Psychological reactance theory and marijuana craving

Melissa Nicole Slavin

*University at Albany, State University of New York*, mnslavin@gmail.com

The University at Albany community has made this article openly available. Please share how this access benefits you.

Follow this and additional works at: https://scholarsarchive.library.albany.edu/legacy-etd

Part of the Clinical Psychology Commons

**Recommended Citation**


https://scholarsarchive.library.albany.edu/legacy-etd/2165

This Dissertation is brought to you for free and open access by the The Graduate School at Scholars Archive. It has been accepted for inclusion in Legacy Theses & Dissertations (2009 - 2024) by an authorized administrator of Scholars Archive.

Please see Terms of Use. For more information, please contact scholarsarchive@albany.edu.
PSYCHOLOGICAL REACTANCE THEORY AND MARIJUANA CRAVING

by

Melissa N. Slavin

A Dissertation

Submitted to the University at Albany, State University of New York

In Partial Fulfillment of

the Requirements for the Degree of

Doctor of Philosophy

College of Arts & Sciences

Department of Psychology

2018
Abstract

Psychological Reactance Theory (Brehm, 1966) asserts that people experience reactance (a retaliatory motivational state characterized by negative cognition and anger) when they perceive their autonomy is threatened. Reactance may lead to “boomerang effects”, where the individual is drawn toward the restricted object or behavior. Anti-marijuana (MJ) messages designed to discourage use might heighten reactance and inadvertently lead to greater craving for MJ and stronger intentions to use. The current online experiment determined that a message discouraging use of MJ evoked greater reactance in student and community member participants than a harm-reduction message. Additionally, reactance was associated with participants’ indirect (e.g., craving and attitudes) and direct (e.g., intent to use MJ and comply) attempts to restore their behavioral freedoms. Across both samples and conditions, individuals who experienced reactance expressed less favorable attitudes toward the advocated behavior, as well as higher MJ craving on a Visual Analog Scale. An interaction between reactance and condition predicted MJ attitudes. Among the student sample, individuals in the experimental condition who experienced high (versus low) reactance expressed more favorable MJ attitudes. Students in the control condition who experienced high (versus low) reactance expressed less favorable MJ attitudes, which may be an effect of cognitive dissonance in their attempts to comply with the message. Lastly, reactance predicted intent to use MJ and lower likelihood of compliance. These findings support applications of reactance theory in the MJ prevention and treatment literature. As more states legalize MJ for medical or recreational purposes, it is important to disseminate harm reduction messages that minimize reactance and MJ-related problems. Reactance-induced craving may also have particular relevance in a court-ordered treatment setting.

*Keywords:* Psychological Reactance Theory, marijuana, reactance, craving
Psychological Reactance Theory and Marijuana Craving

Background

Psychological Reactance Theory

Psychological Reactance Theory (PRT), a social psychology theory developed by Jack Brehm in 1966, asserts that people experience “reactance”, a retaliatory motivational state characterized by negative cognition and affect, when they perceive threats to their “behavioral freedoms”, activities to which they feel they can freely engage (Brehm, 1966). Reactance often results in “boomerang effects”, where individuals attempt to restore their rights either indirectly by developing more favorable attitudes toward the restricted behavior, or directly by engaging or intending to engage in the restricted behavior (Dillard & Shen, 2005).

Several factors contribute to the likelihood of a person experiencing reactance, including the wording of the message, the viewer’s cognitions and judgements elicited in response to the message, and the characteristics of the viewer. First, people are more likely to experience reactance in response to messages with rigid, controlling, and explicit language (Grandpre, Alvaro, Burgoon, Miller, & Hall, 2003; C. H. Miller, Lane, Deatrick, Young, & Potts, 2007), including imperatives (e.g., “must” or “need”), absolute allegations (e.g., “this issue is extremely critical), contempt toward other perspectives, (“any reasonable person would agree that”), or threatening warnings (Bushman, 1998). Conversely, people are less likely to experience reactance to messages with language that incorporates allusion to choice (“you have the chance to”), qualified propositions, (“there is some evidence that”) and objective information (Bushman, 1998). Second, the cognitive response approach to persuasion (for a review see e.g. Petty & Cacioppo, 1996), predicts that the viewers’ cognitions and judgments that are elicited at the time of message will influence the amount and direction of attitude change that occurs. If the
persuasive message evokes disagreement with its content, recipients may develop counterarguments that lead to boomerang effects. Lastly, people are more likely to experience reactance to a message if they are high in “trait reactance” by which they display denial, dominance, independence, and mistrust, as well as strongly value autonomy (Dowd, Wallbrown, Sanders, & Yesenosky, 1994).

**Reactance and Substance Use**

PRT has helped explain why individuals show resistance to persuasive messages in a variety of health domains, including dental flossing (Dillard & Shen, 2005), sunscreen use (Quick & Stephenson, 2008), and condom use (Quick & Stephenson, 2007a). Much research has also focused on substance use, including alcohol (e.g., Dillard & Shen, 2005; Quick & Bates, 2010; Shen, 2010), tobacco (e.g., Grandpre et al., 2003; Henriksen, Dauphinee, Wang, & Fortmann, 2006; Miller, Burgoon, Grandpre, & Alvaro, 2006; Miller & Quick, 2010), and more recently, MJ (e.g., Crano et al., 2017; Czyzewska & Ginsburg, 2007; Nonnemaker et al., 2012; S. Zimmerman et al., 2014). In the substance use literature, it is relevant to consider individuals’ reactance in regard to both clinical treatments and prevention campaigns.

Regarding therapy, PRT is a core philosophy behind two first-line interventions for substance use disorders (SUDs): Motivational Interviewing (MI) and Motivational Enhancement Therapy (MET). Therapists of these approaches encourage autonomy in their clients by meeting them at their stage of readiness to change, “rolling” with clients’ resistance, exploring discrepancies between clients’ current behaviors and broader life goals, and strengthening and reinforcing clients’ own statements and reasoning (Miller & Rollnick, 2002). Although an ultimate goal of these approaches may be abstinence, MI and MET practitioners are generally aware that not all clients are able or willing to meet this objective. Thus, these practitioners may
applaud any steps in the right direction, supportive of harm reduction strategies, interventions aimed to reduce the problematic effects of behaviors (Logan & Marlatt, 2010).

Regarding substance use prevention campaigns, research has highlighted the importance of minimizing reactance in consumers. Forceful instructions or scare tactics often lead to boomerang effects, where individuals are drawn toward the restricted behavior. Some of the most well-known examples of these types of effects involve campaigns aimed toward adolescents, a population prone to rebelliousness. Drug Abuse Resistance Education (D.A.R.E.), a school-based drug prevention program where police officers teach students skills to turn down drugs (e.g., “just say no”), has been found largely unsuccessful due to its tendency to evoke reactance (Birkeland, Murphy-Graham, & Weiss, 2005). Consistently, the National Youth Anti-Drug Media Campaign revealed that greater exposure to anti-drug advertising has led to stronger interest and future intent to use drugs among certain subgroups of adolescents (Hornik et al., 2002). Studies of adults have found that individuals high in trait reactance are less likely to perceive certain anti-tobacco messages as effective, with reactance to these messages associated with increased tobacco use (Grandpre et al., 2003; Henriksen et al., 2006; C. H. Miller et al., 2006; Quick, B.L., Shen, L.J., Dillard, 2013). A recent study (LaVoie, Quick, Riles, & Lambert, 2017) examined adults’ responses to graphic images on cigarette packages (e.g., pictures of diseased lungs, a person dying of lung cancer, a corpse). This World Health Organization (WHO) anti-smoking tactic was put into place by 168 countries (WHO, 2013), but is still controversial in the United States. Individuals exposed to these images experienced freedom threat perceptions related to reactance, with high trait-reactant people experiencing stronger freedom threat perceptions, anger, and source domineeringness.

Relevance of Reactance in the MJ Literature
Reactance may be particularly relevant in the MJ literature for two important reasons. The first reason concerns the public’s perception of harms related to MJ and the second relates to issues of legality. First, the public’s perception of harms associated with a substance will likely affect the probability and extent of reactance to messages restricting the substance’s use. This argument is supported by the cognitive response approach to persuasion (for a review see Petty & Cacioppo, 1996), that asserts viewers’ cognitions and judgments elicited at the time of message will influence the amount and direction of attitude change that occurs. If the persuasive message evokes disagreement with its content, recipients are more likely to develop counterarguments that influence boomerang effects.

Current research reflects a growing perception in society that tobacco, for instance, presents a major health threat, with a large number of studies indicating that adolescents and adults have predominantly negative attitudes toward tobacco and its risks, even smokers themselves (Grandpre et al., 2003; Stockdale, Dawson-Owens, & Sagrestano, 2005). Conversely, survey data indicate that perceptions of MJ use among adults and adolescents are actually becoming more positive (for a review see Carliner, Brown, Sarvet, & Hasin, 2017). National Survey on Drug Use and Health (NSDUH) data indicate a decrease in perceived harmfulness of MJ among U.S. adults since 2002, with younger age groups consistently less likely to perceive great risk from regular cannabis use (Azofeifa et al., 2016; Compton, Han, Jones, Blanco, & Hughes, 2016; Pacek, Mauro, & Martins, 2015). In one U.S. national survey (MTF), adolescents seeing moderate or great risk in occasional use decreased substantially between 1991 and 2015, from 84.0% to 53.8% (Keyes et al., 2016).

Particularly more sophisticated consumers such as college students, and adults with a history of MJ use, are likely to detect logical discrepancies in arguments and assimilate real-life
experiences into their attitude formation that may be counter to the message’s intent. Even if these consumers do not necessarily have “pro-MJ” views, an ambivalent (versus negative) attitude may allow individuals to exhibit more systematic processing of persuasive messages pertaining to the attitude object. This information suggests that reactance may be stronger in response to anti-MJ campaigns than for other substances since people’s attitudes toward MJ may be largely inconsistent with the message. Thus, it is critical to tailor public health campaigns toward the actual risks that a substance presents, providing individuals with accurate information so they can make the most well-informed decisions, rather than use exaggerated scare tactics that may not be consistent with reality or consumers’ experiences.

Second, in addition to the public’s perception of harm associated with use of a substance, another factor that may influence reactance to an anti-drug message is the legality of the substance. Tobacco, for instance, is only considered unlawful for underage consumers, whereas MJ is considered a “Schedule 1” substance (i.e., no accepted medical use and high risk of addiction) under the Federal Controlled Substance Act of 1970, making it illegal under federal law (Pacula, Chriqui, Reichmann, & Terry-McElrath, 2002). Nevertheless, the societal and legal climates across states has substantially changed over the last two decades and are likely to continue to progress. Currently, 29 states have passed medical MJ laws (MML), 13 states have passed decriminalization laws, and 9 have passed legalization laws (for a review see Carliner et al., 2017; NORML, 2017). In regard to public attitudes, a majority (52-58%) of adults in the US have been found to support MJ legalization (Pew Research Center, 2013; Swift, 2013), with its highest support (65%) among young adults (18-32; Pew Research Center, 2013). It is the most frequently used illicit substance worldwide (UNODC, 2013), as well as among U.S. adolescents and young adults, with 44.5% high school seniors, 51% of US college students, 58.7% of young
adults (ages 19-28) reporting lifetime use (Schulenberg, J. E., Johnston, L. D., O’Malley, P. M., Bachman, J. G., Miech, R. A. & Patrick, 2017). These high rates of use, pro-legalization attitudes, and individual state laws are in sharp contrast to the federal law, potentially exacerbating the effect of reactance to anti-MJ messages.

Additionally, even as states legalize MJ, individuals may still exhibit reactance and pursue greater use in an attempt to “restore their behavioral freedoms”. Such reactance may have influenced the responses of high school students in a recent survey, where 10% of non-MJ-using individuals reported that they intend to use MJ if it becomes legal, and 18% of lifetime users reported that they intend to use more frequently (Palamar, Ompad, & Petkova, 2014). Thus, even in states where MJ is legal, it is important to frame harm-reduction messages appropriately so that initial reactance effects diminish over time. Consistently, long-term research has found that MJ use rates among 15-34 year-olds has not been affected across eight countries that have changed their cannabis policy in the past ten years (Italy, UK, Slovakia, Denmark, Finland, Portugal, Bulgaria and Greece; European Monitoring Centre for Drugs and Drug Addiction (2011).

**Reactance and MJ Research**

Although limited in number, several studies have examined reactance in response to anti-MJ messages (e.g., Crano et al., 2017; Czyzewska & Ginsburg, 2007; Ginsburg & Czyzewska, 2005; Nonnemaker et al., 2012; Zimmerman et al., 2014). Ginsburg & Czyzewska (2005) found that college students made more negative comments in response to televised anti-MJ ads than anti-tobacco ads, expressing a perception of them as exaggerated and unbelievable. In another study, these same authors examined implicit and explicit attitudes toward MJ and tobacco after college freshmen’s exposure to anti-MJ and anti-tobacco ads (Czyzewska & Ginsburg, 2007).
Analyses controlling for pre-existing attitudes revealed that individuals who viewed the anti-MJ ads displayed reactance and rated MJ significantly less negatively than individuals who viewed the anti-tobacco ads. Interestingly though, participants who viewed anti-MJ ads did show significantly greater negative implicit attitudes to MJ than anti-tobacco ads. The authors attributed this finding to the Implicit Association Task (IAT) picking up on associations in the environment to which people have been exposed, particularly for a stigmatized subject, which may not actually reflect endorsement of such attitudes (Karpinski & Hilton, 2001).

A study in 2012 examined the impact of parent-child communication about drug use on adolescents’ likelihood of initiating MJ use using discrete-time survival analysis (Nonnemaker, Silber-Ashley, Farrelly, & Dench, 2012). This communication had no punitive influence on the child’s MJ use, and in some instances was associated with an increased likelihood of use, potentially due to reactance. A study in 2017 examined adults’ and peers’ language in response to identical anti-MJ campaigns on the efficacy of these campaigns in adolescents (Crano, Alvaro, Tan, & Siegel (2017). They found that adults who used extreme language to characterize the media communication evoked reactance in adolescents, weakening the messages’ intended effects. Peers’ language did not have a significant impact, which the authors attributed to peers having no authoritative power. Adults who used moderate, nondirective language in their commentaries generated significantly lower perceptions of persuasive intent in their adolescent audience, which was associated with greater efficacy of the anti-MJ ads, resulting in significantly less positive attitudes toward MJ and lower intentions to use. These findings speak to the importance of authority figures using non-controlling language when presenting a message, regardless of its content, to lessen the occurrence of reactance. If the message is communicated effectively, from a knowledgeable, trusted, and skilled communicator, its impact can be greatly
enhanced and have a positive effect (Crano et al., 2017). Another related study in framing effects of preventative tactics examined people high in sensation seeking’s perceived level of threat to either loss-focused (e.g., loss of job, success, relationship), or gain-focused anti-MJ ads (e.g., partner satisfaction, new friends, job/school satisfaction; Zimmerman et al., 2014). This study found that loss-framed messages were perceived as a greater threat, inducing reactance, while messages that were gain-framed were significantly more successful in reducing positive attitudes toward MJ. Additionally, moderate threat/loss-framed messages actually had the opposite effect as intended, in that it significantly increased positive attitudes toward MJ.

**Reactance and MJ Craving**

As the literature suggests, when individuals experience reactance, they are generally conscious of the negative feelings and cognitions that it evokes. In retaliation, they may endorse a greater attraction toward the opposed object or behavior. A question that remains however, particularly in cross-sectional studies, is the implications of these reported attitude changes long-term. A less explicit method of examining the effects of reactance to anti-MJ or abstinence-based messages may be through MJ craving. Although there is no universally accepted definition of drug craving, the experience of craving is broadly conceptualized by its motivational state, whereby a person experiences a strong desire to use the drug (Tiffany & Wray, 2012). Craving differs from a person simply having thoughts of enjoyment, or liking, a drug’s effects, both in degree and kind (West, 1987). Although craving can certainly be conceptualized as a more severe form of liking or wanting (Kozlowski, Mann, Wilkinson, & Poulos, 1989), problematic substance use often does not predict differences across users in how well they like or enjoy the effects of the drug (Volkow, Fowler, & Wang, 2003). Craving represents a shift away from sheer enjoyment of the rewarding effects of the drug toward a
motivational drive to obtain it, often at potentially known costs (Robinson & Berridge, 1993; Wise, 2004). The role of craving in substance use has received increased attention in the research literature due to the new inclusion of craving as a diagnostic criterion for substance-related disorders in the DSM-5 (American Psychiatric Association, 2013). Craving is an important predictor of use, substance use disorders, and risk of relapse following abstinence from the drug (Baker, Morse, & Sherman, 1986; Everitt, 1997; Ludwig, Wikler, & Stark, 1974; Pickens & Johanson, 1992; Robinson & Berridge, 2003; R. A. Wise, 1988)

Individuals who experience reactance may be less inclined to report discrepant craving scores from their actual perception of craving than they are to report more favorable attitudes toward MJ in response to being angered by a restrictive message. Additionally, individuals’ true beliefs or perceived harms associated with a substance may be less linked to craving than drug attitudes. For instance, a person may have experienced negative consequences of his or her use, resulting in negative attitudes toward MJ, but still experience craving. Currently, no known study has examined individuals’ substance use craving in response to reactance. Nevertheless, research has assessed the links between perceived availability of a substance and craving, with mixed findings. Among substance-dependent and heavy users, some researchers have found increased urges to use with perceived opportunity to use the drug (Carter & Tiffany, 2001; Thewissen, Van Der Meijden, Havermans, Van Den Hout, & Jansen, 2008), while others suggest craving is less in which there are opportunities to use the drug, as for tobacco (Carter & Tiffany, 2001; Tiffany, 1999; Van Gucht, Van den Bergh, Beckers, & Vansteenwegen, 2010). A study on alcohol found that craving is increased when the substance is perceived as unavailable (MacKillop & Lisman, 2007). In regard to MJ craving, Shrier, Walls, Kendall, & Blood (2012) examined in-the-moment associations of social, emotional, and temporal contexts and perceived
MJ availability with desire to use the drug among a sample of 15-24 year-olds who frequently use MJ over a span of two weeks. Consistent with the alcohol craving findings, the odds of having a desire to use MJ were greater with slightly decreased perceived availability of the substance. The authors postulated that this finding may be due to the individuals experiencing reactance in which their motivation was aroused when real or perceived behavioral freedoms were reduced or threatened with MJ reduction (Brehm, 1966). Additionally, newer models of substance use treatment assert that consistent availability of substance-related cues may be more effective at managing and ameliorating craving in the long-term than their complete avoidance. For instance, in Cue-Exposure Treatment (CET), individuals are repeatedly exposed to cues that have been previously paired with a substance (e.g., going to a bar) until the association becomes extinct, leading to decreased reactivity to substance-related cues, such as craving (Hone-Blanchet, Wensing, & Fecteau, 2014).

Another relevant area of research is craving in response to food restriction (e.g. Bushman, 1998; West, 1975). Research has demonstrated that restrictive rules may be successful initially in suppressing unhealthy consumption but it is likely to cause people to rebound and behave against the rule once it is no longer in place or unable to be enforced (Albarracín, Cohen, & Kumkale, 2003; Jansen, Mulkens, Emond, & Jansen, 2008). West’s study (1975) examined the effect of eliminating opportunities for certain foods from college students. This experiment lead to increased liking for the eliminated object, even though the object was neither attractive nor unique. In Bushman’s study (1998), participants in a taste test study were randomly assigned to 1 of 3 groups. The first group contained a warning level that 90% of calories from the food come from fat, and that high fat food will increase one’s risk of heart disease. The second group displayed an information label merely stating that 90% of the calories came from fat, and the last
group contained no label at all. After, participants were instructed to rate how much they wanted to taste full-, reduced-, and no-fat cream cheeses, and individuals in the warning- and no-label groups wanted to taste the full-fat product more than individuals who were simply provided with the objective information label.

**Current Study**

This experiment consisted of two distinct samples of participants (community members and students). It provided both samples of participants with a mock concentration task and then randomly assigned participants to either an experimental or control group where they read different messages regarding research on MJ. Additionally, the messages provided unique instructions related to participants’ MJ use in the next three weeks, and stated that individuals may be randomly selected for a re-test on their concentration after that time-frame. Both messages described research on the negative effects of MJ on concentration, but the experimental message incorporated more explicit language (i.e., “research shows” rather than “research indicates”). The experimental message was also more controlling, promoting MJ abstinence rather than harm reduction, as well as describing the advice as “necessary” for improving concentration. Alternatively, the control message was more flexible in its language as well as in its recommendations to use harm reduction strategies. Both messages were gain-focused, describing research and strategies for improving MJ-related concentration problems. Afterward, we examined whether participants experienced reactance, and whether reactance was associated with indirect and direct restoration of freedom. We assessed indirect restoration of freedom by examining participants’ attitudes toward the advocated behavior, attitudes toward the study, MJ attitudes, and MJ craving. We assessed direct restoration of freedom by examining participants’
intent to use MJ in the next three weeks, and intent to comply with the message. This experiment had three hypotheses:

**H1:** Individuals in the experimental condition will experience higher reactance in response to the message than individuals in the control condition.

**H2:** Reactance will predict measures of indirect restoration of freedom (attitude toward the advocated behavior, attitude toward the study, MJ attitudes, and MJ craving as assessed by the MCQ and the VAS). Specifically, reactance will negatively correlate with attitude toward the advocated behavior and the study, and positively correlate with MJ attitudes and MJ craving.

**H3:** Reactance will predict measures of direct restoration of freedom (MJ use in the next three weeks, intended compliance with the message). Specifically, reactance will positively correlate with intended MJ use and negatively correlate with intended compliance.

**Method**

**Participants**

Two distinct samples were used as part of data collection: one sample of community lifetime MJ users and another sample of college lifetime MJ users. Participants were excluded if they were under the age of 18, not proficient in English, and/or did not report any history of MJ use. Each sample had an experimental condition that was shown the abstinence-based message and instructions and a control condition that was shown the harm-reduction message and instructions. The community sample consisted of 198 participants aged 18-75 ($M=39.56$, $SD=14.75$) from 39 U.S. states recruited from Craig’s List and a MJ legalization listserv, National Organization for the Reform of MJ Laws (NORML). Community membered were entered into a raffle to win 20 Amazon gift cards, valued at $20 each. The sample of college
students was comprised of 190 undergraduate students from the University at Albany Psychology subject pool, aged 18-31 ($M=19.82$, $SD=2.17$) who received course credit for completing the experiment. See Table 1 for community and student sample characteristics.

**Procedure**

Following online consent, participants were directed to an online survey that consisted of a number of assessments. The first set of measures included questionnaires regarding demographics, participants’ history of MJ use, and trait reactance. Next, all participants were asked to complete a mock concentration task, in which they were presented with a list of 30 random words, and asked to time themselves for 30 seconds, and then type out as many of the words that they can remember. Participants were then randomly selected to be in the experimental or control condition based on their month of birth (January-June or July-December). After reading the experimental or control message, participants were then assessed on their state reactance, behaviors indicating indirect restoration of freedom (attitude toward the message, attitude toward the advocated behavior, attitude toward MJ, and MJ craving), and behaviors indicating direct restoration of freedom (intended MJ use in the next three weeks and intended compliance with the message).

**Stimuli**

**Experimental message.** The experimental message stated, “Research shows that abstaining from marijuana for three weeks is necessary to achieve high concentration. In order for us to assess you at your best concentration in the next three weeks, please abstain from any marijuana use during the next three-week timeframe.”

**Control message.** The control message stated, “Research indicates that you can improve your daily concentration if you monitor your marijuana dosage and consume marijuana in the
evening rather than first thing in the morning. In order for us to assess you at your best concentration in the next three weeks, please use these strategies if you are consuming cannabis within the next three-week timeframe.”

Measures

Demographics. Standard demographics of all participants were collected, including age, highest level of education, year of college, sex/gender, race/ethnicity, and state in which community participants reside.

MJ use. MJ consumption was assessed by the average MJ frequency item on the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017). The DFAQ-CU is the first psychometrically sound inventory for measuring frequency, age of onset, and quantity of MJ use. Its six-factor structure measuring daily sessions, frequency, age of onset, MJ quantity, cannabis concentrate quantity, and edibles quantity have been found reliable, with Cronbach’s alpha coefficients ranging from .69 (daily sessions) to .95 (frequency). Factors have shown convergent (MSHQ, TLFB), predictive (CAST, CUDIT-R, CUPIT), and discriminant validity (AUDIT; Cuttler & Spradlin, 2017). The item relating to average frequency that was used in this current study queried, “Which of the following best captures the average frequency you currently use cannabis?” with 13 answer choices: “I do not use cannabis”, “less than once a year”, “once a year”, “once every 3-6 months (2-4 times a year)”, “once every 2 months (6 times a year)”, “once a month (12 times a year)”, “2-3 times a month”, “once a week”, “twice a week”, “3-4 times a week”, “5-6 times a week”, “once a day”, and “more than once a day”.

Drug attitudes. The Drug Attitudes Scale (DAS; Goodstadt, Cook, Magid, & Gruson, 1978) was used to assess pre-existing attitudes toward MJ. The scale consists of 60 items
composed of 6-item subscales measuring attitudes toward each of nine drug substances and the
general use of drugs on a 5-point Likert Scale from 1=disagree to 5=agree. This scale has been
found to have high internal consistency and test-retest reliability (Goodstadt et al., 1978). In this
current experiment, participants were assessed on scales related to opiate use, alcohol use,
tobacco use, and general drug use, in addition to MJ use. Multiples drug attitudes were assessed
to reduce the influence of demand characteristics on participants’ responses to targeted attitudes
regarding MJ. The items related to MJ stated, “Using cannabis is a foolish thing to do”,
“Cannabis can make a social gathering more enjoyable”, “using cannabis is wrong”, “the only
bad thing about cannabis is the fact that it is illegal”, “there is not harm in the occasional use of
cannabis”, and “the legalization of cannabis would be a step in the wrong direction”.

Trait reactance. Trait reactance was measured using *Hong’s Psychological Reactance
Scale* (Hong & Faedda, 1996). This scale assesses denial, dominance, independence, and
mistrust, with participants indicating agreement to items on a 7-point Likert scale from 1 =
strongly disagree to 7= strongly agree. It has been validated extensively and used more often
than other trait reactance scales in recent reactance research (Dillard & Shen, 2005; Quick &
Stephenson, 2008).

State reactance. The main variable of interest, state reactance, was measured through a
14-item index combining scales for perceived threat to choice, counter-arguing, cognitive
appraisal and state anger, as introduced by Gardner & Leshner (2016). This model is based off
the current conceptualization of reactance as a latent factor comprised of negative cognitions and
state anger that occur after a perceived threat to freedom. A number of studies have validated this
“intertwined” process model using structural equation modeling techniques (Dillard & Shen,
2005; Quick & Stephenson, 2007a; Rains & Turner, 2007). This combined 14-item scale
has high face-validity in that it comprises four sub-scales validated across multiple studies.

Additionally, Gardner and Leshner’s (2016) study found this 14-item scale to have a high degree of internal consistency (.95).

**Perceived threat to freedom.** Perceived threat to freedom was measured by the four-item scale used by Dillard & Shen (2005). The scale consists of the following items: “The message threatened my freedom to choose,” “The message tried to make a decision for me,” “The message tried to manipulate me,” and “The message tried to pressure me.” Participants were presented with a 5-point response scale from 1= strongly disagree to 5= strongly agree. Multiple studies confirm the reliability and internal consistency of this index, reporting alpha coefficients as high as 0.95 (Quick & Considine, 2008).

**Negative cognitions.** The cognitive component of state reactance was measured with two self-report indices gauging (a) counter-arguing during message exposure and (b) cognitive appraisal of the message, as described below:

**Counter-arguing.** Counter-arguing was measured with a three-item index adapted from Silvia (2006): “Did you criticize the message you just saw while you were reading it?,” “Did you think of points that went against what was being said while you were reading the message?,” and “While reading the message, were you skeptical of what was being said?” Participants respond on a seven-point scales ranging from 1=no, not at all to 7=yes, very much. Silvia (2006) reported an alpha reliability of 0.81 for this three-item index.

**Cognitive appraisal.** Cognitive appraisal was measured with a four-item index adapted from an 18- item scale introduced by Dillard, Kinney, & Cruz (1996; α = .85 to .91) and validated by Miller et al. (2007; α = .87 to .92). Dillard et al.’s (1996) 18-item scale assessed nine dimensions of cognitive appraisal, but only valence, obstacle, and legitimacy appraisals
were significantly associated with controlling and dominating language across both experimental trials. To minimize participant fatigue, this study used the shortened scale reduced to the dimensions of primary interest: valence ("the message was pleasant"), obstacle ("the message got in the way of what I wanted," reverse coded), and ("the message was reasonable," “the message was fair”), as was done by Gardner & Leshner (2016). Participants rated their agreement on a seven-point Likert scale ranging from 1=Strongly disagree to 7=Strongly agree.

**State anger.** State anger, the affective component of reactance was measured with a 4-item-index querying participants on the following questions: “To what extent did this message make you feel [irritated, angry, annoyed, aggravated]” on a seven-point Likert scale ranging from 1=not at all to 7=very strongly. Previous reactance studies have reported alpha coefficients for this four-item index in the .9 range (Dillard & Shen, 2005; C. H. Miller et al., 2007; Quick & Stephenson, 2008).

**Attitude toward the advocated behavior.** Attitude toward the advocated behavior was measured by a 5-item semantic differential scale from Dillard & Shen (2005). The question “How would you rate your attitude toward following the recommendations provided within the next three weeks?” is followed by six seven-point semantic differentials: negative/positive, not necessary/necessary, good/bad (reverse coded), favorable/unfavorable (reverse coded), foolish/wise, or detrimental/beneficial. Negative attitudes toward the message’s advocacy indicates indirect restoration of freedom (Quick & Stephenson, 2007b).

**Attitude toward the study.** The assessment measuring attitude toward the study was adapted from the three-item index from MacKenzie & Lutz (1989) and validated by Lafferty & Goldsmith (1999) assessing attitude toward the message. As the message in this study was not an advertisement, participant’s impression of the message would be very similar to their
impression of the message’s advocated behavior, and so we believed it would be most fitting to ask participants about their overall impression of the study. The three items queried, “How would you rate your overall impression of this study on the following scale?”, followed by three seven-point semantic differentials: bad/good, favorable/unfavorable (reverse-coded), and negative/positive. Negative attitudes toward the study (i.e., low ratings) indicate indirect restoration of freedom in response to a perceived threat of choice (Quick & Stephenson, 2007b).

**MJ craving.** Craving was assessed with the *Marijuana Craving Questionnaire*, 17-item short form (*MCQ*; Heishman et al., 2009). The MCQ is the only known measure of craving that is designed specifically to MJ. The MCQ measures four factors of craving: compulsivity (inability to control use, e.g., “I need to smoke MJ now”), emotionality (relief from withdrawal and negative affect, e.g., “I would feel less anxious if I smoked MJ right now”), expectancy (anticipation of positive outcomes, e.g., “smoking MJ would make me content”), and purposefulness (planning/intention to use for positive outcomes, e.g., “smoking MJ would be pleasant right now”). Items are rated on a Likert scale that ranges from 1 “strongly disagree” to 7 “strongly agree.” Reliability for each of the MCQ’s factor scores is within acceptable range for use among non-treatment seeking cannabis users (Heishman, Singleton, & Liguori, 2001; Heishman et al., 2009). Nevertheless, reliability of the overall craving score, however, has not been established. Additionally, a single-item (Visual Analog Scale) measure of state cannabis craving was also used to supplement the multi-item instrument, as recommended by Drobes & Thomas (1999).

**Intended compliance with health recommendation.** The participant’s degree of intended compliance with the message’s recommendation was measured with the question, “How likely will you be to follow the recommendation provided to you regarding your marijuana
use within the next three weeks? Your honest response will be most helpful for purposes of this study”. This item was measured on a 100-point likelihood continuum ranging from 0=Definitely Will Not to 100=Definitely Will. Low ratings represent noncompliance and direct restoration of personal freedom through message rejection. This likelihood continuum is a common measure in research testing message-related outcomes following reactance to persuasive messages (Dillard & Shen, 2005; C. H. Miller et al., 2007).

**Intent to use MJ.** At the end of the survey, participants were asked about their intent to use MJ on a 10-point Likert scale. Additionally, participants were queried about other substances unrelated to the purpose of study to reduce demand characteristics. Behavioral intention measures are important to consider as they are frequently included in outcome evaluations of anti-drug campaigns and are predictive of future behavior (Harrington et al., 2003; Hornik et al., 2002).

**Analytic Plan**

All data was analyzed using SPSS software with the statistics package (SPSS Version 24). Below were the hypotheses assessed and the methods used to analyze them:

**H1:** *Individuals in the experimental condition will experience higher reactance in response to the message than individuals in the control condition.*

An independent t-test will be used to examine reactance between conditions. Additionally, a multiple regression analysis will examine whether condition could predict reactance, adjusting for MJ frequency. If trait reactance significantly differs between conditions, it will also be adjusted for in this regression analysis, as well as all analyses below.

**H2:** *Reactance will predict measures of indirect restoration of freedom (attitude toward the advocated behavior, attitude toward the study, MJ attitudes, and MJ craving as assessed by...*
the MCQ and the VAS). Specifically, reactance will negatively correlate with attitude toward the advocated behavior and the study, and positively correlate with MJ attitudes and MJ craving.

The second set of hypotheses will be tested using five hierarchical multiple regression analyses adjusting for MJ frequency, with reactance regressing on each of the variables of interest (attitude toward advocated behavior, attitude toward study, MJ attitudes, and MJ craving on the MCQ and VAS). The first block of each regression analysis will consist of MJ frequency, condition, and reactance, and the second block will consist of each of the combinations of standardized variables including condition x frequency, condition x reactance, frequency x reactance, and condition x frequency x reactance.

**H3:** Reactance will predict measures of direct restoration of freedom (MJ use in the next three weeks, intended compliance with the message). Specifically, reactance will positively correlate with intended MJ use in the next three weeks and negatively correlate with intended compliance with the message.

The third set of hypotheses will be tested using two hierarchical multiple regression analyses adjusting for MJ frequency, with reactance regressing on each of the variables of interest (intended MJ use in the next three weeks and intended compliance with the message). The first block of each regression analysis will consist of MJ frequency, condition, and reactance, and the second block will consist of the combinations of standardized variables including condition x frequency, condition x reactance, frequency x reactance, and condition x frequency x reactance.

**Power Analysis.**
To ensure that the study is adequately powered to find the between-groups effects of interest, G*Power 3.1 was used to compute the necessary sample size (Faul, Erdfelder, Buchner, & Lang, 2009). Meta-analyses suggest that the effect size for psychological reactance have reached $r = .59$, although an average range appears to be approximately $r = .3-.4$ (Rains, 2013). Using conventional cut-offs for type I and type II error ($\alpha = .05, \beta = .20$), the a priori required sample size to compute mean differences between two independent groups for a dependent variable effect of 0.4 is $n = 78$ for each of the 2 conditions; $n = 156$ total for each the student and community samples. Sample sizes within this range are common in the reactance literature (Rains, 2013).

**Results**

**Descriptive Information and Bivariate Correlations**

Data were checked for assumptions of normality, homoscedasticity, and absence of multicollinearity. Transformations were performed on any variable with a skew greater than 1 (attitude toward MJ in the community sample, reactance in the student sample, and MJ crave VAS scores in the student sample). As all analytic results were the same, the non-transformed variables were used in all analyses and reported in the tables for easier interpretation. See Tables 3 and 4 for variable descriptions among the community and student samples, respectively.

Among community members, reactance was negatively associated with attitude toward the advocated behavior ($r = -.42, p < .01$) and intent to comply ($r = -.28, p < .01$), and positively associated with intent to use MJ ($r = .16, p < .05$), and MJ craving on the VAS ($r = .19, p < .01$). Reactance was not related to MJ frequency ($r = .09, p > .05$). See Table 4 for bivariate correlations among the community sample. Additionally, a univariate Analysis of Variance (ANOVA) was conducted to determine the effect of a participant’s state (i.e., whether the person lived in a state
where MJ was legalized, decriminalized, or neither) on reactance to the message, and the effect was non-significant (F(2,190)= 1.79, p=.17). Among the student sample, reactance was negatively associated with attitude toward the message (r= -.40, p<.01) and intent to comply (r= -.27, p<.01), and positively associated with MJ craving on the VAS (r= .24 p<.01) and on the MCQ (r= .20, p<.01), as well as average MJ frequency (r= .24, p<.01). See Table 5 for bivariate correlations among the student sample.

Independent t-tests examined whether the experimental and control conditions differed in trait reactance and average MJ frequency. Among the community sample, there was no significant difference in trait reactance across the experimental (M= 42.07, SD=8.11) and non-experimental conditions (M=43.25, SD=8.30; t(196)=-1.013, p = .31), nor in MJ frequency (M_{experimental}= 9.58, SD=4.12; M_{control}=9.29, SD=4.00; t(194)=.50, p = .62). There were also no significant differences among the student sample in trait reactance (M_{experimental}= 40.75, SD=8.07; M_{control}=41.42, SD=8.64; t(187)=-0.55, p = .58), nor in MJ frequency (M_{experimental}= 7.35, SD=3.97; M_{control}=7.98, SD=3.68; t(187) = -1.13, p = .38).

**Hypothesis 1: Reactance in Response to Abstinence-Based Message**

Among community data, an independent t-test revealed that the experimental condition experienced significantly more reactance (M=41.38, SD=13.78) than the control condition (M=36.68, SD=12.49); t(196)=2.51, p=.01. A multiple regression analysis confirmed that the experimental message (β= -0.17, p = .02) predicted reactance scores after adjusting for frequency of use (R^2 =.04, F(2,195)=3.69, p=.03). The student data revealed the same results, with the experimental condition reporting significantly more reactance (M=39.65, SD=12.57) than the control condition (M=33.22, SD=9.57); t(186)=3.96, p<.01, and a multiple regression analysis
confirming that the experimental message ($\beta = -0.30$, $p<.01$) predicted reactance after adjusting for frequency of use ($R^2 = .14$, $F(2,187) = 15.39$, $p<.01$).

**Hypothesis 2: Indirect Restoration of Freedom**

**Attitude toward the advocated behavior.** Among the community sample, the regression analysis predicting attitudes toward the advocated behavior, adjusting for frequency of use, was significant ($R^2 = 0.23$, $F(3,193) = 19.19$, $p<.01$), revealing that the experimental message ($\beta = 0.14$, $p = .03$), reactance ($\beta = -0.38$, $p<.01$), and MJ frequency ($\beta = -0.19$, $p<.01$) all led to participants having lower attitudes toward the message. Additionally, the second block of the regression analysis was significant, ($R^2 = 0.28$, $F(7,193) = 10.28$, $p<.01$), with the interaction of condition x MJ frequency ($\beta = 0.18$, $p < .01$) predicting attitudes toward the message (See Figure 1). High frequency users reported lower attitudes toward the message than low frequency users in the experimental condition, while attitudes remained relatively consistent across low and high frequency users in the control condition. Among the student data, the regression analysis yielded the same results ($R^2 = 0.25$, $F(3,183) = 20.00$, $p<.01$), revealing that the experimental message ($\beta = 0.21$, $p<.01$), reactance ($\beta = -0.27$, $p<.01$) and MJ frequency ($\beta = -0.26$, $p<.01$) all led to participants having lower attitudes toward the message. Additionally, the same interaction of condition x MJ frequency ($\beta = 0.25$, $p = <.01$; $R^2 = 0.31$, $F(7,187) = 11.08$, $p<.01$) predicted reactance, with the exact pattern described in the community sample (See Figure 2).

**Attitude toward the study.** The regression analysis predicting attitudes toward the study was not significant for both the community and student samples.

**Attitude toward MJ.** The regression analysis predicting MJ attitudes, adjusting for MJ frequency, was not significant among the community sample. Among the student sample, this regression analysis was significant ($R^2 = 0.17$, $F(3,186) = 12.57$, $p<.01$), revealing that MJ
frequency ($\beta = 0.42, p < .01$) predicted more favorable attitudes toward MJ. Additionally, the second block of the regression analysis was significant, ($R^2 = 0.20, F(7,186) = 6.27, p < .01$), with the interaction of condition x reactance ($\beta = -0.20, p = .02$) predicting attitudes toward MJ, in addition to the main effects (See Figure 3). Among the experimental condition, individuals who experienced high (versus low) reactance reported more favorable MJ attitudes. Among the control condition, the alternative pattern was found, with individuals who experienced low (versus high) reactance reporting more favorable MJ attitudes.

**MJ craving.**

*VAS.* Among the community sample, the regression analysis predicting scores on the VAS was significant ($R^2 = 0.09, F(3,177) = 5.34, p < .01$), with reactance ($\beta = .18, p = .02$) and MJ frequency ($\beta = .22, p < .01$) predicting craving. Additionally, the second block of the regression analysis was significant, ($R^2 = 0.12, F(7,177) = 3.31, p < .01$), with the interaction of condition x MJ frequency ($\beta = -.16, p = .04$) predicting craving (See Figure 4). Among the experimental condition, high frequency users reported higher craving than low frequency users. Among the control condition, low and high frequency users reported similar craving. The main effects for the regression among the student sample were the same ($R^2 = 0.14, F(3,158) = 8.55, p < .01$), with reactance ($\beta = .16, p = .05$) and MJ frequency ($\beta = .30, p < .01$) predicting craving. The second block of the regression analysis was also significant, ($R^2 = 0.15, F(7,158) = 3.80, p < .01$), although none of the interactions significantly predicted craving on the VAS above and beyond the main effects.

For exploratory purposes, we sought to determine the underlying mechanism that may indirectly affect the relationship between reactance and VAS craving. For the community sample, two out of the four reactance scales, perceived threat to freedom and state anger,
correlated with VAS craving ($r=.20, p<.01; r=.22, p=.03$, respectively). Both variables were also significantly correlated with reactance ($r=.80, p<.01; r=.83, p<.01$, respectively). The four-item perceived threat to freedom scale had a Cronbach’s alpha of .87, and the four-item state anger scale had a Cronbach’s alpha of .94. Nevertheless, when either variable was placed into the regression equation with reactance, they did not significantly predict VAS craving.

For the student sample, state anger ($r=.29, p<.01$), and negative cognition ($r=.18, p=.03$) correlated with VAS craving. Both variables were also significantly correlated with reactance ($r=.77, p<.01; r=.86, p<.01$, respectively). State anger had a Cronbach’s alpha of .96, and the three-item negative cognition scale had a Cronbach’s alpha of .82. When negative cognition was placed into a regression equation with reactance, it did not predict VAS craving. When state anger was added to the regression equation with reactance, the regression was significant ($R^2=0.09, F(2,158)=7.39, p<.01$). State anger significantly predicted VAS craving ($\beta=1.7, p=.02$), and reactance ($p=.92$) was no longer significant. Indirect effects of state anger on the relationship between reactance and VAS craving were confirmed via a bootstrapping method in SPSS, which was bias corrected. 1,000 bootstrap samples with replacement were generated to estimate the magnitude of the indirect effect, an associated standard error, and 95% confidence intervals (Preacher & Hayes, 2004). The bootstrapping procedure supported the significant indirect path (95% CI: 0.14-3.52), suggesting that reactance leads to VAS craving via state anger. See Figure 5.

**MCQ.** Among the community sample, the regression analysis predicting scores on the MCQ was significant ($R^2=0.29, F(3,195)=26.09, p<.01$), with MJ frequency ($\beta=.53, p<.01$) predicting craving. Additionally, the second block of the regression analysis was significant, ($R^2=0.31, F(7,195)=11.99, p<.01$), although none of the interactions predicted craving above and
beyond the main effect. The regression analysis among the student sample yielded the same significant results ($R^2=0.28$, $F(3,186)=36.052$, $p<.01$), with average frequency ($\beta=.60$, $p<.01$) predicting craving. The second block of the regression analysis was also significant, ($R^2=0.39$, $F(7,186)=16.30$, $p<.01$), although none of the interactions significantly predicted craving on the MCQ above and beyond the main effect.

**Hypothesis 3: Direct Restoration of Freedom**

**Intent to use.** Among the community sample, the regression analysis predicting intent to use, adjusting for MJ frequency, was significant ($R^2=0.23$, $F(3,194)=61.12$, $p<.01$), revealing that reactance ($\beta=0.14$, $p=.01$), MJ Frequency ($\beta=0.66$, $p<.01$) and the control condition ($\beta=0.19$, $p<.01$) predicted higher intent to use MJ in the next three weeks. The second block of the regression analysis was not significant. The student data yielded similar results, ($R^2=0.65$, $F(3,187)=112.88$, $p<.01$), with MJ frequency predicting higher intent to use ($\beta=0.78$, $p<.01$) in the first block, and the control message ($\beta=0.10$, $p=.04$) and reactance ($\beta=0.11$, $p=.05$) predicting higher intent to use in the second block.

**Intent to comply.** Among community members, the regression analysis predicting intent to comply with the message, adjusting for MJ frequency, was significant ($R^2=0.14$, $F(3,175)=9.34$, $p<.01$), with reactance ($\beta=-0.25$, $p<.01$) and MJ frequency ($\beta=-0.26$, $p<.01$) predicting lower likelihood of compliance. The second block of the regression analysis was also significant, ($R^2=0.23$, $F(7,175)=7.09$, $p<.01$), with the interaction of condition x MJ frequency predicting intent to comply ($\beta=0.26$, $p<.01$) in addition to the main effects (See Figure 6).

Among the experimental condition, high frequency users were significantly less likely to comply than low frequency users, whereas among the control condition, high and low frequency users responded similarly. The results among the student sample were the same, with reactance ($\beta=-
0.25, \( p < .01 \) and MJ frequency (\( \beta = -0.20, p < .01 \)) predicting lower likelihood of complying on the first block (\( R^2 = 0.13, F(3,168) = 7.90, p < .01 \)), as well as the interaction of condition x MJ frequency (\( \beta = 0.24, p < .01 \)) on the second block (\( R^2 = 0.21, F(7,168) = 6.17, p < .01 \)), producing the same pattern as described above. See Figure 7.

**Discussion**

**Summary**

This experiment assigned students and community members to either an abstinence-based or harm-reduction MJ message. Among both samples, the message encouraging abstinence led to higher reactance, adjusting for MQ frequency. As predicted by PRT, individuals who experienced strong reactance attempted to restore their behavioral freedoms indirectly and directly. In regard to indirect restoration of freedom, individuals high in reactance reported less favorable attitudes toward the advocated behavior, and higher MJ craving on the VAS across both samples. Among the student sample, individuals in the experimental condition who experienced reactance reported more favorable MJ attitudes than those who did not experience reactance, as predicted by the hypotheses. Nevertheless, students in the control condition who experienced reactance expressed less favorable MJ attitudes than those who did not experience reactance, which may be an effect of cognitive dissonance in order to comply with the message, as described below. In regard to direct restoration of freedom, reactance predicted higher intent to use MJ and lower likelihood of compliance with the message.

**Abstinence-Based Message and Reactance**

As the hypothesis predicted, people who received the abstinence-based message were more likely to experience reactance than individuals who received the harm reduction message, regardless of their frequency of MJ use. Both messages described research on the negative
effects of MJ on concentration, but the experimental message incorporated explicit language (i.e., “research shows” rather than “research indicates”), and was more controlling in its content (i.e., promotion of abstinence) and language, describing the advice as “necessary” for improving concentration. The finding that individuals experience reactance to controlling and explicit anti-MJ messages is consistent with work in which individuals perceived strong anti-MJ ads as more exaggerated and unbelievable than for other substances (Ginsburg & Czyzewska, 2005). Nevertheless, much research on MJ and reactance has focused on adolescents’ responses to adults’ and parents’ communication (Crano et al., 2017; Nonnemaker et al., 2012). This experiment helps extend this work to college and community samples.

Additionally, the significant difference in reactance between the experimental and control conditions suggest that a well-framed message providing MJ harm-reduction techniques may be more effective at reducing reactance and increasing compliance than a message that is more controlling. Thus, people may understand the risks involved in MJ use, and are able to receive a message non-defensively when it is framed in an informative and non-restrictive manner. A non-restrictive message may have language that incorporates allusion to choice (“you have the chance to”) and qualified propositions (“there is some evidence that”), as well as objective content that allows individuals to use the information as they please, rather than have a decision made for them (Bushman, 1998).

Reactance and Indirect Restoration of Freedom

Reactance-induced craving. Consistent with the stated hypothesis, reactance predicted several behaviors indicating indirect restoration of freedom among both the community and student samples. The first, and most unique finding of this study, was that reactance predicted MJ craving on the VAS, even after controlling for the effects of MJ frequency. Interestingly,
these effects were found across both the experimental and the control conditions. This finding suggests that individuals may develop an attraction toward MJ that can manifest in craving through mere exposure to a message that they deem is impinging upon their basic behavioral freedoms. Reactance-induced craving may occur regardless of the content of the message (i.e., whether it promotes abstinence or harm-reduction). This finding has implications for assessing individuals’ reactance more objectively in response to anti-MJ prevention campaigns and treatment interventions.

In the social psychology literature, a common way of assessing interest in a restricted object or behavior, such as substance use, is by asking individuals about their attitudes toward it. This type of self-report assessment is often prone to demand characteristics. There are two possibilities for how participants can consciously distort their responses. They may underreport their attitudes toward a substance because they believe it is what the researcher wants to see. They may also overreport their attitudes toward the substance in retaliation, which also may be an inaccurate reflection of their true beliefs. Lastly, another problem with directly assessing attitudes related to common behaviors, such as MJ use, is that these attitudes are often well-established and difficult to realistically change in response to a short message or intervention. This may be particularly the case with more sophisticated substance users, such as college students and adults, who have more experience with the substance and its effects over time. Thus, assessing for substance craving may provide more implicit behavioral data of reactance, less prone to demand characteristics and other social biases.

In regard to applications for substance use treatment, an individual’s endorsement of craving may not only be a reflection of withdrawal or desire to use MJ, but potentially resistance to treatment. In MI or MET interventions, clinicians try to change individuals’ attitudes toward
substance use by helping the client realize that it is not in line with their long-term goals or values. Whereas clients may endorse less favorable views toward a substance in order to be agreeable or to complete treatment, they may feel more comfortable openly discussing their true levels of craving. Reactance-induced craving may be particularly relevant in court-ordered treatment where clients may be more prone to experience resistance (e.g., skepticism regarding benefits of treatment) regardless of their stage of readiness (e.g., perceived need for treatment and commitment to participate; Longshore & Teruya, 2006). Thus, even if clients recognize the need to be treated for substance use, the fact that they are forced to do it through involuntary services may make them more prone to resistance. Reactance-related phenomena in court-ordered treatment may thus even affect a user in the action or maintenance stage of Prochaska & DiClemente (1983)’s Transtheoretical Model, who is no longer regularly engaging in substance use or even experiencing craving. Nevertheless, this person may potentially develop craving from attending treatment against his or her own volition. In such a case, it may be particularly important to work on a client’s affective aspect of reactance, state anger, as this variable was found to indirectly influence the relationship between reactance and VAS craving in the student sample. Interestingly, the cognitive aspect of reactance, negative cognition, was not a significant predictor. The mediating role of state anger in the relationship between reactance and VAS craving provides further support for reactance-induced MJ craving as an implicit process, driven by momentarily-influenced emotions, rather than fully-conscious thought processes. Thus, exercises that allow a person to become more aware of their emotions and resulting behaviors (e.g., mindfulness) may be most helpful in reducing the problematic effects of reactance as they relate to MJ craving.
Nevertheless, it is important to keep in mind some limits to these implications. Firstly, reactance did not predict craving on the MCQ as it did on the VAS. This non-significant finding may be due to the MCQ being a multi-item assessment of four factors related to craving, whereas the VAS solely consists of the one item, “how much are you currently craving MJ?”. This one-item assessment may be more affected by moment-to-moment motivational states, such as reactance, whereas the MCQ may be more reflective of long-standing beliefs about MJ’s effects. Implications for how these two different measurements of craving relate to momentary decisions to use MJ, especially as they relate to reactance, should be examined in a longitudinal design.

Second, the interaction of condition x MJ frequency predicted MJ cravings on the VAS among the community sample, even after adjusting for the main effects of reactance and MJ frequency. As reactance was not involved in this finding, this interaction may likely reflect a distinct mechanism leading to craving other than reactance. In the control condition, both low and high frequency users reported similar levels of craving, whereas in the experimental condition, high frequency users reported significantly greater craving than low frequency users. This finding may be due to high frequency users experiencing craving via simply thinking about abstaining for three weeks, whether or not they have experienced reactance to the message. This explanation underscores the role of cognition and visualization of MJ unavailability influencing craving among high frequency users. Similarly, Shrier, Walls, Kendall, & Blood (2012) examined in-the-moment associations of perceived MJ availability with desire to use the drug among 15-24 year-olds who frequently use MJ over a span of two weeks. The odds of having a desire to use MJ were greater with slightly decreased perceived availability of the substance. Shrier, Walls, Kendall, & Blood (2012) concluded that the effects may be due to reactance, but this current experiment indicates reactance-induced craving may potentially be distinct from
craving in response to substance unavailability. Research should further elucidate the mechanisms that lead a person to crave MJ in response to a message deemed overly restrictive and unnecessary versus a message to which the individual agrees but feels incapable of doing.

**Attitudes toward the advocated behavior, study, and MJ.** Even after accounting for MJ frequency, reactance predicted less favorable attitudes toward the advocated behavior across both the experimental and the control conditions. Thus, regardless of whether participants were told to abstain from MJ or use harm-reduction techniques, if they experienced reactance, they developed less favorable views toward the behavior that was encouraged. The interaction of condition x MJ frequency predicted individuals’ attitude toward the advocated behavior in both samples after accounting for the significant main effects of reactance, condition, and frequency. High (versus low) frequency MJ users reported significantly less favorable attitudes toward the advocated behavior in the control condition, whereas both users’ attitudes were relatively consistent in the control condition. As reactance was already accounted for, it is likely that high frequency MJ users did not feel capable of abstaining from MJ use for three weeks, regardless of whether they agreed with the research supporting it and the way the message was presented.

As a main effect, reactance did not predict attitudes toward the study or attitudes toward MJ, after adjusting for MJ frequency. These non-significant findings may be due to the fact that participants were merely exposed to a message that discussed MJ’s effect on concentration, rather than wide-ranging negative comments against MJ in general. Thus, the stimuli may not have been strong enough to affect participants’ attitudes toward the study, rather than just the advocated behavior itself. Additionally, participants’ attitudes toward MJ, at least as they relate to associated harms and legalization (as tested by the DAS), are likely to be stable and long-standing, and not prone to changing in response to reactance.
Nevertheless, after accounting for the significant effects of MJ frequency, the interaction of reactance and condition did significantly predict MJ attitudes in the student sample. Among individuals exposed to the experimental message, those who experienced high (versus low) reactance expressed more favorable MJ attitudes, as predicted by the hypothesis. In contrast, among individuals exposed to the harm reduction message, those who experienced high reactance (versus low) expressed less favorable MJ attitudes. One possible explanation is that individuals who experienced strong reactance to the abstinence-based message felt justified in their response, leading them to reject the message and assert overly positive attitudes toward MJ. Individuals who experienced strong reactance to the harm reduction message may not have felt as warranted in their reaction, leading them to experience cognitive dissonance, and endorse less favorable attitudes toward MJ in order to comply with the instructions. This effect was only found in the student sample and not the community sample, potentially because the students felt a greater obligation to fulfill the experimental requirement to receive credit. This explanation indicates that reactance may affect attitudes toward the restricted object in either direction depending on a person’s ability to justify their response. Furthermore, these attitude changes may be implicit, potentially leading a person to engage in a certain degree of self-deception in order to comply with a request.

Zimmerman et al. (2014)’s research had similar findings, in that gain-framed and low-threat messages were associated with lower reactance and less positive attitudes toward MJ, whereas moderate-threat, and loss-framed messages increased reactance, leading to more positive attitudes toward MJ. Nevertheless, reactance was not examined as a moderator in the relationship between these messages and individuals’ attitudes. Such analyses in future studies may provide insight into whether reactance to low-threat messages may lead to cognitive
dissonance in some individuals, and thus lower attitudes toward the restricted behavior in order to comply with the message’s request.

**Reactance and Direct Restoration of Freedom**

Consistent with the stated hypothesis, reactance predicted both behaviors indicating direct restoration of freedom among community and student samples. Reactance predicted greater intent to use MJ in the next three weeks, even after adjusting for the significant effects of MJ frequency, and of condition (with individuals in the experimental group reporting lower likelihood of using MJ, either due to social desirability or actual plans to abstain). Additionally, reactance predicted a lower likelihood of complying with the request, even after accounting for the significant effects of MJ frequency. Interestingly, participants’ assigned condition (i.e., whether they were given the harm reduction versus the abstinence-based message) did not affect their likelihood of compliance. This finding is consistent with research indicating that reactance to communication about an anti-MJ message may increase individuals’ intent to use MJ in the future (e.g., Nonnemaker et al., 2012), regardless of the content of the message itself. Along with the significant effects of reactance on MJ craving on the VAS, this finding is particularly concerning, in that individuals may have truly endorsed this attraction to the opposed behavior and plan to act on their intentions, rather than simply stating a false intention in retaliation.

These findings speak to the importance of framing messages appropriately in therapy and in substance use prevention campaigns by promoting autonomy and individual decision-making above and beyond the content of the message itself. For instance, an MI therapist might feel less concerned about framing a message appropriately because they are encouraging a client to use harm-reduction techniques rather than abstain, but if the client feels forced to attend treatment, they may still develop a greater craving and intent to use.
Lastly, an interaction of condition x frequency predicted intent to comply among both community member and student participants. High frequency users were less likely to comply than low frequency users among the experimental condition, but both types of users reported similar likelihoods of complying among the control condition. As mentioned, this result may suggest a mechanism other than reactance influencing intent to comply. Thus, even if individuals in the experimental condition did not experience reactance, they may simply have felt incapable of abstaining from MJ use for three weeks, rather than intending to disregard the message as a retaliatory response. Such individuals who do not feel capable of abstaining from MJ may benefit from a different treatment from those who experience reactance and deliberately intend to disobey.

**Limitations**

Several limitations to this study exist that constrain the implications of these findings. Both the experimental and harm-reduction messages contained two parts, including a sentence about MJ research and subsequent instructions to follow. These two components may influence similar outcomes through unique mechanisms: a) individuals experiencing reactance in response to a message to which they disagreed or b) individuals feeling incapable of following the instructions, even if they agreed with the message. Future work should help differentiate these two processes by adding two other conditions that simply provide instructions, without the research presented beforehand. Additionally, a longitudinal study where participants maintain a thought-diary would provide more information on the long-term effects of reactance-related phenomena, such as MJ craving and intent to use. It may be particularly helpful for differentiating momentary changes in craving on the MCQ versus the VAS and examine the different implications for both of these scales on MJ use and associated problems. Lastly, a
longitudinal design could help elucidate the role of cognitive dissonance in lowering participants’ attitudes toward MJ in the harm-reduction condition by determining whether individuals with high reactance who endorsed lower MJ attitudes did actually have higher compliance rates.

**Conclusion**

Findings of this experiment support important applications of reactance theory in the MJ treatment and prevention literature. This experiment determined that a message promoting MJ abstinence for three weeks lead to higher reactance than a message promoting harm reduction. Reactant individuals in both groups were more likely to express higher MJ craving on the VAS. Reactance-induced MJ craving is a new addition to the substance use literature and has implications for monitoring reactance in a treatment setting. Across groups, reactance also predicted less favorable attitudes toward the advocated behavior. Although reactance itself did not predict MJ attitudes, the interaction of reactance and condition significantly predicted these attitudes in the student sample. Students in the experimental condition who experienced reactance expressed more favorable MJ attitudes than those who did not experience reactance, as predicted by the hypotheses. Nevertheless, students in the control condition who experienced reactance expressed less favorable MJ attitudes than those who did not experience reactance, which may be an effect of cognitive dissonance in their attempt to comply with the message. Reactance also predicted greater intent to use MJ in the next three weeks as well as lower likelihood of complying with the request. Future studies can supplement these findings by differentiating reactance-associated craving and MJ use from other underlying mechanisms. Additionally, future work should examine the effects of reactance and cognitive dissonance on individuals’ MJ attitudes in response to varying levels of restrictions.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Community N</th>
<th>%</th>
<th>Student N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>198</td>
<td>100</td>
<td>190</td>
<td>100</td>
</tr>
<tr>
<td>Male</td>
<td>76</td>
<td>38.4</td>
<td>56</td>
<td>29.5</td>
</tr>
<tr>
<td>Female</td>
<td>122</td>
<td>61.6</td>
<td>134</td>
<td>70.5</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>198</td>
<td>100</td>
<td>190</td>
<td>100</td>
</tr>
<tr>
<td>Caucasian</td>
<td>143</td>
<td>72.2</td>
<td>101</td>
<td>53.2</td>
</tr>
<tr>
<td>African American</td>
<td>15</td>
<td>7.6</td>
<td>34</td>
<td>17.9</td>
</tr>
<tr>
<td>Asian</td>
<td>6</td>
<td>3.0</td>
<td>15</td>
<td>7.9</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>15</td>
<td>7.6</td>
<td>30</td>
<td>15.8</td>
</tr>
<tr>
<td>Native American</td>
<td>5</td>
<td>2.5</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Other</td>
<td>14</td>
<td>7.1</td>
<td>8</td>
<td>4.2</td>
</tr>
<tr>
<td>Education</td>
<td>198</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Some high school</td>
<td>6</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Finished high school/GED</td>
<td>40</td>
<td>20.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Some college</td>
<td>70</td>
<td>35.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Associates degree</td>
<td>25</td>
<td>12.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>33</td>
<td>16.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Some graduate training</td>
<td>8</td>
<td>4.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Advanced Degree</td>
<td>16</td>
<td>8.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Year of College</td>
<td>-</td>
<td>-</td>
<td>190</td>
<td>100</td>
</tr>
<tr>
<td>Freshman</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>39.5</td>
</tr>
<tr>
<td>Sophomore</td>
<td>-</td>
<td>-</td>
<td>43</td>
<td>22.6</td>
</tr>
<tr>
<td>Junior</td>
<td>-</td>
<td>-</td>
<td>48</td>
<td>25.3</td>
</tr>
<tr>
<td>Senior</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>12.6</td>
</tr>
<tr>
<td>U.S. State</td>
<td>193</td>
<td>97.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ legalized</td>
<td>47</td>
<td>23.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ decriminalized</td>
<td>59</td>
<td>29.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Neither</td>
<td>87</td>
<td>43.9</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
**Table 2**  
*Variable Descriptives of Community Sample*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min</th>
<th>Max</th>
<th>$M$ (SD)</th>
<th>Skew (SE)</th>
<th>$\alpha$</th>
<th>$n$ of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>State reactance</td>
<td>14</td>
<td>78</td>
<td>38.95 (13.31)</td>
<td>1.04 (.18)</td>
<td>0.83</td>
<td>14</td>
</tr>
<tr>
<td>Trait reactance</td>
<td>14</td>
<td>66</td>
<td>42.68 (8.21)</td>
<td>-0.26 (.18)</td>
<td>0.83</td>
<td>14</td>
</tr>
<tr>
<td>MJ frequency</td>
<td>1</td>
<td>13</td>
<td>9.43 (4.05)</td>
<td>-0.29 (.18)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Attitude toward bx</td>
<td>6</td>
<td>42</td>
<td>26.38 (10.77)</td>
<td>&lt;0.01 (.18)</td>
<td>0.94</td>
<td>6</td>
</tr>
<tr>
<td>Attitude toward study</td>
<td>3</td>
<td>21</td>
<td>16.49 (4.19)</td>
<td>-0.76 (.18)</td>
<td>0.95</td>
<td>3</td>
</tr>
<tr>
<td>Attitude toward MJ</td>
<td>7</td>
<td>30</td>
<td>26.28 (4.49)</td>
<td>-0.78 (.18)</td>
<td>0.80</td>
<td>6</td>
</tr>
<tr>
<td>MCQ</td>
<td>22</td>
<td>107</td>
<td>69.41 (15.41)</td>
<td>-0.39 (.18)</td>
<td>0.80</td>
<td>17</td>
</tr>
<tr>
<td>MJ Crave VAS</td>
<td>0</td>
<td>100</td>
<td>31.31 (30.85)</td>
<td>1.02 (.19)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Intent to use MJ</td>
<td>1</td>
<td>11</td>
<td>7.52 (4.04)</td>
<td>-0.25 (.18)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Intent to comply</td>
<td>0</td>
<td>100</td>
<td>61.11 (37.35)</td>
<td>-0.28 (.19)</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

**Table 3**  
*Variable Descriptives of Student Sample*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min</th>
<th>Max</th>
<th>$M$ (SD)</th>
<th>Skew (SE)</th>
<th>$\alpha$</th>
<th>$n$ of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>State reactance</td>
<td>14</td>
<td>80</td>
<td>36.50 (11.63)</td>
<td>0.70 (.17)</td>
<td>0.83</td>
<td>14</td>
</tr>
<tr>
<td>Trait reactance</td>
<td>14</td>
<td>68</td>
<td>41.03 (8.24)</td>
<td>&lt;0.01 (.17)</td>
<td>0.86</td>
<td>14</td>
</tr>
<tr>
<td>MJ frequency</td>
<td>1</td>
<td>13</td>
<td>7.67 (3.83)</td>
<td>-0.78 (.17)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Attitude toward bx</td>
<td>6</td>
<td>42</td>
<td>27.03 (9.36)</td>
<td>-0.16 (.17)</td>
<td>0.93</td>
<td>6</td>
</tr>
<tr>
<td>Attitude toward study</td>
<td>3</td>
<td>21</td>
<td>16.97 (4.08)</td>
<td>-0.54 (.17)</td>
<td>0.91</td>
<td>3</td>
</tr>
<tr>
<td>Attitude toward MJ</td>
<td>9</td>
<td>30</td>
<td>24.16 (4.77)</td>
<td>-1.6 (.17)</td>
<td>0.78</td>
<td>6</td>
</tr>
<tr>
<td>MCQ</td>
<td>17</td>
<td>98</td>
<td>61.21 (16.51)</td>
<td>-0.61 (.17)</td>
<td>0.85</td>
<td>17</td>
</tr>
<tr>
<td>MJ crave VAS</td>
<td>0</td>
<td>100</td>
<td>23.03 (25.92)</td>
<td>0.75 (.18)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Intent to use MJ</td>
<td>1</td>
<td>11</td>
<td>6.64 (4.04)</td>
<td>-0.62 (.17)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Intent to comply</td>
<td>0</td>
<td>100</td>
<td>56.95 (37.21)</td>
<td>-0.51 (.18)</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>
Table 4
Bivariate Correlations Among Community Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reactance</th>
<th>Attitude study</th>
<th>Attitude bx</th>
<th>Attitude MJ</th>
<th>MCQ</th>
<th>MJ VAS</th>
<th>Intent use</th>
<th>Intent comply</th>
<th>MJ freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactance</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude study</td>
<td>-0.12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude bx</td>
<td>-0.42**</td>
<td>0.41**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude MJ</td>
<td>&lt;0.01</td>
<td>0.21**</td>
<td>-0.06</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MCQ</td>
<td>0.13</td>
<td>0.21**</td>
<td>-0.16**</td>
<td>0.45**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ VAS</td>
<td>0.19**</td>
<td>0.13</td>
<td>-0.09</td>
<td>0.09</td>
<td>0.51**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intent use</td>
<td>0.16*</td>
<td>0.03</td>
<td>-0.24**</td>
<td>0.31**</td>
<td>0.49**</td>
<td>0.33**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intent comply</td>
<td>-0.28**</td>
<td>0.38**</td>
<td>0.59**</td>
<td>0.07</td>
<td>-12</td>
<td>-0.02</td>
<td>-0.28**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ freq</td>
<td>0.09</td>
<td>0.06</td>
<td>-0.23**</td>
<td>0.38**</td>
<td>0.53**</td>
<td>0.23**</td>
<td>0.67**</td>
<td>-0.27**</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. * = p <.05; **= p <.01

Table 5
Bivariate Correlations Among Student Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reactance</th>
<th>Attitude study</th>
<th>Attitude bx</th>
<th>Attitude MJ</th>
<th>MCQ</th>
<th>MJ VAS</th>
<th>Intent use</th>
<th>Intent comply</th>
<th>MJ freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactance</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude study</td>
<td>-0.06</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude bx</td>
<td>-0.40**</td>
<td>0.36**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Attitude MJ</td>
<td>0.04</td>
<td>0.14</td>
<td>-0.19**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MCQ</td>
<td>0.20**</td>
<td>-0.09</td>
<td>-0.36**</td>
<td>0.43**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ VAS</td>
<td>0.24**</td>
<td>-0.05</td>
<td>-0.21**</td>
<td>0.20*</td>
<td>0.60**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intent use</td>
<td>0.24*</td>
<td>-0.06</td>
<td>-0.35**</td>
<td>0.39**</td>
<td>0.66**</td>
<td>0.44**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intent comply</td>
<td>-0.27**</td>
<td>0.29**</td>
<td>0.56**</td>
<td>-0.08</td>
<td>-0.29**</td>
<td>-0.03</td>
<td>-0.37**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MJ freq</td>
<td>0.24**</td>
<td>0.03</td>
<td>-0.32**</td>
<td>0.42**</td>
<td>0.61**</td>
<td>0.35**</td>
<td>0.80**</td>
<td>-0.28**</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. * = p <.05; **= p <.01
Figure 1. Attitude toward Advocated Behavior Among Community Sample

![Graph showing attitude toward advocated behavior among community sample.]

Figure 2. Attitude toward Advocated Behavior Among Student Sample

![Graph showing attitude toward advocated behavior among student sample.]

Experimental
Control
Figure 3. MJ Attitudes Among Student Sample
Figure 4. MJ VAS Craving Among Community Sample
Figure 5. State Anger as a Mediator of the Relation between Reactance and VAS Craving Among Student Sample

Note. Standardized regression coefficients used; *p < .05, **p < .01
Figure 6. Intent to Comply Among Community Sample

Figure 7. Intent to Comply Among Student Sample
References


https://doi.org/10.1080/03637759609376382


Assessment and Cue-Exposure Therapy in Substance Use Disorders. *Frontiers in Human Neuroscience, 8*. https://doi.org/10.3389/fnhum.2014.00844


https://doi.org/10.1016/0306-4603(89)90031-2


https://doi.org/10.1177/0093650215609669


https://doi.org/10.1016/j.drugalcdep.2005.06.011


https://doi.org/10.1001/archpsyc.1974.01760100093015


MacKillop, J., & Lisman, S. a. (2007). Examining the effect of perceived availability on craving...


Pacek, L. R., Mauro, P. M., & Martins, S. S. (2015). Perceived risk of regular cannabis use in the...


Silvia, P. J. (2006). Reactance and the dynamics of disagreement: Multiple paths from threatened


