Journal of Applied Research on Children: Informing Policy for Children at Risk

Volume 8
Issue 2 *Youth at Risk: New and Emerging Issues related to Tobacco, Alcohol and Other Drug Use*

Article 7

2017

Addressing Youth Perceptions of Harm in Marijuana Prevention Programming

Kristen J. Quinlan
Education Development Center, kquinlan@edc.org

Maria Valenti
Education Development Center, MValenti@edc.org

Gisela Rots
Education Development Center, Grots@edc.org

Joshua Esrick
Carnevale Associates, LLC., josh@carnevaleassociates.com

Kimberly Dash
Education Development Center, kdash@edc.org

See next page for additional authors

Addressing Youth Perceptions of Harm in Marijuana Prevention Programming

Acknowledgements
Disclaimer: Support for this work was provided by and administered through the Center for Substance Abuse Prevention, Contract Number #HHSS283201200024I/HHSS28342002T, Reference number 283-12-2400. The content of the publication does not necessarily reflect the views or policies of the Department of Health and Human Services, and the views expressed in this paper are those of the authors.

Correspondence concerning this article should be addressed to Kristen J. Quinlan, Education Development Center, Inc., 43 Foundry Avenue, Waltham, MA 02453. Contact: Kquinlan@edc.org

Authors
Kristen J. Quinlan, Maria Valenti, Gisela Rots, Joshua Esrick, Kimberly Dash, and

Perception of Harm (PoH) is an individual's assessment of the likelihood that substance use or misuse could cause harmful personal consequences, including physical, social, psychological, legal, or vocational harm (King, Vidourek, & Hoffman, 2012). For youth, marijuana-related PoH is likely contextually-driven, dependent on prior use experience and their assessment of the severity, immediacy, number, and type of perceived anticipated consequence(s) (Ross, 1984). Marijuana-related PoH for youth is also likely to be impacted by type of product (e.g., Do I expect more harm from raw cannabis or cannabis oils?), mode of ingestion (e.g., Is marijuana more harmful if I eat it or smoke it?), frequency of use (e.g., Do I expect use to be more harmful if it happens regularly?), and amount of use (e.g., Do I expect that marijuana will still be harmful if I only use a small amount?). Further, marijuana-related PoH for youth is dependent on a youth's perception of the harm's personal relevance and on the age of the person who may be using (Rothman, Klein, & Weinstein, 1996).

The theoretical, empirical, and practical reasons to focus on PoH as a change-producer in youth marijuana use prevention are strong. PoH plays a critical role in many well-accepted theories of health behavior change. For example, in the Health Belief Model, behavior change is initiated, in part, on an individual's personal threat evaluation (Rosenstock, Strecher, & Becker, 2005, as cited in NCI, 2005). In the Theory of Planned Behavior, attitudes are based on PoH, and these attitudes form the foundation for behavior change (Ajzen & Driver, 1991, as cited in NCI, 2005). In Deterrence Theory and other Social Control Theories, an individual's assessment of the severity, immediacy, certainty, number, and type of perceived consequence(s) is inextricably linked to a person's behavioral choices (Ross, 1984).

Not only do theoretical arguments support PoH as a critical mechanism for changing youth marijuana use behaviors, but empirical evidence supports these links, as well (Derzon, 2010; King et al., 2012; Morrison, 2010). For example, a meta-analysis of 21 well-established risk factors for substance use (as determined by the *Communities that Care* model) found PoH to be a top predictor of youth marijuana use (Derzon, 2010). Sex and age differences can impact PoH, with male high school students viewing marijuana as "less risky" than their female and younger counterparts, perhaps accounting for the higher rates of past year and past month marijuana use among this population (King et al., 2012). Data from the National Survey of Drug Use and Health (NSDUH) provide further evidence of this link at a national level. Sub-state regions with high marijuana use rates are much more likely to have lower percentages of

people who perceive “great risk” of using marijuana (Hughes, Lipari, & Williams, 2016).

The historically strong association between declines in youth PoH and increases in youth marijuana use has led the Substance Abuse and Mental Health Service Administration (SAMHSA) to cite PoH as a leading predictor of future trends, hypothesizing that today’s PoH rates can be an important predictor of future use rates (Hughes et al., 2016). This is of concern because youth attitudes toward marijuana have softened in recent years – while over half (58.0%) of high school seniors endorsed “great risk” for regular marijuana use in 2005, less than a third (31.9%) of current high school seniors endorse the same level of risk for regular use today (Johnston, O’Malley, Miech, Bachman, & Schulenberg, 2015). These changes in youth attitudes might be reflective of more lenient societal norms related to marijuana use and to corresponding changes in US state marijuana policy (Hughes et al., 2016). Studies of the effects of such marijuana-related policy changes on youth use have been met with mixed results and a causal relationship cannot be established (Cerda et al., 2017), in part because medical and recreational marijuana laws and their implementation are so widely varied across states. However, increased PoH does seem to be connected to decreases in youth marijuana use among eighth grade students living in states with medical marijuana laws (Keyes et al., 2016), suggesting that PoH could provide some protection against youth use in states with more lenient norms and greater marijuana-supportive policies.

In addition to changes in the policy landscape of the U.S., emerging forms of marijuana and methods of use might also play a role in PoH for youth. For example, the emergence of e-cigarettes has created a discreet way to use marijuana without tell-tale odor, and although the relationship between PoH and the emergence of e-cigarettes has not been empirically studied, it makes logical sense that the ability to use marijuana with less fear of getting caught could impact PoH for youth. On the other hand, the emergence of stronger, more concentrated forms of marijuana (e.g., shatter) and the general increase in THC levels over time (Walton, 2015) may lead to increased attention to the negative harms of marijuana use, as increased use of more concentrated forms are likely to increase the occurrence of “unexpected highs” and other negative consequences (Allen et al., 2017). In general, the impact of the changing landscape of U.S. state policies on marijuana use and the evolution of new forms and methods of use on youth PoH for marijuana needs continued study.

Despite historically strong associations between PoH and youth marijuana use, and the potential for further declines in PoH as policies

continue to shift and new methods and forms of marijuana become available, the field has not systematically examined "what works" to alter youth PoH regarding marijuana use and whether these altered perceptions make a difference in use. Although existing evidence-based programs may, in some cases, build on the health behavior change theories identified earlier (e.g., Health Belief Model, Theory of Planned Behavior, Deterrence Theory), we do not know how PoH is incorporated into existing youth marijuana prevention programs or the overall effectiveness of such approaches on youth PoH for marijuana and youth marijuana use. Using a systematic review of national registries, we explored whether and how existing prevention programs assess youth PoH for marijuana use and common elements of programs with demonstrated effectiveness in reducing youth PoH for marijuana use. This review was conducted to inform future efforts for addressing PoH and for evaluating the impact of these efforts.

Methods

We reviewed the following 7 online registries or catalogs related to substance abuse prevention to find programs with demonstrated effects on youth marijuana use[1],[2]: (a) the Substance Abuse and Mental Health Service Administration's *National Registry of Evidenced-Based Programs and Practices* (NREPP); (b) Oregon Addiction and Mental Health Services and Washington Division of Behavioral Health and Recovery's *Athena Forum's Excellence in Prevention Strategy List*; (c) the Annie E. Casey Foundation and University of Colorado Boulder's *Blueprints for Healthy Youth Development*; (d) Office of Juvenile Justice and Delinquency Prevention (OJJDP) *Model Programs Guide* (operated by CrimeSolutions.gov); (e) the RAND Corporation's *Promising Practices Network on Children, Families and Communities* (archived); (f) the Coalition for Evidence-based Policy (archived); and (g) U.S. Department of Education: *What Works*

[1] For the purpose of this project, we excluded programs that were closer to treatment than prevention (e.g., Screening, Brief Intervention, and Referral to Treatment; Bernstein et al., 2009) and composite prevention programs that encompassed multiple registry-identified programs (e.g., Promoting School-Community-University Partnerships to Enhance Resilience – PROSPER; Spoth et al., 2013).

[2] Additional private and federally-funded registries were included in the original search, but were found to have significant overlap with other selected registries and are excluded from this paper: FindYouthInfo.gov: http://youth.gov/evidence-innovation/program-directory, which draws significantly from OJJDP's Model Programs Guide; and the U.S. Department of Education: Exemplary and Promising Safe, Disciplined, and Drug-free Schools Programs: http://www2.ed.gov/admins/lead/safety/exemplary01/exemplary01.pdf.

Clearinghouse. We selected these registries because although they had varied definitions of "evidence-based", all required some type of review process to ensure sufficient methodological quality, and many required random control trials or quasi-experimental designs published in a peer-reviewed journal or a comprehensive evaluation report to be considered for registry inclusion. Through this process, we identified 36 programs that demonstrated youth marijuana use outcomes.

To determine whether any of these 36 programs produced changes to PoH for marijuana use, we used three different methods. First, we reviewed registry-listed outcomes for all 36 identified programs to determine whether studies described in the registries identified marijuana- or drug-related PoH as an intermediate outcome. Second, we conducted an EBSCO search of five electronic databases (PSYCHINFO, SocINDEX, PsycARTICLES Medline Complete, and Academic Search Complete) for original, peer-reviewed studies that examined the influence of each of the 36 registry-based programs on marijuana- or drug-related PoH. Search terms included the proper name of the program, combined with "marijuana OR cannabis" and "harm OR risk". Limiters included peer-reviewed journal articles, full text availability, and English language. Third, we reviewed the developer's website for each of the 36 programs to determine if the standard battery of tests for each program included marijuana- or drug-related PoH measures for youth. Programs that measured outcomes related to marijuana or drug PoH using any of these three methods are included in the results. For the purposes of this paper, we excluded programs that: (a) measured PoH for alcohol use only (e.g., Project Northland; Perry et al., 1996); (b) measured positive use expectancies but not marijuana or drug-related PoH (e.g., Keepin' It Real; Marsiglia, Kulis, Wagstaff, Elek, & Dran, 2005); or (c) measured actual consequences or anticipated consequences of cutting down or stopping marijuana use, but not anticipatory marijuana- or drug-related PoH (e.g., Teen Intervene; Winters, Fahnhorst, Botzet, Lee, & Lalone, 2012).

Results

As stated above, we found 36 registry-identified programs with demonstrated impact on youth marijuana use. Although youth PoH for marijuana may be addressed by many of these programs, only ten programs measured PoH for marijuana or drug use as a mechanism for change (identified in Table 1). Seven of these ten programs published results related to PoH in a peer-reviewed research journal.

Measuring PoH

Table 1 provides sample measures from those programs with measured PoH outcomes. Youth PoH for marijuana and drug use was often assessed through one or two items about general harm [e.g., How much do you think people risk harming themselves (physically or in other ways) if they… try marijuana once or twice? Smoke marijuana occasionally? Smoke marijuana regularly? (as developed by Johnston et al., 2015)], as seen in the assessments for Hip-Hop 2 Prevent Substance Abuse (Strategic Community Services, 2006; 2007), Keep a Clear Mind (Jowers, Bradshaw, & Gately, 2007; Young, Kersten, & Werch, 1996), Narconon Truth about Drugs (Lennox & Cecchini, 2008), Project SUCCESS (Kovach Clark, Rigwalt, Shamblen, & Hanley, 2011), and Storytelling for Empowerment (The WHEEL Council, n.d., as cited in Athena Excellence in Prevention). In other cases [Project Alert (Ellickson, Bell, & McGuigan, 1993; Ellickson, Bell, & Harrison, 1993), Midwestern Prevention Project (Mackinnon et al., 1991), LionsQuest (Eisen, Zellman, & Murray, 2003), and Project Towards no Drug (Rohrbach, Dent, Skara, Sun, & Sussman 2010)], marijuana-related PoH was measured through 3 or fewer items assessing social, extracurricular, academic, psychological, and/or addiction-related harms [e.g., “Does marijuana help or harm…your health?” (LionsQuest; Eisen et al., 2003); “Using marijuana…makes you do poorly in school” (Project Alert; Ellickson, Bell, & McGuigan, 1993; Ellickson, Bell, & Harrison, 1993)].

Programs that Influenced Youth Marijuana or Drug-Related PoH

Of the ten programs that assessed youth PoH for marijuana, seven found that participants’ marijuana or drug-related PoH post-program increased significantly, and one additional program (Project Towards No Drug Abuse; Rohrbach Gunning, Sun, & Sussman, 2010) found marginally significant results (p. <.10). The remaining two programs (Lions Quest Skills for Adolescence; Eisen, Zellman, & Murray, 2003; and Midwestern Prevention Project; Mackinnon et al., 1991) measured PoH as an outcome, but did not find significant program effects on marijuana- or drug-related PoH as compared to controls. Of the eight programs with significant or marginally significant increases in PoH post-program, the majority (n = 7) used a pre/post design with comparisons to a control condition (typically a wait-list control). One (LifeSkills; McGovern, Palmer, & Arndt, 2013) used a pre/post design only.

Because evidence-based approaches can fall into and out of favor depending on their ability to demonstrate continued successful outcomes and adapt to changing school-based demographics and needs (Griffin & Botvin, 2010), we focus on the commonalities across these eight programs rather than on their distinguishing features. Six of the eight programs were

designed for and tested with middle school and/or high school populations. Of the remaining two, one was designed to be delivered to a broader range of youth audiences (i.e., Storytelling for Empowerment; from age 6-17) and the other was designed to be delivered to older elementary-age youth (i.e., Keep a Clear Mind). All eight were multi-session, running between 4-14 sessions per year. All eight were multi-component programs with demonstrated effects on multiple substance-related outcomes, with most including outcomes related to alcohol and tobacco, in addition to marijuana. All eight included sessions on increasing drug-related knowledge, and in some cases (e.g., Hip-Hop 2 Prevent, Storytelling for Empowerment), knowledge dissemination was tied to cultural beliefs and practices to increase relevance. Social influence theory, or the belief that the attitudes, beliefs, and behaviors of individuals are shaped by perceived norms (Cialdini & Trost, 1998), informed all eight of these programs; all eight programs teach youth about the impact of interpersonal influence, either through general discussions or through active role play (e.g., Project Alert, Storytelling for Empowerment). Some (e.g., Narconon Truth about Drugs Video Program) explicitly make the connection between social influence and youth PoH, offering information on the role that media plays in shaping beliefs about drug-related harms.

Discussion

This study explores how existing prevention programs assess youth PoH for marijuana use, and describes common elements of those programs with successful impact on this construct. While many programs may address youth PoH for marijuana, only slightly more than a quarter of evidence-based programs for youth marijuana use (i.e., 10 out of 36) actually measure marijuana- or drug-related PoH as an outcome. When PoH is a core program component but is unassessed or inadequately assessed, programs are unable to articulate whether they demonstrated outcomes according to hypothesized mechanisms. Did changes in marijuana-or drug-related PoH help explain reductions in youth marijuana use? What happens to PoH and youth marijuana use if more (or less) program content is focused on increasing PoH? What type of PoH – social, vocational, physical, or legal - is most salient for producing change, and what happens to marijuana use outcomes if we shift program content to zero in on the most salient change-producers?

Our understanding of how PoH operates is limited by inadequacies and inconsistencies in how PoH is measured across program evaluation studies. Youth PoH is frequently measured as degree of harm stemming from single, occasional, or regular marijuana use. When PoH is measured

by asking youth how much they think "people risk harming themselves (physically or in other ways) if they try marijuana 'once or twice', 'occasionally', or 'regularly'", measurement bias is introduced. The respondent is left to interpret what "regular" or "occasional" use might be, whether the hypothetical user is a youth or an adult, and what type of marijuana, mode of ingestion, and amount of use is being assessed. Moreover, perceived harm to some hypothetical other might differ from perceived harm to oneself for engaging in the same behavior (Rothman, et al., 1996). Further, this type of question asks a respondent to imagine what type of harm the hypothetical user might encounter (physical, social, legal, psychological), and respond to the question based on this imaginary assessment. These general questions about marijuana-related PoH were originally developed for population-based tracking systems like Monitoring the Future (Johnston et al., 2015). The psychometrics and level of precision for these measures may be perfectly appropriate in a tracking context, in which brevity is critical. However, these measures feel less appropriate in the context of an evaluation study, particularly when PoH is hypothesized as a core mechanism for change. For this context, we have a greater need to understand PoH as a multidimensional construct and are in need of additional measurement precision (Fuchs & Diamantopoulos, 2009).

With alcohol, the National Institute of Alcohol Abuse and Alcoholism (NIAAA) has offered definitions for specific patterns of use, and these definitions are useful in measurement construction. For example, NIAAA has offered guidance on what constitutes "binge drinking", a pattern of drinking that will generally bring a person's blood alcohol concentration (BAC) to levels of .08% grams or higher (i.e., 5 or more alcoholic drinks in a two-hour period for men, 4 or more alcoholic drinks in a two-hour period for women; NIAAA, 2004). This allows researchers to consistently operationalize PoH for patterns of drinking that have NIAAA-identified definitions. Because the field lacks similar guidelines for marijuana use, we are unable to speak to PoH for particular patterns of marijuana use or for specific levels of THC exposure.

International research offers some insight on how marijuana-related PoH as an outcome might be measured. In a youth sample from the United Kingdom and Norway, Pedersen and colleagues (2016) proposed a multi-criteria assessment, using a 6-point scale (1 = "Not harmful" to 6 = "Very Harmful") to assess perception of physical harm (e.g., cancer; cardiovascular, lung or liver diseases), mental health-related harms (e.g., learning disabilities, mood disorders, psychosis), dependence risks (e.g., withdrawal, problems quitting or cutting down), injury-related harms (e.g., falls, traffic accidents); and social harms (e.g., educational problems, family

problems, legal problems) stemming from the use of different substances (e.g., tobacco, marijuana, alcohol). Using a multi-criteria decision analysis to examine relative PoH for tobacco, alcohol, and marijuana, Pederson and colleagues (2016) found that different substances had different baseline PoH, with tobacco rated highest for physical harm and dependence; alcohol rated highest for injuries and social consequences; and marijuana rated highest for consequences related to mental health. Such information could be used to establish a baseline on the types of harm associations already resonate with youth, finding out why these harms resonate so strongly, and targeting messaging accordingly.

Research on PoH for alcohol use could also guide the development of marijuana-related PoH measures. Project Northland, for example, measures the "functional meaning" of alcohol as an outcome. Evaluation participants are asked to indicate agreement with statements like, "Using alcohol could threaten my eligibility to participate in sports or other activities"; "Using alcohol costs too much money"; "Alcohol use can be bad for my health"; and "Using alcohol could harm my performance as a student or athlete" (Perry et al., 1996). The Perception of Harm Questionnaire, designed specifically for an exploratory study on the perception of different types of harm across different types of alcoholic beverages, might serve as another example of how PoH could be measured for marijuana. The questionnaire offers 24 statements reflecting short-term and long-term physical and social harms. Using a 5-point Likert scale, participants are asked to think individually about different types of alcoholic beverages (i.e., beer, wine, spirits, and alcoholic sodas) and indicate how likely it is that they would personally experience each harm following use (Hasking, Shortell, & Machalek, 2005). Through such items, researchers are better able understand the multidimensional nature of alcohol-related PoH (although questions about how amount of use and frequency of use impact PoH remain).

Our results also identify common components of programs with demonstrated impact on youth PoH for marijuana, even if such impact is sometimes incompletely measured. Specifically, we found that prevention programs that influence youth PoH for marijuana are multi-faceted; they combine education-based strategies on improving knowledge about marijuana-related harms with additional emphasis on how interpersonal influence impacts drug-related decision-making. For example, all of the programs found to impact youth PoH for marijuana engaged in discussion or active role play about perceived norms and the role of others in marijuana use decisions. Previous research underscores the importance of this emphasis, indicating that prevention programs solely directed toward

increasing knowledge of drug-related harms are inadequate for prevention. For example, a 1997 review of over 100 school-based prevention programs revealed that a singular focus on increasing harm-related knowledge will not produce behavior change (Tobler and Stratton, 1997; Tobler et al., 2000 – as cited in Komro and Toomey, 2002). Instead, effective school-based prevention requires: (a) an approach tailored to impact identified risk and protective factors; (b) a focus on interpersonal and resistance skills; (c) an emphasis on correcting misperceived norms; (d) interactivity; (e) multiple sessions, preferably delivered over multiple years; (f) well-trained facilitators; (g) cultural sensitivity; and (h) family and community involvement in message reinforcement (Tobler and Stratton, 1997; Tobler et al.,2000 – as cited in Komro and Toomey, 2002).

Although the programs highlighted in this review sought to increase perception of marijuana-related harms, they engaged in education, not scare tactics. The history of prevention includes an over-reliance on eliciting a fearful reaction to exaggerated harms of substance use (e.g., horrific images of worst-case scenario consequences) in an effort to increase PoH. Scare tactics alone do not produce behavior change, and, if poorly constructed, can actually produce iatrogenic effects (Esrick, Kagan, Carnevale, Valenti, Rots, & Dash, 2017). A recent review by Esrick and colleagues (2017) found that if fear-based messaging is to be successful, it must provide accurate information about consequences and be substance-specific (i.e., not targeting substance use generally, but instead tying specific consequences to a particular type of drug). Finally, it must allow for personal agency, providing the audience with options and opportunities and a belief that change is possible.

In sum, previous research and current findings indicate that *marijuana prevention programs should be directed toward increasing youth PoH through education-based strategies, but they also need to be multi-faceted and interactive, with a focus on improving psychosocial skills (e.g., refusal skills) in order to create lasting change* (e.g., Tobler, 1997; as cited in Danesco, Kingery, & Coggeshall, 1999).

Although we can identify commonalities in programs with demonstrated impacts on youth PoH for marijuana, we are still missing information from 26 evidence-based programs with an impact on youth marijuana use that may be engaging in drug education and seeking to change marijuana-related PoH as a core prevention strategy, but do not measure marijuana or drug-related PoH as an outcome. For these programs, we recommend identifying which core elements identified above the program uses, to identify whether it may indirectly address PoH. Furthermore, program evaluators should draw on “what works” from

programs with established PoH-related outcomes such as those identified in this paper, and also beginning to monitor success in altering marijuana-related PoH using the above measurement recommendations in order to make programming adjustments, if necessary.

Exploratory and theory-based literature can provide additional information on elements of effective programming for impacting youth PoH for marijuana. For example, past literature has shown that although PoH for marijuana is a clear protective factor against marijuana initiation, the relationship is more complicated for current or past users (Kilmer, Hunt, Lee, & Neighbors, 2007; Wilkinson, VanSchalkwyk, & D'Souza, 2016). Among marijuana users, PoH is not significantly influenced by actually experiencing a drug-related adverse consequence. This suggests that intervention approaches designed to impact youth PoH for marijuana should differ based on audience, with current or past users receiving more personalized approaches designed to explore their use experiences (Kilmer et al., 2007).

Exploratory research also suggests that if we simply raise a single type of PoH (e.g., perception of legal consequences), we may only succeed in shifting a youth's decisions about how, when, and where he/she uses a substance instead of in deterring use altogether (e.g., Erickson, Van Der Maas, Hathaway, 2013). Research on drinking and driving may also offer insight into effective principles for deterrence. Perceived immediacy and certainty, rather than perceived severity of punishment has been shown to be a stronger deterrent in alcohol-impaired driving, particularly among heavier alcohol users (Grosvenor, Toomey, and Wagenaar, 1999; Fairlie, Quinlan, DeJong, Wood, Lawson, & Witt, 2010). These principles have yet to be fully tested (and appropriately measured) in an evaluation of evidence-based programming for youth marijuana use.

Limitations

Although three different search techniques were used to determine whether a program had measured youth marijuana or drug-related PoH as an outcome, limiters on our EBSCO search (e.g., full text availability, English language), our selected EBSCO databases, and our selected evidence-based registries may have limited the research found. Our selected definition of youth PoH, although theoretically and empirically informed, may have been narrow. More broadly defined, PoH could encompass constructs like perceived peer and parental support of use or community norms. For example, questions that assess perceived close friend's disapproval of use could be interpreted as an individual's perception of social harms.

Additionally, questions about positive marijuana-use expectancies, when negatively rated, could also be broadly interpreted as PoH (e.g., a respondent "strongly disagrees" that marijuana makes food taste better). Our decision to search only for registry-identified evidence-based programs led to the exclusion of media campaigns and other environmental strategies, although reviews of such strategies in marijuana-based prevention can be found elsewhere (e.g., Quinlan et al., 2015). Finally, it is possible that marijuana-related PoH is actually being measured more frequently than can be identified through the methods we selected. For example, marijuana-related PoH is a required outcome for the Substance Abuse and Mental Health Services (SAMHSA) Drug-Free Communities (DFC) grants. Publication of community-level efforts and outcomes in peer-reviewed journals would further our understanding of marijuana-related PoH as an outcome in substance abuse prevention practice.

Conclusions

Despite these limitations, our work represents a first step in moving toward a more complex understanding of how youth PoH for marijuana might operate and be measured in behavior change programming. This information is timely, as the changing landscape of U.S. marijuana-policy begins to create clinical and legal messages about marijuana use that stand in direct contrast to information presented by the prevention field, which is designed to increase youth PoH of marijuana (Wilkinson, van Schalkwyk, Davidson, & D'Souza, 2016). If marijuana-related PoH messages are not carefully crafted and well-directed, we could see continued erosion of youth PoH (e.g., as seen in trends from Monitoring the Future, 2005 to present; Johnston et al., 2015). Worse, the prevention field's authority might be called into question, as it begins to contrast with competing messages and norms. The prevention field would be well-served by developing a stronger understanding of how PoH plays a role in marijuana-related prevention and comprehensively evaluating its impact in our evidence-based programs.

References

Allen, J.A., Davis, K.C., Duke, J.C., Nonnemaker, J.M., Bradfield, B.R., & Farrelly, M.C. (2017). New product trial, use of edibles, and unexpected highs among marijuana and hashish users in Colorado. *Drug and Alcohol Dependence, 176*, 44-47.

Bernstein, E., Edwards, E., Dorfman, D., Heeren, T., Bliss, C., & Bernstein, J. (2009). Screening and brief intervention to reduce marijuana use among youth and young adults in a pediatric emergency department. *Academic Emergency Medicine, 16*(11), 1174–1185.

Botvin, G.J., & Griffin, K.W. (2014). Life skills training: Preventing substance misuse by enhancing individual and social competence. *New Directions for Youth Development (141),* 57-65.

Cialdini, R. B., & M. R. Trost. (1998). Social influence: Social norms, conformity, and compliance. In *The handbook of social psychology*. 4th ed. Vol. 2. Edited by D. T. Gilbert, S. T. Fiske, and G. Lindzey, 151–192. New York: McGraw-Hill.

Cerda, M., Wall, M., Feng, T., Keyes, K.M., Sarvet, A., Schulenberg, J., O'Malley, P.M., Pacula, R.L., Galea, S., & Hasin, D.S. (2017). Association of state recreational marijuana laws with adolescent marijuana use. *JAMA Pediatrics, 171*(2), 142-149.

Danesco, E.R., Kingery, P.M., & Coggeshall, M.B. (1999). Perceived risk of harm from marijuana use among youth in the USA. *School Psychology, 20*(1), 39-56.

Derzon, J.H. (2010). A synthesis of research on predictors of youth alcohol, tobacco, and marijuana use. In *Improving Prevention Effectiveness*, W.B. Hansen, S.M. Giles, and M.D. Fearnow-Kenney (Eds).Greensboro, NC: Tanglewood Research, pp. 105-114.

deWit, J.B.F., Das, E., & Vet, R. (2008). What works best: Objective statistics or a personal testimonial? An assessment of the persuasive effects of different types of message evidence on risk perception. *Health Psychology, 27*(1), 110-115.

Doyle, A., Swan, M., Roffman, R., & Stephen, R. (2003). The Marijuana Check-Up: A Brief intervention tailored for individuals in the contemplation stage. *Journal of Social Work Practice in the Addictions, 3*(4), 53-71.

Eisen, M., Zellman, G. L., & Murray, D. M. (2003). Evaluating the Lions-Quest "Skills for Adolescence" drug education program. Second-year behavior outcomes. *Addictive Behaviors*, *28*(5), 883-897.

Ellickson, P.L., Bell, R. M., McGuigan, K. (1993). Preventing adolescent drug use: Long-term results of a junior high program*. American Journal of Public Health, 83*(6), 856-861.

Ellickson, P.L., Bell, R.M., & Harrison, E.R. (1993). Changing adolescent propensities to use drugs: Results from Project ALERT. *Health Education Quarterly, 20*(2), 227-42.

Erickson, P.G., Van Der, Maas, M.,& Hathaway, A.D. (2013). Revisiting deterrence: Legal knowledge, use context and arrest perception for cannabis. *Czech Sociological Review,49*(3), 427 – 448.

Esrick, J., Kagan, R., Carnevale, J., Valenti, M., Rots, G., & Dash, K. (2017) Can scare tactics and fear based messages help deter substance misuse? A review of recent research. Manuscript in Preparation.

Fairlie, A. M., Quinlan, K. J., DeJong, W., Wood, M. D., Lawson, D. & Witt, C.F. (2010). Sociodemographic, behavioral, and cognitive predictors of alcohol-impaired driving in a sample of U.S. college students. *Journal of Health Communication, 15*(2), 218 — 232.

Fuchs, C., & Diamantopoulos, A. (2009). Using single-item measures for construct measurement in management research: Conceptual issues and application guidelines. *Business Administration Review, 69*(2), 195-210.

Griffin, K. & Botvin, G.J. (2010). Evidence-based interventions for preventing substance use disorders in adolescents. *Child Adolescent Psychiatry and Clinics of North America, 19*(3), 505-526.

Griffin, K., Botvin, G., & Nichols, T. (2006). Effects of a school-based drug abuse prevention program for adolescents on HIV risk behavior in young adulthood. *Prevention Science, 7*(1), 103-112.

Grosvenor, D., Toomey, T. L., & Wagenaar, A. C. (1999). Deterrence and the adolescent drinking driver. *Journal of Safety Research, 30*, 187–191.

Hasking, P., Shortell, C., & Machalek, M. (2005). University student's knowledge of alcoholic drinks and their perception of alcohol-related harm. *Journal of Drug Education*, *35*(2),95-109.

Hughes, A., Lipari, R.N., & Williams, M.R. (2016). *The CBHSQ Report: Marijuana use and perceived risk of harm from marijuana use varies within and across states*. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration.

Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2015). *Monitoring the Future national survey results on drug use: 1975-2014: Overview, key findings on adolescent drug use.* Ann Arbor: Institute for Social Research, University of Michigan.

Jowers, K. L., Bradshaw, C. P., & Gately, S. (2007). Taking School-Based Substance Abuse Prevention to Scale: District-Wide Implementation of Keep A Clear Mind. *Journal of Alcohol & Drug Education*, *51*(3), 73-91.

Keyes, K.M., Wall, M., Cerda, M., Schulenberg, J., O'Malley, P.M., Galea, S., & Hasin, D. (2016). How does state marijuana policy affect US youth? Medical marijuana laws, marijuana use and perceived harmfulness: 1991-2014. *Addiction, 111*(12), 2187-2195.

Kilmer, J. R., Hunt, S. B., Lee, C. M., & Neighbors, C. (2007). Marijuana use, risk perception,and consequences: Is perceived risk congruent with reality? *Addictive Behaviors*, *32*(12), 3026-3033.

King, K. A., Vidourek, R. A., & Hoffman, A. R. (2012). Sex and grade level differences inmarijuana use among youth. *Journal Of Drug Education*, *42*(3), 361-377.

Komro, K. A., & Toomey, T.L. (2002). Strategies to prevent underage drinking. *Alcohol Research & Health, 26*(1), 5-14.

Kovach Clark, H. Rigwalt, C.L., Shamblen, S.R., & Hanley, S.M. (2011). Project SUCCESS' effects on substance-use related attitudes and behaviors: A randomized controlled trial in alternative high schools. *Journal of Drug Education, 41*(4), 17-44.

Lennox, R. D., & Cecchini, M. A. (2008). The *NARCONON*™ drug education curriculum for high school students: A non-randomized, controlled prevention trial. *Substance Abuse Treatment, Prevention & Policy, 3,* 1-14**.**

Longshore, D., Ellickson, P., McCaffrey, D., & St. Clair, P. (2007). School based drug prevention among at-risk adolescents: Effects of ALERT Plus. *Health Education & Behavior, 34*(4), 651-668.

MacKinnon, D. P., Johnson, A., Pentz, M., Dwyer, J.H., Hansen, W.B., Flay, B.R., Wang, E.Y. (1991). Mediating Mechanisms in a School Based Drug Prevention Program: First-Year Effects of the Midwestern Prevention Project. *Health Psychology, 10*(3), 164-172.

Marsiglia, F.F., Kulis, S., Wagstaff, D.A., Elek, E., & Dran, D. (2005). Acculturation status and substance use prevention with Mexican American youth. *Journal of Social Work Practice in Addiction, 5*(1-2), 85-111.

McGovern, P., Palmer, J., & Arndt, S. (2013). *Youth Development Program Evaluation: Annual Report.* (Iowa Department of Public Health Contract #5882YM50). Iowa City, IA: Iowa Consortium for Substance Abuse Research and Evaluation: http://iconsortium.substabuse.uiowa.edu

National Cancer Institutes (2005, September). *Theory at a glance: A guide for health promotion practice* (NIH Publication No. 05-3896). Washington, DC: U.S. Government Printing Office.

National Health Promotion Associates (2011a). *LifeSkills Training Questionnaire – Middle school version*. Retrieved from: http://www.lifeskillstraining.com/uploads/media/Brief%20LSTQMS%20rev%20October%202011.pdf

National Health Promotion Associates (2011b*). LifeSkills Training Questionnaire – High school version.* Retrieved from: http://www.lifeskillstraining.com/uploads/media/Brief%20LSTQHS%20rev%20October%202011.pdf

National Institute of Alcohol Abuse and Alcoholism. (2004). *NIAAA council approves definition of binge drinking*. *NIAAA Newsletter*, 3, p. 3.

Nelson, A., & Arthur, B. (2003). Storytelling for Empowerment: Decreasing at-risk youth's alcohol and marijuana use. *Journal of Primary Prevention, 24(2)*, 169-180.

Pedersen, W., Fjær, E. G., Gray, P., & Soest, T. V. (2016). Perceptions of harms associated with tobacco, alcohol, and cannabis among students from the UK and Norway. *Contemporary Drug Problems*, *43*(1), 47-61.

Pentz, M. A., Dwyer, J. H., MacKinnon, D. P., Flay, B. R., Hansen, W. B., Wang, E. Y. I., & Johnson, C. A. (1989). A multi-community trial for primary prevention of adolescent drug abuse: Effects on drug use prevalence. *JAMA, 261*(22), 3259-3266.

Perry, C. L., Williams, C. L., Veblen-Mortenson, S., Toomey, T. L., Komro, K. A., Anstine, P.S., & ... Wolfson, M. (1996). Project Northland: Outcomes of a communitywide alcohol use prevention program during early adolescence. *American Journal of Public Health,86*(7), 956-965.

Quinlan, K. J., Valenti, M., Barovier, L., Rots, G., & Harding, W. (2014). Community-based environmental strategies to prevent the nonmedical use of marijuana: A review of the literature. *Drugs: Education, Prevention, and Policy, 22*(4), 316-333.

Riggs, N. & Penz, M.A (2009). Long-term effects of adolescent marijuana use prevention on adult mental health services utilization: The Midwestern Prevention Project. *Journal of Substance Use & Misuse, 44*, 616-631.

Rohrbach, L.A., Dent, C.W., Skara, S., Sun, P., & Sussman, S. (2007). Fidelity of Implementation in Project Towards No Drug Abuse (TND): A Comparison of Classroom Teachers and Program Specialists. *Prevention Science, 8,* 125-132.

Rohrbach, L.A., Gunning, M., Sun, P. & Sussman, S. (2010). The Project Towards No Drug Abuse (TND) dissemination trial: Implementation fidelity and immediate outcomes. *Prevention Science, 11*(1), 77-88.

Rothman, A. J., Klein, W. M., & Weinstein, N. D. (1996). Absolute and relative biases in estimations of personal risk. *Journal of Applied Social Psychology*, *26*(14), 1213-1236.

Ross, H. L. (1984). Social control through deterrence: Drinking and driving laws. *Annual Review of Sociology, 17,* 21–35.

Spoth, R. L., Randall, G. K., Trudeau, L., Shin, C., & Redmond, C. (2008). Substance use outcomes 5 1/2 years past baseline for partnership based, family-school preventive interventions*. Drug and Alcohol Dependence, 96*(1-2), 57-68.

Spoth, R., Redmond, C., Shin, C., Greenberg, M., Feinberg, M., & Schainker, L. (2013). PROSPER community-university partnership delivery system effects on substance misuse through 6½ years past baseline from a cluster randomized controlled intervention trial. *Preventive Medicine, 56,* 190-196.

Spoth, R., Trudeau, L., Redmond, C., & Shin, C. (2016). Replicating and extending a model of effects of universal preventive intervention during early adolescence on young adultsubstance misuse. *Journal of Consulting and Clinical Psychology, 84*(10), 913-921

Strategic Community Services, Inc. (2006). *Year 02 (2004-05) project evaluation report, Hip Hop 2 Prevent Substance Abuse & HIV (H2P)*. Prince George's County, MD.

Strategic Community Services, Inc. (2007). *Year 03 (2005-06) project evaluation report, Hip-Hop 2 Prevent Substance Abuse & HIV (H2P)*. Prince George's County, MD.

Tobler, N., & Stratton, H. (1997). Effectiveness of school based drug prevention programs: A meta-analysis of the research. *Journal of Primary Prevention***,** *18***,** 71–128.

Valente, T., Ritt-Olson, A., Stacy, A., Unger, J., Okamoto, J., & Sussman, S. (2007). Peer acceleration: Effects of a social network tailored substance abuse prevention program among high-risk adolescents. *Addiction, 102*, 1804-1815

Walton, A.G. (2015, March 23). New study shows how marijuana's potency has changed over time. *Forbes.* Retrieved from https://www.forbes.com/sites/alicegwalton/2015/03/23/potevolution-how-the-makeup-of-marijuana-has-changed-over-time/#ac1a51359e59

Werch, C. E., Young, M., Clark, M., Garrett, C., Hooks, S., & Kersten, C. (1991). Effects of a take-home drug prevention program on drug-related communication and beliefs of parents and children. *Journal of School Health, 61*(8), 346-350.

Wilkinson, S.T., van Schalkwyk, G.I., Davidson, L., & D'Souza, D.C. (2016). The formulation of marijuana risk perception in a population of substance abusing patients. *Psychiatric Quarterly, 87(1),* 177-187.

Winters, K. C., Fahnhorst, T., Botzet, A., Lee, S., & Lalone, B. (2012). Brief intervention fordrug-abusing adolescents in a school setting: Outcomes and mediating factors. *Journal of Substance Abuse Treatment, 42*(3), 279–288.

Young, M., Kersten, C., & Werch, C. (1996). Evaluation of a parent child drug education program. *Journal of Drug Education, 26*(1), 57-68.

Table 1: Programs with marijuana-or drug-related perception of harm (PoH) as a measured outcome

Program Name	*Key Program Elements*	*Marijuana Use Outcomes*	*Sample PoH Measures*
Botvin Life Skills Training	Designed for students in grades 6-9, LST is a classroom-based, universal prevention program designed to prevent adolescent tobacco, alcohol, marijuana use, and violence. The 3-year, multisession program teaches self-management skills, social skills, and resistance skills specifically related to drug use.	Students receiving LST reported: • Lower rates of marijuana initiation and frequency of use compared to controls (Spoth, Randall, Trudeau, Shin, & Redmond, 2008) • Lower rates of marijuana use in longitudinal follow-ups compared to controls (Spoth et al, 2016; Griffin, Botvin, & Nichols , 2006) • 82% of LST participants maintained a high PoH or increased their PoH following the program, using a pre-post design (McGovern et al., 2013).	Single item, true/false measure: • "Smoking marijuana causes your heart to beat faster". *Listed on Developer's website [LST Questionnaire (Middle School); National Health Promotion Associates, 2011a; 2011b].* Single item measure with 4-point response option (no risk to great risk, with an additional category of "can't say/drug unfamiliar"): • How much do you think people risk harming themselves if they use marijuana? *Listed as a registry outcome (McGovern et al., 2013).*
Hip-Hop 2 Prevent Substance Abuse and HIV (H2P)	Designed for students ages 12-16, H2P seeks to improve knowledge and skills related to drugs and HIV/AIDS, by incorporating hip-hop culture substance use and HIV risk prevention. The curriculum consists of 10 modules, called "ciphers," delivered by school staff in 2-hour sessions.	Compared to control groups, H2P participants reported: • An increase in PoH associated with regular marijuana use following program participation (Strategic Community Services, Inc., 2006) • A higher percentage of participants disapproving of marijuana use immediately following the program and at 6 month follow-up (Strategic Community Services, Inc., 2007)	Four item measure on PoH for alcohol, tobacco, marijuana, and other drugs with 4-point response option (no risk to great risk): • "How much do you think people risk harming themselves (physically or in other ways) if they try marijuana once or twice?" *Listed as a registry outcome, cited from Strategic Community Services, 2006; 2007.*

Table 1 (continued): Programs with marijuana-or drug-related perception of harm (PoH) as a measured outcome

Program Name	*Key Program Elements*	*Marijuana Use Outcomes*	*Sample PoH Measures*
Keep a Clear Mind (KACM)	Designed for youth ages 9-11, this 4-session, take-home drug education program is designed to increase refusal skills and drug-related knowledge using parent support.	Compared to a wait-list control, KACM participants demonstrated: • More parent-child discussions about how to resist peer pressure to try marijuana (Werch et al., 1991) • More accurate perceptions of peer use (Werch et al., 1991) • Increased perception by children and their parents that marijuana use can have harmful effects on youth (Young et al., 1996).	Single item measure with 4-point response option (yes, for sure; yes; no; no, for sure): • "Marijuana has harmful effects for young people." *Listed as a registry outcome and found in peer-reviewed journal (Jowers et al., 2007; Young et al., 1996).*
Lions Quest Skills for Adolescence (SFA)	Designed for middle school youth (ages 10-14), this 80-session program seeks to improve social competency, produce good citizenship skills, and build attitudes and skills to decrease the likelihood of drug use.	Compared to a control group LQ-SFA participants demonstrated: • Decreased lifetime and past 30-day marijuana use post-program (Eisen et al., 2003). • This program did not produce significant effects on youth PoH for marijuana.	Three item scale with 4-point response option (very helpful to very harmful) asking whether marijuana helps or harms the following: • Health • Ability to relax • Popularity *Listed as a registry outcome and found in peer-reviewed journal (Eisen et al., 2003).*

Table 1 (continued): Programs with marijuana-or drug-related perception of harm (PoH) as a measured outcome

Program Name	*Key Program Elements*	*Marijuana Use Outcomes*	*Sample PoH Measures*
MidWestern Prevention Project (MPP)/Project STAR	A comprehensive, community-based 5-year prevention program. At the start of the program, students are educated on resistance strategies, while parents participate in a program aimed to develop non-drug norms in families and schools. In the final years of implementation, students work with community leaders on prevention policy.	Compared to control groups, MPP recipients reported: • Reduced marijuana use in high school (Riggs & Pentz, 2009) • No significant effects on youth PoH were reported for marijuana.	Three items on the negative consequences of marijuana with 4-point response options (yes, probably, I don't think so, no): • "Marijuana leads to poor sports performance." *Found in peer-reviewed journal* (Mackinnon et al., 1991):
Narconon® Truth About Drugs Video Program	Designed for middle- and high-school students, this 8-session multimedia curriculum covers tobacco, alcohol, marijuana, and other drugs. The program draws from social influence theory and provides scientific information on the dangers of substance use, facts and myths about use, and real-world testimonials.	Compared to control group participants, intervention participants reported: • Reduced rates of non-medical cannabis use and disorders (Lennox & Cecchini, 2008). • Significantly greater endorsement of "great risk" in response to questions about risk for trying marijuana once or twice, or smoking marijuana regularly (Lennox & Cecchini, 2008).	Two items specific to PoH for marijuana with 4-point response option (no risk to great risk, with an additional category of "can't say/drug unfamiliar"): • How much do you think people risk harming themselves (physically or in other ways) if they… o Try marijuana once or twice? o Smoke marijuana regularly? *Found in peer-reviewed journal (Lennox & Cecchini, 2008).*

Table 1 (continued): Programs with marijuana-or drug-related perception of harm (PoH) as a measured outcome

Program Name	*Key Program Elements*	*Marijuana Use Outcomes*	*Sample PoH Measures*
Project ALERT	Designed for youth aged 13-17, this two year, 14-session program includes group activities designed to build protective social factors and increase resistance skills. Lessons include group activities, teaching, and practicing resistance skills.	Compared to participants at control schools, students in intervention schools: • Reported lower rates of weekly marijuana use in 9th grade (among female participants in ALERT PLUS; Longshore et al, 2007). • Reported greater perception of negative consequences resulting from use (Ellickson et al., 1993).	Three items specific to negative consequences of marijuana use with a 4-point response option (strongly disagree to strongly agree): • Using marijuana… o Makes it hard to remember things o Makes you do poorly in school o Makes you do things you might regret *Listed as a registry outcome, identified on the developer's website, and found in peer-reviewed journal (Project Alert, 2017; Ellickson et al., 1993)*
PROJECT SUCCESS (Schools Using Coordinated Community Efforts to Strengthen Students)	Designed for youth aged 12-18, Project SUCCESS seeks to prevent and reduce substance use through school-wide activities, promotional materials, and parent education. The program includes an eight-session curriculum designed to help students resist social pressures to use substances, and understand the consequences of substance use. Counselors provide time-limited counseling and referrals for students.	Compared to students in the comparison groups, Project SUCCESS participants reported: • Less likelihood of having ever used marijuana (Morehouse et al., 2007, as cited in Athena Registry) • A significant increase in PoH for marijuana use (*Kovach Clark et al., 2011*).	Three items with a 4-point response option (no risk to great risk, with an additional category of "can't say/drug unfamiliar"): • How much do you think people risk harming themselves (physically or in other ways) if they… o Try marijuana once or twice o Smoke marijuana occasionally o Smoke marijuana regularly *Found in peer-reviewed journal (Kovach Clark et al., 2011).*

Table 1 (continued): Programs with marijuana-or drug-related perception of harm (PoH) as a measured outcome

Program Name	*Key Program Elements*	*Marijuana Use Outcomes*	*Sample PoH Measures*
Project Towards No Drug Abuse (TND)	Designed for at-risk high school youth, Project Towards No Drug Abuse (TND) offers a 12-session curriculum of 40-minute interactive sessions taught by teachers or health educators over a 4-week period. Topics include increasing motivation not use drugs; improving self-control, communication, and resource acquisition; and building stronger decision-making strategies.	Compared to students in the control group, the TND program produced: • For peer-led TND: Reduced marijuana use at 1-year follow-up (Valente et al, 2007) • For teacher-led TND: Reduced intentions and likelihood to use marijuana immediately post-intervention (Rohrbach et al, 2010) and reduced use at 1-year follow-up (Rohrbach et al., 2010) • Marginally significant effects on addiction concern (Rohrbach et al., 2010).	Two drug-related items on perceived likelihood of abuse/addiction with 4-point response option (not at all likely to very likely) *Found in peer-reviewed journal (Rohrbach, et al., 2010).*
Storytelling for Empowerment	Designed for high-risk youth ages 6-17, this bi-lingual (English/Spanish) skills-based curriculum includes 6 modules and focuses on increasing drug-related knowledge, building interpersonal skills, drawing on personal and cultural power, and building positive connections.	Compared to students in control groups, program-involved youth reported: • Decreased use of marijuana (Nelson & Arthur, 2003) • Significant increases in PoH for alcohol, tobacco and other drug use (Nelson, Walters, & Szecsy, n.d. as cited in Athena Registry)	Single item with a 4-point response option (no risk to great risk, with an additional category of "can't say/drug unfamiliar"): • "How much do you think people risk harming themselves physically or in other ways if they ...try marijuana once or twice?" *Listed as a registry outcome (Nelson et al., n.d.; The WHEEL Council, n.d., as cited on Athena Excellence in Prevention).*