



Published in final edited form as:

Subst Use Misuse. 2016 June 6; 51(7): 912–921. doi:10.3109/10826084.2016.1156701.

Social anxiety and cannabis-related impairment: The synergistic influences of peer and parent descriptive and injunctive normative perceptions

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Abstract

Objectives—Cannabis users, especially socially anxious cannabis users, are influenced by perceptions of other’s use. The present study tested whether social anxiety interacted with perceptions about peer and parent beliefs to predict cannabis-related problems.

Methods—Participants were 148 (36.5% female, 60.1% non-Hispanic Caucasian) current cannabis users aged 18–36 ($M = 21.01$, $SD = 3.09$) who completed measures of perceived descriptive and injunctive norms, social anxiety, and cannabis use behaviors. Hierarchical multiple regressions were employed to investigate the predictive value of the social anxiety \times parent injunctive norms \times peer norms interaction terms on cannabis use behaviors.

Results—Higher social anxiety was associated with more cannabis problems. A three-way interaction emerged between social anxiety, parent injunctive norms, and peer descriptive norms, with respect to cannabis problems. Social anxiety was positively related to more cannabis problems when parent injunctive norms were high (i.e., perceived approval) and peer descriptive norms were low. Results further showed that social anxiety was positively related to more cannabis problems regardless of parent injunctive norms.

Conclusions—The present work suggest that it may be important to account for parent influences when addressing normative perceptions among young adult cannabis users. Additional research is needed to determine whether interventions incorporating feedback regarding parent norms impacts cannabis use frequency and problems.

Keywords

social anxiety; descriptive norms; injunctive norms; cannabis; cannabis problems

Introduction

Cannabis remains the most commonly used illicit drug and the rate of use is increasing (CUD; Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). Almost a quarter of users meet criteria for a cannabis use disorder, the prevalence for which is nearly equivalent to all other illicit substance use disorders combined (SAMHSA, 2013). Individuals with elevated social anxiety (SA) appear to be at particular risk for multiple substance use and dependence, including alcohol (Blumenthal, Ham, Cloutier, Bacon, & Douglas, 2015), nicotine dependence (Buckner & Vinci, 2013), and cannabis-related impairment (Buckner, Mallott, Schmidt, & Taylor, 2006; Nelemans et al., 2015). Relative to other adolescents, those with SA disorder evince seven times the risk of cannabis dependence in young adulthood (Buckner et al., 2008). Even subclinical, elevated SA is prospectively related to cannabis-related impairment (Marmorstein, White, Loeber, & Stouthamer-Loeber, 2010). Despite emerging data suggesting a robust and potentially unique relation between SA and cannabis-related impairment (for review see Buckner, Heimberg, Ecker, & Vinci, 2013), little research has identified factors that may contribute to this relation.

A promising construct that may underlie the relation between SA and cannabis-related impairment is normative beliefs. The social context plays an important role in cannabis initiation, and can be attributed to both peer and familial influence, and studies show that parental influence remains strong for young adults (e.g., Ecker & Buckner, 2014; Neighbors, Geisner, & Lee, 2008). The theory of planned behavior (Ajzen, 1991) posits that perceptions of behavior influence perceived norms, which subsequently impacts behavior. Indeed, normative beliefs are among the strongest predictors of frequent cannabis use (Buckner, 2013b). Perceptions of others' use (i.e., descriptive norms) and others' approval of use (i.e., injunctive norms) have documented relationships with cannabis use and problems (Buckner, 2013b; Ecker & Buckner, 2014b; Grossbard, Hummer, LaBrie, Pederson, & Neighbors, 2009; Kilmer et al., 2006; Neighbors et al., 2008; White et al., 2006).

SA individuals may be particularly influenced by perceptions of others' cannabis use, as these individuals report using cannabis to avoid scrutiny from cannabis-using peers (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007a; Buckner, Zvolensky, & Schmidt, 2012). Among SA individuals, perceiving that friends experience more cannabis problems was related to having more cannabis problems (Ecker, Richter, & Buckner, 2014). Further, parent injunctive norms moderated the effect of SA on cannabis use frequency and problem severity (Ecker & Buckner, 2014a), such that among cannabis users with higher SA, those with greater parent injunctive norms (i.e., perceptions that one's parents view cannabis with more approvingly) reported the most frequent use and severe problems. Interestingly, peer injunctive and descriptive norms did not moderate the SA-cannabis use/problems relationships (Ecker & Buckner, 2014a). This may be due to lack of attention to the synergistic effect between injunctive and descriptive norms. Injunctive and descriptive norms have been found to interact with each other to predict addictive behaviors (Lee, Geisner, Lewis, Neighbors, & Larimer, 2007; Meisel & Goodie, 2014). Specifically, individuals with higher injunctive as well as higher descriptive norms may be at particular

greater risk for greater frequency/quantity of use or problems (Foster, Neighbors, & Krieger, 2015).

The present study follows previous research (Ecker & Buckner, 2014b), and makes unique contributions by examining whether peer descriptive and injunctive norms, parent injunctive norms, and SA would influence the degree of association with cannabis outcome variables (Parent Injunctive Norms \times Peer Norms \times SA). As cannabis behaviors and dependence are known to be impacted by a confluence of factors (Tepe, Dalrymple, & Zimmerman, 2012), the co-occurrence of peer encouragement (in the form of peer descriptive norms) and the absence of parent prohibition (in the form of low parent injunctive norms) may be especially problematic. Thus, understanding how peer descriptive norms and parent injunctive norms synergistically relate to influence cannabis outcomes is an important next step. Identifying young adults for whom cannabis use and problems may be more likely or more severe is an important aspect preceding behavioral intervention development. Furthermore, identification of antecedents to risky cannabis use will facilitate efforts in elucidating this at-risk population and may facilitate clarifying how to best tailor treatment and intervention efforts.

Based on associations between SA and increased cannabis-related impairment (for review see Buckner et al., 2013), and links between parental and peer influence on young adult cannabis use and related problems (e.g., Ecker & Buckner, 2014; Neighbors et al., 2008), the present work was designed to consider how these variables intersected to influence cannabis use frequency and problems. Specifically, the relationship between peer norms and SA was expected to be differentially influenced particularly by high versus low parent injunctive norms such that those who reported the greatest cannabis use frequency and problems would be SA individuals with higher parent injunctive norms who concurrently reported higher peer descriptive. In other words, we expected that SA individuals who perceived that their peers used more cannabis and their parents were more approving of cannabis use, would use cannabis more frequently and experience more use-related problems. Further, the effects hypothesized were expected to emerge above and beyond theoretically relevant covariates including depression and anxiety (Ecker & Buckner, 2014), gender (Buu et al., 2014), race (Peters, Hendricks, Clark, Vocci, & Cropsey, 2014), and level of education (linked with socio-economic status) (Redonnet, Chollet, Fombonne, Bowes, & Melchior, 2012).

Method

Participants

Cannabis users were recruited via community advertisements (e.g., newspaper ads, flyers, online ads) for a study on psychosocial factors related to cannabis use. Interested participants completed an online screening. Eligibility criteria included being between 18–45 years old, past-month cannabis use (confirmed via urine sample using a 50 ng/ml positive cutoff), cannabis as drug of choice, and no interest in, or current receipt of, substance abuse treatment. This study is described in further detail in previous work (Buckner & Zvolensky, 2014; Buckner et al., 2015). Eligible participants were invited to the laboratory to complete study measures which were administered via www.surveymonkey.com. Participants were compensated \$25 for completion of these measures and were asked to refrain from cannabis

use the day of their appointment. Study procedures received Institutional Review Board approval and informed consent was obtained prior to data collection.

The current sample consisted of 148 (36.5% female) current cannabis users aged 18–36 ($M = 21.01$, $SD = 3.09$). Nearly all (95.3%) endorsed past-month alcohol use and 78.3% reported lifetime tobacco use (25.8% endorsed past-week smoking). The ethnic/racial composition was 59.73% Caucasian, 24.83% African American, 0.67% Native American, 3.36% Asian, 8.05% mixed, and 3.36% other. The majority met DSM-IV-TR (American Psychiatric Association, 2000) criteria (with the addition of withdrawal as proposed for DSM-5; American Psychiatric Association, 2013) for a current cannabis use disorder (18.6% cannabis abuse, 70.5% cannabis dependence). Rates of other current Axis I diagnoses were: 18.6% alcohol abuse, 13.2% alcohol dependence, 6.2% other substance use disorder, 31.8% SA disorder, 17.8% specific phobia, 6.2% panic disorder, 4.7% major depressive disorder, and 4.7% dysthymia, 3.9% generalized anxiety disorder, 3.1% post-traumatic stress disorder, and 1.6% obsessive-compulsive disorder.

Measures

Cannabis use frequency—Past 90-day cannabis use frequency was assessed using an item from the *Marijuana Use Questionnaire*. This measure assesses previous 90-day cannabis use using the item “On the average, how often have you used marijuana in the past three months?” Responses ranged from 0 (*Less than once a month [including never]*) to 10 (*21 or more times a week*; Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007b). This measure has successfully assessed marijuana use behaviors (e.g., Buckner et al., 2007b; Buckner & Schmidt, 2008, 2009) and predicts cannabis use during ecological momentary assessment (Buckner, Crosby, Wonderlich, & Schmidt, 2012).

Cannabis problems—The *Marijuana Problems Scale* is a 19-item list of negative social, occupational, physical, and personal consequences associated with cannabis use in the previous 90 days (Stephens, Roffman, & Curtin, 2000). Cronbach’s alpha (0.84) indicates that the measure was internally consistent in the present sample.

Social anxiety—The *Social Interaction Anxiety Scale* (SIAS; Mattick & Clarke, 1998) is a 20-item scale used to assess SA. Respondents indicated level of agreement with items on a scale ranging from 0 (*Not at all*) to 4 (*Extremely*). Example items include “I have difficulty making eye-contact with others” and “I feel I’ll say something embarrassing when talking.” This widely used measure has demonstrated good internal consistency in prior samples (e.g., Heimberg, Mueller, Holt, Hope, & Leibowitz, 1992) and in the current sample ($\alpha = 0.90$).

Descriptive norms—Descriptive norms were assessed via three items which asked participants to give their best estimates regarding how often their peers (same-sex friends, opposite-sex friends, and people in general) typically used cannabis. Respondents indicated perceptions on a scale ranging from 0 (*Never*) to 8 (*Daily*). Cronbach’s alpha was 0.85.

Injunctive norms—Perceptions of parent and peer approval of cannabis use were assessed via two scales with four items which asked participants to indicate how disapproving or approving parents or peers (perceptions of approval) would be if they knew that the

respondent smoked cannabis every weekend, daily, drove a car after smoking cannabis, or smoked enough cannabis to pass out. Responses ranged from 1 = *Strong disapproval* to 7 = *Strong approval*. Cronbach's alpha was 0.84 for parent injunctive norms and 0.84 for peer injunctive norms.

Other substance use—The *Daily Drinking Questionnaire* (DDQ; Collins, Parks, & Marlatt, 1985) was used to assess past month alcohol consumption. It has shown good test-retest reliability (Marlatt et al., 1998) and good convergent validity (Collins et al., 1985). The *Smoking History Questionnaire* was used to assess tobacco use. This measure has been successfully used in previous smoking studies (e.g., Brown, Lejuez, Kahler, & Strong, 2002).

Anxiety and depression—The *Brief Symptom Inventory* (Derogatis & Melisaratos, 1983) is a 53-item self-report scale which yields nine subscales related to dimensions of psychological distress. The BSI scales have previously demonstrated good reliability and convergent validity (Morlan & Tan, 1998). Respondents were asked to indicate responses on a 5-point Likert scale ranging from 0 = *Not at all* to 4 = *Extremely*. Higher scores represent greater distress. For the purpose of this research, the anxiety (6 items; $\alpha = .78$) and depression (6 items; $\alpha = .81$) subscales were included as covariates in analyses.

Descriptive data—Participants provided demographic information including gender, race, age, and education level. Diagnostic status was determined via clinical interview using the *Structured Clinical Interview for DSM-IV Disorders* (Patient Edition, with psychotic screening module; SCID-I/P [w/ Psychotic Screen]; First, Spitzer, Gibbon, & Williams, 2007). Original ratings were compared to ratings of random sample of 20% of the recordings made by trained graduate students blind to initial diagnostic status. Percent agreement between the two raters for primary CUD diagnosis was 92.3%.

Statistical analyses

Zero-order correlations were obtained to examine relationships between predictor and criterion variables. Gender, race, and education level were dichotomous, dummy-coded covariates. Depressive symptoms, general anxiety, and age were also statistically controlled as in previous work in this area (Ecker & Buckner, 2014a). Models were run with and without these variables statistically controlled and results were substantially unchanged. For the model examining cannabis problems as the criterion variable, frequency of cannabis use was included as a covariate. Predictor variables were centered prior to conducting analyses. Incremental validity of covariates and predictor variables were examined in relation to criterion variables. Separate models were constructed for cannabis use frequency and cannabis problems. Models were constructed such that criterion variables (cannabis use frequency or problems), covariates and predictor variables (descriptive norms, injunctive norms, and social anxiety) were entered at Step 1. At Step 2, all possible two-way interactions (product terms) were entered into the model (Peer Injunctive Norms \times Parent Injunctive Norms; Peer Injunctive Norms \times Peer Descriptive Norms; Peer Injunctive Norms \times SA; Parent Injunctive Norms \times Peer Descriptive Norms; Parent Injunctive Norms \times SA; Peer Descriptive Norms \times SA). All possible three-way interactions between descriptive

norms and injunctive and social anxiety were added at Step 3 (Peer Injunctive Norms \times Peer Descriptive Norms \times SA; Parent Injunctive Norms \times Peer Descriptive Norms \times SA; Peer Injunctive Norms \times Parent Injunctive Norms \times Peer Descriptive Norms; Peer Injunctive Norms \times Parent Injunctive Norms \times Peer Descriptive Norms). All statistical analyses were conducted using SAS 9.3.

Results

Means, standard deviations, ranges, and bivariate correlations for all of the study variables are presented in Table 1. Table 2 presents results from multiple linear regression analyses predicting cannabis use frequency and cannabis problems from interactive effects of injunctive and descriptive norms. As hypothesized, a significant three-way interaction emerged between parent injunctive norms, perceived peer descriptive norms, and SA in the prediction of cannabis problems (Table 2). This interaction was not significant for cannabis use frequency. To probe the nature of the significant three-way interaction, regression lines for the SA \times Peer Descriptive Norms interactions were graphed separately by those with higher and lower parent injunctive norms (Figure 1) using parameter estimates from the regression equation where high and low values were specified as one standard deviation above and below respective means (Cohen, Cohen, West, & Aiken, 2003).

Simple slopes analyses were conducted to examine whether slopes of regression lines differed significantly from zero at low and high levels of the moderator (Aiken & West, 1991). The slope for low peer descriptive norms was significantly different from a slope of zero ($t = 3.16$, $p = .0025$, $\beta = 1.83$), indicating that among those with greater parent injunctive norms and lower peer descriptive norms, SA was positively related to cannabis problems. The slope for high peer descriptive norms was not significant ($t = -1.36$, $p = .1784$, $\beta = -.64$), indicating that among those with greater parent injunctive norms and higher peer descriptive norms, SA was not significantly related to cannabis problems. Simple slopes analyses further revealed that among those reporting lower parent injunctive norms, the slope for low peer descriptive norms was significant ($t = 2.25$, $p = .0270$, $\beta = .79$), suggesting that among those with low parent injunctive norms and low peer descriptive norms, SA was significantly related to cannabis problems. This was not the case among those with higher peer descriptive norms ($t = .08$, $p = .9400$, $\beta = .03$).

Discussion

The present study examined interactive relations among descriptive and injunctive norms and SA with respect to cannabis use and problems. Consistent with prior work (see Buckner et al., 2013), SA was associated with greater cannabis-related impairment, and peer and parent injunctive norms were related to more frequent use. The current study extends prior work by identifying a significant three-way interaction among descriptive norms, parent injunctive norms, and SA with respect to cannabis problems.

Partially consistent with hypotheses, the interaction of SA and peer norms varied as a function of parent injunctive norms. However, contrary to expectation, SA was associated with greater cannabis-related impairment among those with lower peer descriptive norms.

Although this relationship emerged whether parent injunctive norms was high or low, it was more pronounced among those with high parent injunctive norms (Figure 1). Thus, SA individuals who perceive greater approval from parents regarding risky cannabis use appeared to be at greater risk for cannabis problems relative to users with less SA or those who perceived their parents were less approving of cannabis use. This may suggest that SA people who believe their parents approve of cannabis may be at greater risk for problems, even if they do not perceive that their peers use cannabis frequently. This is interesting and somewhat unexpected, given that peer influences are known to be strong predictors of substance use among individuals regardless of SA levels (Borsari & Carey, 2001; Ecker & Buckner, 2014a; Lewis & Neighbors, 2006).

It is possible that these individuals may not be frequently exposed to social environments wherein cannabis behaviors are likely to occur, or they may actively avoid these types of social situations due to their SA. Thus, it is possible SA individuals may be more influenced by perceptions of their parents' approval of cannabis compared to perceptions of how frequently their peers engage in cannabis use. These data are in line with studies suggesting that SA cannabis users may be particularly influenced by beliefs with respect to parents' approval of cannabis use (Ecker & Buckner, 2014a). It has been theorized that parental influence is especially salient for SA persons (Bruch & Heimberg, 1994; Ecker & Buckner, 2014a) due to their receiving less encouragement from parents to socialize with others, and therefore, their beliefs about parent approval may be more important relative to other people. Notably, associations emerged after controlling for covariates (Buu et al., 2014; Peters et al., 2014; Redonnet et al., 2012), thereby highlighting a clinically-significant incremental effect.

One interesting consideration is that this three-way interaction emerged for cannabis problems but not frequency of use. This is somewhat consistent with prior work finding that descriptive norms do not moderate the relation between social anxiety and cannabis use frequency (Ecker & Buckner, 2014). It may be that young adults who use cannabis as a function of perceptions of peer behavior may be more strongly influenced by contextual, social, or environmental factors. Given that the majority of cannabis use occurs in social situations (Buckner, Crosby, Silgado, Wonderlich, & Schmidt, 2012; Buckner et al., in press), young adults who believes their peers use and approve of cannabis may be more likely to engage in cannabis using behavior while attending a party or event with friends who they believe use cannabis. In this context, a young adult may feel compelled to conform to what they perceive is the behavioral norm, and may thus be more likely to use cannabis in that environment. Here, SA may be less of a factor in the decision to use cannabis than contextual factors and normative beliefs.

After controlling for covariates, peer descriptive and injunctive norms were significantly related to greater cannabis use frequency. These findings are consistent with the perspective that young adults are strongly influenced by peers (Napper, Hummer, Chithambo, & LaBrie, 2014; Salvy, Pedersen, Miles, Tucker, & D'Amico, 2014). These data suggest that higher perceptions of peer cannabis use frequency and peer approval of cannabis use are associated with more frequent own use. Findings add to prior work (Buckner, 2013a; Conner & McMillan, 1999; Ecker & Buckner, 2014b; Elliott & Carey, 2012; Elliott, Carey, & Venable, 2014) and suggest that, although brief interventions for cannabis tend to include discussion

of peer descriptive norm data (e.g., Lee et al., 2013), it may be advisable to address both descriptive and injunctive norms for those seeking cannabis use treatment. Although not the primary study aim, it is noteworthy to highlight that injunctive and descriptive norms measures were related, but distinct constructs. Indeed, parent injunctive norms and peer descriptive norms shared only 5% of variance with one another. This observation lends further empirical support to the construct validity of these two norm assessments in substance use work.

Strengths of the present work should be considered in light of limitations that point to potential research avenues. These data were cross-sectional in nature, which mitigates the ability to make causal or temporal inferences. Additional work is needed to understand whether other influencing factors exist in relationships among variables, including cognitive causes of social anxiety (e.g., self-focused attention, rumination) or the presence of cannabinoid receptors throughout the brain structures associated with fear learning and extinction. Further, data for present analyses were collected via self-report. Another limitation of this work is how descriptive norms were conceptualized. That is, the measure combined estimates of friends and of people in general, but because cannabis users likely choose friends that also use cannabis, it is possible that these items measure different aspects of the descriptive norms construct. Future work would benefit by utilizing multi-method, multi-informant approaches. Additionally, data regarding parental substance use and use-related disorders were not collected and future studies could benefit from examining heritable risk factors to better understand whether the prominence of perceived parent norms might be due to parental cannabis use or problems reflecting shared genetic characteristics between participants and parents. Further, the sample was comprised of non-treatment-seeking participants. As such, future work could benefit from replication among treatment-seekers. Additionally, although peer and parent injunctive norms were measured with respect to cannabis, only descriptive norms for peers were assessed for the present study. Thus, additional work is needed to determine whether parent descriptive norms (e.g., beliefs concerning frequency of parents' cannabis use) influences cannabis behaviors.

In conclusion, the present findings highlight the importance of SA as well as descriptive and injunctive norms with respect to cannabis-related problems. Results suggest that SA individuals with perceptions that parents approve of cannabis use but who believe their friends use cannabis less frequently may be at greater risk for undesired cannabis problems above and beyond what would be expected given the individuals' frequency of cannabis use, relative to those who believe their friends use cannabis more frequently, those who believe their parents do not approve of risky cannabis use, or those with less SA. These findings may inform behavioral interventions seeking to reduce risk for cannabis dependence and problems among young adults. Addressing modifiable characteristics that impact cannabis outcomes including perceptions of parental permissiveness may provide unique benefit to those at risk for cannabis use or dependence. Such intervening efforts have been applied for alcohol use (Cleveland et al., 2013), and a good next step will be to consider best ways of similarly influencing risky cannabis use.

Acknowledgments

Declarations of Interest: Funding for this study was provided in part by grants from the National Institute of Drug Abuse (5R21DA029811-02, 1R34DA031937-01A1, K12-DA-000167). NIDA had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the manuscript; or in the decision to submit the manuscript for publication.

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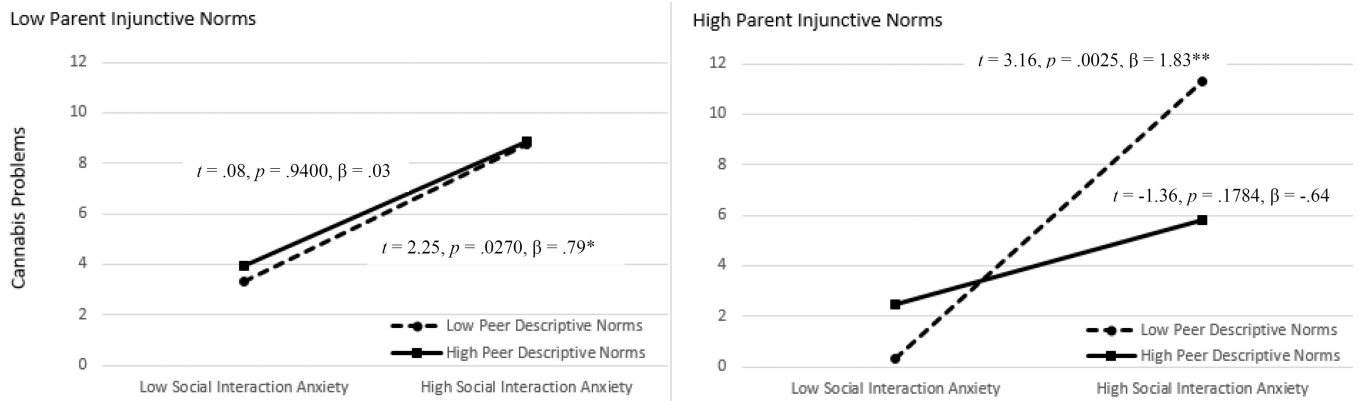


Figure 1.

A three-way interaction emerged between peer descriptive norms, parent injunctive norms, and social anxiety with respect to cannabis problems. The graph on the left represents low (1 standard deviation below the mean) parent injunctive norms and the graph on the right represents high (1 standard deviation above the mean) parent injunctive norms.

N = 148 * *p* < .05 ** *p* < .01

Table 1

Means, Standard Deviations, and Correlations among Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Peer Injunctive Norms	-											
2. Parent Injunctive Norms	0.20*	-										
3. Peer Descriptive Norms	0.21**	0.22**	-									
4. Social Anxiety	0.04	-0.02	-0.03	-								
5. Cannabis Problems	-0.08	-0.01	0.43***	-								
6. Cannabis Use Frequency	0.36***	0.25**	0.35***	0.01	0.03	-						
7. Depression	0.01	-0.01	-0.09	0.56***	0.35***	-0.08	-					
8. Anxiety	-0.04	0.10	0.01	0.64***	0.27***	0.05	0.70***	-				
9. Gender	0.17*	0.10	-0.02	-0.14 [†]	-0.05	0.08	-0.17*	-0.21**	-			
10. Race	0.10	0.08	-0.18*	-0.001	-0.05	0.12	0.12	0.11	-0.05	-		
11. Age	-0.003	0.24**	0.10	-0.01	0.01	0.23**	0.03	-0.01	0.16*	0.01	-	
12. Education Level	-0.02	0.10	-0.02	0.02	0.06	0.15 [†]	-0.01	0.03	0.03	0.12	0.05	-
Mean or %												
	16.62	6.68	17.68	27.63	6.24	7.14	0.96	0.90	36.24% female	57.79% Caucasian	21.01	83.77% Some college
Standard Deviation	4.60	3.35	3.65	13.64	4.82	1.19	0.80	0.80	--	--	3.09	--
Minimum	5.00	4.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	0.00
Maximum	28.00	18.00	24.00	66.00	24.00	8.00	3.33	3.33	1.00	1.00	36.00	1.00

Note. N = 148

*** p < .001.

** p < .01.

* p < .05.

[†] p < .10

Gender: Dummy coded such that males = 1 and females = 0.

Race: Dummy coded such that Caucasian = 1 and non-Caucasian = 0.

Education Level: Dummy coded such that some college = 1 and less = 0.

Table 2

Hierarchical regressions for variables predicting cannabis use frequency and problems from injunctive and descriptive norms, social anxiety, and interaction terms.

Predictor	B	SE	t	p	β	R ²	Adj R ²	F
Step 1								
Gender	0.09	0.16	0.59	0.5555	0.04	0.0158	0.2840	6.83***
Race	0.23	0.15	1.52	0.1313	0.11	0.0236		
Education Level	0.12	0.22	0.54	0.5892	0.04	0.0249		
Age	0.06	0.02	2.52	0.0130	0.18*	0.0666		
Depressive Symptoms	-0.29	0.13	-2.18	0.0306	-0.22*	0.0810		
General Anxiety	0.22	0.14	1.54	0.1252	0.17	0.1016		
Peer Injunctive Norms (A)	0.07	0.02	4.01	<.0001	0.30***	0.2466		
Parent Injunctive Norms (B)	0.02	0.02	0.67	0.5058	0.05	0.2561		
Peer Descriptive Norms (C)	0.08	0.02	3.96	0.0001	0.30***	0.3327		
Social Anxiety (D)	0.0002	0.01	0.03	0.9758	0.003	0.3327		
Cannabis Use Frequency								
Step 2								
A * B	-0.01	0.01	-1.06	0.2905	-0.09	0.3395	0.2614	4.25***
A * C	0.001	0.004	0.35	0.7251	0.03	0.3399		
A * D	-0.0001	0.001	-0.09	0.9321	-0.01	0.3399		
B * C	-0.001	0.01	-0.11	0.9150	-0.01	0.3401		
B * D	0.001	0.002	0.57	0.5693	0.05	0.3417		
C * D	-0.0003	0.002	-0.14	0.8857	-0.01	0.3418		
Step 3								
A * B * C	-0.001	0.002	-0.59	0.5578	-0.06	0.3441	0.2626	3.62***
A * B * D	0.00004	0.001	0.07	0.9426	0.01	0.3506		
A * C * D	0.0002	0.0003	0.72	0.4753	0.07	0.3533		
B * C * D	0.001	0.001	1.38	0.1693	0.13	0.3629		
Cannabis Problems								
Step 1								
Gender	0.37	0.79	0.46	0.6442	0.04	0.0024	0.1875	4.08***
Race	-0.50	0.78	-0.65	0.5198	-0.05	0.0058		
Education Level	0.80	1.09	0.74	0.4635	0.06	0.0087		
Age	-0.005	0.13	-0.04	0.9703	0.00	0.0088		

Predictor	B	SE	t	p	β	R ²	Adj R ²	F
Cannabis Use Frequency	1.47	0.68	2.18	0.0312	0.24*	0.1309		
Depressive Symptoms	-0.77	0.72	-1.08	0.2835	-0.13	0.1326		
General Anxiety	0.53	0.43	1.25	0.2133	0.11	0.1350		
A	-0.13	0.09	-1.48	0.1407	-0.13	0.1460		
B	-0.21	0.12	-1.78	0.0771	-0.14 [†]	0.1692		
C	0.04	0.11	0.38	0.7047	0.03	0.1694		
D	0.13	0.04	3.78	0.0002	0.38***	0.2483		
<hr/>								
Step 2 A * B	-0.01	0.03	-0.35	0.7237	-0.03	0.2486	0.1814	2.92***
A * C	0.02	0.02	0.86	0.3891	0.07	0.2497		
A * D	-0.01	0.01	-1.36	0.1755	-0.13	0.2669		
B * C	-0.02	0.04	-0.59	0.5529	-0.05	0.2688		
B * D	0.01	0.01	0.68	0.4964	0.06	0.2710		
C * D	-0.01	0.01	-0.95	0.3454	-0.09	0.2760		
<hr/>								
Step 3 A * B * C	-0.01	0.01	-0.95	0.3454	-0.09	0.2760	0.1960	2.71***
A * B * D	0.004	0.01	0.43	0.6667	0.05	0.2764		
A * C * D	-0.002	0.003	-0.90	0.3683	-0.10	0.2800		
B * C * D	0.003	0.002	2.05	0.0423	0.20*	0.3028		

Note. N = 148

p < .001

*
p < .05

[†]
p < .10

Gender was dummy coded such that males = 1 and females = 0.

Race was dummy coded such that Caucasians = 1 and else = 0.

Education Level: Dummy coded such that some college = 1 and less = 0.