Perceived Effectiveness of Anti-Marijuana Messages in Adult Users and Nonusers: An Examination of Responses to Messages About Marijuana's Effects on Cognitive Performance, Driving, and Health

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ABSTRACT. Objective: Marijuana use is associated with negative cognitive and health outcomes and risky driving. Given the rapidly changing policies regarding legal recreational and medicinal marijuana use, it is important to examine what types of marijuana prevention messages may be effective in minimizing such outcomes. This study examined cognitive and affective responses to anti-marijuana public health messages in a sample of adult marijuana users and nonusers to determine the correlates of perceived message effectiveness. **Method:** Participants ($N = 203$; mean age = 37.7 years) were adult marijuana users and nonusers recruited via Amazon Mechanical Turk (August 2017). After completing self-report measures of marijuana use, they viewed six anti-marijuana messages presented in a random order, addressing marijuana's effects in each of three topic areas: cognitive performance, driving, and adverse

health outcomes (e.g., two messages per topic). Participants completed assessments of cognitive and affective perceptions after viewing each message. For each message topic, a linear regression model was used to determine which cognitive and affective perceptions were most predictive of perceived message effectiveness. **Results:** For all message topics, nonusers perceived the messages as more effective than did users ($p < .001$). In the majority of analyses, greater message effectiveness was associated with increased perceived harm of marijuana and increased liking of the message. For driving and health messages, greater message effectiveness was also significantly correlated with lower pleasant affect. **Conclusions:** The findings suggest that audience perceptions may be uniquely predictive of message effectiveness, depending on the topic. (*J. Stud. Alcohol Drugs*, 80, 415–422, 2019)

IN THE UNITED STATES, 22.2 million people ages 12 years and older reported using marijuana in the past 30 days (Center for Behavioral Health Statistics and Quality, 2016). Since 1992, heavy use (consuming at least one ounce per month) of marijuana has increased by more than one third in adults (Burns et al., 2013). Marijuana use is associated with myriad negative health and psychosocial outcomes, including increased cancer risk (Cooper & Haney, 2009; Huang et al., 2015; Mehra et al., 2006; Zhang et al., 2015), alcohol and other drug use (Kam et al., 2009; White et al., 2005, 2006), anxiety and depression (Crane et al., 2015; Gage et al., 2015), poor academic performance (Arria et al., 2013; Huang et al., 2011), and car accident fatalities (Blows

et al., 2005). As changes in state-level policies allowing legal medical and recreational use of marijuana become more common in the United States and marijuana availability and access increase, it is important to spread awareness about problematic use behaviors and negative health outcomes (Monte et al., 2015).

Perceptions of marijuana-related harm have been identified as important correlates and predictors of marijuana use (Danseco et al., 1999) and have been hypothesized as a potential mechanism leading to increases in the prevalence of marijuana use over the past decade (Berg et al., 2015). Specifically, lower harm perceptions are associated with more frequent and intense use of marijuana and greater intentions to use marijuana (Lopez-Quintero & Neumark, 2010; Swaim, 2003). Mass media public health communication campaigns have been recommended as effective methods to prevent initiation and escalation of a variety of health-risk behaviors, such as alcohol and tobacco use, unhealthy eating, and obesity (U.S. Department of Health and Human Services, 2013) because of their ability to reach broad audiences and be disseminated at a relatively low cost given the large target audience (Allen et al., 2015; Farrelly et al., 2007, 2017; Goldman & Glantz, 1998; Murphy-Hoefer et al., 2018; Neff et al., 2016). To date, there are only a handful

Received: December 17, 2018. Revision: April 24, 2019.

Elise M. Stevens and Theodore L. Wagener were partially supported by the Oklahoma Tobacco Settlement Endowment Trust. Amy M. Cohn was supported by National Institute on Drug Abuse Grant 1R21DA041548-01. Andrea C. Villanti was supported by the Centers of Biomedical Research Excellence P20GM103644 award from the National Institute of General Medical Sciences.

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of studies examining the efficacy of such campaigns as they relate to marijuana use. One study examined the effects of the National Youth Anti-Drug Media Campaign with a nationally representative sample of 2,993 marijuana users and nonusers ages 12–18 years. Results showed that users had greater positive attitudes toward the ads and reported lower intentions to use marijuana at a 1-year follow-up (Alvaro et al., 2013). In contrast, an earlier study examining the impact of the same campaign on a similar population showed that increased exposure to the messages was associated with lower/decreased intention to avoid using marijuana, often referred to as a “boomerang effect” (Hornik et al., 2008).

Audience message evaluation is an important aspect of understanding how effective a campaign or message may be at producing attitudinal or behavioral change (Alvaro et al., 2013). Advertising and marketing literature show that message evaluation is based on both affective (Batra & Ray, 1986; Burke & Edell, 1986) and cognitive responses (Hastak & Olson, 1989) to the message, as well as liking of the message (MacKenzie et al., 1986) and perceptions of harm in response to information in the message (Brewer et al., 2004). These evaluations can affect the perceived effectiveness of a message, a useful criterion for evaluating public health messages (Fishbein et al., 2002). Previous research shows that when a message is perceived to be more likeable and effective, this then positively affects attitudinal and behavior changes (Fishbein et al., 2002). For instance, Fishbein and colleagues (2002) assert that judgments of effectiveness can be used when understanding the psychosocial determinants of drug use behavior. As such, if certain messages are positively evaluated by audiences, researchers and message designers alike can use similar features (i.e., theme, tone) in those messages when creating other public health messages (Fishbein et al., 2002; Kang et al., 2006; Strasser et al., 2009). In summary, cognitions and emotions affect perceived message effectiveness, and perceived message effectiveness is associated with changes in attitudes and health behaviors (Dillard & Peck, 2000).

The significant increases in marijuana use in adults in the United States and the concomitant decline in marijuana harm perceptions over the past decade indicate that current public health campaigns either do not exist, have not been effective, or have had limited reach, and that more work in this area needs to be done. For example, one of the most well-known intervention strategies for marijuana use is targeting high sensation seekers, which was shown to be effective in reducing youth use in the past 30 days among high sensation seekers who viewed an anti-marijuana television campaign (Palmgreen et al., 2001). Although effective, the campaign was developed 17 years ago, well before marijuana legalization policies swept the United States. Other studies assessing marijuana mass media campaigns, all targeting adolescents, found that campaigns emphasizing themes of autonomy and personal aspirations to reduce marijuana use

showed that exposure to the campaign reduced use (Slater et al., 2011) and that targeting norm-related beliefs about marijuana showed that adolescents had more negative beliefs about marijuana (Zhao et al., 2006). However, another study showed that marijuana scenes in public health campaigns (e.g., paraphernalia, using the product) were associated with decreased liking for high-risk adolescents (Kang et al., 2009). In addition, all of these studies were conducted before the legalization of recreational marijuana use.

In summary, studies consistently cite a link between lower perceptions of harm for marijuana—a primary reason for the appeal of marijuana—and greater likelihood of marijuana use (Azofeifa et al., 2016; Lipari et al., 2017), which public health campaigns have the opportunity to address. Of note, however, a recent systematic review and meta-analysis of the effectiveness of public health education campaigns showed only modest evidence of their effectiveness on preventing drug use, including marijuana use (Allara et al., 2015). Because of the only modest effectiveness of these campaigns, this study begins to address this research gap by examining cognitive and affective correlates of perceived message effectiveness using current, real-world anti-marijuana public health messages focused on marijuana’s negative impact on cognitive performance, driving ability, and health outcomes.

Method

Participants and procedure

Participants were marijuana users and nonusers recruited via Amazon’s Mechanical Turk (MTurk) in August 2017. Inclusion criteria were being (a) 18 years of age or older, (b) able to read and speak English, and (c) located in the United States (based on IP address). A survey link was posted on MTurk inviting individuals to participate in a study on perceptions and attitudes about health messages. Upon consenting, participants provided information on demographics (age, sex, race/ethnicity) and current marijuana use behavior (“some days,” “every day,” “not at all”). Next, participants viewed six real-world anti-marijuana messages in randomized order: two messages about marijuana’s effects on cognitive performance, two messages about marijuana’s effects on driving ability, and two messages about the adverse health effects of marijuana use. After viewing each message, participants answered questions about pleasant and unpleasant affect, arousal, message liking, perceived harmfulness of marijuana, and perceived message effectiveness. Participants were compensated for completing the survey. All procedures were approved by the university’s institutional review board.

Anti-marijuana messages

Messages tested were collected from existing marijuana prevention campaigns that are available to the public: the

Message topic	Message 1	Message 2
Cognitive performance
Driving
Health harms

FIGURE 1. Anti-marijuana messages

“Do the Math” print campaign developed by the Liberty Alliance for Youth, a coalition in Liberty, MO working to prevent youth substance abuse (<http://libertyalliance4youth.com>); and the “Spread the Facts” print campaign developed by the National Institute on Drug Abuse for Teens, a national organization that provides facts to teens about how drugs affect the brain and body (<https://teens.drugabuse.gov>). For further information regarding the campaigns, please visit the above websites. Participants saw one message about cognitive performance, one message about driving, and one message about health from each campaign (Figure 1). Messages in the “Do the Math” campaign were accompanied by illustrations and stick figure drawings. Messages in the “Spread the Facts” campaign were accompanied by photographs. This resulted in two messages about cognitive performance, two messages about driving, and two messages about health. All participants were exposed to and responded to all messages.

Measures

Pleasant. Pleasantness was measured using the question, “How pleasant did this ad make you feel?” on a scale from 1 (*not at all*) to 7 (*extremely*). This measure was adapted to serve as a single dimension for positive affect (Bradley & Lang, 1994; Clayton et al., 2018; Watson & Tellegen, 1985).

Unpleasant. Unpleasantness was measured using the question, “How unpleasant did this ad make you feel?” on a scale from 1 (*not at all*) to 7 (*extremely*). This measure was adapted to serve as a single dimension for negative affect (Bradley & Lang, 1994; Clayton et al., 2018; Watson & Tellegen, 1985).

Arousal. Arousal was measured using the question, “How did this ad make you feel?” on a scale from 1 (*calm*) to 7 (*excited*). This measure was adapted to serve as a single dimension for arousal (Bradley & Lang, 1994; Clayton et al., 2018; Watson & Tellegen, 1985), with higher scores indicating greater arousal.

Message liking. Participants were asked how much they liked each message using a question adapted from Unger and colleagues (1995), “Please rate this message on a scale from 1 (*disliked it very much*) to 7 (*liked it very much*).”

Perceived absolute harmfulness of marijuana. Perceived absolute harmfulness of marijuana was assessed by the question, “How harmful do you think marijuana is to your health?” on a scale from 1 (*not harmful at all*) to 5 (*extremely harmful*) (National Institutes of Health and the U.S. Food and Drug Administration, 2013).

Perceived message effectiveness. Perceived message effectiveness was assessed using six items measured on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*): (a) “this message is worth remembering,” (b) “this message grabbed my attention,” (c) “this message is powerful,” (d) “this message is informative,” (e) “this message is meaning-

ful,” and (f) “this message is convincing” (Davis et al., 2013) (Cronbach’s $\alpha = .97$). The six items were averaged to create a mean score for each message.

Data analytic plan

First, demographic and marijuana use characteristics of the sample were examined. Individuals were categorized as marijuana users if they reported using “every day” or “some days,” or nonusers if they reported currently using “not at all.” Then, each message topic (cognitive performance, driving, health concerns) received a combined mean score for each of the following indices: pleasant affect, unpleasant affect, arousal, message liking, and absolute harmfulness. The mean perceived message effectiveness was calculated for each message across all participants, and then scores were averaged together across each topic (i.e., cognitive performance, driving, health concerns). To address single-message design effects, individuals viewed two messages with the same topic. This ensured that message responsiveness was attributed primarily to the topic of interest and not to any features specific to just one message (Leshner, 2013; O’Keefe, 2003; Reeves & Geiger, 1994; Tao & Bucy, 2007; Thorson et al., 2012). Responses to the two messages within each topic were then combined. We then examined differences in perceived message effectiveness by marijuana use status for each of the message topics using independent samples *t* tests.

To identify the correlates of perceived message effectiveness separately for each message topic (cognitive performance, driving, health concerns), we used multiple linear regression with race, age, gender, marijuana use status, pleasant, unpleasant, arousal, liking, and perceived harmfulness all included as predictors in one model. Standardized betas are reported. SPSS Version 24 (IBM Corp., Armonk, NY) was used for all analyses.

Results

Participant characteristics

The majority (53.7%) of participants ($N = 203$) were female, and they ranged in age from 18 to 76 years ($M = 37.7$, $SD = 11.8$). Participants were 70.9% White, 21.2% Asian, 9.4% Black/African American, and 4.5% Native American/Alaskan Native, Pacific Islander, or “other.” Marijuana users represented 37.9% of the sample. Marijuana use status significantly differed by sex, $\chi^2(1, n = 201) = 5.94$, $p < .05$, with more men (46.8%) being users than women (30.2%).

Differences in perceived message effectiveness by marijuana use status

Independent samples *t* tests showed that for each of the three message topics, marijuana nonusers perceived the mes-

TABLE 1. Models predicting perceived message effectiveness

Predictor	Message topic					
	Cognitive performance		Driving		Health	
	β	p	β	p	β	p
Marijuana use	.04	.41	-.06	.20	-.04	.42
Gender	.04	.38	.01	.90	-.06	.11
Age	-.04	.38	-.06	.11	.03	.46
Race	-.05	.27	-.03	.50	.01	.74
Perceived harmfulness	.25	<.001	.27	<.001	.27	<.001
Pleasant	-.03	.63	-.10	.03	-.10	.02
Unpleasant	.05	.41	.10	.03	.07	.17
Arousal	.000	1.0	.06	.24	.05	.34
Liking	.67	<.001	.62	<.001	.64	<.001

Notes: R^2 for cognitive performance messages = .71; R^2 for driving messages = .77; R^2 for health messages = .76

sages to be more effective than users: cognitive performance, $t(194) = 3.55, p < .001$; driving, $t(195) = 4.42, p < .001$; and health, $t(196) = 4.08, p < .001$.

Regression analyses of correlates of perceived message effectiveness

Cognitive performance messages. The model, $F(9, 182) = 50.16, p < .001, R^2 = .71$, showed that correlates of perceived effectiveness of cognitive performance messages included message liking ($\beta = .67$) and perceived harmfulness ($\beta = .25$), which were both positively associated with perceived message effectiveness (all $ps < .001$). No other associations were significant. See Table 1.

Driving messages. The model, $F(9, 183) = 68.18, p < .001, R^2 = .77$, showed that correlates of perceived effectiveness for the driving messages included message liking, perceived harmfulness, feeling pleasant, and feeling unpleasant. Results showed that message liking ($\beta = .62, p < .001$), perceived harmfulness ($\beta = .27, p < .001$), and unpleasantness ($\beta = .10, p = .03$) were positively associated with perceived message effectiveness. Pleasantness was inversely associated with perceived message effectiveness ($\beta = -.10, p = .03$), meaning that those who felt less pleasant had higher perceived message effectiveness. No other associations were significant. See Table 1.

Health messages. The model, $F(9, 184) = 65.62, p < .001, R^2 = .76$, showed that correlates of perceived effectiveness for the health messages included message liking, perceived harmfulness, and feelings of pleasantness. Message liking ($\beta = .64, p < .001$) and perceived harmfulness ($\beta = .27, p < .001$) were positively associated with perceived message effectiveness. Pleasantness was inversely associated with perceived message effectiveness ($\beta = -.10, p = .02$), meaning that those who felt less pleasant had higher perceived message effectiveness. No other associations were significant. See Table 1.

Discussion

This study examined individuals' responses to anti-marijuana public health messages across three topics: marijuana's effects on cognitive performance, driving ability, and health outcomes. Greater message liking and perceived harm were robustly associated with perceived message effectiveness across all three topics. Greater unpleasantness and lower pleasantness were uniquely correlated with perceived message effectiveness for some (driving ability, health) but not all of the topic areas. In addition, these models accounted for 71% to 77% of the variance in the outcome, suggesting a rather large effect.

These results suggest that stakeholders designing public health messages targeting marijuana use should be concerned with how much individuals like the message and how harmful they find marijuana after viewing the message. These results align with other research focused on branding of consumer goods and health behaviors (marijuana use and getting vaccinations), where brand liking of consumer products (MacKenzie et al., 1986) and perceived harms of marijuana (Brewer et al., 2004; Danseco et al., 1999) correlate with determinants of message effectiveness. This study identified other "candidate" factors that could be targeted in future anti-marijuana campaigns that can be used by health practitioners to help deter problematic use and youth initiation. In particular, this study showed that greater negative affect and lower positive affect were correlated with higher perceived message effectiveness. Similar to "fear appeal" studies, these results suggest that providing individuals with information about the health harms associated with marijuana use may induce a state of "negative affect" that has been shown to have a positive effect on message persuasiveness (Witte & Allen, 2000). These findings are consistent with results from the broader health behavior literature pertaining to smoking cessation, condom use, and sunscreen use, which show that negative emotions are often associated with greater

message effectiveness (Evans et al., 2015; Hammond et al., 2004; Witte & Allen, 2000). The current study, however, extends these findings into public health messages aimed at reducing perceptions of harm and use of marijuana. Beyond informing the development of public health prevention campaigns, this study also has important policy implications. For instance, states with legalized marijuana may consider requiring messaging that elicits perceptions of harm in regions/locations where marijuana is sold (e.g., dispensaries) in order to deter individuals from using it inappropriately or in problematic ways.

Although this study was the first step in examining factors associated with the perceived effectiveness of anti-marijuana messages, it has limitations. First, this study used a convenience sample of adults recruited from MTurk, and findings may not be generalizable to the U.S. population (Kraemer et al., 2017). Second, message effectiveness cannot be used as a proxy for behavior, but when actual effectiveness cannot be measured, perceived effectiveness is considered sufficient for testing messages (Dillard et al., 2007). Last, the real-world public health messages tested were targeted toward a younger population, whereas the sample in this study comprised adults who ranged in age beyond those in young adulthood. Despite this limitation, few real-world anti-marijuana campaigns have been developed and even fewer are targeted toward adults. Future studies should examine the impact of anti-marijuana public health messages over the course of time, while monitoring actual behavior. Nevertheless, this study highlights how cognitive and affective responses to anti-marijuana messages may provide key information to guide future prevention message development in this rapidly emerging area.

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