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The Associations of Basic Psychological Need Satisfaction and Need Frustration with Cannabis-Related Outcomes in a Multi-Site Sample of College Students

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ABSTRACT

Psychological need satisfaction and need frustration, proposed by self-determination theory, may serve as conditions that foster health-promoting and health-impairing behaviors related to cannabis use. In the present study, we examined the measurement model of psychological need satisfaction and need frustration and their associations with cannabis protective behavioral strategies use, negative cannabis-related consequences, and cannabis use severity. Data were from 1394 college students from 10 universities across the U.S. who reported past-month cannabis use. A higher-order factor model representing general psychological need satisfaction and need frustration provided a good fit to the data. Regressing the three observed cannabis outcome variables onto these higher-order latent factors, we found that greater need satisfaction was associated with more frequent cannabis protective behavioral strategies use and fewer negative cannabis-related consequences. Greater need frustration was associated with greater negative cannabis-related consequences and cannabis use severity. Further, an interaction effect between need satisfaction and need frustration emerged for each cannabis outcome such that greater need satisfaction attenuated the associations between need frustration and cannabis outcomes and greater need frustration strengthened the associations between need satisfaction and cannabis outcomes. Implications for the roles of need satisfaction and need frustration in cannabis use and future intervention development are discussed.

Introduction

Data from the Monitoring the Future survey indicate that the prevalence of daily cannabis use in 2020 among college students (7.9%) is the highest it has been in the past four decades (Schulenberg et al. 2021). Preliminary evidence suggests that these increases may be due, in part, to the recent legalization of recreational cannabis use in states throughout the U.S. (Smart and Pacula 2019). Further, research has found that most college students (90.8%) who reported cannabis use in the past month experienced at least one negative consequence associated with their use (e.g., "The quality of my work or schoolwork has suffered because of my cannabis use") (Pearson, Liese, and Dvorak 2017). Thus, identifying novel, modifiable antecedents of cannabis-related outcomes among college students may inform intervention development, providing insight into potential active ingredients for reducing cannabis-related harms. The present study examines the associations between psychological need satisfaction and need frustration, as described by selfdetermination theory, with cannabis-related outcomes among college students.

Basic psychological need satisfaction and need frustration

Self-determination theory (SDT; Ryan and Deci 2000) is a meta-theory of human motivation that has been applied to understand why people engage in health behaviors (for meta-analyses, see Gillison et al. 2019; Ng et al. 2012; Ntoumanis et al. 2021). The Basic Psychological Need Theory of SDT postulates that people have three basic psychological needs for *autonomy*, the experience of volition and willingness; *competence*, the experience of effectiveness and mastery; and relatedness, the experience of warmth, bonding, and care in relationships with others (Vansteenkiste, Ryan, and Soenens 2020). According to SDT, satisfaction of the psychological needs is essential for optimal functioning and well-being, including the experience of autonomous motivation for engaging in health-promoting behaviors, which increases the likelihood of engagement in these behaviors and is essential for maintenance of engagement in these behaviors over time (Ryan et al. 2008). In contrast, frustration of the psychological needs (an active threat to the needs that is distinct from and

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more negative than absence of satisfaction) is proposed to thwart motivation and result in disengagement and experiences of ill-being and distress, and thereby serve a transdiagnostic role in psychological disorders (Vansteenkiste, Ryan, and Soenens 2020). More specifically, need frustration is the experience of pressure and conflict (autonomy); ineffectiveness or failure and helplessness (competence); and social alienation, exclusion, and loneliness (relatedness). As mentioned above, metaanalytic evidence provides support for SDT such that, across a range of health behaviors such as tobacco cessation, medication adherence, and glycemic control, satisfaction of the psychological needs is related to more internalized motivation for engaging in healthpromoting behaviors, and, in turn, more positive health outcomes (Ng et al. 2012). Additionally, there is metaanalytic support for the efficacy of health interventions based on SDT that target satisfaction of the psychological needs through need-supporting techniques (Gillison et al. 2019; Ntoumanis et al. 2021).

Further, given increased attention on need satisfaction and need frustration as distinct conditions (Vansteenkiste, Ryan, and Soenens 2020), studies have considered their interactive relations with outcomes. One study found, for example, that greater need satisfaction reduced the negative associations of need frustration with vitality and exhaustion among athletes (Bartholomew et al. 2011). This finding suggests that experiencing need satisfaction is more critical for positive behavioral outcomes among those who experience more need frustration. As mentioned previously, however, distinguishing need frustration from need satisfaction is a recent endeavor and more research is needed to better understand how these conditions both uniquely and synergistically influence behavior.

Applications of SDT to understand substance use

Psychological need satisfaction and need frustration may be conditions that contribute to the extent to which people experience substance-related harms. That is, need satisfaction may promote behaviors that reduce substance-related harms, whereas need frustration may promote behaviors that increase substance-related harms. Most research on this topic, to date, has focused on alcohol. Richards, Pearson, and Field (2020, 2022) found that college students who fit a latent profile defined by autonomous motivation for drinking responsibly endorsed the highest levels of need satisfaction and lowest levels of need frustration, and reported the least alcohol use and fewest negative alcoholrelated consequences. Other research has found that greater endorsement of need satisfaction while drinking among Indigenous Australians was related to greater alcohol use and dependence, suggesting that drinking may serve as an attempt to satisfy frustrated needs (Conigrave et al. 2021). Despite growing support for a link between the psychological needs and substance-related outcomes, especially alcohol, and the potential for this link to inform substance use intervention for college students, no study to our knowledge has examined relationships between the psychological needs and cannabis-related outcomes. Preliminary, cross-sectional support for the relationship between the psychological needs and cannabis-related outcomes is needed prior to leveraging SDT to address the public health burden of cannabis use among college students.

Present study

We sought to examine the associations between psychological need satisfaction and need frustration with cannabisrelated outcomes among a large, multi-site sample of college students who reported past-month cannabis use. Given the nascency of this research area, we first confirmed the measurement model of psychological need satisfaction and need frustration found in general college student samples prior to testing the structural model. Then, we used structural equation modeling to simultaneously test the associations of higher-order latent factors of psychological need satisfaction and need frustration, and the interaction between the two, with cannabis protective behavioral strategies (PBS) use, cannabis use severity, and negative cannabis-related consequences. Consistent with SDT, we hypothesized that need satisfaction would be positively associated with cannabis PBS use (health promoting) and negatively associated with negative cannabis-related consequences and cannabis use severity (health impairing). We hypothesized associations in the opposite directions for need frustration. Consistent with prior studies, we hypothesized that greater need satisfaction would reduce the negative association of need frustration with PBS and the positive associations with cannabis use severity and negative cannabis-related consequences. In other words, greater need frustration would increase the positive association of need satisfaction with cannabis PBS and the negative association with cannabis use severity and negative cannabis-related consequences.

Methods

Participants and Procedures

A convenience sample of 5497 psychology students were recruited from 10 universities in 8 states across the U.S. (AK, CA, CO, ID, NM, TX, VA, WA). We restricted

Table 1. Descriptive statistics, reliability estimates, and zero-order correlations for the study variables.

	М	SD	1	2	3	4	5	6	7	8	9
1. Autonomy Satisfaction	3.60	0.81	(.80)								
2. Autonomy Frustration	2.61	0.85	28**	(.74)							
3. Relatedness Satisfaction	3.97	0.90	.61**	26**	(.89)						
4. Relatedness Frustration	2.10	0.94	24**	.55**	52**	(.83)					
5. Competence Satisfaction	3.69	0.88	.71**	26**	.62**	30**	(.88)				
6. Competence Frustration	2.55	1.01	34**	.61**	36**	.58**	54**	(.86)			
7. Cannabis PBS	3.99	0.89	.20**	13**	.20**	14**	.15**	12*	(.90)		
8. Negative Cannabis-Related Consequences	0.18	0.20	16**	.15**	17**	.13**	13**	.22**	36**	(.88)	
9. Cannabis Use Severity	16.10	5.67	14**	.20**	15**	.22**	12*	.23**	49**	.64**	(.84)

*p<.01, **p<.001. Reliability estimates (Cronbach's alpha) are reported on the diagonal.

PBS = protective behavioral strategies.

analyses to participants reporting cannabis use at least once in the past month (n = 1394). The sample was 20.25 years of age on average (SD = 3.88) and mostly female (68.9%) and non-Hispanic white (59.5%). Further, the sample was 44.4% freshman, 23.8% sophomore, 17.3% junior, and 14.0% senior. Participants completed an online survey for partial course credit. A random missingness design was implemented to decrease participant burden. All participants in the analytic sample were assigned to complete the measures assessing cannabis-related outcomes, but roughly half (n = 675) were randomly assigned to complete the measure assessing psychological need satisfaction and need frustration. We used full-information maximum likelihood estimation for our analyses which uses all available data for cases with missing on exogenous variables. These procedures were approved by the Institutional Review Board of record and electronic informed consent was obtained from participants.

Measures

Table 1 reports the descriptive statistics and reliability estimates for each of the variables described below.

Basic psychological need satisfaction and need frustration

We used the 24-item Basic Psychological Need Satisfaction and Frustration Scales (BPNSFS; Chen et al. 2015) to assess satisfaction and frustration of the basic psychological needs for autonomy, relatedness, and competence. Each of the 6 subscales are comprised of 4 items. An example item for the satisfaction subscales include: "I feel a sense of choice and freedom in the things I undertake" (autonomy). An example item for the frustration subscales include: "I have to" (autonomy). Participants rate the extent to which each statement is true for them on a 5-point scale (1=*Completely untrue*, 5=*Completely*

true). Observed subscale scores were created by averaging their respective items.

Cannabis PBS

We used the 17-item Protective Behavioral Strategies for Marijuana (PBSM; Pedersen et al. 2016 revised by Pedersen et al. 2017) to assess the frequency of cannabis PBS use (e.g., "Use marijuana only among trusted peers"). Participants rate the frequency in which they engage in each behavior while using cannabis on a 6-point scale (1=Never, 6=Always). A total score was calculated by averaging the items.

Cannabis use severity

We used the 8-item Cannabis Use Disorder Identification Test-Revised (CUDIT-R; Adamson et al. 2010) to assess cannabis use severity during the past 6 months. Items (e.g., "How often have you had a feeling of guilt or remorse after using cannabis?") of the CUDIT-R capture consumption, negative consequences, physical dependence, and psychological features. Participants rate each item using a 5-point scale (0 to 4) such that higher scores indicate more severe cannabis use. A total score was calculated by summing the items.

Negative cannabis-related consequences

We used the 21-item Brief-Marijuana Consequences Questionnaire (B-MACQ; Simons et al. 2012) to assess negative cannabis-related consequences experienced during the past month. The B-MACQ items capture negative cannabis-related consequences across the spectrum of severity (e.g., "I have had less energy or felt tired because of my marijuana use" to "I have gotten into physical fights because of my marijuana use"). Participants indicate whether each consequence was experienced during the past month using a binary scale (0=No, 1=Yes). A total score was calculated by averaging the items to reflect the proportion of consequences experienced.

Statistical analysis

First, we computed zero-order correlations between the observed study variables. We then tested the measurement model of the BPNSFS. Confirmatory factor analysis (CFA) was used to test our hypothesis that a higherorder factor model would provide a good fit to the data (see Figure 1). Specifically, we hypothesized a model with six first-order factors representing satisfaction and frustration of autonomy, relatedness, and competence indicated by their respective items in the BPNSFS and two second-order factors representing general need satisfaction and general need frustration indicated by the three lower-order factors representing satisfaction and frustration of autonomy, relatedness, and competence, respectively (Chen et al. 2015). Correlations between the two first-order factors representing the same psychological need (e.g., autonomy satisfaction and autonomy frustration) and between the two secondorder factors were estimated. To minimize confirmation bias (MacCallum and Austin 2000), we tested two alternative models that are theoretically plausible (see Supplemental Materials): 1) two first-order factors representing general psychological need satisfaction and need frustration, and 2) three first-order factors representing autonomy, relatedness, and competence.

We then tested the structural model of the associations between the BPNSFS and cannabis-related outcomes. To test our hypotheses regarding these associations, we extended the hypothesized measurement model described above by simultaneously regressing observed scores of the PBSM, CUDIT-R, and B-MACQ onto the second-order factors representing general need satisfaction and need frustration and their (standardized) interaction (see Figure 2). Correlations between the two second-order factors and among the three cannabis-related outcome variables (PBSM, CUDIT-R, B-MACQ) were estimated.

The measurement and structural models were conducted using full-information maximum likelihood estimation with robust standard errors (MLR) in *Mplus* 8.5 (Muthén and Muthén 1998-2017). Latent variables were provided a metric by setting the first factor loading to one. To evaluate global fit of the models, we considered joint global fit criteria based on values of the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Hu and Bentler 1999). These joint global fit criteria were prioritized over the chi-square test given its sensitivity to sample size. Values of CFI \geq .95, RMSEA \leq .06, and SRMR \leq .08 were considered as indicative of a good global fit to the data (Hu and Bentler 1999). Statistically significant interactions (p < .05) were probed by displaying the associations between the standardized higher-order need satisfaction and need frustration and the outcome at low (-1 SD) and high (+1 SD) levels of the standardized higher-order need frustration and need satisfaction, respectively. Data to reproduce the results can be obtained from the corresponding author by request.

Results

Descriptive statistics and zero-order correlations

Table 1 reports the zero-order correlations for the observed study variables. Mean scores were higher on the BPNSFS satisfaction subscales than the frustration subscales (M = 3.60-3.97 vs M = 2.10-2.61). Large positive correlations (.61 < rs < .71) were found among the satisfaction subscales and among the frustration subscales (.55 < rs < .61). Negative correlations were found between the satisfaction subscales and frustration subscales, ranging from small-to-large in magnitude (-.24 < rs < -.54). Generally, the magnitudes of these correlations were the largest for subscales of the same psychological need (i.e., relatedness satisfaction and relatedness frustration: r = -.52, competence satisfaction and competence frustration: r = -.54). The exception to this was that autonomy satisfaction had a greater negative correlation with the competence frustration than autonomy frustration (r = -.34 vs. r = -.28).

Measurement model

The higher-order factor model of the BPNSFS provided a good fit to the data: Satorra-Bentler Adjusted X^2 (242, n = 675) = 477.642, p < .0001; CFI = .960; RMSEA =.038, 90% CI =.033-.043; SRMR =.042. Figure 1 displays the statistically significant standardized estimates of the model. Each item loaded saliently onto its respective first-order factor (standardized loadings: $.525 < \lambda s < .883$) and each loaded saliently onto first-order factor its respective second-order factor (standardized loadings: .774 < λ s < .942). Consistent with the zero-order correlations, the relatedness and competence satisfaction factors demonstrated large negative correlations with the relatedness and competence frustration factors, respectively (r = -.722 and -.872), and the correlation between autonomous satisfaction factor and autonomous frustration factor was not statistically



Figure 1. Standardized Parameter Estimates for the Higher-Order Factor of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS). Only statistically significant estimates are shown.

significant (r = -.147, p = .446). There was a moderate-to-large negative correlation between the second-order general need satisfaction and need frustration factors. In contrast, the alternative models provided a poor fit to the data (see Supplemental Materials).

Structural model

We proceeded with examining the latent need satisfaction factor and latent need frustration factor as well as their interaction as predictors of the PBSM, B-MACQ, and CUDIT-R (see Figure 2). The model accounted for 9.3%,

18.7%, and 39.5% of the variance in cannabis PBS use, cannabis use severity, and negative cannabis-related consequences, respectively. We found statistically significant interactions of need satisfaction and need frustration on each cannabis-related outcome, so we interpret all associations conditionally (see Figure 3). Additionally, we conducted a sensitivity analysis controlling for several participants characteristics that have been found to be associated with cannabis outcomes (i.e., age, biological sex assigned at birth, and ethnicity [0=minoritized racial/ ethnic groups, 1 = non-Hispanic white]). The results were identical in regard to statistically significant associations reported in Figure 2 and thus are not presented further.



Figure 2. Standardized Parameter Estimates for the Structural Model Predicting Cannabis-Related Outcomes from High-Order Factors of Psychological Need Satisfaction and Need Frustration and Their Interaction. Only statistically significant estimates are shown. The dot is used to represent an interaction term.

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The association between need satisfaction and cannabis PBS use was moderately positive among those with high (β = .299) and average (β = .208) need frustration and weakly positive among those with low need frustration (β = .117) (see Figure 3 [Panel A]). The association between need frustration and cannabis PBS use was moderately negative among those with low need satisfaction (β = -.200), weakly negative among those with average need satisfaction (β = -.109), and approximately zero among those with high need satisfaction (β = -.018) (see Figure 3 [Panel B]). The association between need satisfaction and negative cannabis-related consequences was strongly negative among those with high need frustration ($\beta = -.570$), weakly negative among those with average need frustration ($\beta = -.192$), and weakly positive among those with low need frustration ($\beta = .186$) (see Figure 3 [Panel C]). The association between need frustration and negative cannabis-related consequences was strongly positive among those with low need satisfaction ($\beta = .689$), moderately positive among those with average need satisfaction ($\beta = .311$), and non-significantly negative among



Figure 3. Standardized Interaction Effects between Higher-Order Factors of Psychological Need Satisfaction and Need Frustration on the Cannabis-Related Outcomes. (A and B) Outcome is cannabis protective behavioral strategies (PBS) with need satisfaction and need frustration plotted on the x-axis, respectively. (C and D) Outcome is negative cannabis-related consequences with need satisfaction and need frustration plotted on the x-axis, respectively. (E and F) Outcome is cannabis use severity with need satisfaction and need frustration plotted on the x-axis, respectively.

those with high need satisfaction ($\beta = -.067$) (see Figure 3 [Panel D]).

The association between need satisfaction and cannabis use severity was weakly positive among those with low need frustration ($\beta = .507$), weakly negative among those with average need frustration ($\beta = -.072$), and moderately negative among those with high need satisfaction ($\beta = .238$) (see Figure 3 [Panel E]). The association between need frustration and cannabis use severity was strongly positive among those with low need satisfaction ($\beta = .507$), moderately positive among those with average need satisfaction ($\beta = .341$), and weakly positive among those with high need satisfaction ($\beta = .175$) (see Figure 3 [Panel F]).

Discussion

Our aim in the present study was to examine the associations of basic psychological need satisfaction and need frustration with cannabis-related outcomes. Consistent with our hypothesis and some previous research, we found support for a higher-order factor structure with six lower-order factors representing satisfaction and frustration of autonomy, relatedness, and competence and two higher-order factors representing general need satisfaction and general need frustration indicated by the first-order satisfaction and frustration factors, respectively. A recent study (Murphy et al. 2023), however, suggests that these higher-order factors may reflect valence of the need satisfaction (positive) and need frustration (negative) items, and that the need frustration items lack content coverage. Indeed, the large negative correlations for competence satisfaction and competence frustration and relatedness satisfaction and relatedness frustration, but not autonomy satisfaction and autonomy frustration, are entirely consistent with Murphy et al. Future research is needed to continue to improve the measurement of need frustration as a distinct condition from need satisfaction as described by SDT. Given support for the hypothesized measurement model of the BPNSFS among a sample of college students with past-month cannabis use, we proceeded with examining the associations of basic psychological need satisfaction, need frustration, and their interaction with cannabis-related outcomes. However, the argument of Murphy et al. that the BPNSFS may not validly assess need frustration due to a lack of active thwarting content suggest caution in interpreting our findings for need frustration and cannabis outcomes, and that replication is needed with improved measures of need frustration.

Our finding that greater need satisfaction demonstrated the strongest positive relationship with

cannabis PBS use (health promoting) is consistent with this proposal of SDT that this condition increases health-promoting behaviors (Ryan et al. 2008). A meta-analysis of 184 datasets found that psychological need satisfaction was related to a host of healthpromoting behaviors, such as smoking abstinence, physical activity, and medication adherence (Ng et al. 2012). More recent research has also found that need satisfaction is associated with more internalized types of motivation for using alcohol responsibly which have been shown to be related to more frequent alcohol PBS use (Richards, Pearson, and Field 2020, 2021). The present study extends these findings to cannabis which may encourage future research on SDTinformed interventions for cannabis use among college students. Importantly, SDT proposes that supporting the psychological needs may serve as active ingredient of health interventions (Ryan et al. 2008), and the efficacy of motivational interviewing, a popular intervention for hazardous cannabis use, has been attributed to its components supporting the psychological needs (e.g., Markland et al. 2005). Initial support found in the present study for SDT proposals in the context of cannabis use may spur future research on intervention development.

In contrast, frustration of the psychological needs is proposed to contribute to dysfunctional behavior and ill-being, including poorer physical health, although less research has focused on need frustration in comparison to need satisfaction (Vansteenkiste, Ryan, and Soenens 2020). Consistent with this proposal, we found that greater need frustration demonstrated the strongest positive relationship with cannabis use severity and negative cannabis-related consequences (health impairing). Some research has found that college students who score higher on risk factors for alcohol use (i.e., less internalized types of motivation for using alcohol responsibly and drinking motives) also report greater endorsement of need frustration (Richards et al. 2022). The present findings are consistent with this research as well as the more general growing body of research that has found that need frustration is related with indicators of ill-being, such as poorer sleep (Vansteenkiste, Ryan, and Soenens 2020). Indeed, Vansteenkiste and colleagues call for research on need frustration as a potential transdiagnostic factor in the development of a diversity of pathological symptoms, and the present findings suggest that future research could examine the role of need frustration in the development of problematic cannabis use. Given the moderate negative association between need frustration and need satisfaction in the present study, future research on SDT-based interventions for cannabis might also consider if support for the psychological needs reduces frustration and thereby risk behaviors for cannabis. However, if the need frustration items are simply reverse-keyed need satisfaction items given the lack of active thwarting content (Murphy et al., 2023), then the above findings only provide further support for need satisfaction in relation to cannabis outcomes.

Notably, the associations of both need satisfaction and need frustration with cannabis outcomes were small in magnitude. This may be for two reasons: 1) need satisfaction and need frustration were assessed in general, not in the context of cannabis use, and 2) SDT proposes motivation as intermediate variable that may explain the influence of need satisfaction and need frustration on behavioral outcomes. That is, need satisfaction promotes the internalization of motivation for healthy behaviors, whereas need frustration thwarts internalization of motivation for healthy behaviors. Future research is needed to develop measures of need satisfaction and need frustration in the context of cannabis use as well as experimental and longitudinal studies that test the causal chain proposed by SDT. The present study is a preliminary step toward future research investigating the potential of need satisfaction for cannabis interventions and the role of need frustration in the development of cannabis problems. It may also be that need satisfaction and need frustration have limited influence on cannabis outcomes among college students, and this possibility as well as the possibilities above should be explored by future research.

Finally, we found evidence for interactions of need satisfaction and need frustration on each cannabisrelated outcome. The protective association of need satisfaction with higher cannabis PBS use was evident across levels of need frustration; however, this positive association was strongest among those with higher need frustration. The associations of higher need frustration with more cannabis use severity and negative cannabisrelated consequences were strong among those with low need satisfaction and weak or non-significant among those with high need satisfaction. As recommended by Vansteenkiste, Ryan, and Soenens (2020), identifying profiles based on satisfaction and frustration of the individual psychological needs with the use of latent profile analysis may be useful for better understanding these combined influences as well as the characteristics of who is more likely to endorse a particular psychological need profile. An important implication of this finding is that it may promote research that tests whether supporting the psychological needs through college student cannabis interventions are an efficacious technique for reducing cannabis-related harms among those who are most vulnerable, or who experience the greatest need frustration. Future research is needed to examine interventions that both satisfy psychological needs and help individuals cope with frustration of psychological needs as active ingredients for reducing hazardous cannabis use and associated harms. Of course, these findings are also contingent upon the valid assessment of need frustration and require replication with need frustration with improved content coverage, i.e. active thwarting of the needs.

Despite the large multi-site sample of college students, we used convenience sampling from psychology department participant pools, so females were overrepresented. This sampling technique could limit generalizability to the broader college student population in the U.S., thus replication of findings using distinct samples is warranted. We also collected data from universities in states with varying cannabis policies and did not test for differences in the hypothesized associations across types of policies (e.g., legal medical use versus legal medical and recreational use) due to statistical power concerns. However, representation of these varying cannabis policies may increase the generalizability of our findings. Given the observational cross-sectional study design, temporal precedence and causality cannot be established. Future research employing longitudinal observational designs to test the hypothesized relationships prospectively as well as experimental studies that support the psychological needs are needed to establish causality. Finally, SDT proposes that the psychological needs influence behavior through motivation. That is, need satisfaction facilitates internalized motivation, and need frustration thwarts internalized motivation, for healthpromoting behaviors which is necessary for the maintenance of these behaviors in the long-term (Ryan et al. 2008). We did not consider motivation defined by SDT in the present study because, to our knowledge, there is no validated measure in relation to cannabis use. Future work is needed to validate such a measure and subsequently test the theorized causal path (i.e., motivational mediation model) that the psychological needs influence internalization of motivation, which, in turn, influences behavior.

We found support for SDT by demonstrating associations between psychological need satisfaction and health-promoting cannabis use behaviors (i.e., cannabis PBS) and associations between psychological need frustration and health-impairing cannabis use (cannabis use severity and negative cannabisrelated consequences) in a large, multi-site sample of college students. Importantly, greater need satisfaction reduced the associations of need frustration with cannabis outcomes whereas greater need frustration increased the associations of need satisfaction with cannabis outcomes. Findings of the present study lend some preliminary support to the application of SDT to understand cannabis use among college students. That is, need satisfaction may be a condition that promotes behaviors that reduce the harms of cannabis use, whereas need frustration may be a condition that promotes behaviors that increase the harms of cannabis use. These preliminary findings may motivate future research, especially with improved measures of need frustration, on cannabis interventions based on SDT for reducing consumption and associated negative consequences and improving well-being.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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