Negative Cannabis Expectancies Are Associated with Driving After Cannabis Use

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ABSTRACT

With the increase in the number of states legalizing cannabis, driving after cannabis use (DACU) has become a significant public health concern nationwide and is one of the riskiest cannabis-related behaviors. Prior research has linked DACU with cannabis outcome expectancies, the positive and negative beliefs one holds about the effects of cannabis. The present study examined the relationships between cannabis expectancies and DACU in a sample of college cannabis users who have engaged in recent DACU. Participants were 85 college students who reported driving after cannabis use at least three times in the past three months. Participants completed measures that assessed positive and negative cannabis expectancies, perceived peer approval and dangerousness of DACU, and driving after cannabis use. In a negative binomial regression model, negative expectancies, perceived peer approval, and perceived dangerousness were significantly associated with DACU (p's <.05). Positive expectancies of cannabis use were not significantly associated with DACU. These results provide evidence that negative expectancies of cannabis use are associated with DACU. In addition to perceptions of dangerousness and peer approval, cannabis expectancies may be an important prevention and intervention target.

Key words: cannabis, impaired driving, expectancies, peer norms, dangerousness, college

Driving after cannabis use (DACU) is a significant public health concern and represents one of the riskiest cannabis-related behaviors (Li et al., 2011). Rates of DACU have been steadily increasing over time as the number of states legalizing cannabis for medical and recreational use has increased (Ramaekers, 2018). Though overall rates of driving after alcohol and cannabis use among college students are similar, rates of DACU among cannabis users have been shown to be significantly higher than rates of driving after drinking among drinkers (O'Malley & Johnston, 2003). Whitehall and colleagues (2014) found that among first-year college students, 31.3% of cannabis users drove after using cannabis, while 6.8% of alcohol users drove after drinking alcohol. While several studies have demonstrated that cannabis impairs a number of functions imperative to driving ability, a large percentage of cannabis users continue to drive after using cannabis (Asbridge et al., 2012; Hartman & Huestis, 2013). Prior research has shown that cognitive perceptions associated with using cannabis are related to level of cannabis use and cannabis-related consequences (Aarons et al., 2001). Specifically, perceived dangerousness and perceived peer approval contribute to cannabis use. In the context of DACU, individuals more likely to drive after cannabis use include those who perceive it to be less dangerous and those who believe that friends or other students are accepting of DACU (McCarthy et al., 2007).

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Another factor that has been shown to be related to DACU is outcome expectancies (Arterberry et al., 2013). Outcome expectancies are beliefs regarding the positive and negative effects of a substance. A large body of literature has linked alcohol expectancies to alcohol use and consequences (Blume & Guttu, 2015; Goldman, 1994; Lac & Luk, 2019). This body of research suggests that expectancies are key determinants of alcohol-related behaviors. Similarly, cannabis expectancies, beliefs regarding the positive and negative effects of cannabis use, have been linked to cannabis use and act as predictors of use (Schafer & Brown, 1991; Vangsness et al., 2005). Specifically, positive expectancies, for example the belief that cannabis helps a person relax, are associated with increased use of cannabis. Whereas, negative expectancies, such as the belief that cannabis makes it harder to think, act as protective factors and have been linked to decreased levels of cannabis use (Schafer & Brown, 1991).

Despite these relationships, only two previously published studies have examined the role of cannabis expectancies in the context of DACU. In a sample of college students reporting any lifetime cannabis use, Arterberry and colleagues (2013) found that greater negative cannabis expectancies were associated with decreased likelihood of driving while under the influence of cannabis. Conversely, in a community sample of weekly cannabis users, Aston and colleagues (2016) found no association with either negative or positive expectancies and DACU when perceptions of danger and peer approval were included in the model, suggesting that cognitive factors, such as perceived dangerousness and perceived peer approval may be more important predictors of DACU than cannabis expectancies in heavier using samples. These mixed findings highlight the necessity for further research on cannabis expectancies and DACU. The present study aims to add to the research by examining the relationships between cannabis expectancies and DACU in a sample of college cannabis users who have engaged in recent cannabis-impaired driving. Based on previous research, it was hypothesized that stronger negative cannabis expectancies would be significantly associated with a decreased likelihood of DACU. Additionally, the present study examined whether a significant association between negative cannabis expectancies and DACU remains when perceived dangerousness of DACU and perceived driving-related peer approval are included in the model. Based on Aston and colleagues (2016) findings in a sample with similar cannabis use frequencies, it was hypothesized that negative cannabis expectancies would not be associated with decreased likelihood of DACU when perceived dangerousness and perceived peer approval were included in the model.

METHOD

Participants

Participants were 85 undergraduate students from a large public university in the southern United States recruited to participate in a larger intervention study aimed at reducing driving after substance use. Students were eligible to participate in the intervention study if they were at least 18 years old, had access to a motor vehicle, and reported driving after drinking two or more drinks or after using cannabis at least three times in the past three months. All data analyzed in the present manuscript comes from the baseline data of the participants who reported DACU. Participants were 66.7% women, 31.0% men, 1.2% transgender, and 1.2% "other", and 89.4% Caucasian, 8.2% African American, 3.5% Hispanic or Latino, 1.2% American Indian, and the remainder not specifying their ethnicity. Note that percentages do not add to 100% due to option to select multiple choices and "Other" choice for race/ethnicity. The average age of participants was 21.5, $SD = 4.20$.

Measures

Demographics. Participants completed a brief questionnaire regarding age, race/ethnicity, and gender.

Cannabis Use. A modified, brief computer-delivered Timeline Follow-Back (TLFB; Sobell and Sobell, 1992) was used to assess cannabis use during the past 7-days prior to the baseline appointment. Additionally, participants were asked to report the number of days they used cannabis in the past month.

Driving after Cannabis Use. Driving after cannabis use was assessed with a question

adapted from prior studies that asked students how many times they have driven after using cannabis in the past 3 months (Arterberry et al., 2013, 2017).

Perceived Peer Approval and Perceived Dangerousness. Questions assessing perceived peer approval and perceived dangerousness of DACU were adapted from previous studies assessing cognitions about cannabis and driving (McCarthy et al., 2007). Perceived peer approval beliefs related to DACU were assessed by asking participants to indicate "How much do you think a typical college student approves of driving a car after using marijuana?" on a 7-point Likert scale from 1 (strongly disapprove) to 7 (strongly approve). Perceived dangerousness related to DACU was assessed by asking participants to indicate, "How dangerous do you believe it is to drive after marijuana use?" on a 4-point Likert scale from 1 (Not at all dangerous) to 4 (Very dangerous).

Cannabis Expectancies. Cannabis expectancies were assessed using the Marijuana Expectancies Questionnaire-Brief (MEEQ-B; Torrealday et al., 2008). The MEEQ-B consists of 6-items that measure participants' level of agreement with assertions about marijuana's effects and has two subscales: Positive Expectancies and Negative Expectancies (derived from the mean composite score of the 3 corresponding items). Participants rated items on a 5-point Likert Scale from 1 (disagree strongly) to 5 (agree strongly). An example item from the Negative Expectancies subscale is, "Marijuana makes it harder to think and do things (harder to concentrate or understand; slows you down when you move)." An example item from the Positive Expectancies subscale is, "Marijuana helps a person relax and feel less tense (helps you unwind and feel calm)."

Procedures

All procedures were approved by the University Institutional Review Board and participants were assured that all data would be kept anonymous and confidential. Participants were recruited via a mass, university-wide email, the psychology subject pool for research participation, and flyers posted around campus. Interested students were invited to complete a brief screening survey online to determine their eligibility. If eligible, they were invited to enroll in a mobile phone-based brief intervention trial aimed at reducing driving after substance use. Eligible participants completed baseline measures on their mobile phones via a secure web platform. All data used in the present analyses came from the baseline survey prior to intervention delivery.

Data Analysis Plan

Data were examined for outliers using standard scores, with a criterion of $Z = 3.29$ to retain maximum data. No outliers were identified. Alpha was set at .05 for all analyses. Bivariate correlations were examined between cannabis use frequency, the positive and negative cannabis expectancy subscales, frequency of cannabis use in the past month, perceived dangerousness, perceived peer approval and DACU. To examine whether positive and negative expectancies were associated with DACU, a negative binomial regression analysis controlling for frequency of past month cannabis use was utilized with number of times DACU as the dependent variable and the positive and negative expectancy subscales as the independent variables. Negative binomial regression was chosen because our dependent variable, number of times driving after cannabis use, is an overdispersed count variable (i.e., the variance exceeds the mean). Perceived peer approval and dangerousness were then added to the model to determine whether positive and negative cannabis expectancies were associated with DACU above and beyond perceived dangerousness and perceived peer approval.

RESULTS

Descriptive Statistics

On average, participants reported 19.3 days of cannabis use in the past month ($SD = 10.4$). For number of times driving after cannabis use in the past month, 25.9% reported DACU between 1-5 times, 17.6% reported DACU 5-10 times, 23.5% reported DACU 10-20 times, and 32.9% reported DACU 20 or more times.

Associations between DACU, Expectancies, Perceived Peer Norms, and Perceived Dangerousness

Bivariate correlations were examined between cannabis use frequency, cannabis expectancy subscales, perceived dangerousness, perceived peer approval, and DACU (see Table 1). Cannabis use frequency and the negative expectancies subscale were associated with DACU frequency (*r*'s = .54 and -.37, respectively). Notably, positive expectancies of cannabis use were not significantly correlated with driving after cannabis use. Additionally, perceived peer approval and perceived dangerousness were significantly associated with DACU (*r*'s = .32 and -.36, respectively). A negative binomial regression analysis controlling for the frequency of past month cannabis use was run with number of times DACU as the outcome variable and positive and negative expectancy subscales as the predictor variables. Stronger negative expectancies were significantly associated with a decreased likelihood of driving DACU (p = .001). An additional negative binomial model regression including perceived dangerousness and perceived peer approval of DACU revealed that stronger negative expectancies (p = .006), less salient perceptions of peer approval (p = .045), and greater perceived dangerousness of DACU (p = .014), were significantly associated with a decreased likelihood of DACU in the negative binomial regression model. Table 2 contains the results of the negative binomial model.

Table 1. *Correlations between DACU, Expectancy Subscales, Perceived Dangerousness, Perceived Peer Norms, and Cannabis Use Frequency*

Variable	1	2	3	4	5	6
1. DACU	1					
2. Negative Expectancy Subscale	-.37**	1				
3. Positive Expectancy Subscale	-.01	.02	1			
4. Perceived Dangerousness	-.36**	.34**	.23*	1		
5. Perceived Peer Norms	.32**	-.09	-.06	-.25*	1	
6. Cannabis Use Frequency	.54**	-.29**	-.03	-.29**	.28*	1

Note. DACU = driving after cannabis use. *p < .05. **p < .01.

Table 2. Negative Binomial Regression Results for Number of Times DACU Model

Predictor Variable	B	*SE*	CI
Number of times DACU			
MEEQ-B Negative Subscale**	-0.328	.118	[-0.560, -0.096]
MEEQ-B Positive Subscale	0.185	.141	[-0.091, 0.462]
Perceived Dangerousness*	-0.377	.154	[-0.679, -0.075]
Perceived Peer Norms*	0.106	.053	[0.003, 0.208]
Cannabis Use Frequency***	0.047	.008	[0.032, 0.063]
Df	1		

Note. CI = confidence interval *p < .05. **p < .01. ***p < .001

DISCUSSION

The present results suggest that among college students reporting recent DACU, negative expectancies of cannabis use play an important role in the decision to drive after cannabis use. More specifically, the present findings indicate that holding stronger negative expectancies of cannabis use, stronger perceptions of dangerousness of DACU, and less salient perceptions of peer approval of DACU are associated with decreased likelihood of DACU. With the increase in the number of states adopting legalization of recreational and medical cannabis, it is becoming increasingly important to understand the factors that are related to driving after cannabis use in order to reduce this risky behavior.

These results add important information to the mixed findings obtained in previous studies examining expectancies and cognitive factors related to DACU. Similar to results obtained in the present study, Arterberry and colleagues (2013) found that college students that had stronger negative expectancies and stronger perceptions of dangerousness of DACU were less likely to drive while high. Conversely, Aston and colleagues (2016) found that after accounting for perceived peer disapproval and perceived dangerousness, negative expectancies no longer significantly predicted driving after smoking cannabis. Results of the present study suggest that among college cannabis users reporting recent DACU, negative expectancies remain a significant predictor of DACU even when frequency of cannabis use, perceived dangerousness, and perceived peer approval are included in the model.

Though reasons for discrepant findings remain unclear, the target samples may have contributed to differential results. Although participants in Aston and colleagues study had similar DACU frequency, participants were recruited from a community rather than a college student sample. Many universities have implemented drug and alcohol education programs into their freshman orientation itineraries that focus on the potential consequences of misusing drugs and alcohol. Due to the information gained from these programs, college students may be more aware of negative cannabis expectancies compared to individuals in community samples. Additionally, Aston et al. examined the relationship between expectancies and driving after smoking cannabis. Thus, other methods of administration (e.g., vaping, edibles, potables, concentrates, etc.) were not tested. The present study and Arterberry et al. asked more generally about driving while high and driving after cannabis use.

Limitations of the present study include that cannabis use data were collected via retrospective self-reports and may have been subject to biases. Previous research is mixed regarding the accuracy of retrospective self-reports of substance use with some researchers indicating that self-report assessments of substance have been shown to be valid and reliable (Martens et al., 2012), while others indicate that young adults are often inaccurate when estimating how much of a substance they consumed (Williams & Nowatzki, 2005). In the present study we attempted to reduce potential self-reporting biases by reassuring confidentiality and anonymity multiple times throughout the consent process and emphasizing that participants could not get into any trouble for responding truthfully. Future studies should use Ecological Momentary Assessment (EMA) or daily diary reporting to track DACU. Additionally, a lot of nuance is missing when asking only about the number of times someone has driven after using cannabis. This measurement does not account for how much cannabis was used, the timeframe of use, method of administration, type of product, or potency of the cannabis used. Though assessment of cannabis use frequency is a commonly cited issue in the literature (Cuttler & Spradlin, 2017), more of these factors should be included to gain a better estimate of impairment rather than just how many times the behavior has occurred. Lastly, it is speculative to suggest that targeting cannabis expectancies will lead to decreases in DACU. Prospective research is necessary to determine whether changing cannabis expectancies leads to decreases in DACU.

Despite these limitations, this study has public health relevance as it identifies negative cannabis expectancies, perceptions of dangerousness of DACU, and perceptions of peer approval of DACU as potential prevention and intervention targets. Greater public awareness of the negative consequences of cannabis, especially in relation to cannabis' physical and cognitive

effects related to driving ability, needs to be a priority in drug education and prevention services. Many studies have utilized brief interventions (BIs) containing personalized feedback to reduce cannabis use and related problems by identifying and correcting faulty normative beliefs in order to increase motivation to change a problematic substance-related behavior (Halladay et al., 2019). Personalized feedback elements that address negative expectancies of cannabis use, perceived dangerousness of DACU, and perceived peer approval of DACU have the potential to reduce incidences of DACU. Prospective research that examines whether changes in negative expectancies, perceived dangerousness, and perceived peer approval mediate changes in DACU is warranted.

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