Examining Approval and Social Norms as Proximal Predictors of the Impulsivity-Cannabis Use Relation

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ABSTRACT

Cannabis is a commonly used substance among college students and is associated with a host of negative consequences. Psychosocial variables (e.g., social norms, attitudes, and impulsivity) may explain individual differences regarding the increased cannabis use in recent years. Attitudes, social norms, and broadband impulsivity have demonstrated consistent, independent relations with increased cannabis use; however, relations among approval and social norms, narrowband impulsivity, and cannabis use remain elusive. The current study (N = 718) examined approval (i.e., approval of peer cannabis use) and social norms as proximal predictors of impulsivity-cannabis use relations among college students across models of varying multivariate complexity. Results from simpler multivariate models indicated that indirect effects of impulsivity-like facets, as assessed by the UPPS-P Impulsive Behavior Scale, were statistically significant for all models via approval, descriptive norms, and injunctive norms. In general, individuals higher in impulsivity-like facets reported more positive attitudes or more perceived use or approval by friends, which, in turn, was associated with more cannabis use. Differential relations emerged for the complex multivariate mediation model, such that approval exhibited the most consistent unique mediation effect. Multi-group analyses by gender revealed an indirect effect of sensation seeking via descriptive norms stronger for males than females. Consistent with the alcohol literature, this research highlights the importance of examining approval and social norms as proximal predictors of cannabis use, particularly as it is relevant for developing efficacious clinical interventions to reduce cannabis use by employing personalized normative feedback.

Key words: cannabis, marijuana, impulsivity, social norms, approval, mediation, multi-group analysis

Cannabis is a commonly used substance on college campuses, and a recent study suggests increasing prevalence rates of use among college students in the United States (i.e., 50.4% lifetime, 37.9% past-year, 21.1% past-month, and 4.6% daily use; Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016) compared to 2007 (i.e., 47.5% lifetime, 31.8% past-year, 16.8% past-month, and 3.5% daily use; Johnston, O'Malley, Bachman, & Schulenberg, 2008). Indeed, past-year and past-month cannabis use are consistently higher among college students compared to non-college-attending young adults (ages 19-28). Thus, identifying individual differences which may contribute to cannabis use among college students is warranted.

Approval, Social Norms, and Cannabis

The extant substance use literature has demonstrated robust relations with social norms

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and attitudes predicting substance use, and this notion is supported by sociocognitive theories (e.g., reciprocal determinism; Bandura, 1986, 1999), including specific models, such as the theory of reasoned action/theory of planned behavior (Ajzen, 1985; Ajzen & Fishbein, 1980) and problem behavior theory (Jessor & Jessor, 1977). However, research has focused on alcohol-related outcomes (see Borsari & Carey, 2001). Nevertheless, there is some evidence indicating beliefs about others' cannabis use (i.e., descriptive norms) are predictive of cannabis use and cannabis-related problems (Grossbard, Hummer, LaBrie, Pederson, & Neighbors, 2009; Kilmer et al., 2006; LaBrie, Hummer, Lac, & Lee, 2010; Napper, Hummer, Chithambo, & LaBrie, 2015; Neighbors, Geisner, & Lee, 2008; Martens et al., 2006; Pearson et al., 2017; White et al., 2006; see Buckner, 2013). Further, others' approval of cannabis use (i.e., injunctive norms) is also associated with more frequent cannabis use and cannabis-related problems (Napper, Kenney, Hummer, Fiorot, & LaBrie, 2016; Neighbors et al., 2008; Pearson et al., 2017), though strength of injunctive norms may vary as a function of the 'other.' For example, Buckner (2013) found descriptive norms of friends (not students in general) and injunctive norms of friends were related to endorsement of more cannabis problems among college students. Additionally, descriptive norms of friends accounted for the most unique variance in cannabis use frequency when examined in a multivariate context with injunctive norms (of friends and parents), positive and negative expectancies, and cannabis motives. This highlights the importance of the reference group when assessing cannabis social norms.

Although less research has examined actual approval (as opposed to perceived approval), approval of cannabis appears to provide consistent positive cross-sectional relations with cannabis use (e.g., LaBrie et al., 2010). LaBrie, Hummer, and Lac (2011) demonstrated approval of cannabis is associated with user status. In a longitudinal study, Napper et al. (2016) evinced approval of cannabis was related to increased cannabis use with large effect sizes (i.e., r = .53-.56) at baseline and 12-month follow-up. Like the alcohol literature, the burgeoning field of cannabis research provides convincing evidence that approval and social norms are important in understanding cannabis-related outcomes within multiple theoretical frameworks. These theories also stress the importance of personality traits, such as impulsivity.

Impulsivity and Cannabis

Another important construct to consider when understanding mechanisms of cannabis use among college students is impulsivity. Within the alcohol literature, impulsivity is the most robust predictor of alcohol-related outcomes of all personality traits (see Littlefield & Sher, 2014), and emerging evidence suggests cannabis use is also associated with impulsivity. For example, broadband impulsivity was associated with cannabis use frequency and more cannabis-related problems (Day, Metrik, Spillane, & Kahler, 2013). Using `ecological momentary assessment, cannabis use was associated with increased impulsivity among young adults (Ansell, Laws, Roche, & Sinha, 2015). Likewise, the prior day's cannabis use predicted significant increases in next-day impulsivity, even without next-day cannabis use (Ansell et al., 2015).

Researchers have begun examining mechanisms of impulsivity-cannabis use relations. Using the acquired preparedness model, Vangsness, Bry, and LaBouvie (2005) found increased impulsivity was associated with fewer negative cannabis expectancies, which, in turn, was associated with increased cannabis use among college students. Consistently, a later study examined positive and negative cannabis expectancies and cannabis refusal self-efficacy and found each fully mediated the relation between self-reported impulsivity and three cannabis-related outcomes (i.e., cannabis use frequency, problems, and dependence; Hayaki et al., 2011).

However, Hakayi et al. (2011) used a 5-item broadband impulsivity measure, as opposed to a multifaceted measure, which could mask differential effects with cannabis-related outcomes. In the cannabis literature, few studies have used multifaceted measures of impulsigenic traits compared to the alcohol literature (e.g., the UPPS-P; see Coskunpinar, Dir, & Cyders, 2013). Reasonable evidence suggests impulsivity is a distal predictor of the impulsivity-cannabis relation, though improvements upon existing methodological limitations (i.e., use of broadband

"impulsivity" measures) are necessary before making significant advancements in this area.

Previous work demonstrates "impulsivity" is not a unidimensional construct, but rather is comprised of separate, related constructs. Importantly, these constructs exhibit differential relations with substance-related outcomes (see Cyders, 2015). Given recommendations for a disaggregated approach, the National Institutes of Health's [NIH] PhenX Toolkit (Hamilton et al., 2011) has recommended the UPPS-P Impulsive Behavior Scale (Lynam, Smith, Cyders, Fischer, & Whiteside, 2007) as the self-report measure of impulsigenic traits. The UPPS-P is comprised of five facets: 1) positive urgency, the tendency to act rashly under extreme positive emotion, 2) negative urgency, the tendency to act rashly under extreme negative mood, 3) sensation seeking, the tendency to seek out new and thrilling experiences, 4) lack of planning, the tendency to act without thinking, and 5) lack of perseverance, the inability to remain focused on a difficult or boring task.

Following these recommendations, Dvorak and Day (2014) examined relations between higher-order factors of the UPPS-P, cannabis use, and cannabis-related problems. Results suggested individuals lower in self-control (i.e., lack of planning, lack of perseverance) were more likely to use cannabis and to use it more intensely. Likewise, sensation seeking was associated with increased likelihood to use cannabis, whereas urgency (i.e., positive and negative urgency) was associated with an increased likelihood to use cannabis, as well as more cannabis-related problems (Dvorak & Day, 2014). Importantly, Bravo et al. (2017b) were the first to examine impulsivity-like facets, as assessed by the UPPS-P, as distal predictors of cannabis outcomes mediated by more proximal predictors among college students. More specifically, protective behavioral strategies mediated relations between lack of planning and lack of perseverance and cannabis use frequency and related consequences (Bravo et al., 2017b). However, no other proximal predictors have been examined as mediators of the facet-level impulsivity-cannabis use link.

Purpose of Study

Taken together, previous research suggests that impulsivity-like facets, approval, and social norms are relevant constructs for understanding cannabis-related outcomes. Simons, Neal, and Gaher (2006) examined both, social norms and impulsivity, as predictors of cannabis nonuser status and found only social norms were predictive of being a nonuser, whereas impulsivity was not. However, to our knowledge, no research has examined the relations among approval and social norms, UPPS-P impulsigenic traits, and cannabis use. Therefore, the purpose of this study is to examine the extent to which social norms (i.e., descriptive and injunctive norms regarding friends) and approval of peer use mediate the relation between impulsivity-like facets and past-year cannabis use across simple and complex multivariate mediation models. Further, although the gender gap is narrowing with respect to substance use (e.g., Steingrímsson, Carlsen, Sigfússon, & Magnússon, 2012), current research shows gender differences with respect to cannabis use (e.g., Bravo et al., 2017b). Gender remains a relevant construct when examining norms and alcohol consumption (e.g., LaBrie, Cail, Hummer, Lac, & Neighbors, 2009; Lewis & Neighbors, 2004; Neighbors et al., 2010), as well as impulsivity-related constructs as assessed by the UPPS-P (see Cyders, 2013). Thus, this study will also determine whether the mediation effects differ by gender.

In general, we expected positive, direct associations between impulsivity-like facets, cannabis approval, and social norms with cannabis use, and we hypothesized individuals higher in impulsivity-like facets would endorse more positive attitudes, perceived use, or perceived approval by friends, which would, in turn, be predictive of more cannabis use (i.e., significant indirect effects). Although no specific hypotheses were proffered regarding differential relations or multi-group analyses by gender due to the exploratory nature of this work, we anticipated different associations to emerge across simple and complex multivariate models.

METHOD

Participants

Participants (N = 718) were enrolled in undergraduate introductory psychology courses at a large, Hispanic-serving, southwestern university and completed a battery of self-report measures online. The plurality of participants (Mage = 19.00, SD = 1.33) identified as White (66%) and female (66%), with a minority identifying as Hispanic/Latino (25%). Three hundred ten participants (43%) endorsed past-year cannabis consumption. All participants received course credit. The study protocol was approved by the Institutional Review Board.

Measures

Demographics. Participants completed a baseline measure of demographic questions including self-identified age, gender, race, and ethnicity.

Impulsigenic traits. The 59-item self-report UPPS-P Impulsive Behavior Scale (Lynam et al., 2007), with a 4-point Likert-type response scale ranging from (1) strongly disagree to (4) strongly disagree was used (negative urgency α = .88, positive urgency α = .94, lack of planning α = .83, lack of perseverance α = .83, and sensation seeking α = .86).

Cannabis approval and norms. Cannabis approval, descriptive norms, and injunctive norms were assessed using select items from the American Drug and Alcohol Survey – Adolescent Version (ADAS; Rocky Mountain Behavioral Science Institute, 2003). Descriptive norms were assessed using a summed score of the following two items using 4-point Likert-type scales: "How often have your friends asked you to use marijuana?" with response options ranging from (1) not at all to (4) very often, and "How many of your friends use marijuana?" ranging from (1) none at all to (4) all of them. Higher sum scores reflected higher (i.e., indicative of more perceived friend use) descriptive norms (α = .75). Injunctive norms and approval were assessed using two items with response options ranging from (4) not at all to (1) a lot: "How much would your friends try to stop you from using marijuana?" and "How much would you try to stop your friends from using marijuana?" respectively. Higher scores on these items reflected higher (i.e., indicative of more perceived peer approval) injunctive norms and more positive attitudes towards cannabis use, respectively.

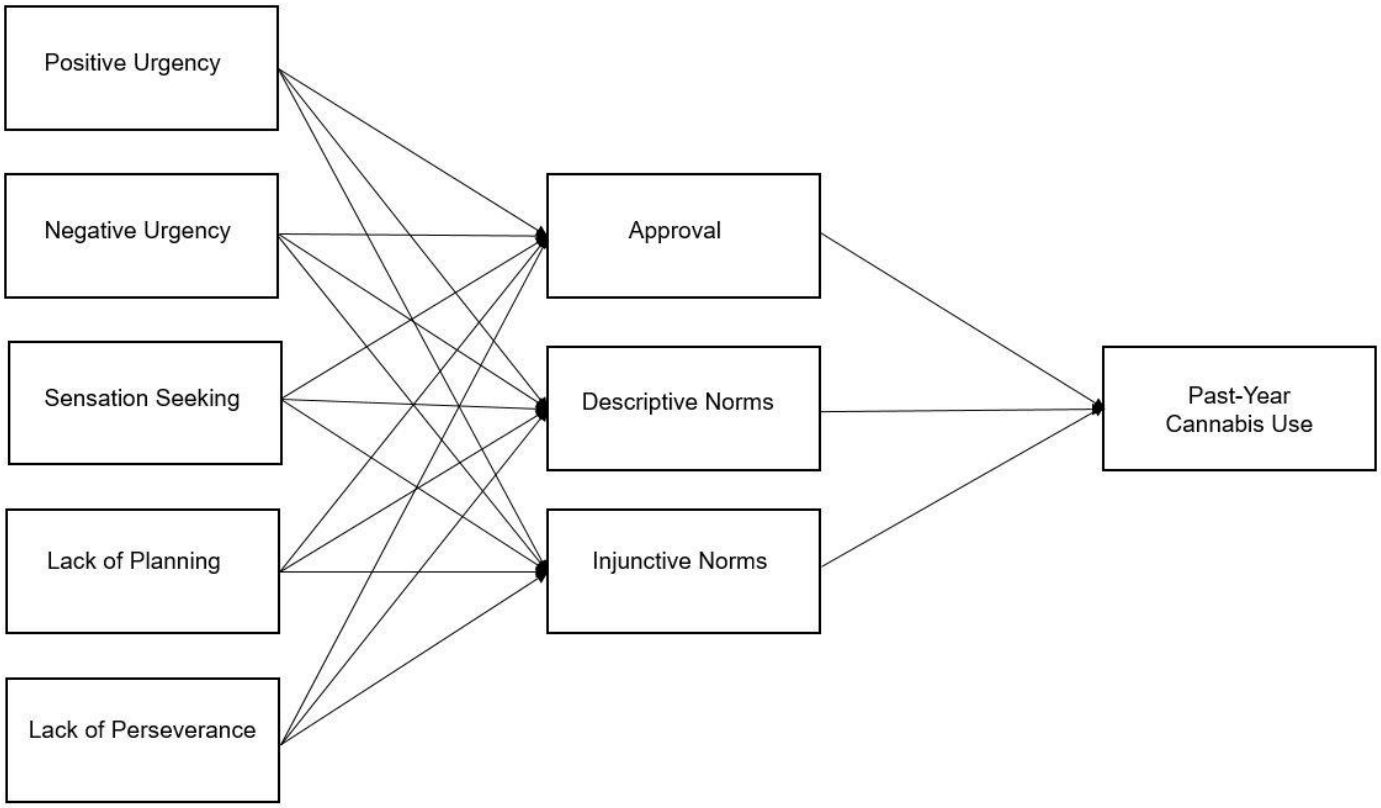
Cannabis use. Past-year cannabis use was assessed using the ADAS (Rocky Mountain Behavioral Science Institute, 2003) using a single item (i.e., "How often in the last 12 months have you used marijuana?"). Participants endorsed frequency of use on a 6-point scale (i.e., "none," "1-2 times," "3-9 times," "10-19 times," "20-49 times," and "50 or more times").

Analytic Strategy

Exploratory data analyses were conducted to assess for normality (Tukey, 1977). Descriptive norms (a continuous outcome) and all impulsivity-like facets were approximately normally distributed (i.e., skewness and kurtosis between -1.00 and +1.00; Fox, 2008). Approval, injunctive norms, and past-year cannabis use were treated as categorical, given these outcomes are single-item indicators using ordinal, Likert-type response options. Past-year cannabis use was rescaled such that low endorsement (i.e., less than 10% of the sample) categories were collapsed, which resulted in five response categories for this outcome (i.e., collapsing "20-49 times" and "50 or more times" into a single category). All data management, coding, and bivariate correlations were conducted using SAS 9.4™ software (SAS Institute Inc.).

All mediation models were conducted in M*plus* 7.11 (see Figure 1, Muthén & Muthén, 1998-2012). To test the extent to which approval, descriptive norms, and injunctive norms mediate the relations between the UPPS-P impulsivity-like facets and past-year cannabis use, MODEL INDIRECT was used to test the strength and significance of indirect effects of 15 simple mediation models (i.e., each impulsivity-like facet and mediator independently) and one complex mediation model (i.e., all impulsivity-

Figure 1. Conceptual Complex Multivariate Mediation Model Predicting Past-Year Cannabis Use



Note. Depicts the conceptual complex multivariate mediation model for manifest impulsivity-like traits, cannabis approval and social norms, and past-year cannabis use. Correlations among exogenous variables and correlations among mediators were also estimated, but not shown for simplicity.

like facets and mediators simultaneously) using weighted-least-squares mean and variance estimation to model categorical variables. Ninety-five percent confidence intervals were computed for all direct and indirect effects with bias-corrected bootstraps (i.e., using 5,000 bootstrapped samples), such that effects were determined to be significant if confidence intervals did not contain zero (Preacher & Hayes, 2004). To test whether these indirect effects differed by gender (i.e., conditional indirect effects), multi-group mediation analyses were conducted for each of the simple mediation models. MODEL CONSTRAINT was used to test whether the difference in indirect effects for males and females was significantly different from zero. Proportion of the total effect that is mediated was calculated for all mediation models by dividing the indirect effect (ab) by the total effect (c; see Kenny, 2016).

RESULTS

All impulsivity-like facets were significantly, positively correlated with social norms, approval, and past-year cannabis use with small-to-medium effect sizes (r's = .10 to .30; Cohen, 1988; see Table 1). Approval and social norms were significantly, positively associated with past-year cannabis use with medium-to-large effect sizes (r's = .30 to .50). Finally, males endorsed more past-year cannabis use when compared to females bivariately.

Simple Multivariate Mediation

All total indirect effects for the 15 simple mediation models were statistically significant (see Table 2). In general, individuals higher in impulsivity-like facets reported increased approval or social norms (i.e., injunctive or descriptive), which, in turn, was associated with increased past-year cannabis use. Overall, lack of planning exhibited the largest indirect effect on

Table 1. Correlations among Impulsivity-Like Facets and Cannabis Approval, Norms, and Past-Year Use

	Gender	NU	PU	LPlan	LPer	SS	Approve	DesNorm	InjNorm	PYUse
Gender										
NU	-0.03									
PU	0.12**	0.68**								
LPlan	0.00	0.24**	0.29**							
LPer	-0.03	0.33**	0.31**	0.48**						
SS	0.33**	0.15**	0.23**	0.02	-0.21**					
Approve	0.17**	0.20**	0.22**	0.25**	0.20**	0.15**				
DesNorm	0.08	0.22**	0.15**	0.11**	0.09*	0.18**	0.45**			
InjNorm	0.09*	0.19**	0.16**	0.24**	0.18**	0.10**	0.74**	0.47**		
PYUse	0.13**	0.24**	0.20**	0.28**	0.17**	0.20**	0.50**	0.59**	0.46**	
M/%	33.61%	27.66	27.31	21.50	19.28	34.41	2.38	4.39	2.66	43.18%
SD	-	7.08	9.17	4.93	4.75	6.96	1.23	1.72	1.20	-

Note. Gender was coded '0' = female, '1' = male; NU = negative urgency; PU = positive urgency; LPlan = lack of planning; LPer = lack of perseverance; Approve = cannabis approval; DesNorm = cannabis descriptive norms; InjNorm = cannabis injunctive norms; PYUse = past-year cannabis use. Pearson product-moment correlations reported for bivariate correlations between continuous variables (i.e., impulsivity-like facets and cannabis descriptive norms). Spearman's rank-order correlations reported for ordinal-ordinal bivariate correlations (i.e., correlations among cannabis approval, injunctive norms, and past-year use), ordinal-continuous bivariate correlations (i.e., correlations among impulsivity-like facets and cannabis approval, injunctive norms, past-year use; correlations between descriptive norms and approval, injunctive norms, and past-year use), and ordinal-binary (i.e., correlations between gender and cannabis approval and injunctive norms). Point-biserial correlations reported for correlations between gender and impulsivity-like facets (i.e., binary-continuous bivariate correlations). Gender frequency reported for male; PYUse frequency indicates binary endorsement of past-year cannabis use. *$p < .05$, **$p < .01$.

Table 2. Effects from Simpler Multivariate Mediation Models Predicting Past-year Cannabis Use

Model	*ß/B*	[95% CI]	% Mediated
Positive urgency-Approval			
Total[a]	.206/.023	[.015, .031]	
Total indirect	.141/.016	[.010, .021]	68.12%
Direct	.066/.007	[.001, .014]	
Negative urgency-Approval			
Total[a]	.259/.038	[.027, .048]	
Total indirect	.129/.019	[.013, .025]	49.62%
Direct	.131/.019	[.010, .029]	
Lack of planning-Approval			
Total[a]	.304/.065	[.050, .081]	
Total indirect	.168/.036	[.027, .045]	55.26%
Direct	.136/.029	[.014, .044]	
Lack of perseverance-Approval			
Total[a]	.202/.043	[.028, .059]	
Total indirect	.143/.031	[.022, .039]	70.79%
Direct	.059/.013	[-.002, .027]	
Sensation seeking-Approval			
Total[a]	.255/.038	[.027, .049]	
Total indirect	.100/.015	[.008, .022]	39.22%
Direct	.155/.023	[.013, .033]	
Positive urgency-Injunctive norms			
Total indirect	.100/.011	[.006, .016]	48.54%
Direct	.106/.012	[.005, .019]	
Negative urgency-Injunctive norms			
Total indirect	.113/.017	[.011, .023]	43.63%
Direct	.146/.021	[.012, .031]	
Lack of planning-Injunctive norms			
Total indirect	.146/.031	[.023, .039]	47.87%
Direct	.159/.034	[.018, .050]	
Lack of perseverance-Injunctive norms			
Total indirect	.111/.024	[.016, .033]	55.22%
Direct	.090/.019	[.005, .034]	
Sensation seeking-Injunctive norms			
Total indirect	.066/.010	[.004, .016]	25.88%
Direct	.189/.028	[.018, .038]	
Positive urgency-Descriptive norms			
Total indirect	.096/.011	[.006, .016]	46.60%
Direct	.110/.012	[.006, .018]	
Negative urgency-Descriptive norms			
Total indirect	.142/.021	[.015, .027]	54.83%
Direct	.117/.017	[.009, .026]	
Lack of planning-Descriptive norms			
Total indirect	.071/.015	[.006, .024]	23.36%
Direct	.233/.050	[.038, .063]	
Lack of perseverance-Descriptive norms			
Total indirect	.057/.012	[.004, .021]	28.36%
Direct	.144/.031	[.019, .044]	
Sensation seeking-Descriptive norms			
Total indirect	.118/.018	[.012, .024]	46.27%
Direct	.137/.020	[.011, .030]	

Note. Significant effects are in **bold** typeface. Significance was based on 95% bias-corrected unstandardized bootstrapped confidence intervals (based on 5,000 bootstrapped samples) that did not contain zero. [a] Total effect (*c*) reflects the sum of the indirect effect and *c'* (i.e., the direct effect when the potential mediators are not included in the model). Total effects for each impulsivity-like facet are identical regardless of mediator, therefore these estimates are only presented once for simplicity. Direct = *c'*. % mediated = the proportion of the effect that is mediated in each mediation model.

past-year cannabis use through approval (standardized indirect effect [IE] = .168, accounting for 55.26% of the total effect), and injunctive norms (IE = .146, accounting for 47.87% of the total effect). Lack of perseverance had the next highest indirect effect on past-year cannabis use through approval (IE = .14), accounting for 70.79% of the total effect (see Table 2).

Complex Multivariate Mediation

When examined simultaneously, the total indirect effects of all impulsivity-like facets except positive urgency remained significant, and differential relations emerged for the unique indirect effects (see Table 3). The combination of approval, descriptive norms, and injunctive norms accounted for 69.19% of the total effect for negative urgency and past-year cannabis use, which explained the most variance of all impulsivity-cannabis use relations (see Table 3).

Multi-group Mediation by Gender

Multi-group mediation analyses were conducted for each of the 15 simple mediation models. Results suggested that the indirect effect of sensation seeking on past-year cannabis use via descriptive norms significantly differed by gender. More specifically, males exhibited a slightly larger indirect effect in this case (male: IE[β/B] = .178/.029; female: IE = .077/.011; unstandardized difference = .017, 95% unstandardized confidence interval [CI]: .004, .031), which suggests a stronger proximal effect of descriptive norms for high sensation-seeking males compared to females. The remaining multi-group mediation analyses were statistically nonsignificant.

DISCUSSION

The present study examined the direct effects of impulsivity-like facets, approval, and social norms on past-year cannabis use, as well as the indirect effects of impulsivity-like facets on past-year cannabis use through approval and social norms regarding friends (as opposed to students in general) using multivariate approaches of varying complexity. Further, the extent to which these indirect effects differed by gender were also tested for simpler multivariate models. Notably, this was the first study, to our knowledge, to test the relations among impulsivity-like facets, as assessed by the UPPS-P Impulsive Behavior Scale, approval, social norms regarding friends, and past-year cannabis use among college students.

Direct Effects

Bivariate direct effects results from the present study suggested that negative urgency, positive urgency, lack of planning, lack of perseverance, and sensation seeking were significantly positively associated with past-year cannabis use. When examined simultaneously, all direct effects remained significant, except for positive urgency. Although the extant cannabis research utilizing the UPPS-P is limited, these results differed from previous findings. For example, Bravo et al. (2017a; 2017b) only found a bivariate relation between lack of perseverance and cannabis use frequency. However, consistent with the current findings, Dvorak and Day (2014) reported significant bivariate associations between urgency (i.e., positive and negative urgency), self-control (lack of perseverance and lack of planning), and sensation seeking, and past-6-month cannabis use intensity. Discrepancies between the results from the present study and the results reported in Bravo et al. (2017a; 2017b) likely are a result of

Table 3. Effects from Complex Multivariate Mediation Model Predicting Past-year Cannabis Use

Predictor variable	*ß/B*	[95% CI]	% Mediated
Positive urgency			
Total[a]	-.064/-.008	[-.018, .003]	
Total indirect[b]	-.018/-.002	[-.010, .006]	28.13%
Approval	.015/.002	[-.001, .006]	-
Descriptive norms	-.032/-.004	[-.009, .001]	50.00%
Injunctive norms	-.001/.000	[-.002, .000]	1.56%
Direct	-.046/-.006	[-.014. .003]	
Negative urgency			
Total[a]	**.172/.027**	**[.013, .041]**	
Total indirect[b]	**.119/.019**	**[.009, .028]**	69.19%
Approval	.019/.003	[-.001, .008]	11.05%
Descriptive norms	**.096/.015**	**[.009, .022]**	55.81%
Injunctive norms	.005/.001	[-.001, .004]	2.91%
Direct	.054/.008	[-.003, .020]	
Lack of planning			
Total[a]	**.218/.049**	**[.032, .068]**	
Total indirect[b]	**.083/.019**	**[.007, .031]**	38.07%
Approval	**.053/.012**	**[.006, .021]**	24.31%
Descriptive norms	.023/.005	[-.002, .013]	10.55%
Injunctive norms	.007/.002	[-.004, .008]	3.21%
Direct	**.135/.030**	**[.017, .045]**	
Lack of perseverance			
Total[a]	**.128/.030**	**[.010, .049]**	
Total indirect[b]	**.070/.016**	**[.004, .028]**	54.26%
Approval	**.044/.010**	**[.004, .019]**	34.38%
Descriptive norms	.022/.005	[-.002, .013]	17.19%
Injunctive norms	.003/.001	[-.001, .005]	2.34%
Direct	.059/.014	[-.001, .029]	
Sensation seeking			
Total[a]	**.276/.044**	**[.032, .057]**	
Total indirect[b]	**.136/.022**	**[.014, .029]**	49.10%
Approval	**.052/.008**	**[.004, .014]**	18.84%
Descriptive norms	**.079/.013**	**[.008, .018]**	28.62%
Injunctive norms	.004/.001	[-.001, .004]	1.45%
Direct	**.141/.023**	**[.012, .033]**	

Note. Significant effects are in **bold** typeface. Significance was based on 95% bias-corrected unstandardized bootstrapped confidence intervals (based on 5,000 bootstrapped samples) that did not contain zero. [a]Total effect (*c*) reflects the sum of the indirect effect and *c'* (i.e., the direct effect when the potential mediators are not included in the model). [b]Total indirect effects reflect the sum of indirect associations via approval, descriptive norms, and injunctive norms. Direct = *c'*. % mediated = the proportion of the effect that is mediated in the complex multivariate mediation model. % mediated is not reported for the approval *unique* indirect effect of positive urgency, as calculations resulted in a negative value. % mediated should be interpreted with caution for variables with total effects less than .20 (see Kenny, 2016).

sampling and measurement differences. More specifically, Bravo et al. (2017a; 2017b) used a large, restricted sample of college students who endorsed at least one day of past-month cannabis use, whereas the present study included cannabis abstainers. Further, Bravo et al. (2017a; 2017b) assessed cannabis use frequency during a "typical week" in the past month, whereas the present study used single-item indicator of past-year cannabis use frequency. Overall, these findings

suggest that differential relations among impulsivity-like facets and cannabis use may emerge depending on sampling characteristics (i.e., including abstainers vs. not), outcome of interest (i.e., past-month vs. past-year cannabis use), method of cannabis use assessment, and methodological approach.

Further, results from this study demonstrated significant positive bivariate associations between cannabis approval, injunctive norms, descriptive norms, and past-year cannabis use, which supports findings in the extant cannabis literature (e.g., Napper et al., 2016; Simons et al., 2006; Pearson et al., 2017), as well as the broader substance use and social norm literature (see Perkins, 2002, 2003 for reviews). Indeed, these results are supportive of the theory of planned behavior (TPB; Ajzen, 1985). Intention is a function of several factors, including attitudes, subjective norms, and the perceived social pressure (Ajzen, 1985). Therefore, findings from the present study support the notion that cannabis approval (similar to TPB attitudes), descriptive norms, and injunctive norms are robust predictors of cannabis use. Speculatively, this relation may be best explained by a "third variable," or an individual's intention to engage in cannabis use.

Notably, the present study was the first study to document the positive bivariate relations among facet-level impulsivity and cannabis approval and social norms regarding friends among college students. Our results are congruent with previous work examining impulsivity and cannabis-related social norms. More specifically, Simons et al. (2006) examined the bivariate correlation between social norms and impulsivity among college students, and reported a small-to-medium effect size for the association (r = .22). However, Simons et al. (2006) did not distinguish between the distinct types of social norms (i.e., descriptive and injunctive) and used an overall measure of "impulsivity" (as assessed by the Eysenck Impulsivity Scale measuring lack of control; Eysenck & Eysenck, 1978). Although our results are consistent with previous findings which used the "lumping" approach to impulsivity and social norms, we maintain that examination of distinct impulsigenic traits is warranted.

Indeed, research has demonstrated the potential loss of vital information and that "lumping" (vs. "splitting") can mask differential relations among constructs (e.g., Blanchard, Stevens, Littlefield, Talley, & Brown, 2017). Further, although the impulsivity-like facets did not necessarily demonstrate differential relations in the simpler models, using a "splitting" approach revealed differences in effect sizes (e.g., negative urgency-descriptive norms r = .22 vs. lack of perseverance-descriptive norms r = .09), which would have been masked if a "lumping" approach had been used. Further, the differential gender effect reported from multi-group analyses would have been masked if a "lumping" approach had been employed in the present study. Therefore, the present study illustrates the benefit of using more nuanced methods of assessment.

Mediational Effects

The primary interest of this study was to determine the extent to which relations between impulsivity-like facets and past-year cannabis use were mediated by approval and social norms. Despite the potential for differential effects when adopting a "splitting" approach, results from 15 simple mediation models suggest that each of the five impulsivity-like facets exhibited significant indirect effects on past-year cannabis use via approval, descriptive norms, and injunctive norms. Indeed, these consistent results across simple mediation models support etiological theories of substance use in the extant literature.

Problem behavior theory (e.g., Jessor & Jessor, 1977; Jessor, 1987) postulates that "problem" or "deviant" behavior is a function of psychosocial forces, which are divided into two systems (i.e., the personality system and the perceived environment system; Jessor, 1987). In this study impulsivity-like facets (a major component of the personality system) and social norms (i.e., perceived environmental system) are considered psychosocial variables, and results indicated significant overlap in individuals higher in facets of impulsivity, higher in approval and social norms, and more frequent cannabis use. These findings may suggest a more general pattern of deviance (e.g., associating with peers who are more approving of cannabis) and may be conceptualized as risk factors in the problem behavior framework. From the broader perspective of reciprocal determinism, it may also be that impulsigenic traits influence environment

and choice of friends, which perpetuates certain norms, yielding increased cannabis use.

Differential relations emerged in the complex multivariate mediation model. More specifically, statistical redundancy and suppressor effects emerged when examined simultaneously. For example, in the simpler models, all total effects, direct effects, and total indirect effects for positive urgency were positive and statistically significant. In the complex model, the same effects became negative and statistically nonsignificant. Given the strength of the bivariate correlation of positive and negative urgency (r = .68), this suppressor effect is not surprising (see Conger, 1974). In fact, to address the statistical redundancy of positive and negative urgency, more recent research combines these two urgency facets (e.g., Burris, Riley, Puleo, & Smith, 2017; Riley, Rukavina, & Smith, 2016), which Smith and Cyders (2016) recommend if "the two traits do not predict differently (which may be the case in the prediction of problem drinking or drug use)" (p. 57). Likewise, in the complex model, injunctive norms no longer emerged as a significant mediator for any impulsivity-like facet, though it significantly mediated relations for all impulsivity-like facets in simpler models. Again, this is likely a result of statistical redundancy, as injunctive norms and approval are highly correlated (r = .74 in the current study), which is suboptimal when examining multiple mediators simultaneously (see Kenny, 2016). Because of this, we caution readers from drawing firm conclusions regarding which mediator is superior in the complex model. Further, it is recommended that the complex multivariate findings be considered in the context of the findings from the simpler models (see Meehl, 1971), as it is likely individuals high in positive urgency may benefit from clinical implications of the present research despite that this facet did not demonstrate significant indirect effects in the complex model.

Interestingly, sensation seeking remained the most consistent in the complex model, as two of the three mediators remained significant. However, it is difficult to speculate about what sensation seeking represents in this complex model after removing variance shared with the other four UPPS-P impulsigenic traits (see Lynam, Hoyle, & Newman, 2006 for the "perils" of partialling). Further, although approval emerged as a robust mediator over and above descriptive and injunctive norms across most impulsivity-like facets in the complex multivariate model, only descriptive norms significantly mediated negative urgency while holding other variables constant. Speculatively, given individuals high in negative urgency are driven by heightened emotional states (which may include anxiety/self-consciousness/other negative social emotion), it is possible that descriptive norms are a more readily available heuristic compared to injunctive norms and approval. It is also plausible that descriptive norms as a construct are a proxy for cannabis availability, and cannabis use for individuals high in negative urgency may be best explained by substance availability.

Finally, multi-group mediation analyses by gender indicated that there were no statistically significant differences in indirect effects tested in the present study, except for the indirect effect of sensation seeking on cannabis use via descriptive norms. The lack of gender differences regarding mediational estimates found in the present study are not surprising, given the minimal gender differences in constructs of interests when examined bivariately. For example, of the five impulsivity-like facets, only positive urgency and sensation seeking were significantly related to gender (consistent with meta-analytic findings; see Coskunpinar et al., 2013), with sensation seeking exhibiting the strongest effect size (r = .33; i.e., males reporting higher levels of sensation seeking). Likewise, only approval and injunctive norms, but not descriptive norms, were significantly associated with gender, such that males endorsed more positive attitudes towards cannabis and perceived that their friends would be more approving of cannabis use.

Although significant differences in indirect effects were not observed in the present study, there is still considerable evidence to suggest that gender plays an integral role in social norms and related constructs. Indeed, even though the present study made a specific reference to norms regarding friends, which is strength of the study, the present study utilized "gender-nonspecific cannabis norms," or the social norms of cannabis use without specific reference to gender (see Lewis & Neighbors, 2004 for more details on gender-specific norms; see Buckner, 2013 for more details regarding norms of friends vs. students in general). Further, in the alcohol literature, there is evidence to suggest that gender-specific norms

(i.e., same-sex norms or opposite-sex norms) are better predictors of alcohol consumption than gender-nonspecific norms; moreover, some research suggests that same-sex norms are stronger predictors of alcohol consumption for females compared to males (Lewis & Neighbors, 2004). Notably, these nuances in assessment of social norms by gender may explain the nonsignificant gender differences in mediational estimates found in the present study, as we did not make a specific reference to gender when asking about social norms. Therefore, this is an important line of inquiry moving forward in the cannabis literature, as little research has been conducted examining the impact of gender-specific social norms – especially as they relate to narrowband assessments of impulsivity.

Given the current findings, speculatively, personalized normative feedback (PNF) interventions may be effective in reducing consumption, (Blevins, Walker, Stephens, Banes, & Roffman, 2018; Copeland, Rooke, Rodriguez, Norberg, & Gibson, 2017). Further, though this is speaking beyond the data, providing PNF interventions to individuals high in impulsivity-like facets, particularly those high in lack of planning and lack of perseverance might be most effective. If providing personality-informed, gender-specific normative feedback interventions, males high in sensation seeking may benefit most, as descriptive norms were more predictive of past-year cannabis use for high-sensation-seeking males compared to females in the current study. Further, to maximize reach and minimize cost, normative-based public service announcements (PSAs) are a potential alternative, especially those targeting high-sensation-seeking males, as previous research has demonstrated effectiveness for sensation-seeking-targeted PSAs in reducing cannabis use and positive cannabis attitudes (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001; Palmgreen, Lorch, Stephenson, Hoyle, & Donohew, 2007).

Limitations

Results should be interpreted in light of study limitations. Notably, participants were recruited from introductory psychology courses, and the plurality of participants were White females, so generalizability of our findings may be limited. Further, a sizeable portion of our sample reported past-year cannabis use (43.18%); this rate is slightly higher compared to the reported national past-year cannabis use average (37.9%; Johnston et al., 2016), which could also impact the generalizability of the current findings. Further, it is recommended that future research replicate our findings using more sensitive measures of cannabis use frequency and cannabis social norms and approval. For example, future research in this area should prioritize the use of the modified Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985) or the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017) as more comprehensive assessments of cannabis use, as opposed to a single-item indicator. To assess descriptive norms, we used two items, one of which assessed offers from peers to use cannabis, which may be more representative of direct peer influence, rather than descriptive norms. This should be taken into consideration when interpreting the current findings. Further, the present study included a single cannabis outcome (i.e., cannabis use frequency), which has been shown in recent research to have weaker associations with UPPS-P impulsivity-like facets than cannabis use consequences (Bravo et al., 2017b). Extensions of the present study should prioritize the inclusion of cannabis use consequences (e.g., Marijuana Consequences Questionnaire [MACQ]; Simons, Dvorak, Merrill, & Read, 2012) to address this limitation. Given that the data was collected in a state without decriminalization or legalization of cannabis, our results may not generalize to states with more lenient cannabis policies. Future studies should also examine the effects of state-level cannabis policies on cannabis-related norms, attitudes, and use. Finally, given the cross-sectional nature of this study, conclusions regarding temporal precedence cannot be drawn from mediation models, and thus longitudinal research is needed.

Future Directions

Expanding on the current study, it is important to consider the influence of different cannabis-related outcomes (e.g., cannabis-related problems, cannabis use frequency over various timespans), as impulsivity-like facets have exhibited differential relations with substance use outcomes (e.g., sensation seeking often relates to frequency, whereas negative urgency often relates to problematic use; see Smith et al., 2007). Further, researchers are encouraged to replicate the present findings using more specific assessments of social norms and approval. For example, it is necessary to determine the effect of gender-specific versus gender-nonspecific social norms on the relations examined in this study, as these potential differing effects have significant clinical implications with the use of social norms as a treatment target for decreasing cannabis consumption. Finally, similar to the broader substance use literature (see Borsari & Carey, 2003), there is emerging evidence to support that cannabis users tend to misperceive (and overestimate) the cannabis use of the typical college student compared to their own use (e.g., Pearson et al., 2017). Therefore, future directions of the present study include considering how misperception of cannabis use relates to impulsivity-like facets.

Conclusions

In conclusion, the current study provides evidence that, in general, approval of cannabis and social norms regarding friends are more proximal predictors of past-year cannabis use, whereas impulsivity-like facets serve as distal predictors in simpler multivariate models. Moreover, differential relations emerge when examining these effects simultaneously. Indeed, given this evidence, clinical interventions aimed at approval and social norms to reduce cannabis use among college students are important to explore, especially for individuals higher in impulsivity-like facets. More specifically, in the alcohol literature, personalized normative feedback has been efficacious in reducing alcohol consumption among college students (e.g., Neighbors, Larimer, & Lewis, 2004), and it is important for future research to continue examining ways to improve these types of intervention strategies to reduce cannabis use.

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