Impulsivity, Mood, and Unplanned Alcohol and Cannabis Use in Young Adults: An Ecological Momentary Assessment Study

NICOLLE FOX

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Abstract

Rates of alcohol and cannabis use are highest among Canada's young people. Unplanned substance use among young adults is associated with heavier use and greater harms than planned use. Although previous research has found associations between mood and alcohol use, there has been less research on the role of mood in *unplanned use.* This study examined daily associations between mood and unplanned alcohol and cannabis use and explored the role of impulsivity in this relationship. Data came from a 21-day ecological momentary assessment (EMA) study, in which young adults, aged 19-25, completed daily surveys assessing intentions for use, and previous day substance use, as well as randomly timed surveys capturing momentary mood states. Impulsive personality traits were assessed at baseline through the UPPS-P Impulsive Behaviour Scale. Multilevel models showed significant daily-level relationships of increased positive mood and decreased negative mood with greater likelihood of unplanned vs. planned drinking. Several impulsive traits weakened the association between mood and unplanned alcohol use, such that high impulsivity appeared to reduce the impact that daily increases in positive mood and decreases in negative mood had on likelihood of unplanned alcohol use. An exception to that was lack of premeditation and perseverance, which strengthened the relationship between daily changes in positive mood and unplanned drinking. Boredom had a nuanced relationship with unplanned use, and impulsivity also appeared to weaken the association between boredom and unplanned drinking. Increases in boredom were associated with a decreased likelihood of unplanned cannabis use at the day level; however, impulsivity did not moderate associations between mood and unplanned cannabis use. These findings can help inform harm reduction interventions targeting unplanned substance use in a young adult population, given the prevalence and concurrent risks associated with unplanned alcohol and cannabis use.

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Introduction

Alcohol and Cannabis use in Young Adults

In Canada, young adults (18-24 years) have the highest rates of substance use (Canadian Alcohol and Drugs Survey, 2019). Some reports estimate that alcohol is used by almost 80 percent of young people, designating it as the most widely used substance, followed by cannabis (Public Health Agency of Canada, 2018). In 2019, almost 50 percent of young adults in Canada reported using cannabis within the previous year (Canadian Alcohol and Drugs Survey, 2019) and in the United States, it's been estimated that 8.1 million young adults use cannabis daily (SAMHSA, 2017). Further, many young adults who use alcohol also use cannabis (Bravo et al., 2021; D'Amico et al., 2020; Karoly, 2020; Yurasek, et al., 2017). Some studies have found simultaneous use of alcohol and cannabis to be prevalent for young adults (Bravo et al., 2021; Lee et al., 2022; Patrick et al., 2018). In fact, one study found that over 70 percent of young adults had engaged in both alcohol and cannabis use simultaneously in the past year (White et al., 2019). Often co-use involves heavier substance use and more substance-related harm at both the event level and the daily level (Coughlin et al., 2022; Patrick et al., 2018; Thompson et al., 2021). For young people, both alcohol and cannabis use are associated with poor mental health, risk of substance use disorder (SUD), and adverse academic outcomes (Aderibigbe et al., 2022; Turner et al. 2017). Continuing substance use beyond young adulthood is associated with decreased work productivity, and increased sexually transmitted infections, primary care utilization, motor vehicle accidents, and drug overdoses (Aderibige et al., 2022; Turner et al. 2017).

Given the detrimental impact of these consequences, understanding why young people choose to engage in alcohol and cannabis use is important. The shift from adolescence to

adulthood has, over the years, come to involve more time spent exploring identities, focusing on self, and experiencing newfound freedoms (Arnett, 2005). Given the developmental stage, young adults often engage in substance use out of curiosity and increased access (i.e., becoming "legal age"), but may also use substances to gain reprieve from some of the discomfort that comes with this identity exploration. Further, the increasing amount of time spent with peers, and greater peer involvement in substance use in this age group, is thought to be a major factor explaining why young adults engage in heavier substance use (Arnett, 2005). The literature on young adult substance use is made up of many theories involving biological, social, and environmental considerations. One theory that allows a more in-depth understanding of why specific behaviours, such as using a substance, are executed is the Theory of Planned Behaviour.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) suggests that behavioural intentions are strong predictors of future behaviour (Ajzen, 2011). One feature of this theory is the proximal determinant of behaviour, which suggests that the stronger the intention, the more likely it is that the behaviour will be carried out (Ajzen, 2020). Given that many barriers can arise and interfere with planned behaviours (i.e., lack of money), there is also a component of control such that managing these barriers will impact whether the behaviour is executed (Ajzen, 2020). Other features of TPB involve determinants of intentions, such as thoughts, beliefs, and attitudes towards the behaviours. Further, several factors (such as emotion) can influence the strength of the intention-behaviour correlation (Ajzen, 2011), and thus contribute to planned or unplanned behaviour.

A variety of studies have investigated the application of TPB to understand alcohol use specifically and found that alcohol use intention and consumption were strongly intercorrelated

(Fairlie et al., 2021). One meta-analysis concluded that attitudes tend to have the strongest association with intention, and intention to use is the strongest predictor of alcohol use for both adult and youth populations (Cooke et al., 2016). Similarly, intention to use cannabis has been associated with actual cannabis use through aspects of TPB (i.e., attitudes towards marijuana use or behavioural intentions to use marijuana) (Jalilian, et al., 2020; Lac, 2009; Malmberga et al., 2012). Although TPB suggests a strong correspondence between intention to use substances and actual substance use behaviour, there may be times that intentions and use behaviour do not correspond. For example, someone might use even if they had intended *not* to use (i.e., *unplanned use*). Moreover, there may be other factors, such as emotional state, that influence the intention-behaviour relationship, and can lead to unplanned substance use.

Unplanned substance use

Unplanned substance use is common among young adults and is associated with heavier substance use and greater harms than planned substance use (Emery, 2020; Leeman et al., 2012; 2014, Wardell et al., 2015). In 2013, Pearson and Henson proposed the Model of Unplanned Drinking Behaviour and found that unplanned drinking predicted alcohol-related problems after controlling for both frequency and quantity of alcohol use. This is congruent with research suggesting that unplanned substance use may be an indicator of impaired control over substance use (Emery, 2020). Impaired control refers to an inability to abstain from, or limit, substance consumption (Emery et al., 2020; Wardell et al., 2016). Impaired control over alcohol has been investigated in young adults and is often associated with heavy drinking and increased problems related to alcohol (Wardell et al., 2016). Thus, unplanned substance use may be an indicator of difficulty controlling substance use, which is known to play a role in substance-related problems.

Most research on unplanned substance use has been cross sectional in design. More recently, there has been increased application of Ecological Momentary Assessment (EMA) – that is, using mobile surveys to assess substance use and intentions as they occur in the real world – to examine within-person processes in the intention-behaviour relationship. However, results of EMA studies have yielded some discrepancies with the predictions of the Model of Unplanned Drinking Behaviour. For example, Stevens et al. (2022) used EMA methods to explore motives and contexts for planned and unplanned drinking, as well as outcomes and consequences associated with each. Unplanned drinking was associated with coping motives and drinking alone or at home, but also with *less* alcohol consumption and consequences, contrary to the Model of Unplanned Drinking. Another study explored event-level alcohol-related consequences when drinking was planned/unplanned in a university-aged sample and found that when drinking was unplanned, *less* alcohol was ingested in comparison to when the drinking was planned (Lauher et al., 2020). Similarly, unplanned drinking was also associated with *less* negative alcohol-related consequences, contrary to the Model of Unplanned Drinking. Other event-level and daily diary studies have found similar results (Hamilton et al., 2021; Lauger et al., 2020).

Most research on unplanned substance use has been specific to alcohol with less focus placed on unplanned use of cannabis (Emery et al., 2020; Leeman et al., 2012). In one exception, Emery et al. (2020) explored factors related to unplanned cannabis use in adolescents and young adults (aged 15 to 24) using EMA methods and found that they were more likely to use cannabis on planned versus unplanned days and when they were with friends who also use cannabis. They also explored whether negative or positive emotional states had an impact; however, this did not appear to uniquely contribute to the prediction of unplanned use. Another study by Fairlie et al.

(2021) investigated planned and unplanned simultaneous use of alcohol and cannabis in a sample of young adults (aged 18 to 25). Consistent with TPB, they found that the participants' intention to engage in simultaneous use was a strong predictor of using both alcohol and cannabis. Overall, unplanned alcohol and cannabis use is a risk factor for problems in young adults, but the mixed findings for alcohol and limited research for cannabis suggest more research is needed on the factors associated with unplanned alcohol and cannabis use among co-users.

Mood

Mood could be a factor that contributes to unplanned substance use. Both positive and negative mood are often recognized as relevant when examining substance use behaviours in young adults (Bravo et al. 2020; Swendsen et al., 2000; Turner et al., 2018). According to the self-medication hypothesis, one of the motivating factors for alcohol and cannabis use is to manage mood symptoms (Khantzian, 1985; Swendsen et al., 2000), which is believed to be a factor contributing to the high rates of substance use disorders (Turner et al., 2018). On the other hand, positive affect has also been connected to drinking, with studies applying motivational theory finding strong enhancement motivations to drink (Cooper, 1994; Gautreau et al., 2015). Drinking to enhance positive emotions versus to cope with negative emotions (Gautreau et al., 2015) both suggest emotions contribute to the decision to drink.

Although the consensus among researchers is that both positive and negative affect are associated with alcohol and cannabis use patterns for young adults (Emery, 2020; Patrick et al., 2016; Webb et al., 2020), there are many confounding variables that vary for each individual and tend to complicate our understanding of these relationships. For example, the literature recognizes that people who experience regular depression symptoms tend to drink more alcohol in comparison to those who do not (Lai et al., 2015; Rush et al., 2008). What remains unclear is

whether those same people who experience regular depression symptoms tend to drink more or less alcohol during periods when they feel relatively better or worse than normal (Kessel, 2010; Mohr et al., 2010). What impact, if any, does a deviation from ones' typical mood state have on one's alcohol and cannabis use? This question reveals the importance of within-person analyses.

Using EMA, researchers have been able to examine, at an episodic level, within-person relationships between mood and substance use behaviours (Mohr et al., 2010; O'Hara, Armeli & Tennen, 2014). One study found that drinking was higher and closer in proximity to the days in which more negative affect was reported in a group of college students (O'Hara et al., 2014). Swendsen et al. (2000) found an association between negative affect, specifically nervousness, and increased alcohol use (within the same day). Another study found that hostility, nervousness, and guilt due to drinking more than intended during the previous 24 hours predicted more next-day drinking in young adults (Mohr et al., 2010). Further, guilt has been positively associated with more alcohol problems at the daily level (Bilevicius et al., 2021), and negative affect has also been associated with drinking alone and in isolation rather than with others at a daily level (Mohr et al., 2010). EMA research has also found associations between positive mood and alcohol use (De Leon et al., 2020; Dvorak et al., 2014; Simons et al., 2005). Dvorak and Simons (2014) found a strong positive association between positive mood on a given day and both the likelihood of drinking and intoxication level on the same day. Other studies also found that on drinking days, positive mood was higher (De Leon et al., 2020; Peacock et al., 2015).

The relationships between mood and cannabis use have also been explored using EMA (Denson et al., 2023). Like alcohol, enhancement of positive emotions is thought to be a large motivator for cannabis use (Matheson et al., 2020). One study found a positive relationship between high positive affect and intention to use cannabis in the next 24 hours for a sample of

college-aged individuals (Matheson et al., 2020). The same study found that lower negative affect also predicted intention to use cannabis in the following 24 hours. Another study found that positive affect was greater on days in which cannabis use was reported in comparison to days in which no use was reported (Buckner et al. 2015). On the other hand, there are also studies that have found a positive association between negative affect (specifically anger/hostility) and cannabis use (Wycoff et al., 2018). There are, however, relatively fewer EMA studies exploring mood and cannabis use in comparison to alcohol use.

Given what is known about the effects of mood on alcohol and cannabis use patterns at the daily level in young adults, it is also important to understand how mood may contribute to *unplanned* versus planned substance use. Emery (2020) investigated whether positive or negative internal states impacted planned or unplanned cannabis use at the daily level and found that there was no unique predictability. However, there was a relationship between positive mood and increased use during days where use was planned. Similarly, Fairlie et al. (2019) explored planned versus unplanned simultaneous use of alcohol and cannabis and found that those with higher average positive mood were less likely to engage in heavy unplanned drinking. However, there were no significant associations between average negative mood and unplanned heavy drinking, and no daily-level effects for either positive or negative mood were observed.

Thus, there appears to be some associations between mood and planned/unplanned substance use at the daily level (Dvorak et al., 2014); however, findings are somewhat mixed and tend to focus on unplanned alcohol rather than unplanned cannabis use. Therefore, research on moderators of the daily association between mood and unplanned substance use may provide additional insight into this link. One such moderator may be impulsive personality traits.

Impulsive Traits

Impulsivity is understood to be a risk factor for alcohol use, especially among young adults (Coskunpinar et al., 2013; Herman & Duka, 2019). However, different sub-traits have been identified within impulsivity. For example, the UPPS Impulsive Behavior Scale (UPPS) includes positive and negative urgency, sensation seeking, (lack of) premeditation, and (lack of) perseverance (Whiteside & Lynam, 2001). Positive and negative urgency refer to acting rashly or without thoughtfulness while experiencing heightened positive or negative emotionality, respectively (Billieux, et al., 2021; Cyders & Smith, 2008; Wardell et al., 2015). Sensation seeking is defined as the tendency to seek out new and exciting things (sensations), lack of premeditation or planning is a tendency to not think through actions or to not plan, and lack of perseverance is the tendency to not finish tasks (Coskunpinar et al., 2013). There is strong theoretical support for the positive relationships between substance use and impulsivity in young adults (Dawe & Loxton, 2004; Moreno et al., 2012; VanderVeen et al., 2016; Wardell et al., 2016). Impulsive traits have also been identified as meditators between contextual influences, for example childhood maltreatment, and substance related consequences (Wardell et al., 2016). Still, associations tend to be strongest for urgency (Coskunpinar et al., 2013).

The ability to cope with both positive and negative mood states may vary; some may cope well, while others may act impulsively. Emotion-related personality traits, especially positive and negative urgency, are commonly elevated among individuals with substance use issues (Pearson & Henson, 2013; Wardell, et al., 2016). Given that urgency is a mood-related construct, it may be especially relevant as a moderator of the effects of mood on substance use. Although there is literature exploring associations between urgency and cannabis use (Robinson et al., 2014; Um et al., 2019; Wardell et al., 2016), most of the research on urgency and substance use is related to alcohol use and problems (Cyders & Smith, 2007; Gonzalez et al.,

2011; Pearson & Henson et al., 2013). While the relationship between urgency and increased substance use has been well established (Wardell et al., 2016; for review, see Coskunpinar et al., 2013), one area of fragmented understanding is how urgency may interact with mood in predicting substance use. More specifically, how positive and negative affect experienced in the moment contribute to *unplanned* alcohol and cannabis use among young adults could differ for those who are high vs. low on trait positive and negative urgency. For example, individuals who are higher in negative urgency may respond impulsively when experiencing a heightened negative mood. Similarly, those higher in positive urgency may respond impulsively when experiencing a heighted positive mood. This may increase the likelihood that these mood states will lead to unplanned substance use for these individuals. However, this moderating role of urgency has not yet been explored in EMA studies of the link between mood and unplanned substance use.

In sum, unplanned drinking and cannabis use are associated with higher risk for negative consequences among young adults. Both positive and negative mood appear to have an impact on substance use, although findings are mixed for the relationship between mood and *unplanned* use, specifically. Although positive and negative mood might not lead to unplanned use for everyone, those high in positive or negative urgency have more difficulty controlling substance use behaviours in these mood states. Consequently, this lack of control could lead to unplanned substance use, suggesting that the link between mood and unplanned use may be stronger for those with greater urgency. This has yet to be examined and is the focus of the current study.

Current Study

This study aimed to examine whether positive and negative mood increase the risk of unplanned alcohol and cannabis use, and whether this relationship is stronger for those with

greater trait positive and negative urgency. This study used data from an EMA study that assessed intended use, actual use, and mood over a 21-day period. EMA allows participants to report both mood and behaviours in real time, allowing a comparison between intentions to use and actual use at the daily level. Given the prospective nature of an intention, EMA provided the ability to reduce bias that is inherent in retrospectively reporting on intentions after the fact. Further, mood is dynamic and may fluctuate day to day, and thus EMA provided the ability to observe the role of mood in unplanned use at the daily level.

The following hypotheses were forwarded:

1. Within-person increases in positive or negative mood will predict unplanned alcohol and cannabis use at the daily level. Unplanned use will be defined in two ways: 1) the participant reports any use on a day when their intention was to abstain, and 2) the participant reports using more than the maximum amount they intended to use on a given day.

2. Negative and positive urgency will strengthen the daily-level relationships between negative and positive mood, respectively, and unplanned alcohol and cannabis use.

3. As an exploratory aim, other impulsivity traits were examined as moderators as well, specifically sensation seeking, (lack of) premeditation and (lack of) perseverance.

Method

Participants and Recruitment

Participants included 155 young adults (19–25-years-old) residing in Ontario who were recruited for a larger Ecological Momentary Assessment (EMA) study examining the outcomes of alcohol and cannabis use among young adults who use both substances. Two participants were dropped because they did not complete the study resulting in a total of 153 participants included, with a mean age of 22.08 (*SD* = 2.10). Most of the participants identified as female (59.4%), with

the remaining participants identifying as male (38.1%), non-binary (3.2%) and transgender (1.3%), and a majority identified as White/Caucasian (61.9 %). Most participants were employed part time (41.9%), had never been married (86.5%), did not have children (99.4%), and had a household income of less than $50,000 (52.9%). See Table 1 for detailed demographic information.

Participants had an average score of 8.07 (*SD* = 4.70) on the Alcohol Use Disorders Identification Test (AUDIT), which suggests borderline hazardous or harmful alcohol consumption (indicated by a score > 8 on the AUDIT; Saunders et al, 19931), and an average score of 9.94 (*SD* = 5.62) on the Cannabis Use Disorder Identification Test – Revised (CUDIT-R), indicating a majority of participants did fall within hazardous cannabis use range (indicated by a score of 8-12 on the CUDIT-R, Adamson et al., 2010). The average scores on the Depression Anxiety Stress Scales (DASS) subscales, all fell within a non-clinical range, depression (M= 4.12 *SD* = 4.07), anxiety (M= 4.27 *SD* = 3.15) and stress (M= 5.26 *SD* = 3.60).

Participants were recruited using paid and free online advertisements (social networking sites, Google ads, online classifieds), as well as posters on York and other University campuses and public spaces in the community. All advertisements included either contact information for the lab or a direct link to the eligibility screening survey. All potential participants who were interested in the study completed an online screening survey to determine eligibility for the larger study from which data were drawn. The screening survey included study information and described the purpose of the screening survey. For the parent study, participants who were between 19 and 25 years, drank alcohol and used cannabis at least once per week on average in the past month, and used alcohol and cannabis at the same time at least twice in the past month were deemed eligible. Participants also had to own a smartphone (Android or iOS) and be

willing to use the smartphone for data collection purposes during the study in order to participate.

Exclusion criteria for the parent study included: regular (monthly) use of substances other than cannabis and alcohol (except tobacco), reporting use of cannabis exclusively for medical reasons, current treatment for (or current efforts to reduce) cannabis or alcohol use, or having been diagnosed with a severe mental illness (e.g., psychosis, mania) or neurodevelopmental disorder. Particpants were also excluded if they were unable to complete study measures in English.

Eligible participants were contacted via email to schedule an appointment for a baseline assessment with a research assistant (conducted in-person prior to the COVID pandemic and via videoconferencing during the pandemic).

Procedures

Baseline assessment. The baseline interview took approximately 2.0 to 2.5 hours to complete. The baseline interview began by obtaining informed consent and providing the participant an opportunity to ask any questions about the process or study. Participants were instructed to download an EMA app onto their smartphones (MetricWire, Inc., Waterloo, ON) and were provided with an orientation to the EMA procedure. At the end of the baseline interview, participants were asked to complete self-report measures administered via an online survey, including demographic, clinical, and individual difference measures. The EMA period began the day following the baseline assessment. Participants were provided a $40 gift card for participating in the baseline session, then $45-$115 for their EMA participation (as bonuses were provided for higher compliance rates).

EMA assessments. Participants were asked to complete multiple brief EMA surveys assessing their substance use behaviours, both alcohol and cannabis, for 21 days. Previous day's

use of alcohol and cannabis was assessed with a *Daily Morning survey*, which participants were prompted to complete each morning at 7am. They were sent several reminder notifications to complete the survey and were able to complete the survey until 1pm, after which time it became unavailable and was considered a missed survey. The daily morning survey also asked participants to indicate if they plan to use cannabis or alcohol over the next 24 hours, and if so, the maximum amount they intend to use. Unplanned use was derived by calculating the discrepancy between intended use and actual use (reported the next morning; see Data Analytic Strategy for details). Participants also received notifications to complete two brief *Random* surveys each day that appeared at random times within a 5-hour window between 1-6pm and 6-11pm. Current mood states were captured on random surveys. Daily positive mood and negative mood scores were derived by averaging mood reports within each day across the 2 random surveys administered each day.

Measures

Baseline Measures

Demographics. A variety of demographic information was collected including information regarding gender and birth sex, race/ethnicity, living situation, marital status, education, employment, and household income.

Impulsive Traits. The UPPS-P Impulsive Behavior Scale (Lynam et al, 2006), a 59 item self-report scale with responses ranging from 1 (agree strongly) to 4 (disagree strongly), is designed to measure five sub-facets of trait impulsivity: sensation seeking consisting of 12 items ($\alpha = .84$), (lack of) premeditation consisting of 11 items ($\alpha = .76$), (lack of) perseverance consisting of 10 items ($\alpha = .62$), positive urgency consisting of 12 items ($\alpha = .93$), and negative

urgency consisting of 12 items (α = .81). Each subscale was scored by averaging the items in the scale for the analysis. See Appendix A for items.

Hazardous Substance Use. The baseline survey also included both the Alcohol Use Disorders Identification Test (AUDIT) and Cannabis Use Disorders Identification Test – Revised (CUDIT-R). The AUDIT is a 10-item brief assessment used to assess consumption, behaviours and consequences related to alcohol use (Saunders et al, 19931) (see Appendix B). A score of 8 or more indicated hazardous alcohol use. The CUDIT-R is an 8-item assessment based on the AUDIT to assess consumption, behaviour and consequences related to cannabis use (Adamson et al., 2010) (see Appendix C). A score of 8 or more indicated hazardous cannabis use and 13 or above indicated possible cannabis use disorder. Both the AUDIT and CUDIT-R were administered to characterize the participants.

EMA Measures

Daily Substance Use. Participants were asked "Did you use any of the following yesterday? (between the time you woke up and the time you went to sleep yesterday)". They were provided multiple choice options that included *Alcohol, Cannabis, Tobacco/Nicotine, Other drug or None of the above.* If alcohol use was reported, participants were also asked, "How many **total** standard drinks did you consume yesterday?" If participants reported using cannabis, they were asked "What form(s) of cannabis did you use yesterday? (check all that apply)". If cannabis flower (i.e., marijuana) was endorsed, they were then asked "How much **total** marijuana did you personally use yesterday (not including concentrates and edibles) in grams?" This was displayed in a dropdown menu that they used to report grams used ranging from *less than 1/8 of a gram (0.125 g)* to *more than 14 grams (more than 1/2 ounce)* (See Appendix D for EMA items).

Surveys also included links to visual examples to help participants report accurate quanities of cannabis in grams and alcohol in standard drinks (see Appendix E).

Intentions to Use Substances. Intention to use alcohol or cannabis within the next 24 hours was also included on the daily morning survey. Participants were asked, "Do you PLAN to consume any alcohol today/tonight?" If they indicated yes, they were asked, "What is the MAXIMUM number of standard drinks that you plan to consume today/tonight?" They were able to respond by typing in an amount and were provided a link to the visual example of standard drinks. Similarly, they were asked "Do you PLAN to consume any cannabis today/tonight?" and if yes, they were asked "What is the MAXIMUM amount of marijuana you plan to use today/tonight?" with a link to the Standard Marijuana Quantity visual aid (See Appendix E). Participants were also able to specify if they had "no set limit" for both alcohol and cannabis (See Appendix D for EMA items).

Mood. Each random survey included 7-items from the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988), a self-report questionnaire consisting of items reflecting both positive and negative mood states (See Appendix F). Participants were asked to "indicate to what extent you feel this way right now" on a touch bar ranging from 1 (*not at all)* to 5 (*extremely)*. Items included *sad, irritable, relaxed, happy, energetic, stressed/anxious,* and *bored*. Responses to the items *sad, irritable,* and *stressed/anxious* were averaged to derive a negative affect score. *Happy, energetic,* and *relaxed* were averaged to reflect positive affect. Although boredom is associated with negative affect, it has also been described as inadequate arousal or lack of tolerance for monotonous situations (Vodanovich et al., 1991), and as such embodies unique properties distinct from negative affect (Vodanovuch & Gilbride, 1994). Boredom has also been independently associated with increased alcohol consumption and binge

drinking behaviour (Biolcati et al., 2018). Due to this, boredom was separated and tested as a separate mood variable. As shown in Table 2, reliability improved after removing boredom from the negative affect subscale at both within-person (with boredom ω_t = .61, CI 95% [0.60, 0.63]; without boredom ω_t = .66, CI 95% [0.64, 0.67]) and between-person levels (with boredom ω_t = .90, CI 95% [0.88, 0.93]; without boredom ω_t = .92, CI 95% [0.89, 0.94]). See Table 2 for both within and between person reliability for the positive and negative affect scales.

Data Analytic Strategy

Analyses were conducted using IBM SPSS Statistics v.28 (Armonk, NY), with the exception of reliability analyses which were conducted in R v. 4.2.2. (R Core Team, 2022) Separate models for unplanned alcohol use versus cannabis use were created. For these analyses, daily-level unplanned substance use was modelled at level 1 and nested within participants at level 2. Model 1 included all days in which drinking alcohol occurred (drinking days), and the outcome variable was binary and coded as 1 = unplanned alcohol use and 0 = planned alcohol use. Unplanned use was identified by comparing intention to drink, as indicated on the daily morning survey, to whether drinking actually occurred, as indicated by the reported use on the next morning's daily survey. If participants indicated that they *did not* intend to use alcohol that day, but then reported they *had* used alcohol that day on the following daily morning survey, the drinking day was coded as unplanned alcohol use. If participants indicated that they *did* intend to use alcohol that day and reported alcohol use on the next daily morning survey, the drinking day was coded as planned alcohol use. The model only included days where there was both a complete survey for intentions and a complete survey the next day reporting use; if either of these surveys were missing, the day was dropped from the model. A subset of this model (Model 2) included only days on which *planned* alcohol use occurred, with outcomes representing the

difference between the actual amount of alcohol that was used (as reported on the Daily Morning survey the following day) and the maximum intended amount reported on the Daily Morning survey of the index day. Unplanned use was operationalized as the difference between the maximum amount intended and actual use, in terms of using greater quantities than intended.

Model 3 included cannabis use days and predicting unplanned cannabis use, which was operationalized in the same way as unplanned alcohol use in Model 1. Model 4 was a subset of Model 3 and included only days on which *planned* cannabis use occurred. This model operationalized unplanned cannabis use the same way as unplanned alcohol use in Model 2.

Multilevel modelling was used for all models. In each model, the outcome was unplanned use at the day level, and these were nested within participants. A logistic model was used for the binary planned vs. unplanned outcomes (both Models 1 and 3) and a linear model for the continuous outcomes of differences between planned and actual quantities used (Models 2 and 4). The independent variables in all models were daily average positive and negative mood as well as boredom (averaged across the 2 randomly timed surveys). The mood variables were person-mean-centered to examine within-person differences across days, represented as a daily-level (level 1) deviation in mood from the participant's own average level of the mood variable (positive affect, negative affect and boredom), which was averaged across all days in the analysis. Models also included aggregate mood (positive, negative, bored) averaged across all days in the analysis (between-person level 2 variable) to control for between-person effects. These variables were grand-mean-centered.

The main effects of mood were examined in each model first without impulsivity. Next the moderating effect of impulsivity was tested, with a separate model for each impulsivity variable. Each impulsive trait was entered as level 2 predictor in separate models to avoid issues

of multicollinearity given the subscales of impulsivity are measuring a similar construct and some of the subscales were highly correlated (positive and negative urgency $r = 0.59$, $p < .001$). Impulsivity variables (positive urgency, negative urgency, sensation seeking, (lack of) premeditation (lack of) perseverance) were grand-mean-centred. Cross-level interactions between daily mood (level 1) and impulsivity (level 2) were entered into models to examine the moderating role of impulsivity variables in the daily associations between mood and unplanned use. Interactions between each impulsivity variable and average daily mood (level 2) were also entered into the model to examine between-person moderation effects. For significant interactions, simple slopes analyses were conducted to assess the strength of the relationships between the relevant mood variables and unplanned alcohol/cannabis use at low (1 SD below the mean) and high (1 SD above the mean) levels of the impulsivity variable (Aiken & West 1991). Finally, age, sex assigned at birth (sex), and day of the week (i.e., weekday or weekend) were used as covariates in all models. Age and sex were grand-mean-centered (level 2), and day of the week (weekend = 0, weekday = 1) was person-mean-centered at level 1 and grand-mean-centered at level 2.

All models were specified with a random intercept and fixed slopes for mood and used maximum likelihood estimation.

Results

Descriptive Analyses

A total of 2850 prompted daily morning surveys were completed in the full sample, across all participants and all days. Given there were a total of 3213 surveys possible (21 daily surveys * 153 participants) the compliance rate was 88.7%. A total of 4897 random surveys were completed, resulting in the compliance rate for of 76.2%. From that full sample, 124 participants

indicated that they used alcohol at least once over the 21-day EMA period, and 129 participants used cannabis at least once. Across these participants, there were 600 surveys submitted on which previous day alcohol use was reported, and 1008 surveys on which previous day cannabis use was reported. Out of the surveys submitted for alcohol use days, 50.17% (n = 301) were unplanned alcohol use days (i.e., no intention to drink was reported on the previous day's survey), and out of the 1008 surveys submitted for cannabis use days, 26.88% (n = 271) were unplanned cannabis use days (See Table 3 for further breakdown of planned and unplanned alcohol and cannabis use). The average number of standard drinks consumed per drinking day was 3.76 (SD = 3.06) and the average maximum number of drinks participants intended to consume was 3.62 (SD = 2.38). Participants used an average of 0.73 (SD = 0.87) grams of marijuana per cannabis use day and the average maximum intended amount was 0.95 (SD = 1.64) See Table 4 for additional cannabis use data on cannabis days. See Table 5 for a breakdown of average daily mood scores for both drinking days and cannabis day.

Multilevel Model Results

Model 1: Predicting Likelihood of Unplanned vs. Planned Drinking at the Day Level

Main effects. In the model examining the main effects of mood without impulsivity, there was a significant main effect for day-level positive affect such that on drinking days when a higher level of positive affect relative to normal was reported, there was a significantly greater likelihood of engaging in unplanned vs. planned drinking (see Table 6). The odds ratio indicated that for every one unit increase in daily positive affect, there was a 1.68 times greater likelihood of unplanned drinking. Further, at the between-person level, participants who had higher positive affect in general across all drinking days tended to have a greater number of unplanned drinking

days (see Table 6). There were no main effects of negative affect or boredom at either the day or person levels.

Moderation by impulsive traits. None of the impulsivity variables had a direct association with unplanned drinking in any of the models (all ps > .05). In the models that included negative and positive urgency as moderators, there were no significant interactions between the impulsivity variables and any mood variables (i.e., positive affect, negative affect, boredom; all ps > .05). However, lack of premeditation had a moderating effect on boredom at the between-person level (B = 1.54, p =.004, 95% CI [0.48, 2.59], OR = 4.65). Simple slopes analysis showed that for participants high in lack of premeditation, individual differences in overall average levels of boredom were positively associated with more unplanned drinking overall across days (B = 0.72, p =.018, 95% CI [0.12, 1.32], OR = 2.05) (See Figure 1). However, for participants relatively low on lack of premeditation, there was no significant relationship between individual differences in overall boredom and unplanned drinking overall across days. Lack of premeditation did not show significant interactions with the positive or negative affect variables (ps > .05).

Further, in the model that included lack of perseverance, lack of perseverance moderated the day-level relationship between positive affect and likelihood of unplanned drinking (B = 0.90, p = .02, 95% CI [0.15, 1.66], OR = 2.47). Simple slopes analysis revealed that on drinking days when participants reported more positive affect than normal, there was an increased likelihood of unplanned vs. planned drinking for those high in lack of perseverance (B = 1.00, p =.001, 95% CI [0.40, 1.60], OR =2.72) (See Figure 2). However, individuals low in lack of perseverance showed no significant within-person relationships between positive affect and unplanned drinking (B = -0.003, p = .993, 95% CI [-0.61, 0.60], OR = 1.00). Lack of

perseverance did not moderate associations between negative affect or boredom and likelihood of unplanned drinking (ps > .05).

In the model examining sensation-seeking as a moderator, there was a marginally significant interaction between sensation seeking and boredom at the day-level (p = .058). After removing the other non-significant interactions from the model, this interaction became stronger and statistically significant (B = 0.57, p = .030, 95% CI [0.05, 1.08]). Simple slopes analysis revealed that on drinking days when participants reported a higher level of boredom than typical, there was a decreased likelihood of engaging in unplanned vs. planned drinking for those who were low on sensation seeking (B = -0.49, p = .031, 95% CI [-0.94, -0.04], OR = 0.61) (see Figure 3), but there was no significant within-person relationship between boredom and unplanned drinking for participants high on sensation seeking (B = 0.16, p = .427, 95% CI [-0.24, 0.56], OR = 1.17). Sensation seeking did not show significant interaction between positive or negative affect and likelihood of unplanned drinking (ps > .05).

Model 2: Predicting Differences between Intended and Actual Consumption of Alcohol on Planned Drinking Days

Main Effects. In the main effect model that did not include impulsivity, there was a significant main effect for negative affect such that on planned drinking days when participants reported a higher negative affect relative to normal, they drank fewer than the maximum number of drinks they planned to consume based on their morning report (see Table 7). Results indicated that for every one unit increase in daily negative affect, participants consumed 1.04 fewer drinks than the maximum number of planned drinks reported in the morning. There were no statistically significant main effects for positive affect or boredom at the day level, and no significant main effect for any mood variables at the between-person level (ps > .05).

Moderation by impulsive traits. None of the impulsivity variables had a direct association with unplanned drinking in any of the models (all *ps* > .05). In the model that included negative urgency as a moderator, there were no significant interactions between the impulsivity variables and any mood variables ($p > .05$). In the model that included positive urgency, positive urgency moderated the day-level relationship between negative affect and differences between planned and actual number of drinks ($B = 4.25$, $p < .001$, 95% CI [2.12, 6.38]). Simple slopes analyses revealed that for those low on positive urgency, planned drinking days with higher-than-normal negative affect were associated with consuming fewer than the maximum planned number of drinks ($B = -3.43$, $p < .001$, 95% CI [-4.87, -2.00]) (See Figure 4). However, for those high on positive urgency, there was no significant within-person relationship between increased negative affect and differences between planned and actual number of drinks consumed ($B = -0.54$, $p = .342$, 95% CI [-0.58, 1.67]). Positive urgency did not show significant interaction between positive affect or boredom and differences in planned versus actual number of drink consumed (ps > .05).

In the model that included lack of premeditation, there was a moderating effect on day-level boredom ($B = -2.82$, $p = .025$, 95% CI [-5.27, -3.64]). Simple slopes analysis revealed that for those low in lack of premeditation, planned drinking days with higher boredom relative to normal were associated with consuming a greater than planned number of drinks ($B = 1.94$, $p = .024$, 95% CI [0.26, 3.62]) (See Figure 5). However, for those who were high in lack of premeditation, there was no significant within-person relationship between increased boredom and differences between planned and actual number of drinks consumed ($B = -0.50$, $p = .282$, 95% CI [-1.41, 0.41]). Lack of premeditation did not show significant interaction between positive or negative affect and consuming more drinks than planned (ps > .05).

In the model that included lack of perseverance, there was a moderating effect on the associations of both day-level negative affect (B = 3.01, p < .001, 95% CI [1.54, 4.49]) and day-level boredom (B = -1.23, p = .016, 95% CI [-2.24, -0.23]) with unplanned drinking. Simple slopes analyses revealed that for those low on lack of perseverance, on planned drinking days when participants reported higher negative affect relative to normal, they tended to drink less than their maximum planned number of drinks (B = -2.93, p <.001, 95% CI [-4.15, -1.71]) (See Figure 6), but on days when they reported greater boredom than normal, there was a tendency to drink more than their planned number of drinks (B = 1.21, p = .029, 95% CI [0.13, 2.29]) (See Figure 7). For those high in (lack of) perseverance, there were no significant within-person relationships between either mood variable or consuming more drinks than the maximum number of drinks reported in the morning (ps < .05). Lack of perseverance did not show significant interaction between positive affect and consuming more drinks than their maximum set limit (ps > .05).

Finally, in the model that included sensation seeking, there was a moderating effect of sensation seeking on the associations of day-level positive affect and discrepancies between planned and actual number of drinks consumed (B = -2.37, p = .004, 95% CI [-3.95, -0.78]). Simple slopes analysis revealed that for those low on sensation seeking, on planned drinking days when participants reported higher positive affect relative to normal, they tended to drink more than their maximum planned number of drinks (B = 1.50, p = .007, 95% CI [0.42, 2.57]) (See Figure 8). For those high on sensation seeking, there was no significant within-person relationships between positive affect and consuming more drinks than their maximum number of planned drinks (B = -1.01, p = .097, 95% CI [-2.20, 0.19]). Sensation seeking did not show

significant interaction between negative affect or boredom and differences in the number of drinks participants had planned versus consumed (ps > .05).

Model 3: Predicting Likelihood of Unplanned vs. Planned Cannabis at the Day Level

Main Effects. In the main effects model that did not include impulsivity, there was a significant main effect for day-level boredom, such that on days when participants reported higher boredom relative to typical, they were less likely to engage in unplanned cannabis use versus planned cannabis use (See Table 8). The odds ratio indicated that for every one unit increase in daily boredom, there was 0.79 times decrease in the likelihood of unplanned versus planned cannabis use. There were no main effects for positive or negative affect at the day level, and no significant main effect for any mood variables at the between-person level (ps > .05).

Moderation by impulsive traits. None of the impulsivity variables had a direct association with unplanned drinking in any of the models (all ps > .05). Across all moderation models, there were no significant interactions between any impulsivity variables and any mood variables (p < .05) in predicting likelihood of unplanned cannabis use.

Model 4: Predicting Differences between Intended and Actual Consumption of Cannabis on a Planned Cannabis Day

Main Effects. In the main effects model without impulsivity variables, there were no significant associations between any mood variables and discrepancies between the maximum number of cannabis grams planned and the actual number of grams used ($p > .05$) (See Table 9).

Moderation by impulsive traits. Negative Urgency ($B = 8.65$, $p = .015$, 95% CI [0.166, 1.564]) and (lack of) Premeditation ($B = 0.65$, $p = .043$, 95% CI [0.020, 1.283]) had a direct association with unplanned cannabis use. In the models that included negative urgency, positive urgency, lack of premeditation, and sensation seeking as moderators, there were no significant

interactions between the impulsivity variables and any mood variables (all *ps* > .05). In the model examining lack of perseverance as a moderator, there was a marginally significant interaction between lack of perseverance and boredom at the between person level (*B* = -0.88, *p* = .025, 95% CI [-1.646, -.108]). However, after removing the non-significant interactions from this model, this interaction was no longer statistically significant (*p* = .138). Given the potential of a suppressor effect, this interaction was not further explored.

Discussion

Given high rates of alcohol and cannabis use among young adults (Canadian Alcohol and Drugs Survey, 2019), and the risks associated with unplanned use (e.g., increased alcohol use; Emery, 2020; Leeman et al., 2012; 2014, Wardell et al., 2015), it is important to identify factors that may contribute to why young adults engage in unplanned substance use. Accordingly, this study aimed to examine whether within-person changes in mood increased the risk of unplanned use, and whether impulsive traits moderated this relationship. Consistent with the theory of planned behaviour (Ajzen, 2011), I hypothesized that within-person increases in either positive or negative mood would predict unplanned alcohol and cannabis use, and that impulsivity – specifically positive and negative urgency – would strengthen this relationship. Overall, the results suggest that fluctuations in daily mood appear to impact the likelihood and degree of unplanned alcohol and cannabis use, although this relationship was stronger for unplanned alcohol than unplanned cannabis use. Although impulsivity did moderate some of the relationships between mood and unplanned alcohol use, urgency was not as important of a moderator as hypothesized. Specific findings are described below along with the implications, limitations, and future directions.

Mood and Drinking

Results from the analyses indicate on days when participants reported more positive affect than typical, there was an increased likelihood they would engage in unplanned drinking (i.e., drinking even though they had no intention of drinking). Although researchers are just beginning to examine within-person associations between mood and unplanned substance use, prior studies have found mixed results for positive affect. Most research on planned vs. unplanned drinking have found that positive affect is associated with *planned* drinking, rather than unplanned drinking (Stevens et al,, 2021b; 2022). One study found that positive affect was associated with next moment likelihood to drink (Duif et al., 2020), whereas another study found positive mood was associated with lower odds of unplanned drinking (Fairlie et al., 2019). Other research has found no association between positive mood and the decision to drink (Howe et al., 2022). My results contribute to the mixed findings in this literature, indicating that experiencing increased positive affect is a risk factor for *unplanned* (rather than planned) drinking specifically. As a large body of literature proposes social enhancement is often a motive for drinking, specifically for young adults (Kuntsche et al., 2005; Lyvers et al., 2010; Stevens et al., 2022), one possible interpretation is that unplanned drinking for young adults may often reflect spontaneous drinking that occurs when there is an unplanned or unexpected social event or opportunity to celebrate, which may be associated with higher positive affect.

Further, a between-person association was observed such that participants who tended to report more positive affect in general across drinking days also tended to engage in more unplanned drinking days overall. So, participants who are generally happy, perhaps more extraverted and around people, may be more likely to find themselves unexpectedly in social drinking contexts even if that had not planned to drink that morning. This is consistent with research that has found that social rewards can act as positive reinforcement for drinking

behaviour (Lyver et al., 2010), and that extraverted young adults have increased alcohol-reward sensitivity (mood enhancement from alcohol; Fairbairn et al., 2015).

Contrary to hypotheses, increased negative mood relative to typical negative mood levels did not result in an increased likelihood to engage in unplanned drinking. There is limited research on unplanned drinking and negative mood, and most results have shown no significant associations (Fairlie et al., 2019; Stevens et al., 2021). Given the developmental context of young adulthood, in which normative drinking behaviour tends to be celebratory and social (Kuntsche et al., 2005), increased negative mood may lead young adults to avoid these contexts and therefore be less likely to spontaneously drink (i.e., unplanned drinking). Although there is research indicating negative affect is associated with drinking to cope (Swendsen et al., 2000), our results suggest that fluctuations in negative mood did not appear to differentiate between planned and unplanned drinking in this young adult sample.

Mood and Cannabis Use

Unplanned versus planned cannabis use is less understood in the literature as the focus has been mostly on alcohol (Emery et al., 2020; Leeman et al., 2012). Results of the current study suggest that boredom may be protective against unplanned cannabis use, as more boredom was associated with less unplanned cannabis use. This finding was unexpected as boredom often increases cannabis use motives (Graupensperger et al., 2021). However, given the stage of development of the present sample, unplanned cannabis use may involve more of an enjoyment or social enhancement component, and thus occur in contexts associated with lower boredom. A study exploring marijuana motives did find that for young adults specifically, cannabis motives include enjoyment, fun, conformity, and social enhancement (Bonar et al., 2017; Lee et al. 2007). As such, when young adults are in situations where they have an unexpected opportunity

to use (i.e., a friend offers them a joint), presumably that situation is less likely to involve boredom and more likely to involve unplanned or spontaneous cannabis use.

In terms of positive and negative mood, fluctuations in typical mood did not impact whether young adults engaged in cannabis use on days in which there was no plan, nor did fluctuations in mood impact whether young adults used a greater amount of cannabis than planned on planned cannabis use days. The lack of association between within-person fluctuations in positive and negative mood and unplanned cannabis use is consistent with recent EMA research (Emery et al., 2020). Further, in the current study, there were fewer unplanned cannabis use days overall (n = 271, less than 30 percent of all cannabis days) in comparison to 50 percent of all drinking days being unplanned. There were, however, about 60 percent more cannabis use days in general (versus drinking days). This pattern suggests our sample was most likely made up of more frequent cannabis users who generally planned to use cannabis most days. As such, there is likely a lot of consistency in cannabis use across days, especially among those who use regularly, as there is a tendency to use the same amount in a routine or habitual nature. Regular cannabis users may be more likely to use regardless of social context, including in solitary environments (Shrier et al., 2012), and could be using cannabis for both recreational and medicinal purposes (i.e., relaxing at night or help with sleeping; Lee et al. 2007). This consistency of use among frequent cannabis users may make cannabis use more robust to fluctuations in mood and make it more difficult to predict *unplanned* use.

The Role of Impulsivity in Associations Between Mood and Drinking

Positive Affect

The relationship between positive affect and unplanned drinking was especially strong for those high on perseverance impulsivity (i.e., lack of perseverance). For these participants,

there was a stronger positive relationship between days when participants reported higher than normal positive affect and likelihood of unplanned drinking, whereas daily changes in positive affect had no impact on likelihood of unplanned drinking for those who were low on perseverance impulsivity (see Figure 2). Impulsivity has long been linked to alcohol use (Pearson & Henson, 2013; Wardell, et al., 2016), and perseverance impulsivity has been mostly strongly associated with drinking quantity (Coskunpinar et al., 2013). My findings extend this work by showing that for people who tend to have difficulty remaining focused on boring or challenging tasks (i.e., lack of perseverance; Whiteside & Lynam, 2003), experiencing an unusually elevated positive mood heightens the spontaneous decision to drink (i.e., unplanned use). Perhaps, it is the positive mood (or social/contextual factors associated with increased positive mood) that distracted them from their plans, leading to the spontaneous decision to drink.

Similarly, on days when young adults who had already decided to drink (i.e., planned drinking days), experiencing higher than normal positive mood was predictive of consuming more drinks than planned, but only for those *low* in sensation seeking. For young adults high on sensation seeking, there was no significant within-person association between positive mood and drinking more than intended, although there was a slight trend toward lower positive mood being associated with drinking more than planned (see Figure 8). Sensation seeking is often associated with frequency of drinking, predicting enhancement drinking motives (Scott & Corbin, 2014), and has been linked to risky drinking behaviour such as binge drinking in a young adult population (Biolcati et al., 2018; Coskunpinar et al., 2013). Perhaps for those who tend to seek out excitement or adventure, a low positive mood elicits more motivation to chase that excitement (perhaps via spontaneous drinking), whereas high positive mood leaves them feeling satisfied and less likely to engage in unplanned drinking. However, this should be interpreted

with caution given the negative relationship between positive affect and unplanned drinking was not significant for participants high on sensation-seeking. Conversely, individuals who are low on sensation seeking appear to be at lower risk for unplanned drinking when experiencing relatively low levels of positive mood, which can be interpreted consistent with the main effect of positive mood described above.

Boredom

When exploring day level fluctuations in boredom, results indicate that for those low in sensation seeking, experiencing more boredom than normal was a deterrent (vs risk factor) for unplanned drinking. Again, young adults tend to engage in spontaneous or unplanned drinking more when they are less bored; however, it appears that for high sensation seekers, this relationship is weakened, and may even be slightly reversed (See Figure 3). Those who seek stimulation (ie., high sensation seeking) may be more motivated to drink for the stimulating effects (Biolcati et al., 2018); thus, boredom might elicit more risky drinking behaviours. As such, unplanned or spontaneous drinking seems slightly *more* likely when more bored for those high in sensation seeking, keeping in mind the slope was not significant but does trend towards this positive relationship.

In contrast, on days in which participants had made the decision to drink, it was (lack of) premeditation and (lack of) perseverance impulsivity that moderated the effects of boredom on the difference between number of drinks planned vs. consumed on planned drinking days. Specifically, days on which participants reported a heightened level of boredom relative to normal were associated with drinking more than planned for those low on both (lack of) premeditation (see Figure 5) and (lack of) perseverance impulsivity (see Figure 7). Results suggest that for people who are less likely to make decisions without considering the

consequences (premeditation), or more likely to sustain effort and follow through on tasks (perseverance), experiencing more boredom than typical may be a risk factor for drinking more than planned. However, for those high in perseverance and premeditation impulsivity, being more or less bored did not seem to impact whether or not they consume more drinks than planned.

Although this within-person result was not expected, when looking at between-person associations between boredom and likelihood of unplanned drinking, it was those who were *high* in premeditation impulsivity and reported more boredom on average across all drinking days who tended to engage in more unplanned drinking overall (see Figure 1). This was not observed for those with low premeditation impulsivity. This between-person effect suggests it was chronically elevated levels of boredom across drinking days, rather than within-person daily fluctuations in boredom, that were a risk factor for unplanned alcohol use among those high in lack of premeditation. This is consistent with research on boredom proneness and drinking behaviours (Biolcati et al., 2016). This differentiation between within-person effect and between-person effects highlights the importance of multi-level modelling and considering both between and within person effects in psychology (Curran & Bauer, 2011). Not only can within-person and between-person effects be opposite of one another but generalizing the individual and aggregate (group) data poses risk our complete understanding of the true relationship (Curran & Bauer, 2011).

Negative Affect

Contrary to my hypothesis, days with increased negative mood were associated with drinking fewer than the planned number of drinks for those with low positive urgency (see Figure 4) and low lack of perseverance (see Figure 4). In other words, for young people who do

not have trouble staying focused (i.e., perseverance), and for those who do not become more impulsive with intense positive emotions (i.e., positive urgency), experiencing heightened negative emotions appears to be linked with drinking less alcohol than planned. However, for those high in these impulsive traits, the effect of increased negative mood on drinking less than planned appears to be negated. Perhaps factors other than mood might play a more important role in unplanned use for those high on these impulsive traits; however, more research is needed to understand what those are.

Another unexpected result was the general lack of support for the moderating role of urgency in this sample. There is strong support for the relationship between both positive and negative urgency and substance use (Berg et al., 2015; Bø et al., 2016; Pearson & Henson, 2013). Further, limited research on unplanned drinking specifically has found an association between higher levels of positive urgency and drinking more alcohol (Waddell et al., 2023). There has however been little research on the role of urgency as a moderator of the association between mood and drinking (or unplanned drinking). My findings suggest that perhaps it is not as important of a moderator as might be expected based on the theory of urgency-related drinking. However, one limitation is the timing of mood measurement. Perhaps the discrepant findings with past research relates to the time in which mood measurements were taken in the current study. Given mood was collected at random times throughout the afternoon and evening, there may have been shifts in mood unaccounted for in the assessment. Perhaps urgency would have moderated the relationship between mood and unplanned use had it been measured in the moment right before use.

The Role of Impulsivity in Associations Between Mood and Cannabis Use

Findings for cannabis use in general, as well as the role of impulsivity as a moderator, were not as expected. There was a higher rate of cannabis use days (n = 1008 survey) in comparison to alcohol (n = 600 survey) and over 73 percent of cannabis use days involved planned use. This indicates that the sample was made up of more regular or habitual users that generally planned to use cannabis most days that they used. As mentioned above, the ability to predict unplanned use or detect significant interactions with impulsivity becomes difficult as regular users tend to consistently plan to use and therefore the effects might be quite small.

No prior research has looked at how impulsivity moderates the relationship between mood and unplanned cannabis use, and this study suggests that perhaps impulsivity is not that important. Alternatively, there may also be other contextual factors that moderate this association instead, such as social settings or environment. Thus, future research is needed to further understand the moderators of the mood-unplanned cannabis association.

Summary of Findings

Overall, the findings indicate that experiencing more positive affect than typical at the daily level significantly predicted unplanned drinking and this relationship was stronger for those high on perseverance impulsivity (i.e., lack of perseverance). Further, participants that tended to report more positive affect in general across drinking days also were more likely to report more unplanned drinking days overall, especially those high in lack of premeditation impulsivity. Similarly, greater negative mood was associated with drinking fewer drinks than planned, and as such it was an decrease in negative affect in comparison to typical mood that predicted consuming more drinks than intended. In addition, on days where there was a plan to drink, it was those lower (vs higher) in impulsivity (lack of premeditation, perseverance and sensation seeking) who were most at risk for drinking more than originally planned when experiencing

fluctuations in mood. Unplanned cannabis use was much more difficult to predict; however, on days in which participants reported lower boredom relative to normal, there was an increased likelihood that they engaged in unplanned cannabis use. Results are suggestive of celebratory or social drinking underlying spontaneous (i.e., unplanned) drinking for these young adults, and that fluctuations in mood may have a larger role in predicting unplanned use depending on relative levels of various impulsive traits.

Strengths and Limitations

The study had many strengths including the EMA method of data collection, which allowed for day-level examination of mood and substance use behaviour that minimized retrospective biases. The compliance rate for the daily morning surveys was well over the recommended compliance rate of 80 percent (Jones et al., 2019; Stone & Shiffman, 2022), signifying validity in capturing the use patterns for this young adult sample. Likewise, the number of surveys (n = 600 for alcohol, n = 1008 for cannabis) included in the analyses permits good power for detecting within-person effects. Another strength of this study was the examination of both within-person and between-person effects. Exploring both levels of analysis provides a more comprehensive understanding of the relationships between mood and unplanned drinking in young adults by allowing inferences to be made regarding both day-level and person-level effects.

However, there are several limitations that should be acknowledged. Firstly, data collection for the larger project began in December 2019. As such, most of the data for this thesis was collected during the COVID-19 pandemic. Not only was the pandemic disruptive of typical daytime activities, but throughout this time there were multiple province-wide lockdowns, which may have influenced drinking and cannabis use behaviour. Given many of the pandemic

restrictions, there were other factors such as mental health concerns, isolation or lack of social interactions and other contextual factors that may influence both mood fluctuations as well as substance use behaviour (Emery et al., 2021; Layman et al., 2022; Wardell et al., 2020).

It is possible there could be a relationship between unplanned use and failure to complete a survey the next morning; therefore, the missing data could contain important information regarding patterns in unplanned use. There may also be an association between mood and survey completion. Perhaps people who were feeling more negative affect than typical were the ones who did not complete their surveys and therefore this information would not have been captured in our analyses. Further, there was also no way to determine mood immediately prior to use given the randomness of the surveys. As such it is unclear exactly what mood looked like at the point a participant decided to use alcohol or cannabis. Similarly, directionality is also a limitation as it is not clear whether mood preceded use or use preceded mood.

Another limitation was the exclusivity of examining only cannabis flower rather than all forms of cannabis use. The maximum intended amount of cannabis was measured in grams of cannabis flower (marijuana); consequently, only discrepancies in intended vs. actual quantity of flower could be calculated, omitting other forms of cannabis. Although cannabis flower is by far the most common form of cannabis used (Wadsworth et al., 2022), the other forms of cannabis are also used frequently, especially since the legalization of cannabis in Canada. Edibles, concentrates, and vaping are also common routes of administration among young adults (Wadsworth et al., 2022), thus weakening the validity in the prediction of using more than intended on planned use days.

Lastly, although there was good power for within-person associations, power to detect the cross-level interactions may have been limited due to the sample size. Large sample sizes are

needed to detect cross-level interactions, when each participant has only a few observations (Arend & Schafer, 2019) some non-significant interactions could be due to low power. Further, it should be noted that there was overlap or *co-use* of alcohol and cannabis on many of the use days (see Table 3). However, examining unplanned co-use as an outcome was particularly challenging given the small number of observations for each combination of planned vs. unplanned alcohol and cannabis use on co-use days (see Table 3). Further, there is an important distinction in the literature between concurrent co-use of cannabis and alcohol (both used within a given time such as same day use without overlapping effects) and simultaneous co-use (both used at the same time such that their effects overlap) (Patrick et al., 2018). Simultaneous use is likely most relevant for understanding mood associations and predictors of unplanned co-use at the event level; however, participants in the current study were not asked specifically about their intention to engage in simultaneous co-use. Thus, future studies that specifically measure intentions to engage in simultaneous use are needed and would be better suited to answer questions about unplanned co-use of cannabis and alcohol.

Conclusions and Implications

This project augments our understanding of unplanned substance use in young adults by clarifying the role of impulsive personality and internal contextual factors (i.e., mood). Although there is existing research focusing on the relationship between urgency and substance use, especially alcohol, this study sought to expand and explore the impact of impulsivity on mood-related *unplanned* substance use. Although the moderating role of impulsivity was complex, the study found that increased positive mood (specifically high positive affect, low boredom, and low negative mood) was most predictive of unplanned drinking in young adults, especially for those with low impulsivity traits.

Findings can inform prevention planning for emerging adults and future policies given the recent legalization of cannabis in Canada. These findings may inform harm reduction interventions by identifying high-risk populations and that can be targeted with tailored intervention programs. For example, interventions might target environments that are conducive to celebratory situations, such university residences, campuses, bars, and festivals, where young adults may find themselves experiencing heightened positive emotions and thus may be prone to engage in unplanned substance use. Engaging in brief interventions or psychosocial education to disseminate information regarding risk factors for unplanned drinking may also be beneficial. Alternatively, if those with fewer impulsive traits tend to be most sensitive to mood fluctuations, focusing on alternative strategies for regulating mood could be integrated into interventions targeted toward these individuals, as unplanned drinking is more likely to occur when in positive or bored mood states. Further, it may be beneficial to focus more research on the contextual factors that target high impulsivity, as it appears daily mood fluctuations are not as important for unplanned use among those young adults. Using the insight gained from this research may help guide funding and resource allocation targeted at reducing unplanned use in young adults, and as such the associated negative consequences.

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Table 1

Participant Demographics and Descriptive Statistics for Impulsivity (N=153)

Variables	n	%
Gender		
Male	57	38.0
Female	89	59.3
Transgender	2	1.3
Nonbinary	5	3.3
Sex at birth[d]		
Male	54	36.0
Female	95	63.3
Prefer not to disclose	1	0.7
Race/Ethnicity[a]		
White	94	62.7
Black/African descent	13	8.7
East Asian	24	16.0
Pacific islander	2	1.3
Indigenous	1	0.7
East Indian	15	10
Middle Eastern	5	3.3
Other	6	4.0
Prefer not to respond	2	1.3
Income[d]		
0-$9,999	13	8.7
$10,000 - $19,999	19	12.7
$20,000 - $29,999	22	14.7
$30,000 - $39,999	10	6.7
$40,000 - $49,999	15	10.0
$50,000 - $59,999	9	6.0
60,000 - $79,999	11	7.3
$80,000 - $99,999	15	10.0
$100,000 - $119,999	5	3.3
120,000 - $139,999	5	3.3
$140,000 - $159,999	4	2.7
$160,000 -199, 999	8	5.4
200, 000 +	14	9.3
Martial Status[d]		
Never married	130	86.7

Living with a domestic partner	14	9.3
Separated	1	0.7
Engaged	3	2.0
Married	2	1.3
Education[b,d]		
Less than high school	3	2.0
Highschool	49	32.7
Some college	33	22.0
Associate degree or technical certificate	8	5.3
Bachelor's degree	54	36.0
Master's degree	3	2.0
Student Status[d]		
Not a student	34	22.7
Full time	87	58.0
Part time	19	12.7
Impulsivity[c]	***M***	***SD***
Positive Urgency	2.21	.51
Negative Urgency	2.52	.46
Sensation Seeking	2.84	.58
(lack of) Premeditation	2.03	.43
(lack of) Perseverance	2.08	.54

Note. [a]cumulative percent is > 100 because participants were allowed to check all that apply; [b]highest level of education completed; [c]average across the items in each subscale with a possible range of 1-4; [d]fewer than 153 participants because they had to option to decline to respond to the item.

Table 2

Within and Between level Reliability of each Mood Scale, including Reliability with each Item Removed.

Positive subscale

	All items[a]		Without Relaxed	
	McDonald's ω_t	95% CI	McDonald's ω_t	95% CI
Within-person	0.683	0.669, 0.697	0.594	0.571, 0.617
Between-person	0.874	0.837, 0.911	0.837	0.780, 0.894
	Without Energetic		Without Happy	
	McDonald's ω_t	95% CI	McDonald's ω_t	95% CI
Within-person	0.639	0.618, 0.659	0.297	0.257, 0.337
Between-person	0.842	0.788, 0.897	0.725	0.627, 0.822

Negative subscale

	All items[b]		Without Boredom	
	McDonald's ω_t	95% CI	McDonald's ω_t	95% CI
Within-person	0.613	0.595, 0.63	0.657	0.64 0.674
Between-person	0.903	0.875, 0.93	0.916	0.89 0.943
	Without Irritable		Without Sad	
	McDonald's ω_t	95% CI	McDonald's ω_t	95% CI
Within-person	0.528	0.502 0.554	0.506	0.482 0.529
Between-person	0.833	0.778 0.888	0.851	0.808 0.895
	Without Stress			

	McDonald's ω_t	95% CI	
Within-person	0.516	0.493	0.538
Between-person	0.882	0.846	0.919

Note. [a] includes *relaxed, energetic, happy*; [b] includes *irritable, sad, stressed, bored*. Reliability improved after removing boredom from the negative affect subscale at both within-person (with boredom ω_t = .61, CI 95% [0.60, 0.63]; without boredom ω_t = .66, CI 95% [0.64, 0.67]) and between-person levels (with boredom ω_t = .90, CI 95% [0.88, 0.93]; without boredom ω_t = .92, CI 95% [0.89, 0.94]).

Table 3

Planned and Unplanned Drinking and Cannabis Use Days

Variable	n	%
Drinking Days	n = 600	
Unplanned	301	50.2
Cannabis Days	n = 1008	
Unplanned	271	26.9
Co-Use Days (both alcohol and cannabis used)	n = 383	63.8% of alcohol days; 37.9% of cannabis days
Planned both[a]	174	45.4[c]
Unplanned both[b]	69	18.0[c]
Unplanned drinking, planned cannabis	106	27.6[c]
Planned drinking, unplanned cannabis	34	8.9[c]

Note. [a] both drinking and cannabis use was planned; [b] both drinking and cannabis use was unplanned, [c] refers to percentage of the co-use days (where both drinking and cannabis use occurred).

Table 4

Cannabis Use Characteristics for Cannabis Use Days (n = 1008 total days)

Variable	n	%
Type		
Cannabis flower	535	53.1
Concentrates[a]	167	16.6
Edibles	90	8.9
Beverages	3	0.3
Route of Administration		
Smoked	532	52.8
Vaporized	160	15.9
Ate/Drank	95	9.4
Other	19	1.9

Note. [a]Oil, Wax, Shatter, Butane Hash Oil, Dabs; missing data = 301.

Table 5

Mood Characteristics for Drinking Days and Cannabis Use Days

Variable	M	SD
Drinking Days[a] (n=599)		
Positive Affect	3.08	0.67
Negative Affect	1.74	0.60
Boredom	1.85	0.76
Cannabis Days[b] (n=1007)		
Positive Affect	2.90	0.91
Negative Affect	1.81	0.75
Boredom	2.05	1.06

Note. [a]average mood scores across all surveys submitted on a drinking day; [b]average mood scores across all surveys submitted on a cannabis day; missing data =1.

Table 6

Mood Variables Predicting Unplanned vs. Planned Drinking Days

Model	*B*	*SE*	t	*p*	95%CI LL	95% CI UL	*OR*
Intercept	-0.12	0.14	-0.88	.380	-0.40	0.15	0.88
Within-person (level 1)[a]							
Positive Mood	0.52*	0.22	2.38	.018	0.09	0.94	1.68
Negative Mood	-0.34	0.23	-1.48	.140	-0.79	0.11	0.71
Boredom	-0.14	0.15	-0.97	.331	-0.45	0.15	0.86
Weekday (vs. weekend)	-0.89**	0.22	-4.04	<.001	-1.33	-0.46	0.41
Between-person (level 2)[b]							
Positive Mood[c]	0.56*	0.26	2.11	.036	0.04	1.07	1.07
Negative Mood[c]	-0.01	0.30	-0.02	.982	-0.59	0.58	0.99
Boredom[c]	0.17	0.24	0.71	.477	-0.30	0.63	1.18
Weekday (vs. weekend)	-0.90	0.55	-1.65	.100	-1.98	0.18	0.41
Sex	0.39	0.31	1.28	.201	-0.21	1.00	1.48
Age	0.01	0.07	0.11	.913	-0.12	0.14	1.01

Note. [a]All level 1 variables were person-mean-centred. [b]All level 2 variables were grand-mean-centred. [c]Level 2 mood variables were averaged across all days in the model for each participant. LL = Lower Limit of 95% Confidence Interval; UP = Upper Limit of 95% Confidence Interval; OR = Odds Ratio.
*p < .05; **p < .01.

Table 7

Mood Variables Predicting the Difference Between Planned and Actual Number of Drinks Reported on Planned Drinking Days.

Model	*B*	*SE*	t	*p*	95% CI LL	95% CI UL
Intercept	0.33	0.32	1.02	.309	-0.30	0.95
Within-person (level 1)[a]						
Positive Mood	0.37	0.40	0.92	.362	-0.43	1.16
Negative Mood	-1.04*	0.44	-2.40	.017	-1.90	-0.19
Boredom	0.20	0.36	0.55	.582	-0.52	0.91
Weekday (vs. weekend)	-0.26	0.52	-0.50	.616	-1.27	0.76
Between-person (level 2)[b]						
Positive Mood[c]	-0.18	0.41	-0.44	.660	-1.00	0.63
Negative Mood[c]	0.54	0.55	0.98	.329	-0.54	1.61
Boredom[c]	-0.47	0.42	-1.12	.265	-1.30	0.36
Weekday (vs. weekend)	1.25	1.01	1.24	.217	-0.74	3.25
Sex	-0.23	0.70	-0.32	.747	-1.60	1.15
Age	0.13	0.15	0.92	.358	-0.15	0.42

Note. [a]All level 1 variables were person-mean-centred. [b]All level 2 variables were grand-mean-centred. [c]Level 2 mood variables were averaged across all days in the model for each participant. LL = Lower Limit of 95% Confidence Interval; UP = Upper Limit of 95% Confidence Interval. *p < .05; **p < .01.

Table 8

Mood Variables Predicting Unplanned vs. Planned Cannabis Days

Model	*B*	*SE*	t	*p*	95% CI LL	95% CI UL	*OR*
Intercept	0.90**	0.24	3.82	<.001	0.44	1.36	2.45
Within-person (level 1)[a]							
Positive Mood	0.09	0.14	0.76	.446	-0.17	0.38	1.11
Negative Mood	-0.06	0.17	-0.17	.868	-0.36	0.30	0.97
Boredom	-0.24*	0.12	-2.07	.038	-0.47	-0.01	0.79
Weekday (vs weekend)	-0.68**	0.20	-3.35	<.001	-1.07	-0.28	0.51
Between-person (level 2)[b]							
Positive Mood[c]	0.31	0.16	1.62	.105	-0.06	0.58	1.30
Negative Mood[c]	-0.48	0.29	-1.52	.130	-1.00	0.13	0.65
Boredom[c]	0.56	0.29	1.86	.063	-0.03	1.11	1.72
Weekday (vs weekend)	1.52	0.78	1.94	.053	-0.02	3.02	4.49
Sex	-0.22	0.40	-0.54	.591	-1.00	0.57	0.81
Age	0.13	0.09	1.46	.144	-0.04	0.30	1.14

Note. [a]All level 1 variables were person-mean-centred. [b]All level 2 variables were grand-mean-centred. [c]Level 2 mood variables were averaged across all days in the model for each participant. LL = Lower Limit of 95% Confidence Interval; UP = Upper Limit of 95% Confidence Interval; OR = Odds Ratio.
*p < .05; **p < .01.

Table 9

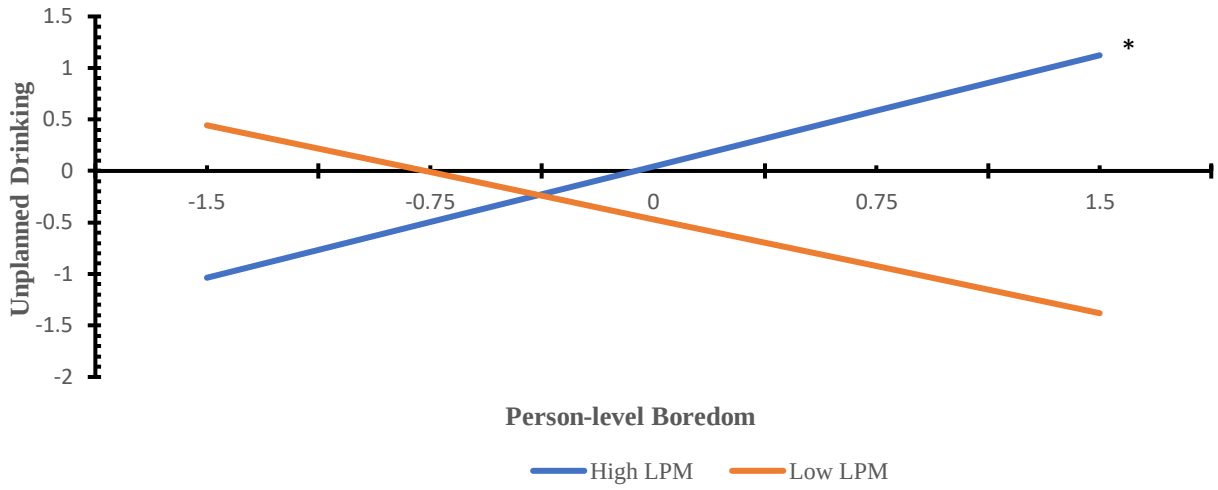
Mood Variables Predicting the Difference Between Planned and Actual Number of Grams Reported on Planned Cannabis Days

Model	*B*	*SE*	t	*p*	95% CI LL	95% CI UL
Intercept	-0.25	0.12	-2.01	.044	-0.49	-0.01
Within-person (level 1)[a]						
Positive Mood	-0.06	0.09	-0.65	.516	-0.24	0.12
Negative Mood	0.09	0.10	0.85	.395	-0.11	0.28
Boredom	0.11	0.07	1.69	.092	-0.02	0.25
Weekday (vs. weekend)	0.19	0.11	1.76	.080	-0.02	0.41
Between-person (level 2)[b]						
Positive Mood[c]	-0.14	0.18	-0.79	.428	-0.49	0.21
Negative Mood[c]	-0.05	0.22	-0.20	.838	-0.47	0.38
Boredom[c]	0.06	0.17	0.33	.744	-0.28	0.39
Weekday (vs. weekend)	-0.51	0.50	-1.04	.301	-1.48	0.46
Sex	-0.46	0.27	-0.17	.084	-0.98	0.06
Age	0.00	0.06	0.00	1.00	-0.11	0.11

Note. [a]All level 1 variables were person-mean-centred. [b]All level 2 variables were grand-mean-centred. [c]Level 2 mood variables were averaged across all days in the model for each participant. LL = Lower Limit of 95% Confidence Interval; UP = Upper Limit of 95% Confidence Interval. *p < .05; **p < .01.

Figure 1

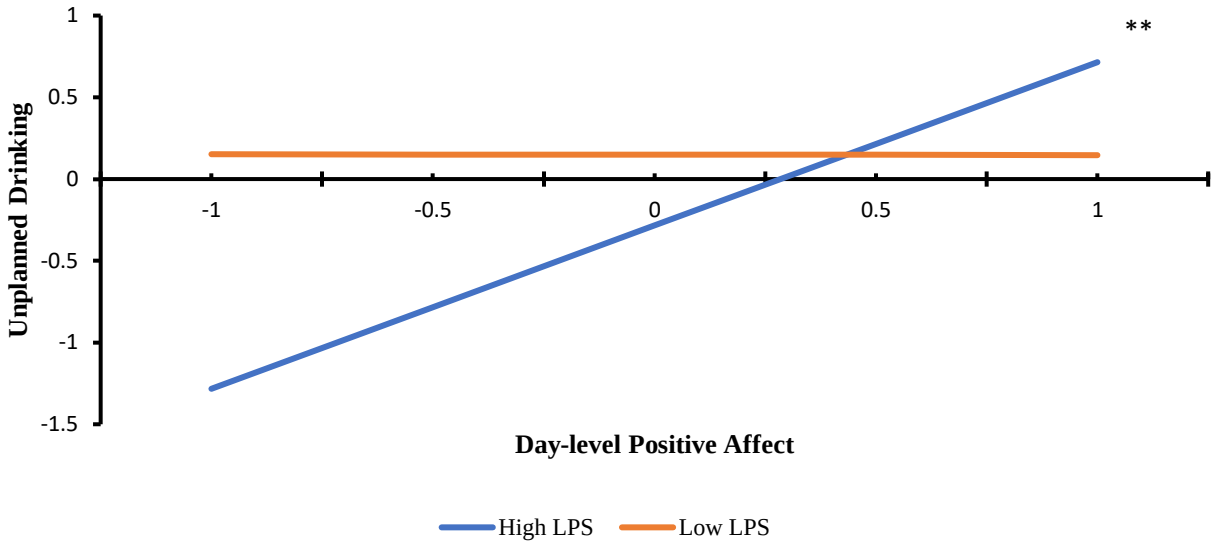
Interaction between Person-level Boredom and Unplanned Drinking for those High vs Low in (lack of) Premeditation



Note. LPM= (lack of) premeditation. Values on y-axis represent log likelihood. *simple slope is statistically significant ($p < .05$).

Figure 2

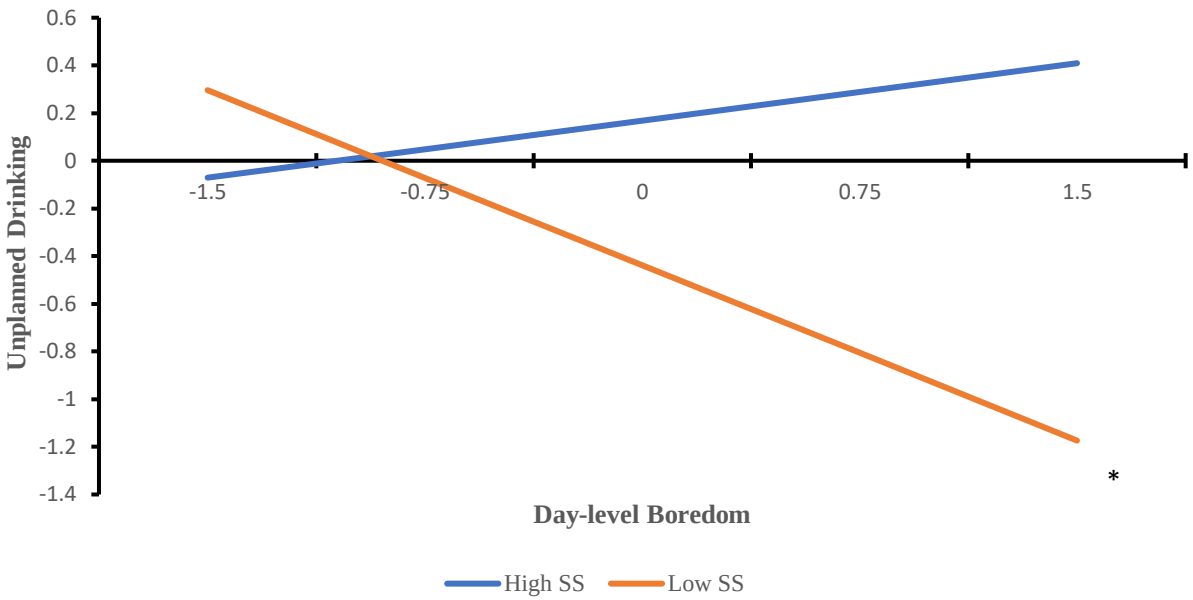
Interaction between Day-level Positive Affect and Unplanned Drinking for those High vs Low in (lack of) Perseverance



Note. LPS = (lack of) perseverance. Values on y-axis represent log likelihood. **simple slope is statistically significant ($p < .01$).

Figure 3

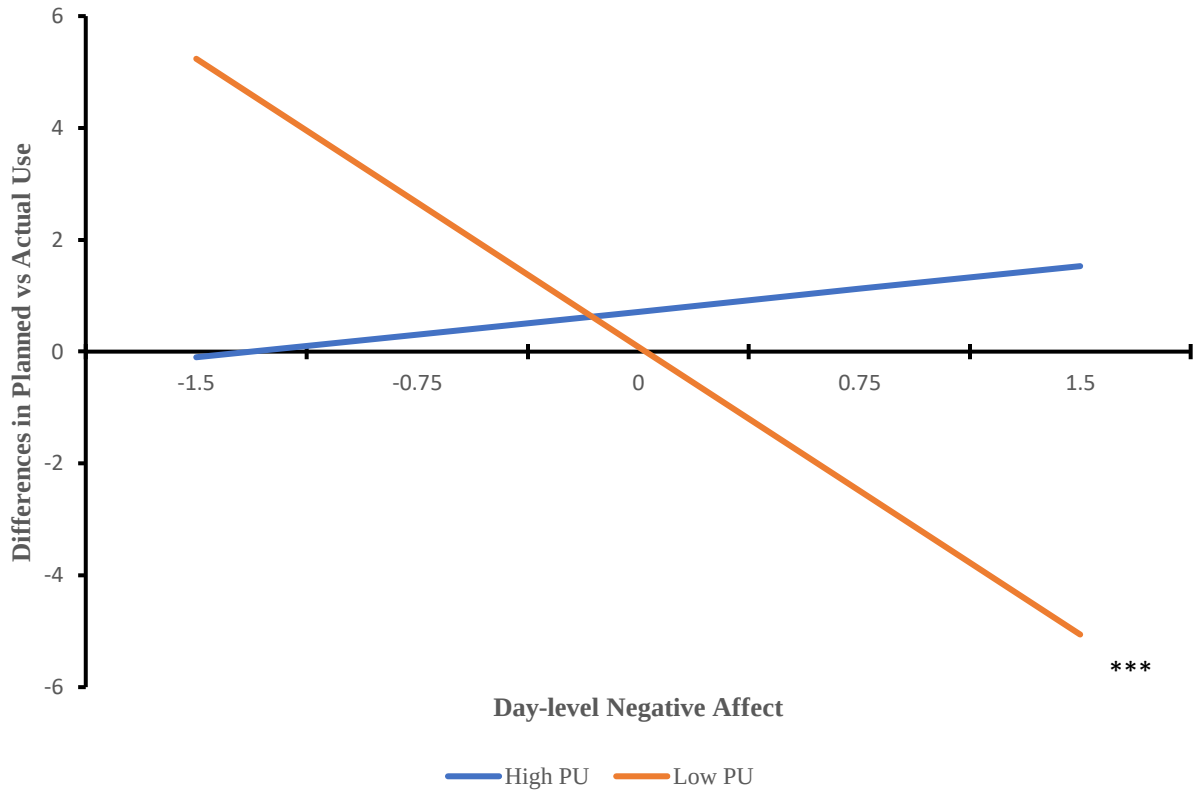
Interaction between Day Level Boredom and Unplanned Drinking for those High vs Low in Sensation Seeking



Note. SS= Sensation Seeking. Values on y-axis represent log likelihood. *simple slope is statistically significant ($p < .05$).

Figure 4

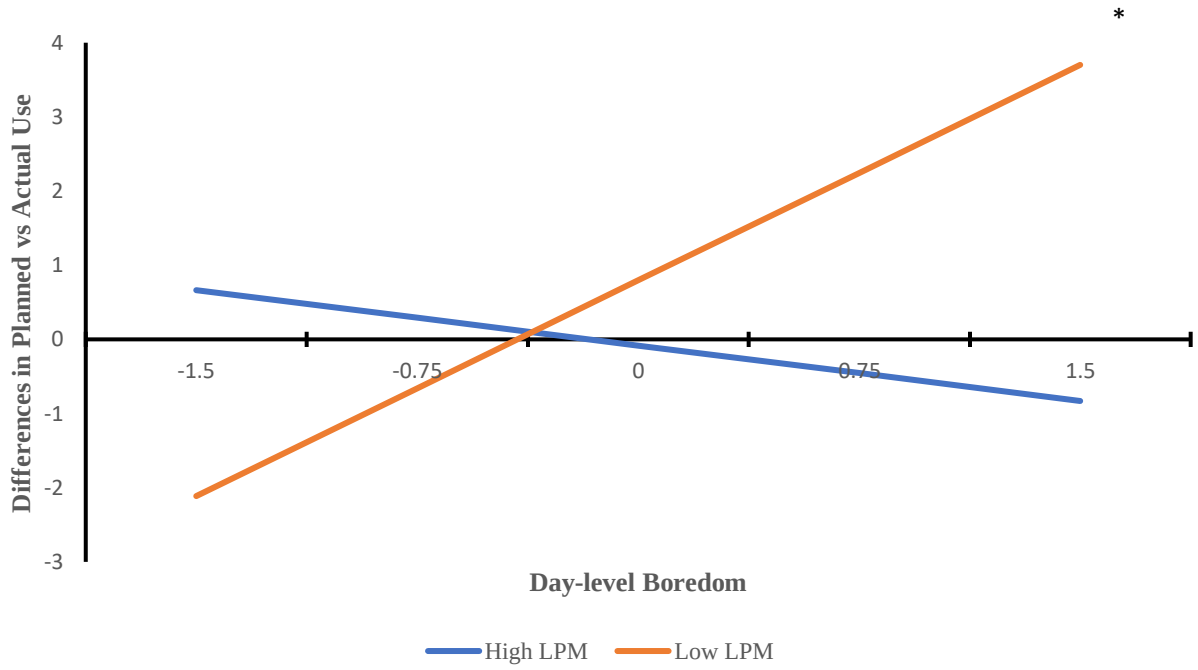
Interaction between Day-level Negative Affect and Drinking more than Intended on a Planned Drinking Day for those High vs Low in Positive Urgency



Note. PU= positive urgency. Values on y-axis represent log likelihood. ***simple slope is statistically significant ($p < .001$).

Figure 5

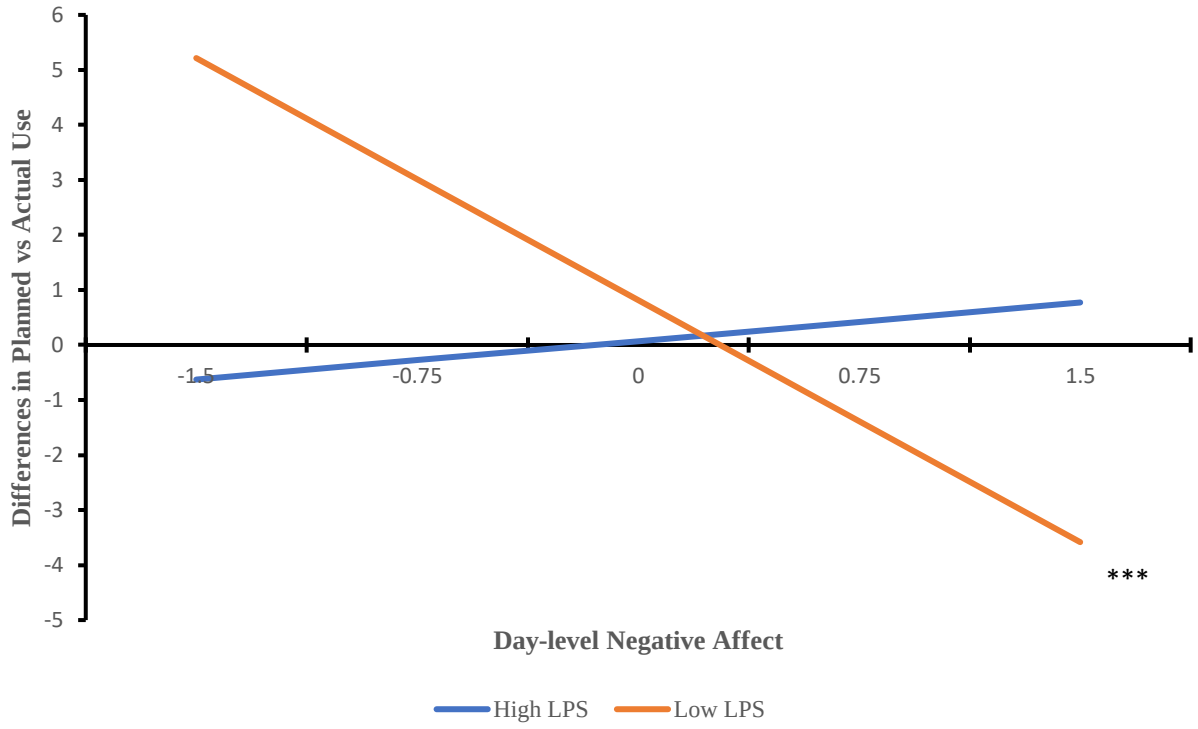
Interaction between Day-level Boredom and Drinking more than Intended on a Planned Drinking Days for those High vs Low in (lack of) Premeditation



Note. LPM= (lack of) premeditation. Values on y-axis represent log likelihood. *simple slope is statistically significant ($p < .05$).

Figure 6

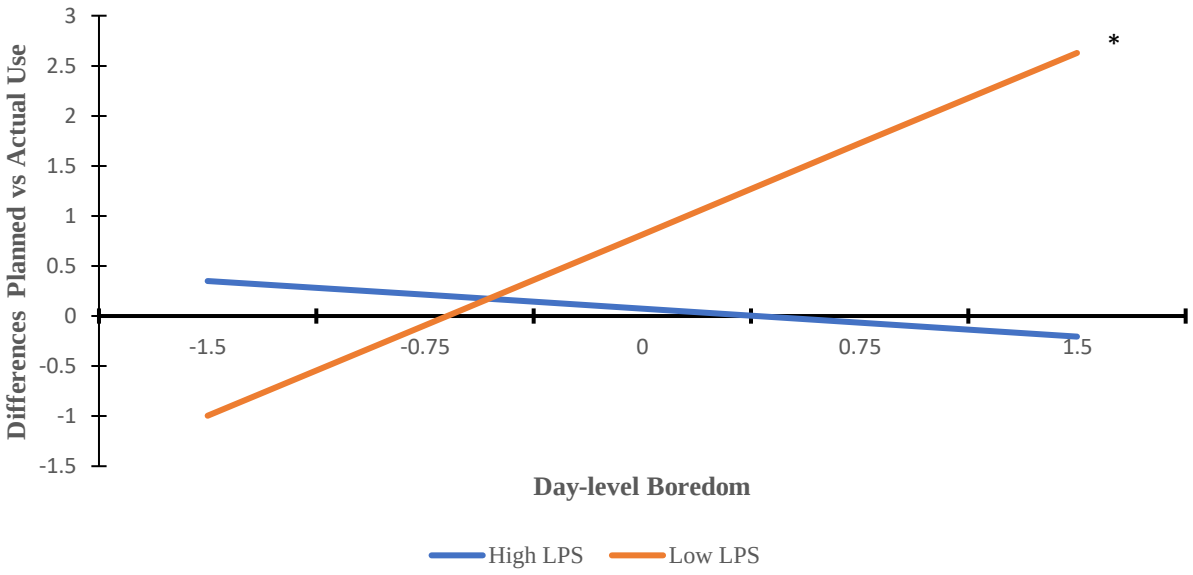
Interaction between Day-level Negative Affect and Drinking more than Intended on a Planned Drinking Days for those High vs Low in (lack of) Perseverance



Note. LSP= (lack of) perseverance. Values on y-axis represent log likelihood. ***simple slope is statistically significant ($p < .001$).

Figure 7

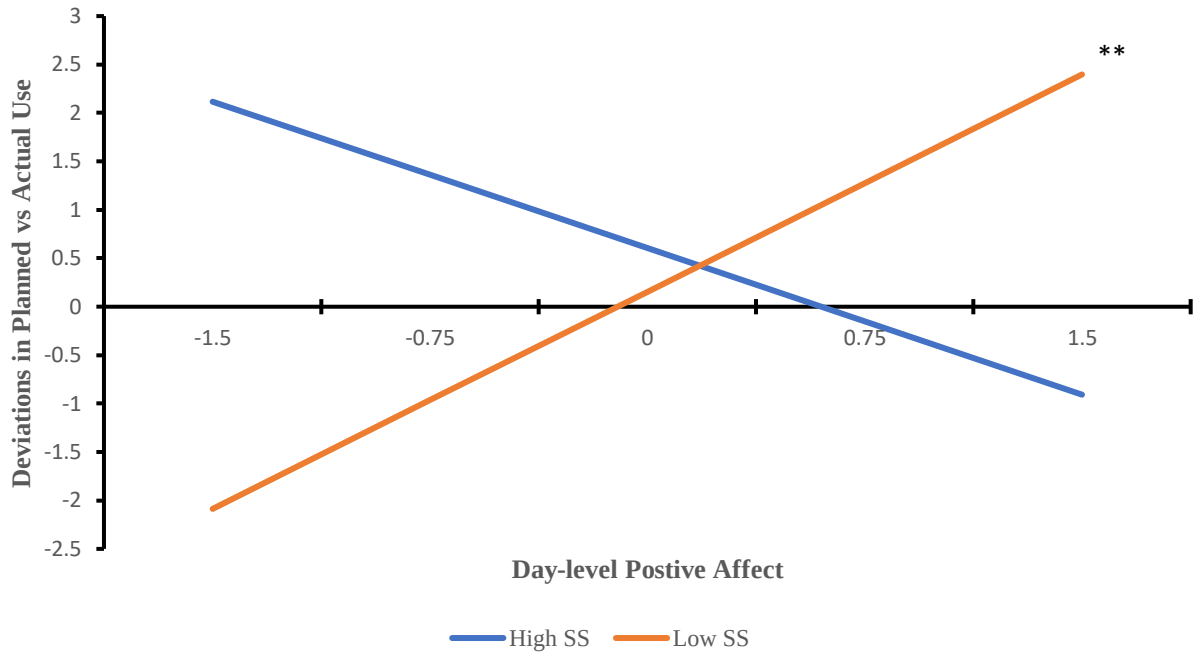
Interaction between Day Level Boredom and Drinking more than Intended on a Planned Drinking Days for those High vs Low in (lack of) Perseverance.



Note. LPS= (lack of) perseverance. Values on y-axis represent log likelihood. *simple slope is statistically significant ($p < .05$).

Figure 8

Interaction between Day Level Positive Affect and Unplanned Drinking for those High vs Low in Sensation Seeking



Note. SS = sensation seeking. Values on y-axis represent log likelihood. **simple slope is statistically significant ($p < .01$).

Appendix A

UPPS-P Impulsive Behavior Scale (UPPS-P)

In the following pages you will be presented with a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement.

	Agree strongly	Agree some	Disagree some	Disagree strongly
1. I have a reserved and cautious attitude toward life.	☐	☐	☐	☐
2. I have trouble controlling my impulses.	☐	☐	☐	☐
3. I generally seek new and exciting experiences and sensations.	☐	☐	☐	☐
4. When I am very happy, I can't seem to stop myself from doing things that can have bad consequences.	☐	☐	☐	☐
5. My thinking is usually careful and purposeful.	☐	☐	☐	☐
6. I have trouble resisting my cravings (for food, cigarettes, etc.).	☐	☐	☐	☐
7. I'll try anything once.	☐	☐	☐	☐
8. I tend to give up easily.	☐	☐	☐	☐
9. When I am in great mood, I tend to get into situations that could cause me problems.	☐	☐	☐	☐
10. I am not one of those people who blurt out things without thinking.	☐	☐	☐	☐

11. I often get involved in things I later wish I could get out of.	☐	☐	☐	☐
12. I like sports and games in which you have to choose your next move very quickly.	☐	☐	☐	☐
13. Unfinished tasks really bother me.	☐	☐	☐	☐
14. When I am very happy, I tend to do things that may cause problems in my life.	☐	☐	☐	☐
15. I like to stop and think things over before I do them.	☐	☐	☐	☐
16. When I feel bad, I will often do things I later regret in order to make myself feel better now.	☐	☐	☐	☐
17. I would enjoy water skiing.	☐	☐	☐	☐
18. Once I get going on something I hate to stop.	☐	☐	☐	☐
19. I tend to lose control when I am in a great mood.	☐	☐	☐	☐
20. I don't like to start a project until I know exactly how to proceed.	☐	☐	☐	☐
21. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.	☐	☐	☐	☐
22. I quite enjoy taking risks.	☐	☐	☐	☐
23. I concentrate easily.	☐	☐	☐	☐

24. When I am really ecstatic, I tend to get out of control.	☐	☐	☐	☐
25. I would enjoy parachute jumping.	☐	☐	☐	☐
26. I finish what I start.	☐	☐	☐	☐
27. I tend to value and follow a rational, 'sensible' approach to things.	☐	☐	☐	☐
28. When I am upset I often act without thinking.	☐	☐	☐	☐
29. Others would say I make bad choices when I am extremely happy about something.	☐	☐	☐	☐
30. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	☐	☐	☐	☐
31. I am able to pace myself so as to get things done on time.	☐	☐	☐	☐
32. I usually make up my mind through careful reasoning.	☐	☐	☐	☐
33. When I feel rejected, I will often say things that I later regret.	☐	☐	☐	☐
34. Others are shocked or worried about the things I do when I am feeling very excited.	☐	☐	☐	☐
35. I would like to learn to fly an airplane.	☐	☐	☐	☐
36. I am a person who always gets the job done.	☐	☐	☐	☐

37. I am a cautious person.	☐	☐	☐	☐
38. It is hard for me to resist acting on my feelings.	☐	☐	☐	☐
39. When I get really happy about something, I tend to do things that can have bad consequences.	☐	☐	☐	☐
40. I sometimes like doing things that are a bit frightening.	☐	☐	☐	☐
41. I almost always finish projects that I start.	☐	☐	☐	☐
42. Before I get into a new situation I like to find out what to expect from it.	☐	☐	☐	☐
43. I often make matters worse because I act without thinking when I am upset.	☐	☐	☐	☐
44. When overjoyed, I feel like I can't stop myself from going overboard.	☐	☐	☐	☐
45. I would enjoy the sensation of skiing very fast down a high mountain slope.	☐	☐	☐	☐
46. Sometimes there are so many little things to be done that I just ignore them all.	☐	☐	☐	☐
47. I usually think carefully before doing anything.	☐	☐	☐	☐
48. When I am really excited, I tend not to think of the consequences of my actions.	☐	☐	☐	☐
49. In the heat of an argument, I will often say things that I later regret.	☐	☐	☐	☐

50. I would like to go scuba diving.	☐	☐	☐	☐
51. I tend to act without thinking when I am really excited.	☐	☐	☐	☐
52. I always keep my feelings under control.	☐	☐	☐	☐
53. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	☐	☐	☐	☐
54. Before making up my mind, I consider all the advantages and disadvantages.	☐	☐	☐	☐
55. I would enjoy fast driving.	☐	☐	☐	☐
56. When I am very happy, I feel like it is ok to give in to cravings or overindulge.	☐	☐	☐	☐
57. Sometimes I do impulsive things that I later regret.	☐	☐	☐	☐
58. I am surprised at the things I do while in a great mood.	☐	☐	☐	☐

Appendix B

Alcohol Use Disorders Identification Test (AUDIT)

Now I am going to ask you some questions about your use of alcoholic beverages during the past 3 months.

Some of these questions ask about how many drinks you usually consume.

These questions ask about your use of alcohol in the past 3 months.

Please keep in mind that "one drink" is equal to one 12 ounce can or bottle of beer, one 5-ounce glass of wine, or a 1.5 ounce shot of liquor.

1. How often do you have a drink containing alcohol?	◯ Never ◯ Monthly or less ◯ 2 to 4 times a month ◯ 2 to 3 times a week ◯ 4 or more times a week
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	◯ 1 or 2 ◯ 3 or 4 ◯ 5 or 6 ◯ 7, 8, or 9 ◯ 10 or more
3. How often do you have six or more drinks on one occasion?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
4. How often during the past 3 months have you found that you were not able to stop drinking once you had started?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
5. How often during the past 3 months have you failed to do what was normally expected from you because of drinking?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
6. How often during the past 3 months have you needed a first drink in the morning to get yourself going after a heavy drinking session?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
7. How often during the past 3 months have you had a feeling of guilt or remorse after drinking?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
8. How often during the past 3 months have you been unable to remember what happened the night before because you had been drinking?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
9. Have you or someone else been injured as a result of your drinking?	◯ No ◯ Yes, but not in the past 3 months ◯ Yes, during the past 3 months
10. Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?	◯ No ◯ Yes, but not in the past 3 months ◯ Yes, during the past 3 months
TOTAL (auto-calculated) :	_____

Appendix C

Cannabis Use Disorders Identification Test (CUDIT-R)

Please answer the following questions about your cannabis use over the past year. How often do you use cannabis?	◯ Never ◯ Monthly or less ◯ 2-4 times a month ◯ 2-3 times a week ◯ 4 or more times a week
How many hours were you 'stoned' on a typical day when you had been using cannabis?	◯ Less than 1 ◯ 1 or 2 ◯ 3 or 4 ◯ 5 or 6 ◯ 7 or more
How often during the past year did you find that you were not able to stop using cannabis once you had started?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
How often during the past year did you fail to do what was normally expected from you because of using cannabis?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
How often in the past year have you devoted a great deal of your time to getting, using, or recovering from cannabis?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
How often in the past year have you had a problem with your memory or concentration after using cannabis?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
How often do you use cannabis in situations that could be physically hazardous, such as driving, operating machinery, or caring for children?	◯ Never ◯ Less than monthly ◯ Monthly ◯ Weekly ◯ Daily or almost daily
Have you ever thought about cutting down, or stopping, your use of cannabis?	◯ Never ◯ Yes, but not in the past year ◯ Yes, during the past year
TOTAL (auto-calculated) :	_____

Appendix D

Daily Morning Survey (DMS) for planned use items

Do you PLAN to consume any alcohol today/tonight?	Definitely Not| Likely Not| Likely Yes| Definitely Yes
[if likely or definitely yes to #34] What is the MAXIMUM number standard drinks do you plan to drink today/tonight?	____Drinks (note: enter 99 if you have no set limits)
Do you PLAN to consume any cannabis today/tonight?	Definitely Not| Likely Not| Likely Yes| Definitely Yes
[if likely or definitely yes to #36] What is the MAXIMUM amount of marijuana you plan to use today/tonight?	No set limit| Planning to consume only concentrates (e.g., dabs)|less than 1/8 of a gram (0.125g) - e.g., one or two hits|1/8 of a gram (0.125 g) |1/4 of a gram (0.25 g) |1/2 of a gram (0.5 g) |3/4 of a gram (0.75 g)|1 gram|1.25 grams|1.5 grams|1.75 grams|2 grams| 2.1 grams to 3.5 grams (1/8 ounce) |3.6 grams to 7 grams (1/4 ounce)|7.1 grams to 14 grams (1/2 ounce) | more than 14 grams (more than 1/2 ounce)

Daily Morning Survey (DMS) for actual use items

Question	Choices
Did you use any of the following yesterday? (between the time you woke up and the time you went to sleep yesterday)	Alcohol|Cannabis|Tobacco/Nicotine|Other drug| None of the above
[if alcohol to #10] How many total standard drinks did you consume yesterday?	
[if cannabis to #10] What form(s) of cannabis did you use yesterday? (check all that apply)	Marijuana|Concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)|Edibles|Cannabis beverages|Other
[if marijuana to #14] How much **total** marijuana did you personally use yesterday (not including concentrates and edibles) in grams? *Remember to add across all of your marijuana sessions yesterday*	less than 1/8 of a gram (0.125g) - e.g., one or two hits|1/8 of a gram (0.125 g) |1/4 of a gram (0.25 g) |1/2 of a gram (0.5 g) |3/4 of a gram (0.75 g)|1 gram|1.25 grams|1.5 grams|1.75 grams|2 grams| 2.1 grams to 3.5 grams (1/8 ounce) |3.6 grams to 7 grams (1/4 ounce)|7.1 grams to 14 grams (1/2 ounce) | more than 14 grams (more than 1/2 ounce)

Appendix E

Standard Drink Chart

Appendix F

Marijuana Amount Chart

For the following questions, please use the image below to refer to various quantities of marijuana. The image is not to scale; the dollar bill is included to help provide size perspective.

Appendix G

Random Survey mood items

Item Number	Questions	Rating
	[mood/craving] For each of the following, please indicate to what extent you feel this way **right now**	
3	Sad	1|2|3|4|5
4	Irritable	1|2|3|4|5
5	Relaxed	1|2|3|4|5
6	Happy	1|2|3|4|5
7	Energetic	1|2|3|4|5
8	Stressed/Anxious	1|2|3|4|5
9	Bored	1|2|3|4|5