# Expectations of How Acute Cannabis Use Affects Gambling Experiences and Behaviors

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## ABSTRACT

Emerging research shows that many individuals commonly consume cannabis while gambling. However, individuals' expectations for how cannabis consumption will impact their gambling behavior remain unknown. Participants who gambled weekly ($N$= 472) were recruited from Amazon Mechanical Turk and completed assessments of gambling behaviors, cannabis consumption, and expectations about the influence of cannabis on gambling. Almost all participants (94%) screened positive for problem gambling. Over half of participants (55%) reported lifetime cannabis consumption, and almost all those participants (99%) reported gambling under the influence of cannabis (GUIC) in the past month. Most participants agreed with positive expectations of gambling; they expected that they would feel calmer when under the influence of cannabis (61.4%), that gambling would be more enjoyable (61.0%), and that their gambling skills would increase when GUIC (60.6%). At the same time, most participants also agreed with negative expectations of GUIC. They expected cannabis use would make them more careless (56.4%), more anxious (54.8%), and less able to concentrate (53.7%) while gambling. Negative cannabis expectancies were significantly associated with the severity of cannabis consumption. Both positive and negative cannabis expectancies were significantly associated with gambling problems and time spent gambling under the influence of cannabis. These findings indicate that expectations may influence the decision to consume cannabis and gamble simultaneously. This study contributes to the need for addressing cannabis expectations during treatment of gambling problems.

**Key words**: = cannabis; cannabis expectancies; acute cannabis use; gambling; problem gambling

Emerging research suggests that cannabis is commonly used while gambling (McPhail et al., 2020; McGrath et al., 2023). Gambling is defined by risking something of value in an event whose outcome is partly defined by chance (Whelan et al., 2007). Over three-quarters (76.9%) of adults report gambling within the past year (Welte et al., 2015). Nearly 50% of those who gamble at least once weekly also reported having used cannabis at least half of the time they gamble (McPhail et al., 2020). This finding is not surprising given that cannabis is the most consumed illicit psychoactive substance in the United States, with 20% of the population reportedly using cannabis within the past year (United Nations, 2020). Individuals' expectations about how cannabis affects their gambling and gambling experience may be associated with engaging in these behaviors simultaneously – a research question that has not yet been examined. The present study explored expectations of acute cannabis consumption on gambling and their relation to gambling behaviors.

Acute cannabis consumption can influence psychomotor behaviors related to regulating behavior while gambling, such as short-term memory, learning, attention, and concentration (Dellazizzo et al., 2022). While under the influence

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of cannabis, individuals often describe feelings of intoxication (Desrosiers et al., 2015; Hart et al., 2001a, 2001b; Morrison et al., 2009a, 2009b). Specifically, those who use cannabis often report a diverse assortment of positive and negative effects, such as relaxation, dizziness, happiness, and feeling withdrawn (Green et al., 2003). These effects inform the perception of acute cannabis consumption while gambling. Not only do these effects influence future use of cannabis and engagement in gambling (Rotter et al., 1972; Bandura, 1977; Jones et al., 2001), but these effects also influence expectations of gambling under the influence of cannabis (GUIC) in a way that may also undermine an individual's engagement in more cautious risk-taking, also known as responsible gambling.

Outcome expectancy theory defines expectancy as the experiences an individual anticipates before engaging in a behavior (Rotter et al., 1972; Bandura, 1977; Jones et al., 2001). Cannabis outcome expectancies classified six areas of cannabis use expectancies: cognitive and behavioral impairment, relaxation and tension reduction, social and sexual facilitation, perceptual and cognitive enhancement, global negative effects, and craving and physical effects (Schafer & Brown, 1991). Broadly, cannabis expectations may be "positive" (relaxation and tension reduction, perceptual and cognitive enhancement, social and sexual facilitation) or "negative" (cognitive and behavioral impairment, global negative effects, craving and physical effects; Anthenien et al., 2021; Kristjansson et al., 2012). Differences in cannabis expectancies have been found consistently between individuals who do and do not consume this drug. Those who do not use cannabis may have more negative expectancies than people who use cannabis (Kristjansson et al., 2012). In contrast, people who use cannabis are more likely to endorse positive expectancies for cannabis use than those who do not use cannabis. Among people who consume cannabis at least three times a week, expectancies are a potential moderator of the relation between frequent use and motivations for use (Anthenien et al., 2021). Expectations such as these may have implications for gambling behaviors.

Research on the acute effects of alcohol consumption on gambling and risk-taking highlights the impact of individuals' expectations about the effect of substance use on gambling. A meta-analysis review revealed that differences in risk-taking are driven by expectations about alcohol rather than the physiological effects of acute alcohol consumption (Horn et al., 2022). To further investigate these expectations, Horn et al. (2023) explored how individuals expect alcohol consumption to influence their gambling behaviors. The authors found that individuals expected alcohol to both positively and negatively influence their gambling. For example, they believed that drinking alcohol would make them more focused while gambling (positive expectation), and they believed that drinking alcohol would make them lose control and gamble carelessly (negative expectation). In the same study, alcohol expectancies were associated with higher scores of alcohol use problems and problem gambling severity. Additionally, positive expectations were associated with higher rates of alcohol consumption while gambling. With the same sample as Horn et al. (2023), this study examines whether similar findings appear among individuals who use cannabis.

Our primary aim was to explore how individuals who gamble frequently expect cannabis to affect their gambling. We also sought to examine how these expectancies aligned with the extant literature on cannabis outcome expectancies by examining the difference in positive and negative expectancies between those who do and do not GUIC. Within individuals who GUIC, we explored whether expectations were associated with measures of cannabis usage and gambling behavior. Finally, the relation between the percentage of time spent GUIC and cannabis expectations was explored.

## METHODS

The same data were used in a previously published study on how participants' expectations of the impacts of alcohol use on gambling were associated with gambling behaviors and problems. However, the current study was distinct in that it examined how participants' expectations of the impacts of cannabis use on gambling were associated with gambling behaviors and problems.

*Participants*

Participants were recruited via Amazon Mechanical Turk (MTurk) and eligible if they were United States residents, at least 18 years old, and self-reported that they gambled at least once per week (the duration of weekly gambling was not specified). The final dataset included 472 individuals with a mean age of 35.37 (*SD* = 10.18). The majority were male (58%), white (95%), heterosexual (67%), married (86%), and held bachelor's degrees or higher (96%). Sample characteristics can be found in Table 1.

Table 1. *Demographic variables of whole sample, non-cannabis use sample, and cannabis use sample*

| Variable | Whole Sample (*N* = 472) | Non-Cannabis Use Subsample (*n* = 213) | Cannabis Use Subsample (*n* = 259) | | |
|---|---|---|---|---|---|
| | *M(SD)* | *M(SD)* | *M(SD)* | *t(df)* | *p* |
| Age | 35.37 (10.18) | 35.3 (10.6) | 35.4 (9.8) | 0.07 (470) | .94 |
| | *n* (%) | *n* (%) | *n* (%) | $\chi^2(df)$ | *p* |
| Race | | | | 2.78(4) | .60 |
| Caucasian | 447 (95) | 204 (96) | 242 (93) | | |
| African American | 9 (2) | 3 (1) | 6 (2) | | |
| Asian American | 8 (2) | 4 (2) | 4 (2) | | |
| Hispanic American | 4 (1) | 1 (1) | 2 (1) | | |
| American Indian or Alaskan Native | 7 (2) | 1(1) | 6(2) | | |
| Gender | | | | 0.51(1) | .48 |
| Male | 273 (58) | 127 (60) | 146 (56) | | |
| Female | 199 (42) | 86 (40) | 113 (44) | | |
| Sexual Orientation | | | | 45.1(4) | <.001 |
| Heterosexual | 317 (67) | 176 (83) | 141 (54) | | |
| Bisexual | 145 (31) | 35 (16) | 110 (43) | | |
| Gay or Lesbian | 8 (2) | 1 (1) | 7 (3) | | |
| Prefer not to say | 1(1) | 1 (1) | 0(0) | | |
| Prefer to self-describe | 1(1) | 0(0) | 1(1) | | |
| Marital Status | | | | 3.87(4) | .425 |
| Married | 406 (86) | 182 (85) | 224 (86) | | |
| Single, Never Married | 46 (10) | 21 (10) | 25 (10) | | |
| Divorced/Separated | 17 (4) | 10 (5) | 7 (3) | | |
| Widowed | 3 (1) | 0 (0) | 3 (1) | | |
| Education | | | | 25.04(7) | <.001 |
| Less than high school | 1 (1) | 0 (0) | 1 (<1) | | |
| High school graduate | 13 (3) | 5 (2) | 8 (3) | | |
| Some college | 3 (1) | 1 (1) | 2 (1) | | |
| Associate Degree | 3(1) | 2(1) | 1(1) | | |
| Bachelor's Degree | 335 (71) | 174 (82) | 161 (62) | | |
| Master's Degree or higher | 117 (25) | 31 (15) | 86 (33) | | |

*Note.* Participants were able to self-identify within multiple categories. There were some missing demographic data. Rows may not sum to total population pool.

*Instruments*

*Demographics.* Participants were asked their age, gender, race/ethnicity, sexual orientation, relationship status, and education.

*Current Gambling Behaviors.* Four items were used to assess current gambling behavior. Items included "How many days per week do you gamble?", "On an average gambling day, how many hours do you typically gamble?", and "On an average gambling day, how much money did you wager?" The fourth question asked for a report of gambling activities they have engaged in over the last 12 months on a 7-point Likert-type scale from Not at all to Daily.

*Cannabis Use.* Four items assessed cannabis use. One item asked, "Have you ever consumed cannabis?" If respondents answered yes, they were asked, "In the past month, how many days did you consume cannabis?" Participants answered with a number between 1 and 30. They were also asked to enter a number between 1 and 100 in answer to the question "In the past month, when you gamble, what percent of the time were you also under the influence of cannabis?" A final question asked, "During a typical session when you gambled under the influence of cannabis, how high are you?" Participants rated their response on a 5-point Likert-type scale from 1 = Not at all high to 5 = Extremely high.

*Cannabis Expectancies While Gambling.* Items were derived from the Alcohol Expectancy Questionnaire (Brown et al., 1987) and the Gamblers' Beliefs Questionnaire (Steenbergh et al., 2002). These items are provided in Table 3. The following was assessed with three items each: perceptual and cognitive enhancement expectancies of cannabis use while gambling, cognitive impairment expectancies of cannabis use while gambling, relaxation and tension reduction expectancies of cannabis use while gambling, and negative expectancies of cannabis use while gambling. Four items assessed expectancies of gambling beliefs with cannabis use while gambling. All items were measured on a 7-point Likert-type scale with ratings from Strongly Disagree and Strongly Agree.

*Cannabis Use Disorder Identification Test-Revised* (CUDIT-R; Adamson et al., 2010). The CUDIT-R is an 8-item screening test that assesses an individual's hazardous cannabis consumption habits over the past six months. Items are rated from 0 to 4 and are summed up to compute a total score with a maximum of 32. Among those who meet the cut-off score of 8, scores are classified as cannabis abuse (8-11) and cannabis dependence (12+; Adamson et al., 2010).

*Problem Gambling Severity Index* (PGSI, Ferris & Wynne, 2001). The PGSI was used to assess participants' gambling behaviors over the past year. This measure contains nine items with responses indicated on a 4-point Likert-type scale, ranging from 0 = Not at all to 3 = Often. Item ratings are summed to yield a maximum score of 27. Individuals are classified as being at high risk for gambling disorder if their score was 8 or greater (Ferris & Wynne, 2001).

*Procedure*

Following IRB approval, those registered as MTurk workers with a successful Human Intelligence Task approval rate of 80% were invited to complete an anonymous questionnaire about gambling behaviors and expectations about how various substances impacted gambling behaviors (Peer et al., 2014). After completing the survey, participants were provided with mental health resources, including phone numbers and websites for mental health and problem gambling services.

*Data Analytic Plan*

The following statistical analyses were conducted using Statistical Package of Social Sciences (SPSS), version 28 (IBM, 2021). Of the 502 who provided consent, 15 did not pass the embedded instructional manipulation checks (Hauser & Schwarz, 2016; Oppenheimer et al., 2009). Eleven were considered outliers on daily money wagered ($3.00 < z < -3.00$), and four provided inconsistent responses. Frequency analyses were used to summarize cannabis consumption behaviors and gambling behaviors of the overall sample.

Using MPlus, version 8 (Muthén & Muthén, 2017), an exploratory factor analysis (EFA) with maximum likelihood estimation and oblique Geomin rotation was conducted on cannabis expectancy items. Parallel analyses (Horn, 1965) – comparing the generated eigenvalues from the actual data to normally distributed random data eigenvalues – and scree plots were used to

determine the number of factors to retain. Items with loadings < 0.32 or loadings across factors ≥ 0.32 were excluded from further analysis (Tabachnick & Fidell, 2007). The EFA was repeated with the remaining set of items. Once the number of factors was determined, composite scores were computed to run further analyses. Factorial analysis was conducted to explore how these cannabis expectancies items aligned with the cannabis expectancies literature. Participants who used cannabis were compared with participants who did not use cannabis on the resulting factors and individual items with independent t-tests to assess how these expectancies fit into the broader literature.

Pearson correlations were used to see whether the level of agreement with each expectancy item was associated with the percentage of time spent consuming cannabis while gambling. Lastly, excluding those who did not consume cannabis, multiple linear regressions were conducted to predict the percentage of time spent GUIC, PGSI score, and CUDIT-R score. Predictors included both positive and negative cannabis expectancies while gambling.

## RESULTS

### *Sample Characteristics*

Participants reported gambling an average of 4.31 days (*SD* = 1.75) per week, spending 10.11 hours per gambling episode (*SD* = 6.20), and spending $413 USD (*SD* = $1,378) per episode. 94% percent (*n* = 444) evidenced problem gambling on the PGSI (*M* = 16.37, *SD* = 5.09). For demographics of the whole sample and those who endorsed cannabis use, see Table 1.

About half the participants (55%, *n* = 259) reported lifetime cannabis use, and 99% of those participants (*n* = 256) endorsed cannabis use in the past month. Only 3 of the 259 (1%) participants who reported cannabis consumption reported not having GUIC. Those who reported lifetime cannabis consumption showed increased risk of problem gambling on the PGSI (*M* = 17.05, *SD* = 4.38) in comparison to those who did not consume cannabis (*M* = 15.52, *SD* = 5.76; *t*(468) = 3.28, *p* = .001). For comparisons of gambling behaviors between those who consume cannabis and those who do not, see Table 2.

Table 2. *Gambling behaviors of those who use cannabis and those who do not*

| | Non-Cannabis Use (*n*=213) | Cannabis Use (*n*=259) | | | |
|---|---|---|---|---|---|
| | *M*(*SD*) | *M*(*SD*) | *t* | *df* | *p* |
| Gambling days per week | 4.21(1.76) | 4.40(1.74) | 1.15 | 470 | .25 |
| Gambling hours per day | 8.54(5.55) | 11.41(6.42) | 5.13 | 470 | <.001** |
| Average dollars gambled | 448.15(1241.30) | 383.41(1483.00) | 0.51 | 470 | .62 |
| PGSI | 15.52(5.76) | 17.05(4.38) | 3.28 | 468 | .001** |
| | *n (%)* | *n (%)* | $\chi^2$ | *df* | *p* |
| No risk | 12(5.6) | 2(0.8) | 13.24 | 3 | .002* |
| Low risk | 7(3.3) | 1(0.4) | | | |
| Moderate risk | 3(1.4) | 3(1.2) | | | |
| High risk | 191(89.7) | 253(97.7) | | | |

*Note.* PGSI = Problem Gambling Severity Index. The reported categories coincide with modified categories on the PGSI identified by Currie et al., (2013). The Chi-square test was conducted with a Fisher's Exact test as some observed cell-groups had a count less than 5. *Denotes significance at $p < .05$. **Denotes significance at $p < .001$.

Those in the subsample of participants reporting cannabis use reported consumption at an average of 14.25 (*SD* = 7.38) days a month. Of those who reported lifetime cannabis use, participants held an average CUDIT-R score of 17.19 (*SD* = 6.57), with 81.4% (*n* = 259) classified as experiencing cannabis dependence. On average, those who endorsed GUIC reported that they were under the influence of cannabis about 48% (*SD* = 26.10) of the time that they gambled in the last month. On a scale of 1-5 describing how high they usually feel, these individuals reported having an average score of 3.37 (*SD* = 1.00).

### *Expectancy Dimensions*

The whole sample was included when examining dimensions of cannabis expectancies in order to understand the relation between these cannabis expectancies and gambling. Results from parallel

analysis and a scree plot suggested a two-factor structure (Horn, 1965). An EFA was then conducted, and two factors were retained. Eigenvalues for these factors were 8.69 and 1.44. The two-factor solution explained 68% of the variance. The first factor, positive expectations, explained 58% of the variance and the second factor, negative expectations, explained 10% of the variance.

Using the factor loadings summarized in Table 3, expectations showed that participants who used cannabis showed stronger positive expectancies ($M$ = 4.68, $SD$ = 1.17) compared to participants who did not use cannabis ($M$ = 3.76, $SD$ = 1.49), $t(397.69) = -7.41$, $p < .001$, $d$ =.70. Those participants who consumed cannabis also showed significantly greater negative expectancies ($M$ = 4.55, $SD$ = 1.34) of cannabis' impact on their gambling behavior compared to those who did not use cannabis ($M$ = 3.83, $SD$ = 1.55), $t(421.07) = -5.35$, $p < .001$, $d$ = -.50.

Table 3. *Exploratory Factor Analysis Factor Loadings*

| Items | *M*(*SD*) | Factor Loadings | |
|---|---|---|---|
| | | I | II |
| I am more focused… | 4.29 (3.20) | **0.824** | -0.130 |
| I feel more confident… | 4.21 (3.14) | **0.874** | -0.101 |
| I am better at gambling… | 4.24 (3.04) | **0.816** | -0.008 |
| It is more enjoyable… | 4.30 (3.02) | **0.836** | -0.027 |
| I cannot concentrate… | 4.25 (3.14) | -0.003 | **0.775** |
| I am not alert… | 4.14 (3.14) | -0.109 | **0.903** |
| I am indecisive… | 4.23 (2.89) | 0.008 | **0.809** |
| I feel calm… | 4.32 (2.94) | **0.763** | 0.046 |
| I am less tense… | 4.22 (3.14) | **0.684** | 0.152 |
| I lose control and become careless… | 4.29 (3.15) | 0.038 | **0.773** |
| I feel anxious… | 4.25 (3.14) | 0.047 | **0.758** |
| I feel more impulsive… | 4.27 (2.78) | **0.571** | 0.276 |
| I win more… | 4.29 (3.18) | **0.704** | 0.142 |
| My skills increase… | 4.33 (2.86) | **0.738** | 0.046 |
| I have more luck… | 4.23 (2.83) | **0.743** | 0.038 |
| I lose less… | 4.22 (3.10) | **0.572** | 0.209 |

*Note.* Bold indicates factor item loaded onto the strongest. I = Positive Expectancy; II = Negative Expectancy. All items are written as "_____ when I gamble under the influence of cannabis" and have been shortened above to simplify presentation. Items are displayed in the order they were presented to participants.

After adopting a Bonferroni correction to control for type 1 error, independent samples t-tests were used to compare individual expectancy items of participants who GUIC and participants who did not. All comparisons were significant (all $p$s < 0.001), with participants who GUIC endorsing all expectancy items more strongly than participants who did not (see Table 4).

### *Expectancies for How Cannabis Affects Gambling*

Frequency analysis showed that over 50% of participants who used cannabis showed some degree of agreement with every expectancy item. Most of the CUDIT-R items had modest positive correlations with both positive and negative expectancy items ($r$s = 0.21-0.28, $p$s < .003; Table 5). All positive expectancy items were endorsed with some degree of agreement by at least 52.1% of the sample. The three most endorsed positive expectancies were "I feel calm when I GUIC" (61.4%), "It is more enjoyable to GUIC" (61.0%), and "My skills increase when I GUIC" (60.6%). Most participants who used cannabis reported some agreement that they were more focused (60.3%) and that they felt they won more (57.5%) when GUIC. All negative expectancy items were endorsed with some degree of agreement by at least 52.5% of the sample. The three most endorsed negative expectancies were "I lose control and become careless when I GUIC" (56.4%), "I feel anxious when I GUIC" (54.8%), and "I cannot concentrate when I GUIC" (53.7%; Figure 1).

The linear regression predicting CUDIT-R score based on positive and negative expectancies was statistically significant, $F(2, 256) = 12.31$, $p < 0.001$, adjusted-$R^2$ = 0.081. Negative cannabis expectancies were significantly associated with a higher CUDIT-R score ($b$ = .17, $p$ = .04), and positive expectancies were not significantly associated with CUDIT-R score ($b$ = .08, $p$ = .08; Table 6).

### *Cannabis Use Expectancies and Problem Gambling*

All expectancy items, positive expectancies, and negative expectancies were positively correlated with PGSI scores ($r$s = 0.22 - 0.43, $p$s < .001; Table 5). The linear regression predicting PGSI score based on expectancies was statistically significant, $F(2, 256) = 31.89$, $p < 0.001$, adjusted-$R^2$ = 0.193. Both positive ($b$ = .06, $p$ = .048) and negative ($b$ = .21, $p$ < .001) cannabis expectancies significantly predicted higher PGSI scores.

Table 4. *Independent samples t-test comparing participants who did and did not GUIC*

| Items | Non-GUIC (*n*=216) | GUIC (*n*=256) | | | |
|---|---|---|---|---|---|
| | *M*(*SD*) | *M*(*SD*) | *t* | *df* | *p* |
| I am more focused… | 3.74 (1.84) | 4.76 (1.61) | 6.36 | 429.87 | <.001 |
| I feel more confident… | 3.65 (1.93) | 4.68 (1.48) | 6.42 | 399.81 | <.001 |
| I am better at gambling… | 3.69 (1.88) | 4.7 (1.47) | 6.46 | 402.69 | <.001 |
| It is more enjoyable… | 3.69 (1.84) | 4.81 (1.47) | 7.17 | 409.53 | <.001 |
| I cannot concentrate… | 3.84 (1.88) | 4.6 (1.6) | 4.67 | 425.09 | <.001 |
| I am not alert… | 3.81 (1.84) | 4.42 (1.67) | 3.76 | 439.71 | <.001 |
| I am indecisive… | 3.79 (1.73) | 4.59 (1.59) | 5.18 | 442.38 | <.001 |
| I feel calm… | 3.79 (1.82) | 4.76 (1.49) | 6.24 | 414.08 | <.001 |
| I am less tense… | 3.61 (1.82) | 4.74 (1.56) | 7.15 | 425.00 | <.001 |
| I lose control and become careless… | 3.85 (1.92) | 4.66 (1.56) | 4.94 | 414.30 | <.001 |
| I feel anxious… | 3.88 (1.84) | 4.57 (1.65) | 4.23 | 436.33 | <.001 |
| I feel more impulsive… | 3.8 (1.71) | 4.67 (1.53) | 5.79 | 435.81 | <.001 |
| I win more… | 3.75 (1.88) | 4.75 (1.56) | 6.27 | 417.95 | <.001 |
| My skills increase… | 3.9 (1.79) | 4.69 (1.51) | 5.11 | 422.15 | <.001 |
| I have more luck… | 3.79 (1.76) | 4.61 (1.52) | 5.38 | 428.93 | <.001 |
| I lose less… | 3.77 (1.81) | 4.6 (1.63) | 5.21 | 436.62 | <.001 |

*Note*. All statements are worded as "_____ when I gamble under the influence of cannabis."

Table 5. *Correlations between cannabis expectancies while gambling and percentage of time spent consuming cannabis while gambling and CUDIT-R and PGSI scores*

| | Time Spent GUIC | CUDIT-R score | PGSI score |
|---|---|---|---|
| I am more focused… | .21** | .23** | .30** |
| I feel more confident… | .19* | .24** | .25** |
| I am better at gambling… | .13 | .18 | .27** |
| It is more enjoyable… | .21** | .19* | .27** |
| I cannot concentrate… | .15 | .21** | .31** |
| I am not alert… | .20* | .19* | .32** |
| I am indecisive… | .18* | .26** | .36** |
| I feel calm… | .20* | .16 | .29** |
| I am less tense… | .19* | .16 | .33** |
| I lose control and become careless… | .26** | .27** | .41** |
| I feel anxious… | .18 | .21** | .39** |
| I feel more impulsive… | .21** | .21** | .32** |
| I win more… | .25** | .23** | .33** |
| My skills increase… | .27** | .17 | .22** |
| I have more luck… | .16 | .25** | .29** |
| I lose less… | .20* | .23** | .35** |
| Positive Expectancies | .27** | .27** | .38** |
| Negative Expectancies | .24** | .28** | .43** |

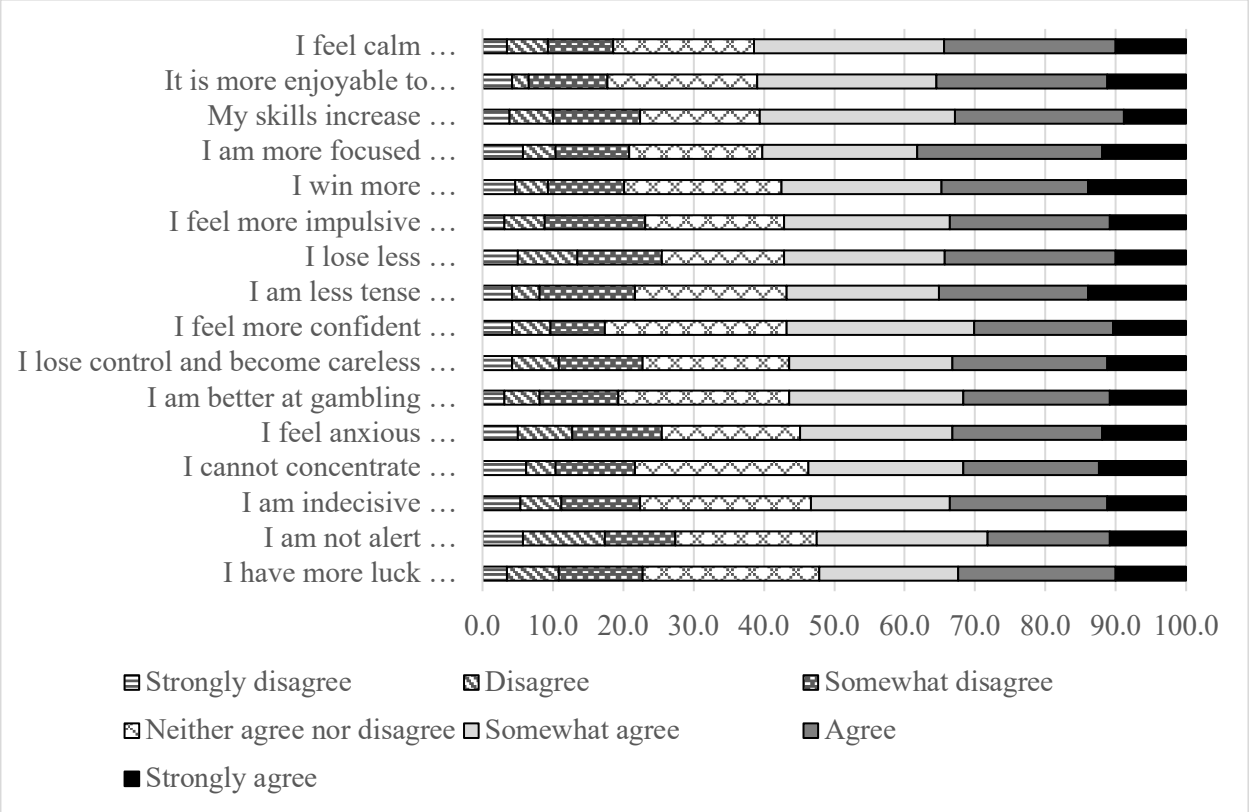
*Note.* All statements are worded as "_____ when I gamble under the influence of cannabis." For all expectancy items, $n = 259$ *Denotes significance at $p < .003$ **Denotes a finding that was significant at $p < .001$. Supplemental tables 1-3 offer the linear regressions predicting PGSI score, CUDIT-R score, and time spent GUIC for individual items.

Table 6. *Linear regressions of positive or negative cannabis expectancies predicting PGSI score, CUDIT-R, and percentage of time using cannabis while gambling*

| | *b* | SE | *p* |
|---|---|---|---|
| *Predicting PGSI Score* | | | |
| Positive cannabis expectancies while gambling | .06 | .03 | .048* |
| Negative cannabis expectancies while gambling | .21 | .05 | <.001** |
| *Predicting CUDIT-R Score* | | | |
| Positive cannabis expectancies while gambling | .08 | .05 | .077 |
| Negative cannabis expectancies while gambling | .17 | .08 | .040* |
| *Predicting percentage of time spent gambling under the influence of cannabis* | | | |
| Positive cannabis expectancies while gambling | .46 | .20 | .021* |
| Negative cannabis expectancies while gambling | .33 | .34 | .333 |

*Note*. Model fits: PGSI: $F(2, 256)=31.89$, $p < .001$ with adjusted $R^2=0.193$. CUDIT-R: $F(2, 256)=12.31$, $p < .001$ with adjusted $R^2=0.081$. Time spent GUIC: $F(2, 255)=10.31$, $p < .001$ with adjusted $R^2=0.068$. *Denotes significance at $p < .05$ **Denotes a finding that was significant at $p < .001$. The individual items that comprised each variable in the model are presented in Tables 4 and 5.

Figure 1. *Participants' percent agreement with expectations regarding how cannabis impacted gambling behavior*




*Note.* All items are written as "_____ when I gamble under the influence of cannabis" and have been shortened above to simplify presentation. The order of questions is presented as mostly likely to agree to least likely to agree rather than the order of presentation to participants.

*Cannabis Use Expectancies and Time GUIC*

Most negative and positive cannabis expectation items (62%) were modestly and positively correlated with GUIC ($r$s = 0.21-0.27, $p$s < .003; Table 5). The linear regression predicting the percentage of time spent GUIC was statistically significant, $F(2, 255) = 10.31$, $p < 0.001$, adjusted-$R^2 = 0.068$. Positive cannabis expectancies significantly predicted a higher percentage of time spent GUIC ($b = .46$ $p = .021$), and negative expectancies were not significantly associated ($b = .33$, $p = .333$; Table 6).

## DISCUSSION

Given the reported co-occurrence of gambling and cannabis consumption, this study aimed to examine individuals' expectations of the effect of cannabis consumption on gambling. Cannabis expectancy theory (Anthenien et al., 2021; Kristjansson et al., 2012; Schafer & Brown, 1991) indicates that peoples' experience with cannabis will inform what outcomes they expect will follow consumption. In this sample of participants who almost all screened positive for problem gambling, who on average gambled four days per week, "positive" and "negative" dimensions underlie individuals' reported cannabis expectancies. Six areas of cannabis expectancies have been identified within the literature (Schafer & Brown, 1991). Consistent with the broader cannabis expectancy literature, this two-factor structure of positive and negative expectations broadly categorizes the six areas into positive and negative expectancies. Positive expectations include relaxation and tension reduction, perceptual and cognitive enhancement, and social and sexual facilitation. Negative expectations include cognitive and behavioral impairment, global negative effects, and craving and physical effects (Anthenien et al., 2021; Kristjansson et al., 2012) Both positive and negative expectations have implications for gambling behaviors, experiences, and performances.

Those who used cannabis held stronger positive cannabis expectations than those who did not use cannabis. In contrast to previous findings, participants who used cannabis also held significantly stronger negative expectancies than participants who did not use cannabis. When the expectancy results were examined on an item level, those who used cannabis endorsed significantly stronger agreement with all cannabis and gambling expectancies than participants who did not use cannabis, with no significant difference found in the proportion of participants endorsing positive or negative expectancy items. There are several possible explanations for this unique finding. First, the current sample predominately reported clinically significant levels of both cannabis use and gambling harms. Approximately 94% were identified as at high risk for gambling disorder, and 81.4% of those participants were classified as experiencing cannabis dependence. Prior research into cannabis expectancies has primarily focused on non-clinical samples, resulting in a call for more research into expectancies in individuals with more severe cannabis usage (Anthenien et al., 2021). The clinical nature of this sample may not reflect the general population of those who gamble or consume cannabis recreationally. However, the current sample reveals a strength of this dataset as it provides greater insight into the experiences of individuals with both cannabis use disorder and gambling disorder – a group that would benefit from greater attention to help develop responsible gambling policies and treatment protocols (McGrath et al., 2023; McPhail et al., 2020).

Another reason why the current findings may differ from the findings of previous research is methodological differences. This study prioritized examining a range of cannabis expectancies as they relate to gambling. For this reason, we elected to use items from the Alcohol Expectancy Questionnaire (Brown et al., 1987) and the Gamblers' Beliefs Questionnaire (Steenbergh et al., 2002), although the majority of cannabis expectancy literature uses the Marijuana Effect Expectancy Questionnaire (MEEQ), either in its original (Schafer & Brown, 1991) or brief form (Torrealday et al., 2008). Although both methodological approaches capture both positive and negative expectations of cannabis use, our selected approach prohibited us from assessing the "craving and physical effects" domain of items on the MEEQ. Instead, our approach prioritized the following domains of cannabis use expectancies: cognitive and behavioral impairment, relaxation and tension reduction, perceptual and cognitive enhancement, and global negative effects (Schafer & Brown, 1991). Future studies should seek to understand how the craving and physical effects items relate to gambling behaviors.

Consistent with the research on cannabis expectancies, participants who used cannabis reported a mixture of positive and negative cannabis expectancies, with all items endorsed by 50-62% of the sample (Anthenien et al., 2021; Kristjansson et al., 2012). Among the expectancy items, the top five most endorsed items overall were positive expectancies. While GUIC, individuals reported feeling calmer (61.4%), finding gambling more enjoyable (61.0%), believing that their skills increased (60.6%),

feeling more focused (60.2%), and feeling that they won more (57.5%). The three most endorsed negative expectancies were "I lose control and become careless when I GUIC" (56.4%), "I feel anxious when I GUIC" (54.8%), and "I cannot concentrate when I GUIC" (53.7%). Increases in negative cannabis expectancy effects predicted an increased CUDIT-R score. This finding could reflect greater awareness of the negative impacts of cannabis use generally among the individuals with increased problems, especially when engaging in a specific task. Increases in both positive and negative cannabis expectancies were significantly associated with increased gambling problems. As the participants showed both positive and negative expectations of cannabis consumption on gambling, these findings indicate that individuals do not have extreme unidirectional expectations about cannabis consumption. Because of this, these findings are novel in that they are the first to identify the specific expectations (both positive and negative) about the effect of cannabis consumption on gambling behavior. This warrants future examination, as these findings may reflect a broader relation between cannabis attitudes generally and increased gambling behavior or may be indicative of a missing moderating variable (e.g., whether cannabis expectancies motivate cannabis use while gambling), as suggested by Anthenien and colleagues (2021).

Stronger positive cannabis expectancies were associated with an increased proportion of time spent gambling under the influence of cannabis. This is in line with the broader expectancy theory that an individual is more likely to engage in an activity that they believe will have a positive outcome. However, this finding also highlights the importance of assessing how an individual who GUIC believes that cannabis affects their gambling behavior, as increased percentages of time spent GUIC have been associated with greater gambling problems (McPhail et al., 2020). The implication for clinicians is the assessment for cannabis use when seeing an individual for gambling disorder, and visa-versa. The belief that using cannabis while gambling increases luck or gambling ability is particularly problematic and could produce an overall increase in both problematic gambling and cannabis use. There is currently no research on how to best treat individuals with a gambling disorder and comorbid cannabis use disorder (Dowling et al., 2016; Pfund et al., 2023). The current study stresses the importance of developing more effective regulations and treatments for this population.

A potential limitation of this study was the use of a convenience crowdsourced sample. Consistent with our sample, MTurk samples have been found younger, less employed, and more politically liberal than the general United States population (Goodman & Paolacci, 2017). Although MTurk samples have been increasingly prominent within psychological research, they have also shown an increase of low-quality data (Chmielewski & Kucker, 2020). Researchers have noted MTurk samples have been at risk for noise from bad data and bots; this risk may be exacerbated by the length and nature of the research task (Webb & Tangney, 2022). At the same time, research has found that MTurk may be useful and appropriate for collecting samples of individuals who gamble frequently and who consume cannabis (Kim & Hodgins, 2017). The national spread of the MTurk sample is additionally appropriate to gauge cannabis consumption since the legalization status of cannabis across different states has not been associated with cannabis consumption behaviors (McPhail et al., 2024). The current study was also limited in that expectations of cannabis on gambling did not explore types of cannabis ingestion such as dabbing, vaping, smoking, or edible consumption. For example, emerging adults perceive dabbing and vaping cannabis as conferring more risk than smoking cannabis occasionally (Florimbio et al., 2023). Depending on their methods of cannabis ingestion, participants may carry different expectations of how cannabis influences their gambling. Finally, the sample of the study was limited to participants screening positive for cannabis dependence who held a mixture of positive and negative expectations. Consistent with other literature, individuals with cannabis dependence hold both positive and negative expectations (Connor et al., 2011; Schafer & Brown, 1991). However, future research is needed to understand whether individuals without cannabis dependence hold both positive and negative expectations and whether the associations among expectations, cannabis problems, gambling problems, and gambling

behavior replicate in samples without cannabis dependence.

In conclusion, this study provided a potential explanation for why some individuals might use cannabis and gamble simultaneously – they expected that GUIC made gambling more enjoyable, helped them focus while gambling, feel calmer, and have greater skills. At the same time, this study provided a potential explanation for why some individuals might not use cannabis and gamble simultaneously – they expected that GUIC made them more careless, anxious, and unfocused. Together, these findings further highlight the importance of how individuals expect substance use to influence their gambling behavior, as negative expectations were associated with higher cannabis severity, and both positive and negative expectancies were associated with greater problem gambling severity. Future research is needed to understand how individuals expect cannabis to influence gambling and how such information might inform treatments for cannabis and gambling behaviors.

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