



HHS Public Access

Author manuscript

Subst Use Misuse. Author manuscript; available in PMC 2020 August 16.

Published in final edited form as:

Subst Use Misuse. 2019 ; 54(14): 2359–2367. doi:10.1080/10826084.2019.1650771.

Effects of Messaging and Psychological Reactance on Marijuana Craving

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Abstract

Background: Psychological Reactance Theory (Brehm, 1966) asserts that people experience reactance (a motivational state characterized by negative affect and cognition) when they perceive threats to their autonomy. Reactance may lead to “boomerang effects” by which individuals engage in the opposed behavior.

Objectives: This experiment sought to determine whether a message encouraging marijuana (MJ) abstinence evoked greater reactance than a harm-reduction message and whether the message and reactance influenced individuals’ attitudes, MJ craving, and intent to comply with the message request.

Methods: College students and community members (n=388) participated in an online study where they were randomly assigned to receive a message promoting MJ abstinence or harm reduction. Regression analyses adjusting for MJ use, alcohol use, and age determined the effects of the message and reactance on individuals’ attitudes, MJ craving, and intent to comply. Follow-up analyses determined the significant reactance subscales.

Results: The abstinence message evoked greater reactance than the harm reduction message and led to less favorable attitudes toward the advocated behavior. Across messages, reactance (specifically negative cognitive appraisal) was related to less favorable attitudes toward the advocated behavior and the study, as well as lower intent to comply. Additionally, reactance (specifically anger) was associated with greater self-reported craving.

Conclusions/Importance: Anti-MJ messages designed to discourage use might heighten reactance and inadvertently lead to greater craving and intent to use. The link between reactance and craving may be more affectively mediated than the link between reactance and message rejection.

Keywords

Psychological Reactance Theory; reactance; messaging; marijuana; craving

Background

Psychological Reactance Theory (PRT) asserts that people experience reactance (a motivational state characterized by negative affect and cognition) when they perceive threats to their “behavioral freedoms”, activities which are typically deemed accessible (Brehm, 1966). Individuals may attempt to restore these freedoms through increased attraction or engagement in the opposed behavior, known as “boomerang effects” (Dillard & Shen, 2005).

PRT has helped explain resistance to persuasive messages relating to substance use including alcohol (e.g., Shen, 2010), tobacco (e.g., Miller & Quick, 2010), and more recently, marijuana (e.g., Crano et al., 2017). PRT is also relevant to substance use disorder (SUD) treatment. It is a core philosophy behind the therapeutic approach Motivational Interviewing (Miller & Rollnick, 2002), designed to emphasize clients' autonomy and reduce resistance. Additionally, harm reduction strategies focused on reducing the problematic effects of drug use (Logan & Marlatt, 2010) may reduce reactance by meeting clients at their stage of readiness for change (Prochaska & DiClemente, 1983).

Several factors contribute to the likelihood of a person experiencing reactance, including message language and content, as well as personality factors. People are more likely to experience reactance in response to messages with rigid, controlling, and explicit language (e.g., Grandpre et al., 2003; 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. Second, the cognitive response approach to persuasion (Greenwald, 1968) predicts that individuals' cognitions and judgments elicited at the time of message will influence the amount and direction of attitude change that occurs. Thus, if the persuasive message evokes disagreement with its content, recipients may develop counterarguments that lead to boomerang effects. Third, 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).

Anti-marijuana (MJ) messages may be particularly vulnerable to reactance, with policy and public opinion often at odds. MJ is illegal under the Federal Controlled Substance Act of 1970, in which it is considered a Schedule I substance (i.e., no accepted medical use and high risk of addiction; Pacula, Chiqui, Reichmann, & Terry-McElrath, 2002). Nevertheless 33 states have passed medical MJ laws (MML), 13 have passed decriminalization laws, and 11 have passed legalization laws (NORML, 2017). Consistently, a majority (62%) of adults in the US support MJ legalization (Pew Research Center, 2018). 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 (for a review see Carliner, Brown, Sarvet, & Hasin, 2017). In one U.S. national survey (Monitoring the Future), adolescents seeing moderate or great risk in occasional use decreased from 84.0% to 53.8% between 1991 and 2015 (Johnston, O'Malley, Miech, Bachman, & Schlenberg, 2014; Keyes et al., 2016). MJ is the most frequently used illicit substance worldwide (UNODC, 2013) and among U.S. adolescents and young adults, with a majority reporting lifetime use (Schulenberg, J. E., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Miech, R. A. & Patrick, 2017).

In this context of disparate laws and perceptions, anti-MJ communications can backfire. For example, college students criticized anti-MJ ads more than anti-tobacco ads, viewing them as exaggerated and unbelievable (Ginsburg & Czyzewska, 2005). In other work, anti-MJ parent-child communications had little influence on the child's behavior, sometimes increasing the likelihood of use (Nonnemaker, Silber-Ashley, Farrelly, & Dench, 2012).

Similar work on adolescents found that those who viewed adults using extreme language to discuss an anti-MJ campaign were more resistant to the message than those who viewed adults using less directive language (Crano, Alvaro, Tan, & Siegel, 2017). Another experiment examined high sensation seeking individuals' 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). Participants perceived loss-framed messages as a greater threat, inducing reactance. In contrast, messages that were gain-framed were significantly more successful in reducing positive attitudes toward MJ. These results suggest that PRT can play a clear role in shaping MJ-related attitudes.

Reactance and MJ Craving

As in the studies described, researchers often assess reactance by querying individuals on their attitudes toward the restricted object or behavior. A potential problem with this method of inquiry is that participants may underreport their attitudes to be a "good participant" or exaggerate their attitudes in retaliation. In this current study, we used MJ craving as an additional measure of reactance to prohibitory MJ messages. Craving differs from mere thoughts of enjoyment, or liking, of a drug's effects, both in degree and kind (West, 1987). It is an important predictor of use, substance use disorders, and risk of relapse following abstinence (Robinson & Berridge, 2003). Although MJ craving may relate to MJ attitudes, the relationship may not always be straightforward. For example, those who experience negative consequences of use might report unfavorable attitudes toward MJ, yet still experience craving.

To our knowledge, no study has examined substance use craving in response to psychological reactance, although research has examined similar concepts in the food literature. One study found that eliminating opportunities for certain foods that were neither attractive nor unique led to college students' increased desire for these foods (West, 1975). Other research found that individuals desired to taste full-fat cream cheese if they were exposed to threatening warnings for health consequences versus objective information regarding calories. In regard to substances, research has assessed the links between perceived availability of a substance and craving, with mixed findings. For example, craving for cigarettes can increase when smokers know they are available (Carter & Tiffany, 2001), while craving for alcohol can increase when it is *unavailable* (MacKillop & Lisman, 2007). One experiment on MJ craving revealed that a slight decrease in MJ availability increased desire to use, as reactance theory would predict (Shrier, Walls, Kendall, & Blood, 2012).

This current experiment sought to determine whether a message encouraging MJ abstinence evoked greater reactance than a harm-reduction message. Additionally, we examined the effects of the message and reactance on restoration of freedom measures (items reflective of increased attraction or engagement in the opposed behavior): individuals' attitudes, MJ craving, and intent to comply with the message request. First, we predicted that reactance would correlate with unfavorable attitudes toward the advocated behavior and the study, lower intent to comply, positive attitudes toward MJ, and increased MJ craving. For exploratory purposes, we determined the significant subscales of reactance leading to these

outcomes. Second, we predicted that the abstinence message would produce greater reactance than the harm reduction message, and that reactance would mediate any relationships between the abstinence message and restoration of freedom variables.

Method

Participants

This experiment was conducted online through SurveyMonkey and was approved by the University at Albany Institutional Review Board. The sample consisted of 388 participants aged 18 to 74 ($M=29.72$, $SD=14.45$). There were 198 community participants from 39 U.S. states recruited from Craig's List and a MJ legalization listserv, National Organization for the Reform of MJ Laws (NORML). Craig's List participants were entered into a raffle to win 20 Amazon gift cards, valued at \$20 each. NORML participants were entered into a raffle to win a Firefly Vaporizer valued at \$270. There were 190 undergraduates from the Psychology subject pool participating for course credit. Individuals were allowed to participate if they were 18 or above, proficient in English, and endorsed a history of having used MJ. See Table 1 for sample characteristics.

To ensure privacy and confidentiality, participant responses were coded with a subject ID number and no personal identifying information that might directly relate participants to the subject ID number were collected. Additionally, SurveyMonkey uses Hypertext Transfer Protocol Secure (HTTPS), which ensures industry standard protection typical of banking and other payment websites. All data collected online were stored in a password protected account and computer.

Stimuli

After providing informed consent, participants were queried on demographics and trait reactance. Participants completed a mock concentration task before they were randomly assigned based on birth month to receive the abstinence or harm-reduction message. Both messages described potential negative effects of MJ on concentration, but the abstinence message incorporated more explicit language (i.e., "research shows" rather than "research indicates") and was more controlling in content (promoting MJ abstinence vs. harm reduction) and language (describing the advice as "necessary"). Participants were advised to follow the instructions for the next three weeks, as they may be randomly selected for another assessment of their concentration after that time frame. After the mock concentration task, participants were queried on their marijuana and alcohol use, reactance, and restoration of freedom variables. At the end of the experiment, participants were informed that they were not selected to be re-assessed in three weeks.

Abstinence message.—The abstinence 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."

Harm reduction message.—The harm reduction 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, 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 item 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”, “more than once a day”.

Alcohol use.—Alcohol use frequency was assessed with the question, “Approximately, how many days do you usually consume alcohol in one week?”, with answer choices ranging from 0 to 7 days.

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. Sample items include, “Regulations trigger a sense of resistance in me” and “I am content only when I am acting of my own free will”. $\alpha = 0.83$.

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, negative cognitive appraisal and state anger, as introduced by Gardner & Leshner (2016). This model is based off the conceptualization of reactance as a latent factor comprised of negative cognitions and state anger that occur after a perceived threat to freedom (e.g., Dillard & Shen, 2005; Quick & Stephenson, 2007). $\alpha = 0.83$.

Perceived threat to freedom. Perceived threat to freedom was measured by the four-item scale used by Dillard & Shen (2005). Participants responded to items, such as, “the message threatened my freedom to choose” on a 5-point Likert scale. $\alpha = 0.87$.

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

Counter-arguing.: Counter-arguing was measured with a three-item index adapted from Silvia (2006), consisting of items such as, “Did you think of points that went against what was being said while you were reading the message?”. Participants responded on a 7-point Likert scale. $\alpha = 0.86$.

Negative cognitive appraisal.: Negative cognitive appraisal was measured with a three-item index adapted from an 18- item scale introduced by Dillard, Kinney, & Cruz (1996). As done by Gardner & Leshner (2016), we used the shortened scale reduced to the dimensions of primary interest: obstacle (“the message got in the way of what I wanted”), valence (“the message was pleasant”; reverse-coded), and legitimacy (e.g., “the message was reasonable”; reverse-coded). Participants rated their agreement on a 7-point Likert scale, with higher scores indicating more negative appraisal. $\alpha = 0.76$.

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 7-point Likert scale. $\alpha = 0.94$.

Attitude toward the advocated behavior.—The question “How would you rate your attitude toward following the recommendations provided within the next three weeks?” was followed by six seven-point semantic differentials: bad/good, unfavorable/unfavorable, negative/positive, undesirable/desirable, unnecessary/necessary detrimental/beneficial (Dillard & Shen, 2005), with higher scores indicating more positive attitudes. $\alpha = 0.94$.

Attitude toward the study.—The question “How would you rate your overall impression of this study?” was followed by three seven-point semantic differentials: bad/good, unfavorable/unfavorable, negative/positive. $\alpha = 0.95$.

Drug attitudes.—The *Drug Attitudes Scale (DAS;* Goodstadt, Cook, Magid, & Gruson, 1978) assessed attitudes toward MJ. Participants in this experiment were also asked about use of opiates, alcohol, tobacco and drugs in general to reduce the influence of demand characteristics. All drug attitudes were assessed through 6-item subscales on a 5-point Likert Scale. Examples of the MJ items include: “Cannabis can make a social gathering more enjoyable,” “There is no harm in the occasional use of cannabis.” $\alpha = 0.80$.

MJ Craving.

Marijuana craving questionnaire.: Craving was assessed with the *Marijuana Craving Questionnaire*, 17-item short form (*MCQ;* Heishman et al., 2009). The MCQ measures four factors of craving: compulsivity (e.g., “If I smoked a little marijuana right now, I would not be able to stop using it”, emotionality (e.g., “If I smoked marijuana right now, I would feel more tense”; reverse coded), expectancy (e.g., “Smoking marijuana would help me sleep better at night”), and purposefulness (e.g., “It would be great to smoke marijuana right now”). Items were rated on a 7-point Likert scale. $\alpha = 0.80$.

Visual Analog Scale.: A single-item measure of state MJ craving was also used to supplement the multi-item instrument, as recommended by Drobles & Thomas (1999). This

item asked participants, “On a scale from 0 to 100, how strongly are you currently craving marijuana?”.

Intended compliance.—The participant’s degree of intended compliance with the message’s request 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”, on a continuum from 0 to 100. This continuum is a common measure in research testing message-related outcomes following reactance to persuasive messages (Dillard & Shen, 2005; Miller et al., 2007).

Analytic Plan

First, we performed independent *t*-tests, analyses of covariance (ANCOVAS), and bivariate correlations to determine the potential differences in demographics (age, sex, race, source of recruitment, residing state MJ laws, education) and pre-existing variables (trait reactance, MJ use frequency, and alcohol frequency) across messages and reactance. Next, bivariate correlations were examined between reactance and restoration of freedom measures. For significant relationships, confirmatory regression analyses adjusting for MJ use frequency, alcohol frequency, and age were conducted. For each analysis where reactance was a significant predictor, we performed follow-up analyses replacing reactance with its four subscales to determine which subscales were significant. Lastly, we performed independent *t*-tests to determine the effects of message on restoration of freedom measures to determine if mediation analyses (reactance as a mediator between message and outcomes) would be conducted.

Results

Data Cleaning and Covariates

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 (skew= -1.1) and alcohol frequency (skew=1.7). As analyses yielded the same significant results with the transformed variables, the non-transformed variables were used in all analyses for easier interpretation.

Randomization was effective in producing equal variance of all but one demographic and pre-existing variables across the abstinence and harm reduction groups. There was a significant difference in age ($t(362)=1.94, p=.05$), with the harm reduction group being slightly older ($M=31.19, SD=15.59$) than the abstinence group ($M=28.30, SD=13.10$). See Table 2 for descriptive information of pre-existing and dependent variables across abstinence and harm reduction groups. Lastly, reactance was positively correlated with trait reactance ($r=.24; p<.01$), MJ use frequency ($r=.15; p<.01$), and alcohol use frequency ($r=.11; p<.05$). Reactance was not related to any demographics.

Message and Reactance

Individuals who received the abstinence message reported greater reactance ($M=39.51$, $SD=14.48$) than those who received the harm reduction message ($M=33.08$, $SD=12.57$; $t(377)=-4.67$, $p<.001$). A regression adjusting for MJ use frequency, alcohol frequency, and age confirmed significant effects of the abstinence message ($p<.01$), MJ frequency ($p<.01$), and alcohol frequency ($p=.01$) on reactance. See Table 3 for results of regression analyses. The abstinence message predicted only one restoration of freedom measure ($p<.01$): less favorable attitude toward the advocated behavior ($M=24.27$, $SD=10.40$) than the harm reduction group ($M=29.10$, $SD=9.20$). When reactance was placed into the regression equation, the abstinence message remained significant, indicating that reactance did not mediate this relationship.

Reactance and Restoration of Freedom

Bivariate correlations revealed that reactance was negatively associated with attitude toward the advocated behavior ($r=-.56$; $p<.01$) and attitude toward the study ($r=.19$; $p<.01$), although it was not related to MJ attitudes ($r=-.02$; $p=.66$). Reactance was positively correlated with MJ craving on both the MCQ ($r=.17$; $p<.01$) and the VAS ($r=.21$; $p<.01$). Regression analyses adjusting for covariates confirmed these significant findings. See Table 3 for results of regression analyses. In predicting attitudes toward the advocated behavior, the abstinence message ($p<.01$), reactance ($p<.01$), and MJ frequency ($p<.01$) were related to less favorable attitudes. Negative cognitive appraisal was the significant reactance subscale ($p<.01$). In predicting negative attitudes toward the study, reactance was the only significant predictor ($p<.01$). Negative cognitive appraisal was the significant reactance subscale ($p<.01$). In predicting intent to comply with the message request, reactance ($p<.01$) and MJ frequency ($p<.01$) were related to lower intent. Negative cognitive appraisal was the significant reactance subscale ($p<.01$).

In predicting MJ craving on the MCQ, reactance ($p=.05$), MJ frequency ($p<.01$), and age ($p<.01$) were related to higher craving. Anger trended toward being the significant reactance subscale ($p=.07$). In predicting craving on the VAS, reactance ($p<.01$) and MJ frequency ($p<.01$) were related to higher craving. Anger was the significant reactance subscale ($p<.01$).

Discussion

Given the changing political and legal landscape surrounding MJ, insights into how to decrease associated problems can prove valuable. Reactance theory suggests that explicit or controlling public service announcements about health behaviors can lead to “boomerang effects” and inadvertently increase potential harm. In this current study, individuals who received a message to abstain from MJ were more likely to experience reactance than individuals who received a message promoting harm reduction. Across both groups, reactance was related to lower attitudes towards the advocated behavior, the study in general, and lower intent to comply with the message. The majority of comparable work has focused on children or adolescents (e.g., Crano et al., 2017; Nonnemaker et al., 2012), and this current experiment helps extend this work to college and adult community samples. Of note, negative cognitive appraisal was the significant reactance subscale driving these

relationships. That is, individuals who viewed the message as interfering, unpleasant, or unreasonable were more likely to dislike the recommendation they received and the study in general, and report less intent of changing their behavior. These findings suggest that any approach to anti-MJ messages will require considerable finesse. Language supporting autonomy and individual decision-making may prove as important as the information being presented.

Also consistent with reactance theory, reactance predicted significantly greater MJ craving on two different scales. The choice of craving as a dependent measure may sidestep demand characteristics that can occur with querying attitudes. In fact, reactance was not related to MJ attitudes in this study. Consistently, the subscale of reactance explaining the most variance in the MJ craving scales was anger, which differed from the cognitive appraisal subscale influencing attitudes and intent to comply. This affective link between reactance and craving may indicate a more implicit process than the cognitively mediated association between reactance with attitudes and intentions. Consistently, negative and positive affect have been found to occur along with substance craving in the cue-reactance literature (e.g., Baker, Morse, & Sherman, 1986). Thus, reactance and craving might share an automaticity that lacks the cognitive aspects inherent in articulated attitudes.

In addition to individuals reporting reactance, high frequency MJ users endorsed less favorable attitudes towards the advocated behavior, greater craving, and lower intent to comply with requests for behavior change. MJ use frequency and reactance simultaneously predicting outcomes may have implications for SUD treatment. For instance, high-frequency users who do not feel capable of abstaining from MJ might benefit from a different approach (e.g., skill-building) from those who experience reactance and deliberately intend to disobey (e.g., mindfulness to manage emotions related to craving). Furthermore, an individual's endorsement of craving may reflect resistance to treatment. Reactance-induced craving may be particularly relevant in court-ordered treatment where individuals may experience resistance to treatment due to its forced nature, regardless of their stage of readiness for change. Consistently, treatment resistance and readiness appear as two separate constructs (Longshore & Teruya, 2006).

Limitations

Several limitations constrain the implications of these findings. The abstinence message itself did not predict restoration of freedom outcomes, except for attitudes toward the advocated behavior. Perhaps the abstinence message was not a strong enough stimulus to produce outcomes on its own because it was not an explicit "anti-MJ" ad. Another limitation is that the abstinence message differed in both content and language from the harm reduction message, and so further research should differentiate whether less suggestive language can affect responses toward abstinence. Additionally, a longitudinal study where participants complete reactance measures in response to certain stimuli, in addition to measures of attitudes, MJ craving, and use would help determine the causal influence of reactance and its cognitive and affective subscales on outcome measures. Lastly, generalizability may be limited, as we did not assess for certain factors including psychiatric status (e.g., depression,

anxiety, bipolar, ADHD, etc.) and SUD treatment history, which may affect message response.

Conclusion

Findings of this experiment support applications of PRT in the MJ prevention and treatment literature. Although encouraging abstinence has considerable intuitive appeal for preventing MJ use and problems, abstinence-based messages may induce reactance. Still, results of this experiment suggest that any approach to anti-MJ messages will require considerable finesse. Across messages, reactance appears likely to generate negative attitudes toward the advocated behavior and the study in general, as well as decrease intended compliance. Negative cognitive appraisal served as the significant influence of these links. Reactance also appears likely to increase MJ craving, with underlying mechanisms of anger, suggesting a potentially more implicit and affective route to this response. Tailoring messages and treatment in an effort to decrease reactance will likely increase their potential to reduce MJ-related harms.

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Table 1

Sample Characteristics

Characteristic	n	%
Sex	388	100
Female	256	65.8
Male	132	33.9
Race/Ethnicity	388	100
Caucasian	244	62.9
African American	49	12.6
Hispanic/Latino	45	11.6
Asian	21	5.2
Native American	7	2.1
Other	22	5.7
Education (Community)	198	100
Some high school	6	3.0
Finished high school/GED	40	20.2
Some college	70	35.4
Associates degree	25	12.6
Bachelor's degree	33	16.7
Some graduate training	8	4.0
Advanced degree	16	8.1
Education (Students)	190	100
Freshman	75	39.5
Sophomore	43	22.6
Junior	48	25.3
Senior	24	12.6
U.S. State (Community)	193	97.5
MJ legalized	47	23.7
MJ decriminalized	59	29.8
Neither legalized or decriminalized	87	43.9

Table 2

Variable Descriptives by Message

Variable	Sample M (SD)	Abstinence M (SD)	Harm Reduction M (SD)	P-value
<i>Pre-Existing</i>				
Age	29.72 (14.45)	28.30 (13.10)	31.19 (15.59)	.05
Trait reactance	41.87 (8.30)	41.41(8.09)	42.39 (8.49)	.25
MJ frequency	8.56 (4.03)	8.45(4.19)	8.66 (3.90)	.61
Alcohol frequency	1.27 (1.52)	2.24 (1.49)	2.30 (1.56)	.70
<i>Outcome Measures</i>				
State reactance	36.28 (13.91)	39.51(14.48)	33.08(12.57)	<.01
Perceived threat	9.66 (4.22)	10.56(4.37)	8.76 (3.87)	<.01
State anger	7.00 (4.94)	7.82(5.42)	6.20 (4.26)	<.01
Negative cognitive appraisal	9.15 (4.55)	10.44(4.76)	7.88 (3.94)	<.01
Counter-arguing	10.49 (4.99)	10.73(5.02)	10.25 (4.96)	.34
Attitude toward advocated behavior	26.69 (10.10)	24.27(10.40)	29.10 (9.20)	<.01
Attitude toward study	16.73 (4.13)	16.48(4.07)	16.87 (4.20)	.25
Attitude toward MJ	25.25 (4.74)	25.31(4.60)	25.19 (4.89)	.81
MCQ craving	65.41 (16.46)	65.54 (16.07)	65.29 (16.87)	.88
VAS MJ craving	27.41 (28.89)	27.11 (29.58)	27.73 (28.26)	.84
Intent to comply	59.08 (37.29)	58.50 (38.87)	59.60 (35.90)	.79

Note. MCQ Craving= Marijuana Craving Questionnaire. VAS Craving= Visual Analog Scale MJ craving.

Table 3

Regression Analyses Adjusting for MJ Frequency, Alcohol Frequency, and Age

Predictor & Outcome	Significant Variables	B	SE B	β	t	Sig.	Equation
Message & Reactance	Abstinence message	5.83	1.40	0.20	4.17	<.01	$F(4,364)=8.97, p<.01$
	MJ frequency	0.60	0.17	0.18	3.45	<.01	
	Alcohol frequency	-1.17	0.45	-0.13	-2.57	.01	
Message & Attitude Bx	Abstinence message	-4.70	1.00	-0.23	-4.70	<.01	$F(4,358)=13.53, p<.01$
	MJ frequency	-0.68	0.12	-0.28	-5.51	<.01	
Reactance & Attitude Bx	Abstinence message	-2.54	0.88	-0.13	-2.90	<.01	$F(5,358)=41.04, p<.01$ $F(8,357)=37.89, p<.01$
	MJ frequency	-0.45	0.11	-0.18	-4.23	<.01	
	Reactance	-0.37	0.03	-0.51	-11.45	<.01	
	Negative cognitive appraisal	-1.21	0.12	-0.55	-10.57	<.01	
Reactance & Attitude Study	Reactance	-0.06	0.02	-0.19	-3.53	<.01	$F(5,363)=3.59, p<.01$ $F(8,362)=4.74, p<.01$
	Negative cognitive appraisal	-0.28	0.06	-0.31	-4.62	<.01	
Reactance & Intent Comply	MJ Frequency	-1.93	0.48	-0.21	-4.05	<.01	$F(5,331)=14.37, p<.01$ $F(8,330)=12.41, p<.01$
	Reactance	-0.95	3.85	-0.35	-6.66	<.01	
	Negative cognitive appraisal	-3.55	0.55	-0.41	-6.44	<.01	
Reactance & MCQ Craving	Age	0.16	0.05	0.14	3.23	<.01	$F(5,363)=43.80, p<.01$ $F(8,362)=27.74, p<.01$
	MJ frequency	2.31	0.18	0.56	13.15	<.01	
	Reactance	0.11	0.05	0.09	2.00	.05	
	Anger (trending significance)	0.34	0.19	0.10	1.85	.07	
Reactance & VAS MJ Craving	MJ Frequency	2.00	0.39	0.28	5.15	<.01	$F(5,320)=9.15, p<.01$ $F(8,319)=7.08, p<.01$
	Reactance	0.34	0.11	0.16	2.97	<.01	
	Anger	1.23	0.42	0.21	2.96	<.01	

Note. Attitude Bx= Attitude toward advocated behavior. Negative cognitive appraisal= Negative cognitive appraisal subscale of reactance. Attitude Study= Attitude toward the study. Intent Comply= Intent to comply. MCQ Craving= Marijuana Craving Questionnaire. Anger= State anger subscale of reactance. VAS MJ Craving= Visual Analog Scale MJ craving.