Four databases (PSYCHINFO, SocINDEX, PsycARTICLES and Academic Search Complete) were searched for articles examining environmental strategies for NMUM prevention. Articles included were peer-reviewed, published in English between 2003 and 2013 and had full-text availability. The references listed in retrieved articles were included when they met selection criteria.

Findings: Twenty articles met inclusion criteria. Seven described evaluations of media strategies to prevent marijuana use; eight examined the impact of policy on marijuana use (six described the impact of medical marijuana laws on use; two explored the impact of national-level policy and enforcement on use); and five explored price and availability and their impact on marijuana demand and use.

Conclusions: Media prevention campaigns for NMUM work best when they are well-targeted and bolstered by community-level support. Marijuana-related policy studies on medical marijuana laws (MML) show inconsistent findings about their impact on NMUM. Unique distribution characteristics of marijuana make its use relatively insensitive to price fluctuations compared to other illicit drugs. Future research should focus on evaluation of: (a) policies that expand beyond MMLs, (b) marijuana enforcement strategies and (c) other types of state or local-level environmental strategies.

funding. Such strategies seek to change contextual factors in an effort to foster individual behaviour change. Environmental strategies can be implemented at the community, regional or national level and typically involve community mobilization, changes in the neighbourhood or community connectedness, policy changes, changes in enforcement, or communication campaigns (Pettibone, Friend, Nargiso, & Florin, 2012). The current trend of promoting evidence-based practice and policies, along with the increasing use of environmental-level strategies, has led community leaders to look to research to guide decision-making about which environmental strategies to use, and, perhaps more importantly, to attempt to match specific environmental strategies to the prevention of specific substances (e.g. heroin, cocaine) or substance use patterns (e.g. heavy episodic drinking). Although the legality of marijuana production, consumption and sale for medical and non-medical purposes varies from country to country, and among states in the US, community leaders remain interested in preventing the non-medical use of marijuana (NMUM)¹, particularly for youth, because of the associated negative consequences. These public health consequences can include adverse short-term consequences ranging from acute psychiatric reactions (as cited in Hall & Degenhardt, 2009) to risk of accidents and injury (Gerberich et al., 2003) and long-term consequences ranging from respiratory effects (as cited in Kalant, 2004) to dependence (Stinson, Ruan, Pickering, & Grant, 2006). However, research has yet to thoroughly address how the use of environmental strategies can effectively reduce NMUM-related public health problems.

INTRODUCTION

Environmental strategies are widely used in substance abuse prevention and are often a required component of prevention programming for recipients of public health

ENVIRONMENTAL-LEVEL RISK AND PROTECTIVE FACTORS FOR NMUM

Successful implementation of environmental strategies requires proper identification of the

environmental-level factors that are most virulent and malleable, as they relate to the identified public health problem. These environmental-level factors can include availability, community-level norms favourable to use, neighbourhood disorganization and price/modes of exchange (Hawkins, Catalano, & Miller, 1992). Successful application of environmental strategies also requires a clear understanding of the target population. For NMUM, adolescents are the most commonly studied target population, and availability emerges as a consistently linked and well-studied environmental-level risk factor (e.g. Fagan, Van Horn, Hawkins, & Arthur, 2007; Martino, Ellickson, & McCaffrey, 2008). Perceived (lower) availability has been shown to be associated with both lower lifetime and past-month NMUM among 6–10th graders (Fagan et al., 2007), and the increased availability of marijuana in and around cities is a contributor to marijuana use for youth living in urban areas (Martino et al., 2008). Evidence about the impact of community-level norms on NMUM is inconsistent; some studies demonstrate that community-level norms impact youth marijuana use (Fagan et al., 2007; Friese & Grube, 2013), whilst others find little impact, even among youth with strong community ties (Musick, Seltzer, & Schwartz, 2008). This discrepancy may simply be the result of different operational definitions of community-level norms – those involving adolescent perception of community norms, those involving adult perception of community norms, and norms, or those involving some other contextual variable (e.g. measures of drug-possession enforcement, as cited in Nalls, R.L. Mullis, & A.K. Mullis, 2009). Neighbourhood disorganization, defined as neighbourhoods with high population density, low surveillance, high crime rates and low neighbourhood attachment (Hawkins et al., 1992), has inconsistent association with youth marijuana use (Fagan et al., 2007; Galea, Ahern, Tracy, & Vlahov, 2007; Martino et al., 2008). Some research has shown that the greater perceived neighbourhood disorder is linked to greater risk of marijuana use for adolescents (Wilson, Syme, Boyce, Battistich, & Selvin, 2005), whilst other research found no link after accounting for more individual-level factors, such as poorly modulated affect (Ridenour et al., 2009). In terms of price/mode of exchange, young adults, particularly in the U.S., generally obtain marijuana in non-economic ways through social networks. The U.S. National Survey on Drug Use and Health indicates that more than half of past-year young adult users of marijuana obtained their marijuana for free, and that regardless of whether marijuana was obtained for free or purchased, the majority of past-year young adult users obtained marijuana through friends or relatives (Substance Abuse and Mental Health Services Administration [SAMHSA], 2006)². These exchanges generally happened in apartments, dorms or private homes (SAMHSA, 2006).

UNIQUE CONSIDERATIONS ABOUT ENVIRONMENTAL-LEVEL PREVENTION EFFORTS FOR NMUM

Just as environmental risk factors for marijuana differ from those for alcohol and other illicit drugs, environmental strategies for preventing NMUM may also differ from strategies for other substances. For example, public space interventions, which include cutting down trees, increasing visibility through lighting, and changing traffic patterns to make drive-by purchases more difficult have been used to curb the distribution of other types of illicit drugs (Birckmayer, Fisher, Holder, & Yacoubian, 2008), but may have minimal effect on reducing NMUM rates, particularly in the U.S., because, as noted above, U.S. marijuana exchanges generally take place indoors (SAMHSA, 2006).

Moreover, in the United States, Australia, Great Britain and many other countries, there is much social and political controversy over marijuana cultivation, distribution and utilization (Abel & Casswell, 1998; European Monitoring Centre for Drugs and Drug Addiction [EMCDDA], 2008; Fischer, Ala-Leppilampi, Single, & Robins, 2006; Hall, 2000; Jones & Hathaway, 2008; Marcoux, Larrat, & Vogenberg, 2013; Moravek, 2008; Rubens, 2014). The resulting attention marijuana receives from these national debates can impact environmental factors like perception of harm, perception of norms about acceptability of use and perception of enforcement, potentially making the prevention of NMUM different than the prevention of other substances.

Such differences highlight a need for a review of whether and how the prevention field may be reflexively applying ‘lessons learned’ from environmental strategies with other public health issues to NMUM, and whether or when these applications are appropriate. A 2009 Cochrane review examined randomized controlled trials delivered in U.S., non-school settings (including multi-component community-based interventions) for drug use in general and suggested, based on one included study, that community-based strategies may impact adolescent cannabis use, although the results were ‘of marginal statistical significance’ (as cited in Gates, McCambridge, Smith, & Foxcroft, 2009, p. 9). To the best of our knowledge, no additional published systematic reviews exist that consider evidence beyond randomized controlled trials and examine environmental strategies for marijuana specifically.

The current review summarizes the published evidence for environmentally based NMUM prevention strategies in an effort to guide decision making for implementation. Because legality, norms and enforcement of NMUM vary internationally, this review is explicit about the source of the data in the cited studies (i.e. the countries included in sample, identification of whether the sample was nationally representative). Also, because changes in various national policies

about the decriminalization of marijuana possession, cultivation and use have altered the landscape in which prevention activities occur, this review is clear about the year of data collection for cited studies. Since proper identification of the target population is a critical component of the planning and delivery of environmental strategies, the target population is also explicitly noted.

METHODS

Four electronic databases from EBSCO (PSYCHINFO, SocINDEX, PsycARTICLES and Academic Search Complete) were searched for original quantitative research articles examining environmental strategies for marijuana use prevention. Articles selected for inclusion were published in English, came from peer-reviewed journals, and had available linked full text. Selected articles were published between January 2003 and June 2013, to account for a decade of research on environmental strategies and NMUM. Studies that reported outcomes solely for combined indicators of substance use (e.g. marijuana combined with illicit drugs) were excluded. Studies focusing on in-treatment or institutionalized populations or that focused solely on family, peer or individual-level strategies were also excluded, as were classroom curriculum-based interventions (e.g. Lifeskills; Botvin & Kantor, 2000), which may also be regarded as fundamentally individual-level strategies. Dissertations, policy papers without supporting data, ethnographic studies, reviews and qualitative studies (e.g. case studies) were also excluded. Search terms included 'marijuana' or 'cannabis' (in the title) in combination with 'policy' or 'strategy' or 'enforcement' or 'prevention' (all fields). The references listed in retrieved articles were also examined and included in this review when they met the above selection criteria.

RESULTS

Study Characteristics

Identified abstracts and exclusion rationale are presented in Figure 1. Although 413 articles were identified using the search terms described above, 405 did not meet inclusion criteria based on abstract review. Over a third ($n = 138$) were excluded because they did not provide original quantitative data (e.g. policy paper, non-systematic review). Over a third of the abstracts ($n = 141$) were excluded because they could not be considered an environmental intervention (e.g. a study on the risk and protective factors associated with marijuana use) or marijuana use was not the outcome (e.g. illicit drug use more generally was the outcome). Eight articles identified through these search methods met inclusion criteria. A review of the reference lists of included articles yielded an additional 12 articles that met inclusion criteria, resulting in a total of 20 articles that satisfied the

criteria. A list of included studies and their sampling procedures, measures, analyses and key outcomes related to marijuana use can be found in Table I.

Of the 20 articles reviewed, 12 described outcomes in the youth population ranging from 10 to 18 years old (Alvaro et al., 2013; Bjarnason, Steriu, & Kokkevi, 2010; Carpenter & Pechman, 2011; Harper, Strumpf, & Kaufman, 2012; Hornik, Jacobsohn, Orwin, Piesse, & Kalton, 2008; Scheier & Grenard, 2010; Lynne-Landsman, Livingston, & Wagenaar, 2013; Palmgreen, Lorch, Stephenson, Hoyle, & Donohew, 2007; Simons-Morton, Pickett, Boyce, ter Bogt & Vollebergh, 2010; Slater et al., 2006; Slater, Kelly, Lawrence, Stanley, & Comello, 2011; Wall et al., 2011), two examined intervention outcomes with adults 18 years and older (Cerda, Wall, Keyes, Galea, & Hasin, 2012; Reinerman, Cohen, & Hendrien, 2004), and six examined outcomes for the general population of youth and adults combined (Desimone & Farrelly, 2003; Gallet, 2013; Gorman & Huber, 2007; Khatapoush & Hallfors, 2004; Van Ours & Williams, 2007; Williams, 2004). Of the articles reviewed, 14 were based on U.S. samples, four included cross-country comparisons/samples and two were based on Australian samples. Additional study characteristics are included at the beginning of the subsections below on media, policy and price.

INTERVENTIONS: MEDIA

Seven articles described evaluations of media strategies to prevent marijuana use among youth. Four (Alvaro et al., 2013; Carpenter & Pechmann, 2011; Hornik et al., 2008; Scheier & Grenard, 2010) focused on the marijuana use outcomes of U.S.-based national campaigns ('My Anti-Drug' and 'Above the Influence') with national samples, whilst one (Palmgreen et al., 2007) evaluated outcomes of a U.S.-based national campaign ('My Anti-Drug') using a two-community sample. Two additional articles (Slater et al., 2006, 2011) examined the simultaneous influence of U.S.-based national campaigns and a local media intervention (i.e. 'Be Under Your Own Influence') on marijuana use.

U.S. National Campaigns

The National Youth Anti-drug Media Campaign, 'My Anti-Drug', was the first national campaign in the United States to focus specifically on marijuana. The campaign, which ran from 1999 to 2004 with heavy targeting toward marijuana in 2002, was comprised of ads about three themes: (1) resistance skills and self-efficacy; (2) normative education and positive alternatives; and (3) negative consequences of drug use (Hornik et al., 2008; Scheier & Grenard, 2010). The cognitive and behavioural effects of 'My Anti-Drug' were evaluated using 4 years of data from an in-home survey of youth and their parents. Results demonstrated little evidence that exposure to the anti-drug

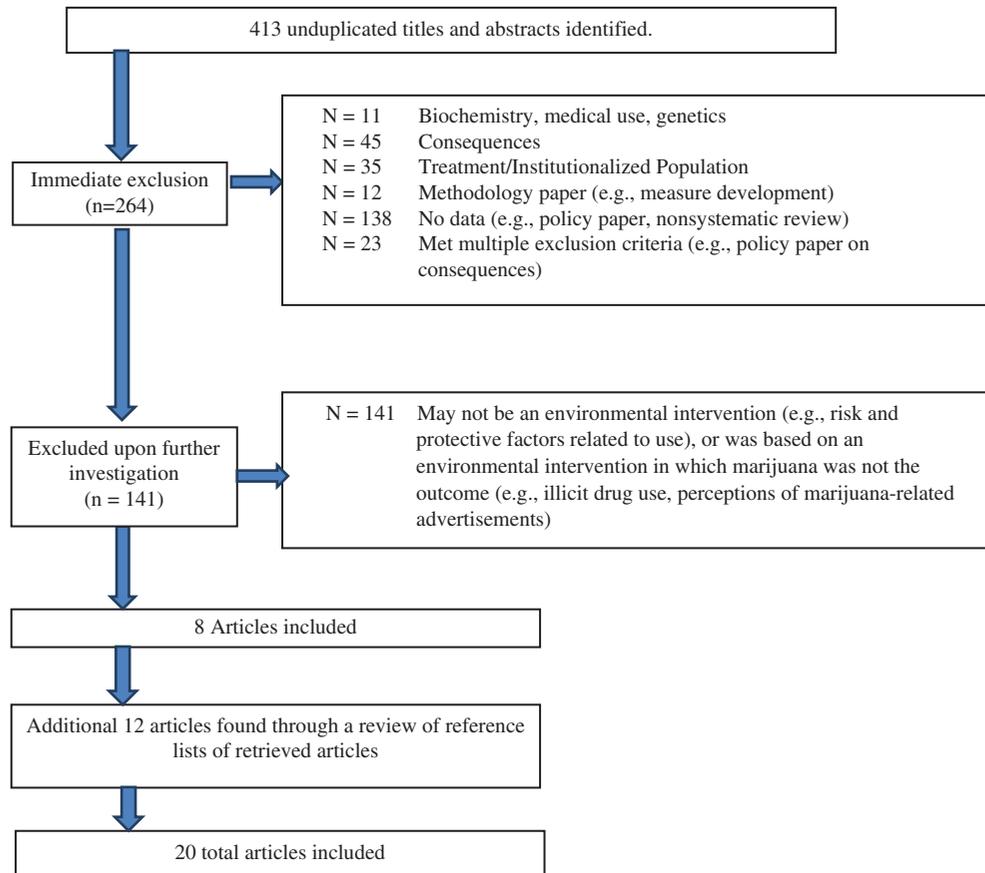


Figure 1. Systematic review of the literature on environmental-level strategies and interventions to impact the non-medical use of marijuana (NMUM).

advertising impacted lifetime, past-year or past-30-day marijuana use. In fact, some evidence suggested the possible presence of pro-marijuana effects in response to the anti-drug messaging (Hornik et al., 2008), particularly for younger adolescents (age 12–14; Scheier & Grenard, 2010).

To understand why this early U.S. National Anti-Drug Media Campaign was unsuccessful, Alvaro et al. (2013) investigated adolescents' judgments of the anti-marijuana TV ads used in the campaign and their association with future marijuana use. Using data from the same nationally representative sample as Hornik et al. (2008), the authors found that youth who positively evaluated the ads at the time of the first survey were less likely to report using marijuana at follow-up and were also less likely to report future intentions to use. Current marijuana users and 'vulnerable users' (i.e. those who indicated that they may use marijuana in the next 12 months) liked the ads less than 'resolute non-users' (i.e. those who indicated no intention to use marijuana in the next 12 months). Although the reach of the campaign was high, the ads were not well-liked by the target risk population (i.e. 'vulnerable non-users' and 'users'), which could account for its overall failure.

Another investigation into the U.S. National Anti-Drug Media Campaign looked specifically at the campaign's foray into marijuana-specific messaging during 2002, when it focused on at-risk, high-sensation

seeking adolescents with ads featuring messages about the negative consequences of marijuana use. Prior to the initiative, high sensation seekers showed a rising trend in use. This trend was interrupted by a statistically significant decrease in use after the initiative started, and this decrease continued throughout the measurement period. Impacts on trends in use were not demonstrated for low-sensation seekers. The findings imply that whilst the ads may have not been successful in creating behaviour change for the general adolescent population, they may have been successful in reducing use among high-sensation seeking youth (Palmgreen et al., 2007).

The lacklustre performance of the broader U.S.-based National Anti-Drug Media Campaign ('My Anti-Drug') led to significant revision and a re-release in 2005. The new campaign, branded as 'Above the Influence', used ads centering on the adolescent need for personal autonomy and the positive consequences of abstaining from substance use (e.g. pursuing career goals, exciting activities; Comello, 2013). Carpenter and Pechmann (2011) evaluated the new campaign using past-month and lifetime marijuana use from 'Monitoring the Future' surveys conducted from 2006 to 2008. 'Above the Influence' had an effect on eighth grade girls, for whom increased exposure to the anti-drug ads was significantly related to lower odds of lifetime and past-month marijuana use.

Table 1. Study characteristics and findings from a 10-year systematic review of the literature on environmental-level strategies and interventions to prevent the non-medical use of marijuana (NMUM), organized by date of intervention and type of intervention.

Author	Years of intervention studied, location of intervention	Description of intervention	Sampling and sample characteristics	Measures and analysis	Key findings
Alvaro et al. (2013)	September 1999–June 2004; United States	National Youth Antidrug Media Campaign	A nationally representative sample of three cohorts of U.S. youth (9–18 years) participated in four rounds of interviews from 1999 to 2004. For this study, Time 1 and 2 data were used. <i>N</i> = 2993, 12–18 year olds.	This study used the National Survey of Parents and Youth, an in-home survey of youths and their parents in the US. Youth were categorized into 1 of 3 mutually exclusive categories: ‘Users’ were those who had used at least once in their lifetime. ‘Resolute nonusers’ were those with no intentions to use. ‘Vulnerable nonusers’ were those with possible intentions to use. Past-year and past 30-day use and attitudes toward personal use of marijuana (i.e. ‘extremely bad’ to ‘extremely good’) were also assessed. A multilevel HLM analysis was conducted. Control variables were respondents’ attitudes toward marijuana, number of ads viewed, age and gender. Ad evaluations were an identified outcome; user status was the independent variable.	Men, vulnerable non-users, users, and those with more positive attitudes toward marijuana were less likely to view the ads positively. Positive ad evaluation was associated with lower intentions to use marijuana. In general, those who viewed the ads positively at time 1 were less likely to use marijuana at time 2. Users who evaluated the ads positively at time 1 were more likely to show reduced use at time 2.
Carpenter & Pechmann (2011)	2006–2008; United States	‘Above the Influence’ – ads with the theme that substance use interferes with autonomy and aspiration	Random sample of adolescents in U.S. (grades 8, 10, 12); <i>n</i> = 130,245.	Monitoring The Future surveys from 2006 to 2008 assessing past-month and lifetime marijuana use; race and parental education were used as controls in multivariate models. Exposure to the media campaign was also assessed.	Greater exposure to antidrug ads was significantly related to lower odds of having ever used marijuana and for past-month marijuana use among 8th-grade girls. Findings were not significant for boys in grade 8, or students of both genders in grades 10 and 12.
Hornik et al. (2008)	September 1999–June 2004; United States	National Youth Antidrug Media Campaign	A nationally representative sample of three cohorts of U.S. youth (9–18 years) participated in 4 rounds of interviews. Round 1, <i>N</i> = 8117; Round 2, <i>N</i> = 6516; Round 3,	This study used the U.S. National Survey of Parents and Youth, an in-home survey of youths and their parents. Exposure to antidrug advertising was measured through recall questions (e.g. ‘Have you ever seen or heard this ad?’). Cognitive measures included: (1) marijuana intentions; (2) marijuana beliefs and attitudes; (3) social	No change in marijuana use prevalence during the years of the campaign. Little to no evidence that exposure to anti-drug advertisements impacted outcomes, after controlling for confounds. Lagged analysis demonstrated some indications of pro-marijuana effects.

(continued)

Table I. Continued.

Author	Years of intervention studied, location of intervention	Description of intervention	Sampling and sample characteristics	Measures and analysis	Key findings
			<i>N</i> = 5854; and Round 4 <i>N</i> = 5126.	norms; and (4) self-efficacy to resist use. Outcome measures included lifetime, past-year, and past-30-day use of marijuana. Analyses included: (1) examining trends over the course of the campaign; (2) examining exposure to anti-drug advertising and marijuana-related outcomes after controlling for confounds; and (3) examining association between exposure on an initial survey and outcomes on a following survey.	
Palmgreen (2007)	October 2002–June 2003; United States	U.S. National Youth Antidrug Media Campaign – Marijuana-Specific messaging targeted toward high sensation seeking youth	Evaluation included two moderate-size counties in Kentucky and Tennessee. The initial cohort was in the 4 th –8 th grade at the start of data collection. Monthly random samples of 100 students were selected from each county from April 1, 1999–March 2003.	Sensation seeking was measured by the Brief Sensation Seeking Scale. The primary dependent variable was past 30-day marijuana use. Attitude toward marijuana use, marijuana beliefs, and social norms were assessed, as was self-reported, past 30-day exposure to TV and radio anti-marijuana ads. Trends were tested before and after the intervention with a 48-month, independent-sample interrupted time-series design.	Trends in use for high-sensation seekers were significantly impacted by the intervention. Low sensation seekers did not demonstrate the same impact on trends.
Scheier & Grenard (2010)	1999–2004; United States	National Youth Antidrug Media Campaign	A nationally representative U.S.-based sample of youth, ages 12–18 years, recruited through the National Survey of Parents and Youth. <i>N</i> = 2515	This study used the National Survey of Parents and Youth, an in-home survey of youths and their parents in the US. Researchers assessed the frequency with which youth reported seeing/hearing ads across various media types (e.g. on television, radio). Researchers also assessed general media exposure and past-year marijuana use. Using univariate and bivariate growth curve models, the researchers tested whether increased exposure to anti-drug messaging and increased memory of that messaging is associated with past 12-month marijuana use and how/whether that relationship changes as youth age.	Youth between the ages of 12–14 show simultaneous increases in marijuana use and in campaign awareness. Among older youth (age 15–18), increased awareness of the campaign was not associated with reductions in marijuana use.

Slater et al. (2006)	Fall 1999–Spring 2003; United States	Implementation included an in-school media campaign, a broader community media effort, and implementation of All Stars (an evidence-based school curriculum). The media campaign, titled 'Be Under Your Own Influence', targeted alcohol, marijuana and cigarette use. Messages were aligned to youth's need for autonomy and independence.	Randomized community design: eight media treatment and eight control communities in four major regions of the U.S. (NE, SE, mid-west and west). Communities randomized to media treatment condition received community- and in-school media materials and efforts. In each community (media treatment or media control), one of the two middle schools also received the 'All Stars' curriculum, whilst the other did not. $N = 4216$ in intervention communities, mean age at baseline = 12.2	The study used the American Drug and Alcohol Survey and assessed marijuana use through five measures (ever used, past-month use, age of first use, use when alone and self-classification on a scale from a non-user to a very heavy user). Longitudinal data were collected (four waves) and analyzed using a four-level random intercept model to test for intervention effects.	The final wave of data collection revealed a significant impact of the media condition on lifetime marijuana use. The addition of the curriculum did not appear to interact synergistically with the media efforts.
Slater et al. (2011)	2005–2009; United States	Assessed the simultaneous impact of two media campaigns in the U.S.: (1) 'Be Under Your Own Influence' – a local, in-school and community-based media intervention; (2) 'Above the Influence' – a national media campaign.	Randomized community and middle school trial with four conditions: community intervention plus in-school media, community intervention with no in-school media, in-school media only, no intervention (all conditions were exposed to the nation-wide 'Above the Influence' campaign). Four waves of data were collected. Twenty participating communities located in 13 different states. 3236	The study measured beliefs about whether autonomy and aspirations were inconsistent with marijuana use. Four measures assessed marijuana use (age of first use, past 30- and 90-day use, and lifetime use). Exposure to 'Above the Influence' was evaluated using the following stem: 'Have you seen the following lines in ads or posters about drugs or alcohol?' (including two fake campaign slogans).	The school-level treatment had no significant effects on use. Community-level treatment 'Be under your own influence' lowered the tendency to use marijuana over and above the effect of the 'Above the Influence'. Whilst controlling for the effects of 'Be Under Your Own Influence', exposure to 'Above the Influence' campaign also predicted reduced marijuana use.

(continued)

Table I. Continued.

Author	Years of intervention studied, location of intervention	Description of intervention	Sampling and sample characteristics	Measures and analysis	Key findings
			students participated in at least one survey. Mean age was 12.4 years.		
Policy					
Cerda et al. (2012)	Medical Marijuana Laws (MMLs) prior to 2004; United States	Examined the impact of the enactment of MMLs in the U.S. prior to 2004. Individuals living in one of the 10 states with MMLs established prior to 2004 were compared with individuals living in states that did not have MMLs.	This study used a national survey of adults aged 18 and older $n = 34,653$. In addition, the study used a national survey of youth and adults aged 12 and older (selecting only those 18+), $n = 136,068$.	Past 12-month and lifetime marijuana use, dependence and abuse were assessed using the National Epidemiologic Survey on Alcohol and Related Conditions. The National Survey on Drug Use and Health (NSDUH) was used to assess past 12-month marijuana use. This study utilized a state-level regression model to determine whether states with MMLs had higher rates of past-year marijuana use, after controlling for other state-level variables. The analysis also incorporated a multilevel regression analysis of individuals nested within states.	Significant differences were found between states with MMLs and those without in NESARC and NSDUH measures of past-year marijuana use. Odds of engaging in past-year marijuana use were 1.92 times higher for those living in states with MMLs.
Gorman & Huber (2007)	1994–2002 (dates of data collection); United States	Examined the impact of MMLs on use rates in high risk subgroups: adult arrestees and Emergency Room (ER) patients.	The study used data from 23 participating cities in the Arrestee Drug Abuse Monitoring system (ADAM). Five of these cities were in states with MMLs. The study also used data from 21 metropolitan sites in the Drug Abuse Warning Network (DAWN), which reviews ER visit records to determine which may be related to drug use. Five of the metropolitan areas are in states with MMLs.	From ADAM, urinalysis and self-report data were obtained from arrestees (mainly aged 18 and older, but some data available on juvenile arrestees aged 10–17). Quarterly data was drawn from DAWN (age could not be discerned). The study used an interrupted time-series design to compare changes pre- and post-MML passage.	MMLs did not impact marijuana use among high risk subgroups (i.e. arrestees and ER patients).

Harper et al. (2012)	2002–2009 (enactment of MMLs); United States	Examined the impact of the enactment of MMLs in the U.S. by plotting prevalence of past 30-day marijuana use with MML status, accounting for differences between states that did and did not pass MMLs.	This study used a U.S. national survey of youth and adults, selecting only those aged 12–17 for analysis, and compiling data from 2002 to 2009. $N =$ approximately 23,000.	This study used the NHDUH to assess past-month (30-day) marijuana use and perception of harm (risk-level associated with once a month marijuana use). The authors plotted past-month marijuana use and perceived risk by state and MML status, comparing states year by year of MML passage. This study extended the analysis of Wall et al. (2011), by accounting for differences between those states that did eventually pass a MML and those that never passed an MML.	In states with MMLs, past-month marijuana use rates decreased among those aged 12–17 after controlling for state characteristics that are considered fixed effects.
Khatapoush & Hallfors (2004)	1995–1999; United States	Examined marijuana related attitudes and use rates in California and comparison states prior to and after legislation was passed in California allowing for medicinal use.	Data were collected through random digit dialling as part of the ‘Fighting Back’ initiative, a US, community-based collaborative effort focused on reducing substance demand. 16–25 year olds. California, $n = 2651$; Comparison states, $n = 12,916$.	Used logistic and bivariate regression to determine whether attitudes toward use changed over time in California, and whether attitudes and use rates differed between California and other states, particularly post-passage of California MMLs. Past-month and past-year marijuana use was assessed (dichotomized into use/no use), as was perceived availability, perceived risk of harm and general approval. Various demographic variables (e.g. religious service attendance, marital status, level of educational attainment and income) were also assessed as potential covariates.	Perception of harm declined over time in California, whilst past-month or past-year use did not. When compared with other states, Californians saw marijuana as less harmful. Past-month and past-year use in California were also higher than other states.
Lynne-Landsman et al. (2013)	1996–2011; United States	Enactment of MMLs in the U.S. – treated as repeated experiments.	Four focal study states in the US: RI, MI, DE and MT with MMLs and for which individual-level Youth Risk Behavior Survey (YRBS) data were available by state and year ($n = 1814–4030$), age 12–18 years.	Lifetime and past-month marijuana use were assessed by the YRBS. All analyses controlled for age, ethnicity and gender. Because the authors hypothesized that states that enact MMLs differ from states that do not, they conducted a difference in differences analysis of the four focal study states, such that states that later enacted MMLs serve as a comparison group for those who enacted MMLs earlier.	No evidence of effects within the first few years of MMLs on individual-level adolescent marijuana use (lifetime or past month).

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Table 1. Continued.

Author	Years of intervention studied, location of intervention	Description of intervention	Sampling and sample characteristics	Measures and analysis	Key findings
Reinarman et al. (2004)	1996 (date of data collection); United States and Netherlands	Examined the impact of drug control policies in the United States (criminalization) and Netherlands (decriminalization) on the use patterns and use trajectories of experienced marijuana users.	Amsterdam's Municipal population registry was used to obtain an initial random sample of non-institutionalized residents. Those who had used marijuana 25 or more times participated in an in-depth interview ($n = 216$). In San Francisco, a short prevalence survey was conducted among a random sample of non-institutionalized residents. Those who had used marijuana 25 or more times were asked to participate in an in-depth interview ($n = 266$).	Participants from both countries were asked about use trajectories, including age of initial use, age of commencing regular use (greater than once a month), and age and duration of maximum use. Patterns of use were assessed by asking about 4 periods: first year of regular use (greater than once a month), maximum use period, past-year use and past 3-month use.	No differences were found between Amsterdam and San Francisco in use trajectories or patterns of use among experienced users.
Simons-Morton et al. (2010)	2005–2006; United States, Canada and Netherlands	Cross-country comparison of the impact of national-level policy and enforcement strategies on adolescent marijuana use.	Participating countries in the Health Behavior in School Aged Children Survey Project provided a nationally representative sample of 10 th grade students selected using pre-approved sampling methodologies. U.S., $n = 1559$, Canada, $n = 1973$, Netherlands, $n = 1326$.	Health Behavior in School Aged Children survey was used to assess past 30-day and past 12-month marijuana use rates. Scores were assigned to the U.S., Canada and the Netherlands that reflected the restrictiveness of policies related to criminality of adult possession, consumption and purchase and the jurisdiction of the legislation (e.g. Federal, state/local/provincial). Relative risk rates were constructed using confidence intervals.	Marijuana use rates could not be linked to restrictiveness of national policies, with the exception of lower use rates among girls in the Netherlands. National culture and social norms were not assessed, and may impact these findings.

Wall et al. (2011)	2002–2008 (enactment of MMLs); United States	Examined the impact of the enactment of MMLs in the U.S. by plotting prevalence of past 30-day marijuana use with MML status.	This study used a U.S. national survey of youth and adults, selecting only those aged 12–17 for analysis, and compiling data from 2002 to 2008. <i>N</i> = approximately 23,000	This study used the NSDUH to assess past-month (30-day) marijuana use and perception of harm (risk-level associated with once a month marijuana use). The authors plotted past-month marijuana use and perceived risk by state and MML status, comparing states year by year along MML passage.	Marijuana use rates were higher, and perceived risk of marijuana use lower in states with MMLs.
Price					
Bjarnason et al. (2010)	2003; 31 European Countries	An examination of how supply and demand reduction efforts at the country level can impact individual level use, over and above individual-level prevention programs.	Over 80,000 15–16 year old students from 31 European countries. All but three countries (Turkey, Germany and Russia) contributed nationally representative samples.	Data were generated from the European School Survey Project on Alcohol and Other Drugs (ESPAD), a collaborative European research project. The outcome variable was past 30-day marijuana use, dichotomized into a yes/no measure and weighted by country contribution. The independent variables were perceptions of availability at the country level from non-users (proxy measure for country-level supply) and perceptions of harm at the country level from non-users (proxy measure for country-level demand). The researchers used multi-level modelling to estimate the impact of country-level supply and demand on individual 30-day use. They also examined variations in slope to determine the impact of supply and demand on individual 30-day use in each of the 31 countries.	A single standard deviation increase in perception of availability at the country level by non-users (proxy measure for supply) resulted in an increase in marijuana use by a factor of 2.3. A single standard deviation increase in perception of harm at the country level by non-users (proxy measure for demand) resulted in an increase in marijuana use among adolescents by a factor of 2.3, as well. Variations in slope indicated that availability has a stronger impact on use in some countries (e.g., UK, Switzerland) than others. Perceived risk also has a stronger impact on use in some countries than others (e.g., France, Czech Republic).
Desimone & Farrelly (2003)	1990–1997; United States	Impact of price of marijuana and enforcement of possession violations on marijuana demand	Nationally representative sample of U.S. population aged 12–39. Separate analyses were conducted for 12–17 year olds ('juveniles') and 18–39 year olds ('adults').	National Household Surveys on Drug use measured past-year marijuana use. Price estimates for marijuana were calculated from a quarterly report by the DEA Intelligence Division containing estimates of the minimum and maximum price in 19 cities for commercial grade marijuana. Each state was assigned the price/average price of its reporting city/cities. The probability of arrest equalled the number of	Adult and juvenile marijuana demand was not impacted by marijuana price. Enforcement of cocaine possession laws reduced demand for both marijuana and cocaine. For both youth and adults, increases in the likelihood of arrest for marijuana possession reduced the likelihood of marijuana use.

(continued)

Table I. Continued.

Author	Years of intervention studied, location of intervention	Description of intervention	Sampling and sample characteristics	Measures and analysis	Key findings
Gallet (2013)	1972–2010; United States Australia and India.	Meta-analysis.	14 studies of marijuana found during a search of EconLit, Social Science Research Network and Google Scholar databases provided price elasticity estimates of marijuana (Heroin and cocaine were also included).	<p>possession arrests in the state (from the FBI) divided by the number of drug users in the state that year (based on census estimates). Analyses controlled for age, family size, real family income, race, sex, marriage/divorce and educational attainment (where applicable).</p> <p>Quantitatively examined the impact of price elasticity using a meta-analytic techniques which controlled for study characteristics such as whether the study held a subpopulation focus (youths, males and females), whether the study accounted for addiction, and whether the study accounted for the influence of 'substitutes or complements' like alcohol or other drugs.</p>	<p>Marijuana is less impacted by price than cocaine and heroin. The predicted elasticity for marijuana is nearly half that of other drugs.</p>
Van Ours & Williams (2007)	1998 wave of the Australian National Drug Strategy's Household Survey; Australia	Impact of price on initiation and cessation of marijuana use among those aged 14–22.	This study used data from the Australian National Drug Strategy's Household Survey of individuals 14–22 years of age, non-institutionalized population. $N = 1861$.	<p>Outcomes of interest included age of initiation into marijuana use and age at cessation of use. The researchers used state-level information to estimate the predicted price of a gram of high quality cannabis. Correlations of marijuana initiators were identified (e.g. Australian born, drop out of education system prior to 10th grade). Correlations between initiation and price in a given state (after controlling for state-level fixed effects) were estimated. Similarly, the researchers modelled the effects of state-level price on cessation of use (after controlling for state-level fixed effects).</p>	<p>Whilst initiation into cannabis use is price sensitive (with elasticity estimates between -0.50 and -0.70), the cessation of use is not price sensitive. Instead, cessation is associated with early initiation of use, meaning that those who begin their use trajectories earlier are more likely to remain using. The price of cannabis may have an indirect effect on quit rate, through its impact on age of initiation.</p>

Williams (2004)	1988, 1991, 1993, 1995 and 1998 waves of data from the Australian National Drug Strategy's Household Survey; Australia	Impact of price and criminalization policies on adult and youth use.	This study uses data from the Australian National Drug Strategy's Household Survey of individuals 14 years and older – non-institutionalized population (This may result in under-representation of illicit drug users, who may be at increased risk for homelessness, incarceration or involvement in treatment). <i>N</i> = 15,468.	Researchers examined past 12-month use and frequency of use for those who have used in the past 12 months. Price of marijuana was recorded by police during undercover purchases and used to estimate price at the state level. The researchers also established a dichotomized measure of decriminalization, to differentiate those states that allow for the cultivation and consumption of marijuana (including those states that have 'prohibition with civil penalties'), and those who do not.	Youth are more sensitive to fluctuations in price than adults (aged 25 and older), and adult females (aged 25 and older) are also more sensitive to fluctuations in price than adult men. Adult men (aged 25 and older), however, are at higher risk of use in states with decriminalization, although decriminalization does not appear to impact youth or females.
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Disappointingly, the anti-drug ads did not appear to have any impact on 8th grade boys or 10th and 12th graders of either gender.

Community Campaigns

Whilst the first U.S. National Anti-Drug Media Campaign was occurring ('My Anti-Drug'), Slater et al. (2006) implemented an in-school and community-based media intervention, titled 'Be Under Your Own Influence', that focused on the adolescent goal of autonomy. The first intervention took place in 16 selected communities in the United States and incorporated a four-group design: (1) community-delivered media efforts and in-school media reinforcement of message combined with a curriculum-based prevention program (i.e. 'All Stars'); (2) community-delivered media efforts and in-school media reinforcement with no curriculum-based prevention program; (3) curriculum-based prevention program only (i.e. 'All Stars'); and (4) no treatment. The community-based media campaign was found to significantly decrease lifetime youth marijuana use at the final wave of data collection, and the treatment effects on marijuana became larger over time. A few years later, Slater et al. (2011) assessed the simultaneous impact of the revised and re-released national campaign ('Above the Influence') with the 'Be Under Your Own Influence' community-based campaign. This time, they conducted a randomized community and school trial in 20 communities in the United States with four conditions: (1) community intervention combined with in-school media (dissemination of promotional materials and posters), (2) community intervention without in-school media, (3) in-school media and no community intervention and (4) no intervention (controls). The community component for 'Be Under your Own Influence', which included trainings to increase community readiness, media, coalition activities and provision of various marketing materials, was effective at reducing lifetime marijuana use and increasing perceptions that marijuana use was inconsistent with personal aspirations.

INTERVENTIONS: POLICY

Eight articles examined the impact of policy on marijuana use. Six described the impact of U.S.-based medical marijuana laws (MML) on marijuana use (Cerde et al., 2012; Gorman & Huber, 2007; Harper et al., 2012; Khatapoush & Hallfors, 2004; Lynne-Landsman et al., 2013; Wall et al., 2011). Two articles focused more broadly on the impact of national policy and enforcement strategies (e.g. criminalization versus decriminalization; Reinerman et al., 2004; Simons-Morton et al., 2010).

Medical Marijuana Laws

The literature is generally inconsistent regarding the impact of U.S.-based medical marijuana laws (MMLs)

on NMUM. Using two national, U.S. datasets, Cerda et al. (2012) found that states with MMLs had higher past-year, adult marijuana use rates than those without MMLs after controlling for various state-level demographics. In fact, individuals over the age of 18 living in one of the 10 states that had enacted an MML prior to 2004 were 1.92 times more likely to have engaged in past-year marijuana use when compared to adults living in those states without MMLs, although the authors did caution against inferring a causal relationship (Cerda et al., 2012). Interestingly, none of the national datasets used in this study differentiate between medical and non-medical use of marijuana in measures of use, which is a clear confound for these findings (e.g. more people may be using marijuana medically in states with MMLs).

Using NSDUH data on over 23,000 12–17 year olds, Wall et al. (2011) compared past-month marijuana use in states with and without MMLs, and found that states with MMLs had higher rates of use and lower rates of perception of harm when compared to states without such laws. Using the same data, a replication and extension by Harper et al. (2012) found that once state-level fixed effects were accounted for, adolescent marijuana use seemed to decrease following the passage of MMLs, and that the passage of MMLs had no effect on perception of harm. The authors suggested that previous findings that MMLs increase adolescent marijuana use rates were simply the result of confounding – states that eventually pass MMLs differ in some unmeasured way that is related to marijuana use from those states that do not. These findings mirrored past work by Khatapoush and Hallfors (2004), who found that following the 1996 passage of California's MML, marijuana use rates among young adults remained unchanged but higher than comparison states. Lynne-Landsman et al. (2013) examined the impact of MMLs on adolescent lifetime and past-month marijuana use as measured by the Youth Risk Behaviour Survey (YRBS). Treating four states with MMLs (RI, DE, MT and MI) as a series of repeated real-world experiments, the authors used a difference-in-differences method, in which states with later MMLs were treated as controls for those with earlier MMLs. Similar to Harper et al. (2012) and Khatapoush and Hallfors (2004), the authors found no evidence that MMLs have an impact on lifetime or 30-day adolescent marijuana use, lending additional support to the hypothesis that unmeasured state characteristics account for the differences between those states with and without MMLs.

Gorman and Huber (2007) used the U.S. Arrestee Drug Abuse Monitoring (ADAM) system and the U.S. Drug Abuse Warning Network (DAWN) to analyze marijuana use among high risk groups of all ages (i.e. adult and juvenile arrestees and emergency room patients). These datasets are thought to serve as indicator systems that provide some insight into emerging local and national trends in substance use.

Echoing the findings of Harper et al. (2012), Khatapoush and Hallfors (2004), Lynne-Landsman et al. (2013) and Gorman and Huber (2007) found no discernible differences in use rates among these particular groups when comparing states with and without MMLs.

Criminalization and Other National Policies

In a cross-cultural investigation of marijuana use patterns and use trajectories among experienced marijuana users, Reinerman et al. (2004), found no significant differences between Amsterdam (Netherlands) or San Francisco (United States) in age of initial use, age of commencing regular use, age or duration of maximum use or use patterns among experienced marijuana users. The authors suggested that if policy (i.e. decriminalization versus criminalization) truly played a role in inhibiting use, then experienced users would have longer use trajectories in Amsterdam than in San Francisco. The authors suggested that informal etiquettes (e.g. use for relaxation only, use mainly with friends and use in moderation) may be a bigger driver of marijuana use patterns and trajectories than state or federal policies. These findings were echoed by Simons-Morton et al. (2010), who found little evidence that marijuana use rates could be tied to the restrictiveness of national policies among youth, in a cross-country comparison of the U.S., Canada and the Netherlands.

INTERVENTIONS: SUPPLY/DEMAND REDUCTIONS (INCLUDING PRICE)

Five articles explored the impact of supply and demand reductions on marijuana use. The first article examined general supply and demand reduction efforts using evidence from 31 European countries (Bjarnason et al., 2010). Another examined the relationship between price or intensity of marijuana possession law enforcement in the United States and marijuana demand (Desimone & Farrelly, 2003). Two additional articles used Australian samples to look at price and policy (i.e. criminalization versus decriminalization; Williams, 2004) and price and initiation/cessation of use (Van Ours & Williams, 2007). A final article provided a meta-analytic look at 14 studies of price elasticity using samples from Australia, the United States and India (Gallet, 2013).

Using data from over 80,000 adolescents from 31 countries, Bjarnason et al. (2010) found that country level efforts at controlling supply and demand can impact individual-level marijuana use over and above the impact of individual-level prevention programs. Using non-user perception of availability as a proxy measure for supply and non-user perception of harm as a proxy measure for demand, the researchers found that living in a country where most non-users perceive high levels of availability and low levels of risk increases

the likelihood of individual marijuana use, regardless of individual-level perceptions.

Although country-level supply and demand policies may impact use, the impact of price specifically on past-year marijuana use has demonstrated inconsistent results. Using a U.S.-based nationally representative sample, Desimone and Farrelly (2003) examined the impact of price and enforcement of possession laws on use, after controlling for socioeconomic and demographic variables and for fixed-effect state-level characteristics. They found that for both adolescents and adults, demand for marijuana is not sensitive to price; however, increases in the probability of arrest for drug possession do impact demand. In Australia, Williams (2004) found that past-year marijuana use and frequency of use can both be responsive to changes in price, particularly for adolescents. Echoing these findings, Van Ours and Williams (2007) found that price reduces initiation, but not cessation, of marijuana use among adolescents and young adults in Australia. Using a meta-analysis of price elasticity estimates, Gallet (2013) concluded that marijuana use is generally less responsive to fluctuations in price, with a predicted price elasticity that is approximately half that of other illicit drugs (i.e. cocaine, heroin).

DISCUSSION

The 20 studies on environmental-level strategies for the prevention of NMUM included in this review provided evidence for three main types of environmental prevention strategies: national and local media campaigns, policies and price (or supply/demand strategies). The literature on media campaigns offers a picture of the evolution of ‘what works’ in media messaging for NMUM, namely, well-directed, well-liked media messaging bolstered by community-level support. An understanding of the history of media-messaging is critical for avoiding the iatrogenic effects seen in some past campaigns; formative research and careful process evaluations are imperative in the use of this strategy. The efficacy of media campaigns for reducing adult NMUM remains untested. Current knowledge on marijuana-related policies is limited mainly to investigations of MMLs and whilst the findings are inconsistent, there is increasing evidence that states with MMLs differ in some unmeasured way from those that do not pass MMLs, possibly due to pre-existing community norms, and that this accounts for increases in use rates in these states (Harper et al., 2012; Khatapoush & Hallfors, 2004; Lynne-Landsman et al., 2013; Gorman & Huber, 2007). Regarding price/availability, demand theory dictates that a combination of marijuana price, plus perception of enforcement and probability of ensuing penalties, should predict use rates (Desimone & Farrelly, 2003). The current review points to marijuana primarily as a shared substance that is relatively insensitive to fluctuations in price, at least among U.S.-based samples, suggesting that demand

reduction strategies or policies need to account for marijuana as a socially transferred substance, particularly for U.S. adolescents (Hamilton, 2005). Evidence from Europe suggests that reductions in perceived availability at the country level may correspond with reductions in individual-level marijuana use, although understanding which specific availability-reduction strategies are effective remains a bit more elusive (Bjarnason et al., 2010), as the general restrictiveness of global national policies does not appear to impact individual-level use (Reinarman et al., 2004; Simons-Morton et al., 2010). Demographic groups may also be differentially affected by decriminalization policies, a theory that requires additional exploration (Williams, 2004). Taken together, the results from the three main ‘types’ of environmental strategies presented here indicate that existing state characteristics (e.g. community norms) impact policy (Harper et al., 2012; Khatapoush & Hallfors, 2004; Lynne-Landsman et al., 2013; Gorman & Huber, 2007) and that policies regarding supply/demand (through enforcement) may also impact use (Desimone & Farrelly, 2003). This suggests that prevention of NMUM and its related consequences may be best served through a combination of environmental level prevention strategies, although more research is needed to verify synergistic effects.

LIMITATIONS

The current review did not weigh the methodological quality of included studies, nor did it speak to effect sizes. Search term selection, limitations in the scope and selection of databases, and lack of full-text availability influenced the number of studies found and included. Cultural differences in the social and political contexts in which environmental strategies are delivered may make cross-country findings non-transferrable. As intended, this review focused solely on environmental-level strategies; individual-level interventions were excluded, though some are effective in reducing marijuana use (Stephens et al., 2009; Walker, Roffman, Stephens, Berghuis, & Kim, 2006) and their use in combination with environmental strategies might have synergistic effects (Jackson, Geddes, Haw, & Frank, 2012).

DIRECTIONS FOR FUTURE RESEARCH

Perhaps just as significant as what is present in the extant literature is what is absent. Because of vast heterogeneity in cultural norms, national laws and local policies on marijuana use, the prevention field lacks some agreement on what pattern of NMUM is problematic, for whom, and under what circumstances. Marijuana use rates and correlates of marijuana use that stem from some national surveys do not account for marijuana use as legally prescribed for medicinal purposes (e.g. National Survey on Drug Use and

Health), causing serious confounds when attempting to assess the impact of MMLs and other policies about medicinal use on general use rates. Conflicting operational definitions create a significant hurdle in the systematic review of literature on the non-medical use of marijuana. The field would clearly benefit from addressing these issues.

Extant literature is hindered by a lack of information about protective factors associated with NMUM and a corresponding lack of information about interventions designed to promote such factors. In addition, the literature has largely relied on dichotomous use measures (e.g. lifetime use), which may mask associations between environmental strategies and the frequency of marijuana use or progression onto dependence. Finally, few articles account for the possible differential effects of strategies on non-users versus users.

Evaluation research is also needed on: (a) policies beyond MMLs; (b) other environmental strategies implemented at the state or local level; and (c) marijuana enforcement strategies. For U.S.-based policy, future research should move beyond a simple analysis of whether a state does or does not have a MML to look at the differences in MMLs. The treatment of MMLs as a dichotomous measure in current research (i.e. a state allows medical marijuana use or it does not allow medical marijuana use) obscures important policy differences (e.g. patient registries, allowances for home cultivation, allowance of medical marijuana as prescribed for general ‘pain’ diagnoses and regulation of medical dispensaries) that may impact recreational use (Pacula, Powell, & Sevigny, 2013). MML research should account for the number and type(s) of controls the state puts on the distribution, possession and cultivation of medical marijuana. When considering MMLs, states and/or communities have used a variety of additional policies, ordinances and laws to limit availability locally. Examples of these include zoning limitations (such as limiting dispensaries to industrial or commercial zoning districts), increasing the distance of dispensaries from schools and other places where those under 21 gather, and setting medical dispensary policies (e.g. security measures like cameras, ID cards required for entry or the presence of a guard; Williams, Freisthler, Sims, Martin, 2011). Studies using NSDUH data to examine the impact of MMLs are forced to use 2-year estimates that do not allow for a precise examination of the impact of the law, or the timeline in which supporting policies are implemented and enforced (Harper et al., 2012). Although the quality and availability of existing data is always a concern when evaluating environmental strategies (Pettibone et al., 2012), future research should consider the use of alternative data sources to triangulate findings and gain additional perspective, such as marijuana-related arrests for cultivation, distribution and use, treatment admission data and emergency room data (Harper et al., 2012).

Coalitions and local preventionists have been creative in the transfer of policies used with alcohol and tobacco to marijuana. For example, some have implemented environmental strategies that limit the sale of paraphernalia and eliminate pro-marijuana merchandise sold in public places. Evaluation of these types of local-level interventions could show whether they are an effective use of prevention resources. In addition, a better understanding of the risk and protective factors associated with NMUM, perhaps through a meta-analysis on the impact of community-level norms or neighbourhood disorder, is needed to determine the interventions most likely to impact NMUM at the environmental level.

Enforcement data from the 1990s suggests that increased enforcement of drug possession laws may impact marijuana demand (Desimone & Farrelly, 2003). This analysis, however, has not been updated, nor have additional enforcement strategies been singularly and properly evaluated, such as requiring those who sell marijuana paraphernalia to register for a tobacco license regardless of whether they sell tobacco, and requiring those with a medical marijuana license to not only carry it, but also to register their cards with the local chief of police. Further, evidence suggests cross-cultural differences on the impact of perceived risk on use, which may include perception of risk of apprehension (Bjarnason et al., 2010); these are differences that should be further explored.

Highlighting research on environmental strategies for NMUM prevention accomplishes two important purposes: (a) it offers prevention practitioners working at local and state levels guidance on ‘what works’ in community-based strategies, and (b) it points to ‘next steps’ for future evaluation. States and local communities see environmental strategies, such as policy, media, and enforcement as cost-effective vehicles for NMUM prevention due to their demonstrated efficacy in preventing the abuse of other substances (e.g. alcohol or tobacco). Additional research can help practitioners by establishing whether these are also effective practices for NMUM prevention.

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NOTES

1. Mirroring definitions from the literature on the non-medical use of prescription medications (SAMHSA, 2007), in this article, unless otherwise noted, we defined the non-medical use of marijuana (NMUM) as marijuana use without a prescription belonging to the user or the use of marijuana simply for the experience or feeling that it causes.

2. Current NSDUH reports do not separate medicinal and non-medical marijuana users.

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