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Special Section Editor
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KEYNOTE ADDRESSES

Cannabis Research at NIDA:
Implications for Public Health
Marsha Lopez

NIH/National Institute on Drug Abuse

Advances in Adolescent Cannabis Use Disorder:
Bridging Science and Practice

Robert Miranda Jr.
Brown University

POSTER PRESENTATIONS

All poster presentations and symposia were peer-reviewed by the 2022 Conference Program Committee of the Research Society on Marijuana (RSMj) (Bradley T. Conner, Colorado State University, Benjamin O. Ladd, Washington State University Vancouver, Kristina T. Phillips, Kaiser Permanente, Verlin Joseph, University of New Mexico, Kirstyn Smith-Lecavalier, University of Washington). All abstracts below were approved and voluntarily submitted for publication in Cannabis by the presenting or contact author.

The power of placebo: Does cannabidiol (CBD) expectancy alone impact acute stress and anxiety?

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Background. There have been notable increases in the use of cannabidiol (CBD) for therapeutic purposes, such as in the treatment of stress- and anxiety- related disorders. Preliminary research

has demonstrated that CBD decreases indices of stress and anxiety. However, drug effects in humans are thought to be comprised of both pharmacological properties as well as a placebo response. Little is known about the extent to which the purported therapeutic effects of CBD result from pharmacological versus expectancy factors.

Aims. The aim of this study was to evaluate whether (i) CBD expectancy alone could influence stress, anxiety, and mood, and (ii) the extent to which beliefs regarding CBD effects predicted these responses. Generalized estimating equations (GEE) were used to evaluate the research questions of interest.

Methods. In this randomized crossover study, 43 health adults (23 women) attended three laboratory sessions. During the first session, they were oriented to the study and rated the extent to which they believed that CBD helped with stress, anxiety, and mood. They then participated in two identical experimental laboratory sessions, where they self-administered CBD-free hempseed oil sublingually. During one session, they were (incorrectly) informed that the oil contained CBD and in the other session, that the oil was CBD-free. Following administration, participants engaged in the Maastricht Acute Stress Test (MAST) to induce moderate levels of stress and anxiety. Heart rate variability (HRV) was assessed continuously, and subjective state (i.e., stress, anxiety, mood, other subjective states) was assessed at baseline, 90-min following oil administration, immediately following the MAST, and after a 10-min recovery period.

Results. The CBD expectancy condition was associated with increased sedation as well as significant fluctuations in HRV that could indicate heightened anticipatory stress regulation. Overall, there were no observed changes in subjective stress, or anxiety, according to expectancy condition. However, participants

who endorsed the strongest a priori beliefs about CBD possessing anxiolytic properties reported significantly lower anxiety in the CBD expectancy condition and higher anxiety the CBD-free expectancy condition.

Conclusions. Results from this study indicated that CBD expectancy alone impacted several subjective and physiological responses. Additionally, expectancy-related factors were implicated in anxiolytic effects of CBD for those who strongly believed it was helpful for such purposes, suggesting that expectation plays some role in the purported stress- and anxiety- reducing effects of CBD. Findings from this study emphasize the need to measure and control for CBD-related expectancies in clinical research that involves the administration of CBD. Future investigations would benefit from replicating these findings and using a full balanced-placebo research design to elucidate the relative contributions of pharmacology and expectancy.

Effects of cannabidiol with and without other cannabinoids and terpenes on short-term and long-term stress-related behaviors

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Introduction: Stress-related disorders, such as anxiety and post-traumatic stress disorder, are a primary reason for treatment (and self-medication) with medical cannabis products. Research suggests endocannabinoids regulate neurotransmitters involved in stress but whether phytocannabinoids such as cannabidiol (CBD) reduce stress behaviors is not fully established. To that end, we sought to examine how CBD with and without other cannabinoids or terpenes might alter behavior in mouse models of short-term and long-term responses to acute stressors.

Methods: For short-term stress responses, adult male C57Bl/6J mice received a 30-60-minute restraint stress followed by testing with open field and light-dark box tests. Mice were treated with vehicle, CBD (10mg/kg), or CBD with low dose delta-9-tetrahydrocannabinol (THC, 2.5mg/kg and 7.5 mg/kg CBD for 10mg/kg total cannabinoid content) 45-60 minutes prior to stress exposure. For long-term stress behavior, mice underwent conditioned place avoidance to restraint plus predator odor contexts, with controls receiving

individual stressors or no stress. Avoidance to the stress paired context was examined 1, 7, and 28 days later. Groups received vehicle, CBD (3.07 mg/ml CBD, 3mg/kg cannabigerol, low terpenes), CBD+THClo-terp (3.07 mg/ml CBD, 3mg/kg cannabigerol, 0.76 mg/ml THC, low terpenes), or CBD+THChi-terp (3.29 mg/ml CBD, 3mg/kg cannabigerol, 0.76 mg/ml THC, high terpenes) 30-45 minutes after stress exposure. Researchers were blinded to treatment conditions during all analyses.

Results: In the short-term experiments, mice treated with CBD trended towards an increase in the time spent and decreased latency to enter the light side of the light-dark box compared to vehicle, suggesting reduced anxiety-like behaviors. Additionally, CBD treated mice showed reductions in freezing, immobility time, and latency to enter the center of the open field compared to vehicle treated mice, with no differences in the time spent in the center of the field. CBD+THC treatment showed no significant differences compared to vehicle. In the long-term experiments, mice exposed to restraint plus predator odor showed reduced time spent in the stress paired chamber on days 1, 7, and 28 post-stress, although there did appear to be stress susceptible and resilient mice in this paradigm. Avoidance behaviors were not seen when stressors were presented individually or if no stress was used. In this paradigm, CBD+THClo-terp was the only treatment to reduce avoidance behavior at the post-stress time points tested.

Conclusions: These results suggest that CBD has a differential effect on anxiety-like behaviors based on type of stress, post-stress timing of behavioral testing, and CBD/THC/cannabigerol/terpene content. Further studies are needed to uncover the effect of phytocannabinoids on short-term and long-term stress responses as well as related neurotransmitters and circuitries driving these effects.

“I just smoke marijuana, which is not a drug, and cigarettes, which is a drug”: Health Perceptions of Cannabis Use Among African American Tobacco Smokers

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Cannabis and tobacco co-use has increased in recent years, including co-administration, in which tobacco and cannabis are consumed simultaneously. One common method of co-administration is the use of blunts, in which cigars or little cigars and cigarillos (LCCs) are combined with cannabis. LCC use is associated with negative health outcomes and is elevated among Black/African American populations and lower income adults. Little is known about health perceptions of LCCs among these populations, particularly as it relates to cannabis use. We report results from a mixed-methods study examining multiple tobacco use among African American adults. Participants (N=22) were largely single (81.8%), male (59.1%), and had an annual household income of less than \$30,000 (72.7%). All participants used combustible cigarettes in the past month (M days=26.23, SD=7.38) and the majority (91.0%) used LCCs in the past month (M days=14.24, SD= 0.67). Of these, 50.0% reported using LCCs with cannabis all or some of the time. Participants who reported co-use smoked LCCs marginally more days (M=18.45, SD=11.88) than those who used LCCs alone (M=9.60, SD=7.12, $t(19)=-2.04$, $p = .055$, $d=.89$). Perceptions of the health risks of LCCs compared to combustible cigarettes were variable among those who reported co-use and those who did not. For example, 45.5% of co-users vs. 20.0% LCC only users said they “Don’t know” if LCCs are more or less harmful than cigarettes, whereas 27.3% of co-users and 10.0% LCC only users thought LCCs were “More harmful.” There was no difference between the groups on overall relative risk perceptions ($\chi^2(3)=4.25$, $p=.24$). Semi-structured interviews assessed tobacco use motives, including cannabis consumption, risk perceptions, and stress. Similar to quantitative indices, participants reported variable perceptions of the health risks associated with co-use of cannabis and tobacco. For example, a number of participants indicated that smoking LCCs with cannabis may be healthier than smoking them with the original tobacco inside. Many reported different motives for seeking out cannabis vs. nicotine (e.g., coping with stress, social situations). Quotations from qualitative interviews will be included on the poster. In conclusion, health risk perceptions among this sample demonstrate the need for clearer public

health messaging regarding tobacco products and co-use with cannabis.

Cannabis Nomenclature: Perceptions and Preferences Among Women of Reproductive Age

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Background: Cannabis use among women of reproductive age has been rapidly increasing over the past decade in the United States (US). Effective communication about risks of cannabis use is essential for preventing adverse health effects. However, prevention efforts, including public health messaging and clinician-directed communication often interchange the terms marijuana and cannabis. Few studies have examined how women perceive cannabis terminology to guide the development of cannabis prevention efforts.

Methods: In April of 2021, we recruited women of reproductive age (18-40 years) for an online survey. We collected sociodemographic information and asked women about their knowledge of and attitudes towards cannabis, including perceptions of cannabis terminology. We used descriptive statistics and chi-squared tests to examine variations in cannabis terminology perceptions and preferences across sociodemographic characteristics and state-level cannabis policies.

Results: Our sample (N=166) consisted of predominantly low-income (52.63%), white (77.19%) women, of whom 58.9% were currently pregnant or pregnant within the last 2 years. About 23.49% of women perceived the word marijuana to reference the smoked form of the plant only (e.g., joint). Although not statistically significant, more women residing in states where recreational cannabis was legal were more likely to report this perception (26.56%) compared to women residing in states yet to legalize cannabis (21.57%). Overall, most women (62.42%) preferred that the term, cannabis should be used when referencing THC-containing products.

Conclusions: Future cannabis prevention efforts should consider these findings when designing interventions and public health campaigns to address cannabis use among women of reproductive age, including pregnant women.

The impact of cannabis edible packaging elements on appeal, harm perceptions and knowledge: an experimental study among a national convenience sample of adults in the United States

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The state-legalized cannabis industry is rapidly evolving, and regulators lack scientific data as to how product packaging should be regulated to protect public health. Cannabis edibles in particular pose unique public health and regulatory challenges. While smoking cannabis results in an immediate high, intoxication from consuming edibles can be delayed up to 2 hours or more which can lead to overconsumption of THC, particularly by naïve users. The packaging of edibles as appealing food products may also reduce harm perceptions. The goal of this pilot study was to examine the impact of flavor imagery and a cannabis warning on product appeal, harm perceptions, knowledge, and willingness to try edibles. We recruited a convenience sample of 700 adults ages 19-79 (mean age 38), 52% female, 77% white, 14% Hispanic, 59% college-educated from Amazon Mechanical Turk (MTurk). Participants were randomized to one of four experimental conditions to view a cannabis edible package that varied by presence of fruit imagery (yes/no) and type of warning (Washington State cannabis warning; control warning). More than half of our sample had tried edibles and 36% were current users. Participants viewing packages with fruit imagery were significantly more likely ($p < 0.05$) than participants viewing packages without fruit imagery to think the product was appealing (69% vs 39%) and safe to consume (69% vs 52%) and were more likely to want to try the product (58% vs 39%). Among participants exposed to the cannabis warning, only 42% believed the package clearly indicated how to safely consume it and fewer than half knew the correct serving size, which was not significantly different than those not viewing the warning. Only 17% of those viewing the warning knew the effects could be delayed by more than two hours. These results provide preliminary evidence of the impact of

product packaging on appeal, knowledge, harm perceptions and willingness to try cannabis edibles and demonstrate the need for improved, edible-specific warnings to educate consumers about safe use.

Are cannabis use motives and consequences stronger by gender?

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Background: Cannabis is the most commonly used federally illicit substance among emerging adults (18-25). As cannabis use rates increase it is important to further understand reasons why individuals use cannabis and the problematic consequences of cannabis use. Previous research has shown a variety of gender differences in recreational use vs. medical use, methods of cannabis use, and consequences related to cannabis use. However, little is known about gender differences in cannabis use motives and consequences related to cannabis use. To further understand the differential impact of cannabis use motives on problematic cannabis use, the present study examined whether gender moderated the connection between cannabis use motives and cannabis-related problems. It is hypothesized that gender will moderate the connection between cannabis use motives and cannabis-related consequences.

Method: 401 emerging adults (51.9% female; 59.1% Caucasian) completed an online survey assessing gender, frequency of cannabis use, cannabis use motives, and cannabis related problems. Motives for cannabis use were measured using the Comprehensive Marijuana Motives Questionnaire (CMMQ) and problems related to cannabis use was measured using the Marijuana Problems Scale (MPS). The CMMQ consists of 36 items that assess 11 subtypes of cannabis use motives including alcohol, celebration, relative low risk, conformity, boredom, altered perception, sleep, availability, social anxiety, coping, and enjoyment. Bivariate correlations were used to examine the association between cannabis use motives, consequences related to cannabis use, and gender. Moderation analyses were then conducted to assess whether gender moderated the relationship between each cannabis use motive and consequences related to cannabis use.

Results: Bivariate correlations revealed significant positive correlations for each cannabis use motive and consequences related to cannabis use (alcohol $r = .28$, $p < .001$, celebration $r = .20$, $p = .01$, relative low risk $r = .29$, $p < .001$, conformity $r = .23$, $p = .003$, boredom $r = .49$, $p < .001$, altered perception $r = .47$, $p < .001$, sleep $r = .30$, $p < .001$, availability $r = .29$, $p < .001$, social anxiety $r = .41$, $p < .001$, coping $r = .45$, $p < .001$, and enjoyment $r = .31$, $p < .001$). Several moderation analyses revealed gender moderated the relationship for cannabis use motives and cannabis related consequences, but only for boredom motives (95% CI [-.75, -.26]), altered perception motives (95% CI [-.52, -.03]), availability motives (95% CI [-.85, -.28]), coping motives (95% CI [-.72, -.21]), and sleep motives (95% CI [-.67, -.18]). The connection between each of these motives and cannabis-related problems was significantly stronger for males vs. females.

Conclusions: The results indicate that gender moderated the relationship between boredom motives, altered perception motives, availability motives, coping motives, and sleep motives and cannabis-related problems. The connection between these motives and cannabis-related problems was significantly stronger for males, suggesting that males who use cannabis for these reasons may be at elevated risk for experiencing cannabis-related problems relative to females who use cannabis for these reasons. Interventions that target cannabis-related problems may benefit from tailoring intervention elements based on gender.

Motives and Consequences Associated with Solitary Alcohol and Cannabis Use among Co-Users during the COVID-19 Pandemic

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Background: The COVID-19 pandemic resulted in lockdowns that had an impact on alcohol and cannabis use behavior. During the height of the early lockdowns, many individuals shifted to using alcohol and cannabis in solitary contexts (e.g., Wardell et al., 2020). Solitary drinking is a non-normative behaviour that can predict severe alcohol problems and is associated with coping-motivated drinking (Keough et al. 2018; Skrzynski & Creswell, 2020). Similarly, solitary cannabis use is associated with cannabis use

disorder and using cannabis to cope (Spinella et al., 2019). Further, co-use of alcohol and cannabis is related to negative consequences such as alcohol use disorder, depressive symptoms, and impaired driving (Yurasek et al., 2017). As there has been limited research on solitary alcohol and cannabis co-use, this study examined substance use motives and consequences associated with solitary use of both alcohol and cannabis among co-users during the pandemic.

Methods: Canadians (N=149; 46% female; mean age = 31 years old) who reported co-use of alcohol and cannabis completed an online survey approximately 6-8 weeks into the first COVID-19 lockdown. Participants reported on past 30-day alcohol and cannabis use, solitary use, motives, and problems (i.e., Short Inventory of Problems and Marijuana Problems Scale). Participants were divided into two groups: those reporting predominantly solitary use of both alcohol and cannabis during the lockdown (solitary co-users; n=61) and those reporting predominantly social use of one or both substances during the lockdown (social co-users; n=88). Logistic regression was used to examine the unique associations of drinking motives and cannabis motives with co-use group (solitary vs. social), and to examine if the solitary co-use group was more likely to report alcohol and cannabis problems (controlling for alcohol and cannabis use).

Results: Coping motives for drinking were associated with greater likelihood of being in the solitary vs. social co-use group after controlling for other drinking motives and alcohol use (OR=2.02, $p=.023$). Conversely, none of the cannabis use motives were significantly associated with membership in the solitary vs. social co-use group. Additionally, compared to social co-users, solitary co-users had higher odds of reporting alcohol problems, including one or more physical problems (OR=2.37, $p=.033$), intrapersonal problems (OR=3.95, $p=.002$), and social problems (OR=2.79, $p=.022$), after controlling for alcohol use. Cannabis-related problems did not differ between solitary and social co-users.

Conclusions: Findings provide insight into the motives and consequences of solitary alcohol and cannabis use among co-users during the early stages of the COVID-19 pandemic. These findings suggest that interventions should target co-users who are using both alcohol and cannabis in a solitary context during the pandemic as they

appear to be at higher risk for alcohol-related problems. Future research should examine the long-term outcomes of solitary co-use throughout the COVID-19 pandemic. Given that it is not known if the solitary co-users in this study were engaging in simultaneous use of cannabis and alcohol (i.e., using both substances on the same occasion), future ecological momentary assessment (EMA) studies should focus on understanding solitary simultaneous use during the pandemic.

Medicinal versus recreational cannabis use among youth: A systematic review

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Background: Adolescents and young adults have high rates of cannabis use. Although a sizeable portion of youth report that they use cannabis for medicinal reasons (Wardell et al., 2020; Wardell, in press), most research on youth cannabis use tends to focus on recreational use. It is important to understand how youth who use cannabis for medicinal reasons differ from those who use for recreational reasons. We aimed to review the limited research comparing youth engaging in medicinal cannabis use to those engaging in recreational cannabis use.

Methods: A systematic literature search of three databases (PsychInfo, PubMed, MEDLINE) was conducted to identify studies that compared adolescents and/or young adults who engage in medicinal cannabis to those who engage in recreational cannabis use. Studies that defined medicinal cannabis use either as self-reported use of cannabis for therapeutic reasons or as obtaining authorization/prescription for medical cannabis from a healthcare provider were included. Only quantitative research studies published in a peer-reviewed journal were included. After conducting the initial search and removing duplicates, 748 abstracts were reviewed independently by two researchers. Any discrepancies were resolved by consensus in consultation with a third researcher.

Results: A total of 13 articles met inclusion criteria. Outcome variables reported in the literature included cannabis use (frequency and amount), cannabis-related problems, use of other substances including illicit drug use or prescription medication misuse, and health-related variables such as mental health symptoms

or physical pain. Overall, the literature suggests that youth who use cannabis medicinally are more likely to use greater amounts of cannabis, to use more frequently, and to use a variety of different forms of cannabis, relative to youth who use cannabis recreationally. Further, several studies reported that medicinal cannabis use among youth was associated with problems related to cannabis use, such as the risk for cannabis use disorder and problematic behaviour (e.g., driving under the influence). Several studies also found that medicinal (vs. recreational) cannabis use was related to poorer mental or physical health, although a couple of studies did not support this finding. However, the results were mixed regarding the associations between medicinal cannabis use and the likelihood of using other drugs.

Conclusion: There is evidence that using cannabis for medicinal reasons is associated with greater cannabis consumption, cannabis-related problems, and negative health-related correlates among youth. Although there was some consistency in findings across studies, the limited number of studies make it difficult to draw firm conclusions. Causal inferences are difficult to make owing to the frequent reliance on cross-sectional designs. The findings are further complicated by the heterogeneous definition of medicinal cannabis use (i.e., self-report vs. medically authorized). Given that many young people engage in both medicinal and recreational cannabis use, it is difficult to fully disentangle the differences. Additional research is needed for a complete understanding of the unique outcomes associated with medical cannabis use among youth.

Differences in alcohol and cannabis motives among simultaneous, concurrent, alcohol-only, and cannabis-only users

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Substance use motives are strong predictors of alcohol and cannabis use and consequences among college students. Both simultaneous alcohol and cannabis (i.e., marijuana; SAM) and concurrent alcohol and cannabis (i.e., marijuana; CAM) use are associated with higher endorsement

of certain types of motives compared to single drug-only use, which may explain heightened risks for experiencing negative consequences evidenced by co-users. Understanding whether motives differ according to type of use could provide an important avenue for intervention efforts; however, research has not yet examined if motives differ between SAM and CAM users. Thus, the purpose of this study was to examine how SAM, CAM, and single drug-only users differ on alcohol and cannabis motives. Participants were 2295 college students (72.4% female, 50.6% white) from seven US universities who reported past-month alcohol and/or cannabis use (41.2% SAM, 12.4% CAM, 39.1% alcohol-only, 7.3% cannabis-only). Participants completed measures of alcohol and cannabis motives and past-month substance use frequency via online survey. Two multivariate analyses of covariance (MANCOVA) models were conducted to examine differences on cannabis motives (i.e., enjoyment, celebration, conformity, and coping) and alcohol motives (i.e., social, coping, enhancement, and conformity) separately by past-month user status, controlling for sex and frequency of use. The overall cannabis model was significant, with between-group effects on conformity ($F(2,1398)=3.90, p=.02$), coping ($F(2,1398)=6.96, p=.005$), and celebration ($F(2,1398)=5.83, p=.015$) motives. Pairwise comparisons utilizing a Bonferroni-corrected alpha ($p<.017$) indicated that SAM users endorsed greater coping ($p=.002$) and celebration ($p=.004$) motives than CAM users. Moreover, cannabis-only users held greater coping motives than CAM users ($p=.009$). SAM and cannabis-only users did not differ on any motives. The overall alcohol model was also significant, with between-group effects on all four alcohol motives. Pairwise comparisons indicated that SAM users endorsed greater social ($p=.012$), coping ($p=.003$), and enhancement ($p<.001$) motives than CAM users. Moreover, SAM users were higher on all four motives (all $ps<.01$) than alcohol-only users, and CAM users were higher on social motives ($p=.013$) than alcohol-only users. Results indicate that SAM and CAM users can be importantly differentiated by alcohol and cannabis motives, with SAM users reporting greater motives for use related to coping with negative mood and enhancing positive mood/celebrating for both substances. Interestingly, SAM users did not differ from single drug-only users on cannabis

motives, though they uniformly reported greater alcohol motives. Given that SAM users reported stronger enhancement and coping motives than CAM users across both drugs, it is possible that college students may opt to combine their substances when they are predominantly motivated to use for mood-related reasons. Considering that SAM users only differed from single-drug users with regard to alcohol, but not cannabis motives, it may be that simultaneous use particularly enhances alcohol-related desirable outcomes, though not necessarily desirable cannabis outcomes. As such, intervention efforts designed to reduce SAM use may benefit from specifically targeting alcohol and mood-related motives. Moreover, research is needed to examine the within-person effects that motives may have on type of use.

Marijuana Beliefs

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Cannabis has routinely been identified as one of the most frequently used illicit substances among adolescents, young adults, and the general adult population in the United States by epidemiological studies. Recent policy changes in legal status have inspired calls for replication and further research on the biopsychosocial relationships between cannabis use and related outcomes. Theoretical psychological perspectives of behavior, such as outcome expectancies, social norms, and motivation, have found success in explaining aspects of why substance use occurs. Previous studies suggest that there are also underlying motivations, expectancies, and social norms for discontinuing use and maintaining abstinence-oriented behaviors. The present study sought to identify beliefs about cannabis as a substance in the process of constructing a measure of cannabis-related beliefs able to evaluate populations of cannabis users and non-users. We will examine two important types of validity for new measures in unique content areas; distinguishing them from existing measures, (i.e. construct validity) and evaluating the ability to predict meaningful scores on other measures (i.e. predictive validity). We will examine the relationships among cannabis-related beliefs in the context of social norms, expectancies, and motivation as well as the

associations with indicators of psychosocial well-being and cannabis-related consequences. Thus, results will indicate if the proposed cannabis beliefs scale possesses validity as another approach to evaluating this area of substance-related perceptions among more general populations than substance users alone.

The Influence of Anxiety and Avoidant Coping Style on Probable CUD

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Introduction: Cannabis is frequently used to cope with anxiety symptoms (Sexton et al., 2016). Unfortunately, individuals with anxiety are also at greater risk for developing probable cannabis use disorder (CUD; Marel et al., 2019), although mechanisms are not well understood. Previous literature suggests avoidant coping styles (AVC) are associated with higher anxiety levels, whereas action oriented coping styles (AOC) are associated with lower anxiety levels (Ribadier & Varescon, 2019). While cannabis coping motives are a significant predictor of probable CUD for those with anxiety (Buckner & Zvolensky, 2014), no research has identified how anxiety and specific coping styles predict probable CUD. The aim of the present study was to determine how AVC and AOC interact with anxiety to predict the presence of probable CUD. It was hypothesized that overall individuals with high anxiety would be more likely to endorse probable CUD than low anxiety. Among both anxiety levels, AVC would be more likely to have probable CUD than those with low AVC. Furthermore, individuals with high anxiety and high AOC would be less likely to have probable CUD, compared with those with low AOC, even when anxiety is high.

Methods: College students (N = 371; 72.2% female) who used cannabis in the past six months were recruited as part of a study examining the influence of cannabis use on academic success. Participants completed self-report measures to assess anxiety (DASS-21), coping (B-COPE), and probable CUD (CUDIT-R). A confirmatory factor analysis was used to derive coping subscales using items from the B-COPE (Grosso et al., 2014).

Results: The data was analyzed through a logistic regression conducted in HAYES Process Macro.

Even after controlling for gender, anxiety ($b = .032$, $SE = .016$, $p = .046$) was a positive significant predictor of probable CUD, however neither AOC ($b = .030$, $SE = .025$, $p = .221$) or AVC ($b = .048$, $SE = .056$, $p = .392$) were significant predictors of probable CUD. The interaction between Anxiety X AVC on probable CUD was significant ($b = -.011$, $SE = .005$, $p = .026$), indicating that those with low anxiety and high AVC were more likely to have probable CUD than those with low anxiety and low AVC; however, this interaction did not apply when anxiety levels were high. The interaction between AOC and anxiety was not significant ($b = .004$, $SE = .003$, $p = .134$), which did not support our initial hypothesis.

Discussion: Even when anxiety levels are low, individuals with higher AVC are more likely to endorse probable CUD. In contrast, individuals with higher anxiety are more likely to exhibit probable CUD, regardless of AVC levels. Interestingly, anxiety and AOC did not interact to predict probable CUD, suggesting that risk for CUD may be more about what people avoid than what they do to actively cope. These findings emphasize the importance of targeting both anxiety and AVC when considering risk for probable CUD. Longitudinal data are needed to examine how anxiety and AVC contribute to the development of CUD over time.

Changes in Mental Health as a Predictor of Marijuana Coping Motives and Consequences: Examining the Impact of COVID-19 on College Students

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Background: The spread of COVID-19 has increased anxiety and depression (Khan et al., 2020), especially among college students (Wang et al., 2020). Several theoretical models focus on the impact of poor mental health on marijuana outcomes, largely via coping motives (Cooper et al., 2016). College students may be turning to marijuana to cope with the mental health problems that COVID-19 has exacerbated. The present study compared students who reported increases in anxiety and depression since COVID-

19 stay-at-home orders to those who reported no change in anxiety and depression on marijuana coping motives, use frequency, and negative consequences. Specifically, we examined whether self-reported changes (i.e., group that indicated increases) in poor mental health during COVID-19 were associated with problematic marijuana use via higher marijuana coping motives.

Method: Students were recruited to participate in an online study examining the effects of COVID-19 on mental health and substance use between Fall 2020 - Spring 2021. Given aims of the present study, our analytic sample was limited to 300 students that reported past-month marijuana use and completed measures of changes in mental health due to COVID-19 (single item each for depression and anxiety), measure of general depression/anxiety, and measures of marijuana use, motives, and negative consequences. Among our analytic sample, a majority of participants identified as being White (61.0%), female (71.3%), college freshman (46.8%), and reported a mean age of 20.36 (Median = 19.00; SD = 3.78) years. To test study aims, we conducted two mediation models (changes in depression [Model 1] or anxiety [Model 2] due to COVID-19→marijuana coping motives→ marijuana consequences) using the PROCESS Macro (Hayes, 2013) in SPSS.

Results: Within our analytic sample, we found that 58% of students reported increases in depression since COVID-19 stay-at-home orders, with the remainder (42%) reporting no change. For anxiety, trends were similar, with 63.6% indicating increases in anxiety due to COVID-19, with the remainder (36.4%) reporting no change. Within both of our mediational models, we found support for coping motives mediating the effects of changes in mental health on marijuana problems (depression model: indirect effect = 0.65, 95% CIs = 0.29, 1.08; anxiety model: indirect effect = 0.57, 95% CIs = 0.22, 0.98). Specifically, we found that students reporting an increase in anxiety/depression (compared to those that indicated their mental health remained the same) reported more marijuana problems via higher marijuana use coping motives. It is important to note that we found these effects even when controlling for past month marijuana use frequency and past 2-week depression/anxiety levels (assessed via DASS-21).

Conclusions: We found that in young adults, increases in levels of anxiety and depression due

to COVID-19 were associated with higher problematic marijuana use through higher motivation to use marijuana to cope. Future prevention/interventions efforts targeting problematic marijuana use may benefit from considering changes to mental health before or during major events like COVID-19.

From Adverse Childhood Experiences to Problematic Marijuana Use: Examining the Role of Distress Tolerance and Coping Motives on Negative Marijuana Use Consequences

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(William & Mary)

Cross Cultural Addiction Studies Team

Background: Problematic marijuana use is highly prevalent globally, particularly in young adults, with marijuana use disorder affecting 5.8%, or 2.0 million, of young adults (ages 18 – 25) in the United States alone (SAMHSA, 2020). Previous research has reported a significant association between Adverse Childhood Experiences (ACEs) and later marijuana use (Scheidell et al., 2018). Though existing research reports an association between exposure to ACEs and marijuana use outcomes, the underlying mechanisms that could explain these associations are unclear. In previous research, general drug use coping motives have been shown to significantly mediate the relationship between childhood emotional, physical, and sexual abuse and later drug use problems (Hogarth et al., 2019). Other research has suggested that the factors like distress tolerance, typically negatively associated with childhood trauma (Robinson et al., 2021) and maladaptive coping strategies (Zvolensky et al., 2010), can also play a role in specifically predicting future problematic marijuana use (Buckner et al., 2018).

Objective: The present study aimed to probe this relationship by exploring the associations between ACEs, distress tolerance, marijuana use coping motives, and negative marijuana-related consequences. Specifically, we hypothesized that greater experiences of ACEs would relate to more negative marijuana-related consequences via lower distress tolerance and higher coping motives.

Method: Participants were 752 marijuana-using (i.e., used marijuana in the past month) U.S.

college students (66.0% female) who completed an online survey including measures of basic marijuana use patterns, marijuana use consequences (Brief Marijuana Consequences Questionnaire (MACQ); Simons et al., 2012), marijuana use motivations (Marijuana Motives Questionnaire (MMQ); Simons et al., 1998), ACEs (Adverse Childhood Experiences International Questionnaire (ACE-IQ); WHO, 2018), and distress tolerance (Distress Tolerance Scale, Simons et al., 2005). To address study aims, path analysis was performed within the whole sample to test the serial unique associations between ACEs → distress tolerance → using marijuana to cope → negative marijuana-related consequences. Results: Within our analytic sample, we found that only marijuana coping motives uniquely indirectly influenced the relationship between ACEs and negative marijuana-related consequences (indirect $\beta = .079$, 99% CIs = .042, .121). Distress tolerance did not significantly uniquely indirectly influence the relationship between ACEs and negative marijuana-related consequences. However, a significant double-mediation effect was found illustrating that a higher endorsement of ACEs was associated with lower distress tolerance, which in turn was associated with higher using marijuana to cope motives, which in turn was associated with more negative marijuana-related consequences (indirect $\beta = .011$, 99% CIs = .002, .026).

Conclusions: These findings provide support for the relevance of distress tolerance and coping motives as potential factors in linking ACEs to problematic marijuana use among college students. Our preliminary findings encourage further exploration of these associations in longitudinal or experimental studies. Further these results lend support to the therapeutic targeting of distress tolerance and using marijuana to cope to mitigate harms stemming from ACEs and its impact on problematic marijuana use.

The Role of Impulsivity on Cannabis and Alcohol Use Frequency and Problems Among Frequent Cannabis Users

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Background: Although the relation between impulsivity and substance use outcomes is well-documented (Jones et al., 2014; Stautz et al., 2017), less is known about individual facets of impulsivity among individuals who use cannabis. There is some research suggesting that positive urgency, sensation seeking, and lack of premeditation are associated with greater cannabis use problems, but much of this research has been conducted in normative adolescent or young adult samples (VanderVeen et al., 2016). Given that more than 11% of legal cannabis users currently use daily/near daily (Goodman et al., 2020), this study examined relations between individual facets of impulsivity and cannabis use, alcohol use, simultaneous cannabis and alcohol use, and problem use within a sample of frequent, adult cannabis users.

Methods: Individuals ($n=167$) with a mean age of 34.89 (SD=11.19) who reported using cannabis on average once per day completed measures of individual facets of impulsivity (positive urgency, negative urgency, lack of premeditation, lack of perseverance, and sensation seeking; UPPS-P), cannabis use frequency, alcohol use frequency, simultaneous cannabis and alcohol use frequency, cannabis use problems, cannabis use disorder, and alcohol use disorder. Path models were used to predict frequency of use (cannabis, alcohol, and simultaneous cannabis/alcohol) and problem use (cannabis consequences, cannabis use disorder, and alcohol use disorder) from each facet of impulsivity. Models were first run using sex, age, and race as covariates, and subsequently run after adding depressive and anxiety symptoms as covariates.

Results: After controlling for sex, age, and race, positive urgency was associated with less frequent cannabis use ($b=-0.28$, S.E.=0.13, $p=0.03$), more frequent simultaneous cannabis and alcohol use ($b= 0.24$, S.E.=0.11, $p=.04$), and greater cannabis consequences ($b=0.30$, S.E.=0.10, $p=0.002$). Negative urgency was associated with greater cannabis consequences ($b=0.31$, S.E.=0.09, $p<0.001$), cannabis use disorder ($b=0.27$, S.E.=0.09, $p=0.002$), and alcohol use disorder ($b=0.27$, S.E.=0.10, $p=0.01$). After including depressive and anxiety symptoms as covariates, relations with positive urgency, but not negative urgency, remained significant.

Conclusions: The findings of the current study suggest that positive urgency may be uniquely

linked to riskier behavior in frequent cannabis users given that no other facet of impulsivity was significantly associated with cannabis use outcomes after all covariates were included in the model. Although not directly assessed in the current study, the findings suggest that relations between negative urgency and cannabis use frequency and cannabis and alcohol use disorder may be mediated by depressive and anxiety symptoms. This possibility should be explicitly examined in future studies. The lack of relations between other facets of impulsivity and alcohol and cannabis use outcomes in the current study suggest that effects of impulsivity among daily users may be restricted to urgency, in contrast to studies in normative adolescent and young adult samples (VanderVeen et al., 2016).

Does Anxiety Mediate the Relationship Between Cannabis Use and Psychotic-Like Experiences in Emerging Adults? Investigating a Conditional Process Model in a Multi-Site University Sample

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Background/Aim: Cannabis is commonly used by Canadian emerging adults (ages 18-25 years), many of whom attend post-secondary institutions. Frequent cannabis use has been linked with psychotic-like experiences (PLEs); however, the exact nature of this complex relationship remains to be fully understood. Anxiety is a prevalent mental health concern in emerging adults and university students, and anxiety has been independently linked with both cannabis use and PLEs. Males and females use cannabis and experience mental health differently: females tend to be more anxious while males tend to use more cannabis and are at higher risk for psychotic-like experiences. In this first of two studies for my Masters, I evaluated whether

anxiety mediated the relationship between cannabis use frequency and PLEs in emerging adult undergraduates. I then tested the impact of moderation by biological sex by assessing if the mediation model held statistical significance across sexes.

Hypotheses: H1) Consuming cannabis more frequently will be associated with more anxiety which, in turn, will be associated with greater PLEs in emerging adults, H2) the anxiety mediation pathway will be statistically stronger for females; and H3) males will have a stronger direct association between cannabis use and PLEs.

Method: A sample of 1,507 first- and second-year emerging adult university students (mean [SD] age = 19.2 [1.52] years; 67% female) were recruited. Cross-sectional, self-report survey data were collected throughout fall 2021 from five Canadian universities as part of the UniVenture substance misuse prevention trial. Validated measures capturing demographics, cannabis use frequency, anxiety, and PLEs were administered. **Results:** The mediation model with cannabis use frequency as the predictor, PLEs as the outcome, and anxiety as the mediator was tested, followed by testing a moderated mediation (conditional process) model with biological sex moderating the paths from cannabis use frequency to anxiety and from cannabis use frequency to PLEs using the PROCESS macro for SPSS. Bootstrapped 95% confidence intervals showed evidence of a significant indirect effect of cannabis use on PLEs through anxiety for emerging adults (a-path $p < .001$; b-path $p < .001$; 95% CI [.016, .048]), supporting H1. No direct effect was found (c' -path $p = .946$) suggesting that the relationship between frequent cannabis use and PLEs may be fully mediated by anxiety. In the second model, significant moderated mediation was found (95% CI [.005, .060]). More frequent cannabis use was associated with increased anxiety among females only. Conditional indirect effects showed significant mediation through anxiety for females (95% CI [.020, .056]), but not males (95% CI [-.015, .028]), consistent with H2. No significant sex moderation was found for conditional direct effects of cannabis on PLEs for either males ($p = .667$) or females ($p = .907$), contrary to H3.

Conclusion: Assuming replication in prospective research, results highlight anxiety as an important intervention target in frequent female

cannabis users to potentially prevent the development or worsening of PLEs. Understanding differential trajectories from frequent cannabis use to PLEs is important for informing individualized prevention and programming and encouraging health equity.

Feasibility and utility of a structured guide for cannabis tolerance breaks in young adults

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Objective: To explore the feasibility and utility of a tolerance break (T-break) guide on young adults' cannabis use.

Participants: Young adults aged 18-29 (n=125) who were current cannabis users.

Methods: Participants recruited through posters and listservs at various universities were offered the T-Break Guide to help complete a 21-day cannabis break. Bivariate analyses examined associations between Guide use and follow-up measures.

Intervention: The T-Break Guide was designed to help people complete a 21-day break from cannabis. For each day of the break, the Guide offers inspiration in the form of a quote, reflections based on likely experiences occurring at that point during the break, advice on ways to overcome challenges, alternative activities in which to engage, and encouragement. The first week focuses on physical symptoms of cannabis withdrawal (e.g., sleep, appetite); the second week focuses on the emotional experience (e.g., anxiety, boredom); and the third week focuses on behavioral aspects (e.g., examining patterns, connections). The T-Break Guide follows the Motivational Interviewing principles of affirmation and autonomy.

Results: Compared to non-Guide users, participants who used the Guide “a lot” were more likely to complete the 21-day abstinence break (84% vs. 57%), revise their personal definition of balance to mean less cannabis (84% vs. 62%), and plan a future break (32% vs. 11%).

Conclusion: Use of this self-directed Guide may help young adults take a break from cannabis use and reduce future use, and offers a novel approach

to cannabis harm reduction. Further research to test the Guide's longer-term efficacy is needed.

Associations of Momentary Mindfulness with Affect and Cannabis Desire in a Trial of Cannabis Use Interventions with and without Momentary Assessment

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Background. Mindfulness, a state of awareness that results from intentionally attending to the present moment without judgment, has been associated with improved health. In substance use treatment, mindfulness-based interventions (MBIs) improve mood and emotional regulation, possibly through increased positive affect and effective coping with negative affect. MBIs may also decrease substance cravings and use. Because affect, substance desire, and mindfulness vary moment-to-moment in daily life contexts, examining their associations may improve understanding of how MBIs reduce substance use. Momentary effects of mindfulness also have implications for ecological momentary assessment (EMA) and interventions (EMIs) for substance use. EMA samples momentary experience and EMIs administer treatment in real-time, real-life contexts. In bringing attention to thoughts and feelings at the time of the report, EMA can raise self-awareness. EMIs can provide content tailored to time or situation. EMA studies have shown that increased momentary negative affect predicts momentary cannabis desire and use events. If mindfulness decreases momentary negative affect, then EMA to raise awareness of momentary states and EMIs to prompt mindfulness practice in daily life may be effective cannabis use treatment. We examined whether momentary mindfulness changed after cannabis use interventions that included EMA, and explored associations with momentary negative affect, positive affect, and cannabis desire.

Methods. Hospital clinic outpatients 15-24 years using cannabis ≥ 3 times per week were randomized to one of three interventions to reduce cannabis use. All interventions included two weekly 1-hour motivational enhancement therapy (MET) sessions. In two interventions, participants also received two weeks of EMA with or without supportive messages following report of contexts

personally triggering for cannabis use. We used EMA to measure cannabis-related momentary states, contexts, and behavior 4-6x/day for one week at baseline and three months post-intervention. Of 70 participants enrolled, 68 (MET+EMA, n=40; MET-Only, n=28) contributed momentary data (N=1,971 reports) to these analyses. We calculated individual-level mean scores for the continuous momentary variables and normalized them using z-score or Blom transformation, as appropriate. Using generalized linear mixed effects models, we examined momentary mindfulness trends from baseline to 3-month follow-up, and whether changes differed by study group (MET+EMA vs. MET-Only) via phase-by-group interaction. We then examined associations of momentary mindfulness with negative affect, positive affect, and cannabis desire in separate models. We ran models unadjusted and adjusted for momentary contexts, group, phase, and mean reports/day in phase.

Results. Mean momentary mindfulness was significantly higher at follow-up, compared to baseline (adjusted β difference=0.146, SE=0.034, $p<.0005$). Momentary mindfulness increased from baseline to follow-up in the MET+EMA group, but did not change significantly in the MET-Only group (β EMA_difference=0.237, SE=0.045, $p<.0005$; β MET-Only_difference=0.055, SE=0.050, $p=0.269$; β phase_x_group =0.182, SE=0.066, $p=.006$). Higher momentary mindfulness was associated with lower negative affect (adjusted β mindfulness=-0.526, SE=0.045, $p<.0005$) and with lower cannabis desire (adjusted β mindfulness=-0.521, SE=0.044, $p<.0005$). Momentary mindfulness was not significantly associated with momentary positive affect (adjusted β mindfulness =0.013, SE=0.035, $p=.712$).

Conclusions. Among youth using cannabis frequently, momentary mindfulness increased following interventions with EMA after counseling, and was inversely associated with negative affect and cannabis desire. Mindfulness may be a useful target for momentary intervention.

(University of Washington)

Purpose: The provision of cannabis storage devices paired with consumer prevention messages at point-of-sale has been considered by local health agencies to reduce youth access to cannabis in homes with adult cannabis consumers. This project sought to learn about current storage practices, interest in safe storage devices, and acceptability of youth prevention messages among adult consumers with youth at home. **Methods:** Potential participants responded to a Facebook advertisement and then completed an online survey which identified those who were over 21, used cannabis at least six times in the past six months, had children at home, lived in a target WA state county, and made at least one purchase from a cannabis store. Semi-structured interviews were conducted over Zoom, in May-June 2021. Participants responded to open-ended questions and reacted to existing prevention messages. Thematic analysis was performed by the three authors in two iterations; first initial themes were identified, and a coding framework was developed, then focused coding was conducted using this framework. **Results:** Sixteen parents ranging in age from 21-50 were interviewed. Most were women (14; 88%), 10 (63%) were White/Caucasian, 3 (19%) Black/African American, and 1 (1%) each Pacific Islander and White/Caucasian, Native American/American Indian, and Black/African American and White/Caucasian. Eleven had children between 2-10 y.o. and six between 11-17 y.o. in the home. Thirteen (81%) used cannabis daily, many for medicinal reasons. Parents described a wide range of storage practices and were supportive of receiving storage devices from retail stores. Health messages were well received when they were simple, depicted parents in a positive light, included relatable images, and emphasized edibles and that children may not know that products contain cannabis. Parents saw the importance of messages focused on brain development and the social consequences of teen use but were wary of messages that encouraged adult cannabis use to be hidden, that suggested that adults should communicate their disapproval of cannabis, or that described cannabis as addictive. **Conclusions:** Parents who use cannabis expressed concern for their kids and understood that cannabis use can negatively affect child

Are parents who use cannabis receptive to safe storage interventions and point-of-sale education?

Beatriz H. Carlini, Sharon B. Garrett, Lexi Nims

development. While most were willing to store their cannabis out of reach of their children, cannabis was not viewed as being as harmful as other products that they consider a priority to store out of reach of children, such as opioids, alcohol, and guns. Content of health messages can easily be rejected if perceived as judgmental, stigmatizing, or untrue. Most parents trusted that open dialogues with their kids was the most effective prevention, and most were not willing to hide their own use.

Responsible Vendor Training as a Macro-Level Prevention Tool– A Case Study of the Massachusetts Cannabis Industry

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As of March 2022, adult-use cannabis is legal in 18 states and medical-use is legal for certain patients in 37 states. Unlike the illicit market(s), legal market(s) present new opportunities to embed public health strategies in varying levels of policy and regulation, such as Public Awareness Campaigns or Responsible Vendor Training (RVT). Using the Social Ecological Model (SEM) as a guiding framework, we conceptualize state-implemented public health strategies as operating at the macro-level through public policy or regulations, and interacting within and across varying social environments to impact individual behaviors. Macro-level prevention and intervention tools that aim to reduce and prevent adverse cannabis outcomes, such as developing cannabis use disorder and cannabis impaired driving, are imperative to more safely implement cannabis legalization. RVT programs are an under-studied, yet critical macro-level intervention, in many new cannabis industries that sell varying cannabis products with both known and unknown effects on the human body. RVT programs, operated by varying education providers and curriculums, are trainings provided to cannabis industry employees (“agents”) involved in the handling and sale of cannabis.

Training may include, but is not limited to, learning the law and regulations, identifying fake identification cards (IDs), health effects of cannabis, and other public health and safety practices. At the implementation level, RVT training may affect individual change by shaping industry employees’ perceptions of their role in order to better support public health, clarifying the latest research on health effects, and roleplaying judgement-free strategies to provide public health education. Currently, 31 states have RVT programs, however, Massachusetts is currently the only state with both legalized adult-use and medical markets that mandates an RVT program by regulation [935 CMR 500 and 935 CMR 501]. As of February 2022, Massachusetts certified 22 RVT program vendors and trained 10,142 out of 23,772 (42.7%) agents in the medical and adult-use workforce. RVT programs have the potential to counteract potential unsafe cannabis use behaviors following cannabis legalization implementation. However, the effectiveness of RVT programs is largely unknown. Guided by the SEM, this presentation will take a holistic view of the overlapping social environments surrounding an individual, to assess the potential of RVT programs operating at the macro-level to interact across social levels, including meso- and individual-levels, in order to prevent adverse outcomes (Bronfenbrenner, 1977). This presentation provides a theoretical model and potential quantifiable metrics of study for researchers to better assess RVT program effectiveness. To reduce potential health and safety risks of cannabis legalization, policymakers and regulators can embed varying public health strategies in legal cannabis markets, including RVT programs. It is imperative that research assist policymakers and regulators to assess the effectiveness of current RVT programs to ensure RVT program(s) have the intended public health outcomes, in order to facilitate evidence-based cannabis policy in these new and emerging cannabis markets.

Identifying Cannabis Use Patterns via Latent Profile Analysis

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Epidemiological surveys consistently report that cannabis use prevalence peaks during the college years. College students who use cannabis do so in a variety of contexts (e.g., at a party, when experiencing craving, for physical pain). Cannabis use is associated with risk for experiencing undesirable consequences. Protective Behavioral Strategies (PBS) are behaviors one can engage in to reduce use or to mitigate the risk of experiencing unwanted consequences. However, research has yet to explore which strategies are most effective in which specific contexts of use. It is likely that a strategy that works well to reduce the risk of consequences in one context may not work well in another context. We aimed to identify unobserved patterns of cannabis use contexts in a sample of college students, and examined whether these patterns of cannabis use contexts differed in cannabis use frequency, cannabis-related negative consequences (both at the item level and the cumulative number of consequences), and PBS use (also examined at the item and cumulative levels).

Using Latent Profile Analysis of self-reported data, we identified three latent profiles of cannabis users. Profile 1 (Social Use Profile; $n=100$) reported use cannabis in predominantly social or uplifting contexts, profile 2 (Physical & Emotional Pain Profile; $n=109$) reported use primarily in the contexts of relieving physical and emotional pain, and profile 3 (All Contexts Profile, $n=56$) reported frequent use in all contexts assessed. The Social Use Profile was associated with the least frequent cannabis use, the most PBS use, and fewest consequences compared to the other profiles. The Physical and Emotional Pain Profile was associated with moderate levels of cannabis use, consequences, and PBS use. The All Contexts Profile was associated with the most frequent cannabis use in all contexts. This included the contexts that were least associated with the Social Use Profile and the Physical & Emotional Pain Profile, which were related to a craving to use cannabis and using cannabis in response to a fight with friends, family members, or partners. The All Contexts Profile was also associated with the most cannabis-related consequences, and the lowest level of PBS use. Beyond the examination of overall indices of cannabis use, consequences, and PBS use, our data indicated that each profile was associated

with the experience of specific consequences of use in differing frequencies and the use of certain PBS to a differing degree across profiles.

This study provides preliminary evidence that the contexts in which people use cannabis may be associated with use level, number of consequences experienced, and PBS use. Future prevention and intervention efforts may consider identifying those whose use pattern is consistent with profiles identified in this study that carry greater risk of cannabis-related consequences. This would include screening for use in many different contexts (All Contexts use pattern) or for use primarily when in physical or emotional pain (Physical & Emotional Pain use pattern), as these use profiles carry greater risk for frequent use, experiencing more consequences, and engaging in fewer protective strategies.

Time Trajectories of Medical Cannabis Purchases by Patients with Medical Cannabis Prescriptions

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Background: Medical cannabis (MC) use is rising with limited clinical data to support products and dosing for specific conditions. This study relies on observational data to examine MC purchases across time, and to assess dosing trajectories for different conditions.

Methods: A retrospective study of MC patients of dispensaries located in New York (NY). This study relies on secondary analysis of point-of-sale (POS) invoice data from 16,727 unique patients with 79,885 purchases between 2016-2019. Group-based-trajectory modeling (GBTM) was used to identify clusters of MC patients following similar progressions in potency utilization (e.g., THC and CBD) over time. Multinomial logit models were estimated to identify group membership based on patient level characteristics and qualifying medical conditions.

Results: Six distinct trajectory groups were identified. Four of the groups comprised (75%), (39.9%), (8.2%), and (8.5%) of the population and purchased a steady dosage (ranging from low to high) of THC over time. The fifth (14.9%) and

sixth group (10.1%) demonstrated MC patients who gradually increased their THC dosage across time. Patient characteristics and qualifying medical conditions for MC use were strong predictors of group membership. Men, older individuals, and those with a qualifying pain condition were more likely to be part of a group that consumed higher doses of THC across time, compared to other reference groups.

Conclusion: This study identified distinctive trajectories of monthly THC and CBD potency levels purchased, and factors associated with these trajectories. Examining MC purchasing patterns over time may help understand whether MC treatment works, subgroups of MC patients, and risk factors. This study pioneer's analysis of POS data, which could help guide policy decisions to effectively monitor MC use, aid in the design of future MC programs and target prevention efforts. This study provides a strong foundation upon which that research can build by utilizing new-technologically advanced sales data sets.

Gender by Ethnicity Differences in Trajectory of Cannabis Use Among Cannabis-Using Young Adults during Pre- and Post-Recreational Cannabis Legalization (RCL) in Los Angeles

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Introduction: By the end of 2022, most states across the US except for three would have enacted some form of legalized cannabis policy. Support for the legalization of cannabis for recreational purposes are particularly high among young adults. Given the rapidly changing policy landscape, understanding how these policies may have impacted cannabis use among different groups of young people can help inform current

and future policy decisions and programs/intervention to curb problematic use. There is evidence to suggest significant and meaningful differences in use behaviors among individuals from different racial/ethnic backgrounds and gender identities. However, limited research has examined how these groups based on the intersection of these identities might differ in their cannabis use prior to and after recreational cannabis legalization (RCL).

Method: 366 cannabis-using young adults (aged 18-26) comprising 210 medical cannabis patients and 156 non-patients were surveyed annually between 2014-2020 in Los Angeles culminating into 6 waves of data. Bilinear spline growth curve models examined changes in cannabis use trajectory, with three waves pre-RCL and three waves post-RCL after accounting for patient status and age. Multi-group analyses investigated differences between six genderXrace/ethnicity subgroups: 1) African American Females (AAF); 2) Caucasian/White Females (WF); 3) Hispanic Females/Latina (HF); 4) African American Males (AAM); 5) Caucasian/White Males (WM); and 6) Hispanic Males/Latino (HM). Omnibus tests investigated homogeneity in the latent growth constructs across the 6 groups. We tested equality of covariances (correlations) and means across groups ($p < .05$). If inequality was shown, further tests were conducted.

Results: Overall, significant group differences were observed in cannabis use trajectories and the correlations between intercepts and growth factors. Specifically, HF, HM, AAM and WM reported moderate level of cannabis use (between 50 to 56 days of use) compared to AAF and WF at baseline, whereby AAF reported significantly higher use (70.72 days) relative to all other groups. In contrast, WF reported significantly lower use (35.42 days). There were different patterns in pre-RCL growth parameters. Whereas AAF and HF had relatively flat rate of change, WF, WM, and HM had relatively similar significant decrease in use pre-RCL. Interestingly, during the period post-RCL, AAF, WM, and HM all showed significant decline in use, but WF was the only group with a significant increase in use while HF and AAM had modest increases in use. While baseline use generally predicted pre-RCL use within each subgroup (for some, baseline use led to more rapid increase while for others, it led to more rapid decrease in

use), this is less true for post-RCL use. Significant effects associated with age and patient status were also observed.

Conclusions: These are among the first findings to show how cannabis policy has differentially impacted cannabis use behaviors prior to and after RCL among a diverse population of cannabis-using young adults. Additional research should investigate potential mechanisms of these difference and longer-term health impacts.

Medical Cannabis Use Among Adults Who Report Non-Medical Use of Prescription Opioids for Pain Relief

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Objectives: This study uses a nationally representative sample of adults to investigate racial-ethnic differences in reasons for cannabis use among those reporting past 12-month misuse of prescription opioids for pain relief.

Methods: Data from the 2015-2019 National Surveys on Drug Use and Health were used to study 3,093 adults 18 to 49 years old reporting past 12-month pain-related prescription pain reliever (opioid) misuse. Logistic regressions assessed the association between past 12-month cannabis use – (non medical vs. any medical) – and multiple socio-demographic, psycho-social and drug use correlates. NSDUH analysis weights were applied to accommodate for the sampling design.

Results: Half of individuals who reported misuse of prescription opioids for pain relief used cannabis in the past 12-months. In this sample of cannabis users, 87.6% (95%CI = 86.1, 88.9) used non-medically, and 12.4 (95%CI = 11.1, 13.9) used for both medical and recreational reasons. Individuals with past 12 months diagnosis of opioid use disorder were 1.8 (95%CI = 1.29, 2.63) times as likely to be medical cannabis users compared to those without a disorder.

Conclusions: The findings indicate that medical cannabis might be an alternative for nearly one in eight individuals misusing pain relievers to alleviate their pain, primarily those with an opioid use disorder. Despite increased rates of cannabis use among males and non-Hispanic Whites in the general population, no gender or

racial-ethnic differences were found in the selected sample. Future studies should investigate simultaneous use and the analgesic effects of co-use in this sample.

Changes in Marijuana Use Frequency Among People with HIV During the COVID-19 Pandemic: A Multi-Methods Exploration

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Background: People with HIV (PWH) report unique reasons for using marijuana. Similarly, they report unique concerns resulting from marijuana use. Assessing and understanding the reasons driving marijuana use among PWH could provide critical insights into how to help maximize the therapeutic benefits and minimize potential harms of marijuana use. The COVID-19 pandemic has impacted the access and use of substances globally. This study describes changes in patterns of marijuana use and reasons for those changes among PWH during the pandemic and implications for these findings in the future. The objectives of this study are to: 1) describe self-reported changes in marijuana use frequency during the COVID-19 pandemic among a cohort of PWH in Florida and 2) understand the reasons behind these changes through an analysis of open-ended qualitative questions.

Methods: Data are cross-sectional and come from questions in a follow-up phone survey administered to a prospective cohort of PWH (75% current marijuana use) in Florida between May 2020-March 2021. Participants who used marijuana were asked about changes in their frequency of marijuana use due to the pandemic using a closed-ended quantitative survey and reasons for any reported changes in a qualitative open-ended question. Descriptive statistics and significance testing were completed in SAS 9.4. Qualitative data were analyzed using thematic analysis.

Results: Among the total sample of 227 PWH (mean age 50, 50% men, 69% Black/African American, 14% Hispanic/Latino); 15% reported a decreased frequency of marijuana, 9% reported

increased frequency, and 76% reported no change. The most common reason for increasing the frequency of marijuana use was to reduce the increased anxiety or stress experienced during the COVID-19 pandemic. Participants also reported that marijuana helped them cope with self-reported depression and other negative life events and helped reduce boredom while their regular activities were restricted. Concerns about the impacts of marijuana on COVID-19 risk, using the pandemic as an opportunity to reduce or quit marijuana use, and issues with obtaining marijuana were common reasons for decreased use. Additionally, some participants reported that a primary reason for using marijuana was the social aspect of using in a group, and without being able to gather they were less motivated to use, contributing to decreased use.

Conclusions: Nearly one-quarter of the participants had changes in their marijuana use frequency during the pandemic, and most of the participants with a change decreased their frequency of use. The changes in the frequency of marijuana use experienced by PWH during the pandemic might continue and prevent a return to “normal,” so it is important to understand how to best address the new needs of PWH who use marijuana. Understanding the reasons behind changes in marijuana use patterns in this population—and what demographics, attitudes, and beliefs might differentiate those with increases, decreases, or no change in marijuana use—can allow researchers and providers to make greater connections between HIV-specific health outcomes and marijuana use. These findings provide specific targets for interventions to maintain or even improve health among PWH during public health emergencies and beyond.

Medical Marijuana & Me (M3): Designing Measures of Medical Marijuana Dose in an Observational Study

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Measuring marijuana exposure represents one of the biggest challenges in marijuana-related outcomes research. The challenge mainly emerges from the significant variability in medical marijuana (MMJ) use characteristics on both the

product level, including inter-product and intra-product composition variability and possibility of using multiple consumption modes, and the patient level, including variations in use patterns, frequency and intensity of use, and routes of administration. While MMJ-related observational research still mainly relies on self-reported MMJ exposure, there remains a lack of validated and reliable exposure measures and a lack of standardized dose units, necessitating the development of such measures. In the Medical Marijuana & Me (M3) study, a new combined cohort and cross-sectional study aiming to assess a multitude of MMJ-related outcomes among MMJ patients in Florida, we developed a set of new comprehensive measures to quantify MMJ use by assessing the specific modes of consumption, doses, frequency, and patterns of MMJ use. After reviewing the literature for existing MMJ measures, a multidisciplinary team of MMJ certifying physicians, pharmacists, researchers, MMJ patients, and dispensary personnel designed and developed a questionnaire covering a wide range of MMJ products, including flower, vape cartridges, concentrates for smoking, topical products, tinctures, oral concentrates, edible products, and others. MMJ dose and use are assessed via a nine-item MMJ use measure for each MMJ product participants use that gauges modes and routes of administration, frequency of use (per day, per week, per month), amount of consumed products, tetrahydrocannabinol and cannabidiol concentrations and ratios, and potency. For specific consumption modes (e.g., smoking and vaping), additional questions (e.g., number of inhalation seconds) were included to ensure a comprehensive approach of exposure measurement. Visual prompts such as product example photos were also included to enhance participant engagement and ease. We pilot-tested the questionnaires on twenty current MMJ patients in Florida, who provided feedback to improve the measures' reliability and enhance accuracy in capturing their MMJ exposure. Some of the key challenges we encountered were measuring the “amount” of solid and liquid concentrates, and difficulty in determining dose of vape cartridges due to inconsistencies in THC concentration between nearly identical cartridges. The nine-item MMJ use questionnaire developed for M3 offers a framework for MMJ exposure quantification in current and future observational

MMJ-outcomes research. Analyses resulting from M3 data will add to the sparse literature on MMJ dose measures and assist in validating measures similar to the measure developed for M3.

Acute cannabis-related alterations in an fMRI time estimation task

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Introduction: Cannabis is widely popular recreational drug of choice in the US. The drug is known to alter the subjective experience of time. However, its effects on time estimation at a brain level are still largely unexplored. Our goal was to investigate acute effects of cannabis on an fMRI time estimation task by evaluating brain activation differences between cannabis and placebo conditions. We hypothesized that participants' time estimation accuracy and corresponding BOLD response would be altered during the cannabis condition in a dose-related manner, compared to placebo. **Methods:** In this placebo-controlled, double-blind randomized trial, a total of N=44 participants had 3 dose visits, at each of which they received either high-dose cannabis (0.5 gm of ~12.5% THC flower), low dose cannabis (0.5 gm of ~5.7% flower) or 0.5 gm placebo, using paced inhalation from a volcano via vaporizer. Drug material was supplied by NIDA/RTI. For the current study we analyzed fMRI data from the first of placebo and high dose fMRI sessions throughout each dosing day in which participants performed a time estimation task. Participants were asked to respond with a mouse click as to which box of two boxes displayed for different intervals was displayed on the screen longer. Both sub-second and supra-second temporal intervals were tested, with a range of easy to hard discriminations. We used the Human Connectome Project processing pipeline to prepare fMRI data for GLM modeling of activation using the FSL FEAT toolbox. This model estimated the unique effect sub-second (short) and supra-second (long) interval discrimination, their

average effect, and their difference. From these contrasts, the mean activation amplitudes within 387 brain parcels from the Human Connectome cortical atlas were extracted. Robust statistics in R software estimated a paired t test equivalent using the `bootdpci` function to assess the difference between placebo and the high dose drug conditions for each contrast. **Results:** Only premotor cortex survived False Discovery Rate corrections for searching all 387 parcels across the entire brain for the average of short and long temporal estimation conditions. Numerous other brain regions differed between placebo and high doses at $p < .05$ uncorrected for various task contrasts: **Short duration stimuli:** Premotor cortex, posterior cingulate cortex, medial temporal cortex, visual area, somatosensory cortex, anterior cingulate and medial prefrontal cortex, paracentral and mid-cingulate cortex, inferior frontal cortex. **Long duration stimuli:** Premotor cortex, visual areas, somatosensory motor cortex, paracentral and mid-cingulate cortex, the tempo-parieto-occipital junction, dorsolateral-prefrontal cortex, posterior opercular cortex, medial temporal cortex, posterior cingulate cortex, orbito-frontal cortex. **Average of short and long duration stimuli:** Premotor cortex, somatosensory and motor cortex, posterior cingulate cortex, visual are, medial temporal cortex, paracentral and midcingulate cortex, anterior cingulate and medial prefrontal cortex, inferior frontal cortex, tempo-parieto-occipital junction, premotor cortex, somatosensory motor cortex, posterior cingulate cortex, medial temporal cortex, orbital and polar frontal cortex, hippocampus. **Difference of short and long duration stimuli:** Anterior cingulate and medial prefrontal cortex, ventral stream visual cortex, dorsal stream visual cortex, early visual cortex. **Conclusions:** The current study elicited multiple brain activation differences for the initial, acute high-dose cannabis vs. placebo condition, but only premotor cortex region survived as significant following multiple comparison correction for short and long duration stimuli contrast. A post hoc power analysis showed that adding 10 additional subjects to this sample would achieve significance with multiple comparison correction for medium effect sizes at $\alpha = 0.05$. Future studies on a larger sample can help identify such significant activation differences, and examining all doses and tasks would elucidate unfolding of effects

longitudinally post-dose, and dose-dependence of effects.

Effect of Acute Stress Induction on Cannabis Demand

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Objective: Substance demand, defined as the persistently high valuation of a reinforcer, is a critical factor that contributes to initiating and maintaining substance use. This study examined how cannabis demand was affected by an acute stress induction. Here we focused on the most commonly used demand indices: Intensity (i.e., the amount of drug consumed at zero cost) and Omax(maximum expenditure). **Method:** 33 young adults (66.67% female, 54.55% white, mean age = 22.88 years) reporting cannabis use at least 5 days per week in the past month and at least weekly use in the past 6 months were recruited from the community and a northwest college campus. After confirming eligibility, each participant was scheduled for an online Zoom appointment with an experimenter. During this appointment, participants completed a pre-test stress assessment and Marijuana Purchase Task (MPT). Following, they completed the Trier Mental Challenge Test (TMCT) for stress induction, during which they were asked to work four trials of arithmetic problems while being observed by the experimenter. Finally, they completed the post-test stress assessment and MPT, as well as a cannabis use survey. **Results:** Stress ($d = .58$, $p = .002$) and Intensity ($d = .46$, $p = .014$) significantly increased as a result of the stress induction. However, there was no significant difference between the pre-test and post-test in terms of Omax ($d = .21$, $p = .25$). **Conclusion:** This study demonstrates the effectiveness of administering stress induction (i.e., TMCT) online among cannabis users. The study results also suggest heightened cannabis demand in young adult high-frequency cannabis users after experiencing acute stress, suggesting interventions on how to manage stress in the moment may provide valuable techniques for individuals trying to moderate or cut down on their cannabis use.

Ecological Momentary Assessment of Cannabis Use Contexts

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BACKGROUND: As recreational cannabis use increases, it is important to document the context in which use occurs. Cannabis use contexts may relate to safety and daily functioning (e.g., if cannabis is used while driving or at work/school) as well as motives for use (e.g., if cannabis is used in social environments). The present study used ecological momentary assessment (EMA) to examine the context surrounding cannabis use in adults' natural environments. **METHODS:** Participants were recruited for a longitudinal study of dual use of cigarette and e-cigarettes. Data were collected in Illinois prior to legalization of recreational cannabis use. Participants completed baseline questionnaires and two seven-day waves of EMA; the current study included those who reported cannabis use on EMA interviews. Participants completed EMA when randomly prompted (5-6 times/day) and when using tobacco products. EMA reports measured past-hour substance use and current location, behavior, and social environment. Descriptive analyses evaluated relative frequencies of EMA events when cannabis use was reported (cannabis use events) and not reported (non-use events). Cannabis use and non-use event frequencies were examined by social environment (alone; with a partner/spouse, family, friends, children, coworkers, other), location (home, school/work, coffee shop/restaurant, sport/entertainment venue, car, other transit, bar/club), and behavior (hanging out, socializing, transit/driving, relaxing, texting/talking on phone, using a computer/app, nothing, other). Participants chose one location and could select all items that applied for social environment and behavior. Event frequencies were also examined by day of the week and time of day (4:00-8:59 AM, 9:00 AM-1:59 PM, 2:00-5:59 PM, 6:00-9:59 PM, and 10:00 PM-3:50 AM). **RESULTS:** Data come from 200 participants (35.5% female; mean age = 30; 11.5% Hispanic/Latino; 44.5% Non-Hispanic White; 29.5% Non-Hispanic Black; 10.0% Asian/Pacific Islander; 4.5% other race/ethnicity). Past 6-month cannabis use frequency was reported at baseline: 12.5% no use, 10.5% monthly or less, 14% 2-4 times/month, 15% 2-3 times/week, 48% 4+ times/week. The average baseline score on the Cannabis Use Disorders Identification Test-

Revised was 9.90 (SD = 6.57). Overall, 14,160 EMA events were captured with 2,672 cannabis use events and 11,488 non-use events. Most cannabis use (77.2%) occurred at home. 9.1% of cannabis use occurred when driving/in transit. At cannabis use times, participants reported hanging out (41.5%), relaxing (35.0%), watching TV/movies (29.2%), and socializing (24.4%). Participants were alone in 41.0% of cannabis use events; when not alone during cannabis use, participants were most often with friends (48.0% of social cannabis use events), a partner/spouse (43.1%), or a family member (24.1%). Cannabis use was relatively consistent across days of the week, with slight increases on Thursday (15.9%) and Friday (16.4%). Most cannabis use (34.5%) occurred between 6:00-9:59 PM.

CONCLUSIONS: These findings characterize the naturalistic context of cannabis use among a community sample of adults. Most cannabis use occurred at home and when engaging in leisure activities (e.g., relaxing, hanging out). Cannabis use did not appear to be very common in hazardous situations (e.g., while driving). As cannabis use continues to increase, the naturalistic context of cannabis use has implications for safety, motives, and cannabis use disorder.

Variations in likelihood to use protective behavioral strategies for marijuana across physical and social contexts of use

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Protective behavioral strategies for marijuana (PBSM) are intended to reduce harms associated with use of marijuana. Harms may vary based on the physical and social contexts in which individuals use marijuana resulting in people employing PBSM differentially across contexts. We examined where and with whom young adults are likely to employ PBSM when using marijuana. In Fall 2021, we conducted an online survey with 506 young adults who were current users of marijuana and lived in the U.S. (N=506; 55.6% female, 62.6% White). Participants were evenly distributed across states according to marijuana policy (33% each in recreational, medicinal, or neither). Participants rated their likelihood ('not

at all,' 'somewhat,' or 'extremely/very likely') to engage in 8 strategies derived from the PBSM Scale that focused on using marijuana only with trusted peers, minimizing intoxication, and driving a vehicle after using marijuana. Participants indicated their likelihood to use each strategy in 4 physical contexts (own home, friend's home, someone else's home, public location) and 3 social contexts (alone, one or few closest friends, large group). We conducted generalized logit mixed models with a multinomial dependent variable, treating the respondent as a random effect, to assess differences in likelihood to use PBSM across physical and social contexts. Separate models were run for each PBSM by physical (referent: at own home) and social (referent: alone) context. Physical context: Odds of being 'somewhat likely' or 'extremely likely' (referent: 'not at all likely') to 'use marijuana only among trusted peers' were lower when using marijuana at someone else's home or in a public location compared to their own home. Odds of being 'somewhat likely' or 'extremely likely' (referent: 'not at all likely') to 'use a little marijuana and then wait to see how you feel before using more,' 'avoid mixing marijuana with other drugs,' and 'avoid driving a car after using marijuana' were lower when using marijuana in public settings compared to their own home. Odds of being 'somewhat likely' (referent: 'not at all likely') to 'limit the amount of marijuana they use in one setting' were lower when using marijuana in public settings compared to their own home. Social context: Odds of being 'somewhat likely' (referent: 'not at all likely') to 'avoid mixing marijuana with other alcohol' were greater when using marijuana with a few close friends than alone. Odds of being 'extremely likely' (referent: 'not at all likely') to 'use a little marijuana and then wait to see how you feel before using more' and 'avoid driving a car after using marijuana' were lower when using marijuana at an event with a large number of people compared to alone. Our findings suggest that people differentially utilize PBSM based on the physical and social contexts in which they are using marijuana. People may be less likely to engage in PBSM in public locations and large groups of people compared to when they use marijuana at their home or alone. Interventions for young adult marijuana use should consider the context of use

when providing behavioral intervention strategies.

Cannabis craving in response to alcohol cues in the laboratory and in daily life

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Background: Cannabis use is prevalent among adolescents and young adults who drink alcohol. Compared to individuals who only drink alcohol, those who (co-)use both alcohol and cannabis are at greater risk of experiencing substance-related problems. One factor that could maintain patterns of co-use is the potential for one substance to elicit craving for another. This idea has been studied extensively in the alcohol and tobacco co-use literature but has yet to be applied to alcohol and cannabis co-use. Thus, the present study examined whether alcohol cues elicit cannabis craving in the lab and in daily life.

Method: Participants were 54 adolescents and young adults ages 15 to 24 (M age = 19.69, SD = 2.04) who were enrolled in one of two medication trials targeting alcohol use and endorsed lifetime cannabis use. Participants were 51.9% female, 75.9% white, and 87.0% not Hispanic or Latino. Average age at first alcohol use was 15.28 (SD = 2.07), and average age at first cannabis use was 15.91 (SD = 2.37). Participants reported cannabis use on an average of 22.4% of the last 90 days via timeline follow-back. Participants also completed a lab cue-reactivity task where they rated cannabis craving when presented with alcohol and control cues. Finally, participants completed one week of ecological momentary assessment in their daily lives, reporting multiple times per day on their cannabis craving and the presence of alcohol cues in their surroundings. The data used in the present analyses were collected prior to randomization into medication condition and prior to taking any medications for the larger pharmacotherapy trials.

Results: Results from mixed models demonstrated that baseline cannabis use frequency was positively related to lab cannabis craving, regardless of cue type, although this association was larger for control cues than for alcohol cues ($b = -0.01$, $SE = 0.00$, $p = .004$). In daily life, the presence of alcohol cues was associated with greater momentary cannabis craving ($b = 0.57$, SE

$= 0.25$, $p = .029$). Finally, greater lab cannabis craving in response to alcohol cues predicted greater momentary cannabis craving across all moments in daily life (not solely when alcohol cues were present; $b = 0.61$, $SE = 0.11$, $p < .001$).

Discussion: Results suggest that cannabis craving in the lab translates to daily-life cannabis craving across contexts, and that daily-life cannabis craving may be heightened in the presence of alcohol cues in individuals' natural environments. Collectively, these findings support the idea that alcohol cues may elicit cannabis craving among adolescents and young adults who report a history of alcohol-cannabis co-use. Our findings may inform future work seeking to tailor cannabis use interventions among individuals who co-use cannabis with alcohol.

Concurrent Alcohol and Cannabis Use Influences EEG Processing of Alcohol Cues

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Background. Concurrent use of alcohol and cannabis (CAM) has been shown to be common among college students (Bravo et al., 2021), and is associated with more alcohol use and related negative consequences (Cummings et al., 2019). There is evidence that both alcohol and cannabis use may be associated with changes in brain functioning and cognition (Oomen et al., 2018), including differences on tasks related to cognitive inhibition/inhibitory control (i.e., Go/NoGo tasks; Lopez-Caneda et al., 2014). A promising method for assessing potential neurocognitive changes associated with alcohol and cannabis use is by examining substance-associated event-related potentials (ERPs) using electroencephalography (EEG; Zhang et al., 2021). The present study aimed to examine differences in P300 ERPs associated with alcohol cues between binge drinking alcohol only students and binge drinking students who also consumed cannabis in the past 30-days (i.e., CAM use).

Method. Fifty binge drinking college students (26 of whom also reported using cannabis over the past 30 days) were recruited from a Psychology department research pool to participate in an alcohol-related Cued Go/NoGo task while their brainwaves were measured. The task was characterized by within-subjects factors block

(indicating probability of Go/NoGo task cue-target combinations), Cue (Alcohol vs. Neutral), and Target (Go vs. NoGo). Participants identified as mostly White (78%), female (72%), were freshman (64%), and reported a mean age of 18.86 (SD=0.90). To test study aims, at electrode Cz, we conducted a 2x2x2x2 mixed ANOVA with all within-subjects factors (Block, Cue, Target), and between-subjects factor CAM over the past 30 days (CAM use vs. No CAM use).

Results. We observed a significant block*target*CAM interaction with a medium effect size (Richardson, 2011), $F(1,47)=4.09$, $p=.049$, $\eta^2=.08$. Cue was retained as a factor in subsequent analyses in order to effectively evaluate the hypothesis. In Block 2, we found a non-significant cue*CAM interaction, $F(1,47)=3.10$, $p=.085$, $\eta^2=.06$, with a medium effect size. Paired-samples t-tests revealed that individuals who used cannabis did not display a significant difference between alcohol and neutral cues, $t(25)=0.243$, $p=.81$, while individuals who did not use cannabis showed significantly greater alcohol vs. neutral cues, $t(23)=2.34$, $p=.025$.

Conclusions. While preliminary, we observed a significant difference in P300 ERPs for alcohol vs. neutral cues, only in individuals who did not report using cannabis over the past 30-days. In other words, we found that CAM using individuals display similar neural reactivity to alcohol compared to neutral cues, while an alcohol vs. neutral difference was observed for alcohol-only individuals. It may be that by using another substance, alcohol stimuli lose salience, and evaluative processing indexed by the P300 is reduced. These are interesting results to be observed within a non-clinical sample of mostly-freshman college students, and provides rationale for examining neuropsychological differences between individuals who use multiple substances versus one substance in populations with more severe levels of dependence.

Brain-behavior relationships of simulated naturalistic automobile driving under the influence of acute cannabis intoxication: A double-blind, placebo-controlled study

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Background: Driving is a complex everyday activity that requires the use and integration of different cognitive and psychomotor functions, many of which are known to be affected when under the influence of cannabis (CNB). Given legal implications of drugged-driving and rapidly increasing use of CNB nationwide, there is an urgent need to better understand the effects of CNB on such functions in the context of driving. This longitudinal, double-blind placebo-controlled study investigated the effects of CNB on driving brain-behavior relationships in a controlled simulated environment using functional MRI (fMRI).

Methods: N=26 frequent cannabis users were administered 0.5 grams of 13% THC or placebo flower cannabis via a Stortz+Bickel 'Volcano' vaporizer using paced inhalation, on separate days at least 1 week apart. On each study day, participants drove a virtual driving simulator (steering wheel, brake, gas pedal) inside an MRI scanner approximately 40 minutes post-dosing. Each fMRI driving session presented a naturalistic simulated environment that unobtrusively engaged drivers with scenarios that tested specific driving skills and response. There were three, approximately 10 min epochs where drivers engaged in task of lane keeping/weaving (LK), lead car following (CF), and safe overtaking (OT).

fMRI data were prepared for analyses using the Human Connectome Project pipeline, then subjected to group independent component analysis (ICA) to isolate 50 spatially independent networks. 40 ICA networks were deemed valid and non-noisy. Network regions in these components were identified using 387 parcel locations, incorporating a cortical parcellation atlas (Glasser et al 2016) and detailed subcortical labels. A placebo minus high difference connectivity map was generated for each subject. A similar placebo minus high behavioral score was generated for each subject and then subjected to a principal component analysis (PCA) to reduce it to 8 orthogonal behavioral factors. Of the 8 driving behavior factors, two represented CF

events (F1 and F5), three LK (F3, F4, and F8), and three OT (F2, F6, and F7). Driving behavior factors were evaluated for linear association with connectivity maps via FSL's randomize ($p < 0.01$ FWE-corrected significance).

Results: Across all components examined, we found connectivity differences between placebo v high THC within right motion-sensitive visual cortex (parcel FST) (visual) and right superior temporal gyrus (social cognition) to positively correlate with LK driving performance. The strongest brain-behavior relationships were found for OT-related behavioral factors. Connectivity in left dorsolateral parcel a9-46v (cognitive flexibility) and right motor cortex parcel 3b (somatosensory) correlated negatively with F6 (OT). A left superior frontal parcel (higher order cognition/working memory) correlated negatively with F7 (OT) and finally R inferior frontal gyrus (response inhibition and reward deduction) correlated positively with F7 (OT).

Conclusion: Our preliminary analyses yield a complex yet informative picture of key brain areas sensitive to acute CNB exposure on different driving behaviors using a simulated environment, further underscoring the impact of substance use on driving as a potential public safety issue.

Day-level associations of craving and anxiety with self-reported attention and concentration problems in young adults who use cannabis: A key role for anxiety

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Aim: Acute effects of cannabis use on cognitive functions such as attention and concentration are well studied. Less is known about how subjective states such as craving and anxiety, both of which can occur during cannabis withdrawal, impact cognitive functioning in daily life. This smartphone survey study examined the extent to which day-level cannabis craving and anxiety were associated with self-reported attention and concentration problems, accounting for trait anxiety and cannabis withdrawal. Study findings have implications for understanding how cannabis-related subjective states impact aspects of cognitive functioning in daily life.

Methods: Young adults (ages 18-25), who reported using cannabis at least twice per week, were

recruited (2017-2019) using Craigslist and research registry to participate in a smartphone daily survey study for up to 30 days in Pittsburgh, PA. Participants completed a baseline lab assessment (cannabis withdrawal scale, State-Trait Anxiety Inventory). Phone surveys were delivered 3 times/day: morning, afternoon, evening. Participants also self-initiated reports of cannabis use. Phone survey items (rated: 0= none to 10= a lot) queried cannabis craving, "How are you feeling now?" (e.g., anxious), and in the evening: "Today, how much difficulty did you have with..." "keeping your attention on an activity for long"; and "concentrating and thinking clearly". On days with a completed evening survey, cannabis use was coded 0=none and 1=any use. Multilevel models tested associations of day-level attention and concentration (separate outcomes) with daily cannabis craving and anxiety, accounting for day-level cannabis use, and baseline trait anxiety and cannabis withdrawal.

Results: Young adults (N=57; 60% female; mean age=19.8 [SD=1.7]; 78.9% White, 10.5% Black, 10.6% Other race/ethnicity) reported cannabis use on 390 out of 558 days. At baseline, average trait anxiety was 20.6 (SD=5.9, range=11-33/40 maximum) and withdrawal severity was 6.3 (SD=6.6, range=0-29/68 maximum). Average daily craving was 3.3 (SD=3.0) and momentary anxiety was 2.0 (SD=2.6). Participants reported low average daily attention (2.5+2.5) and concentration (2.3+2.4) problems. In a multilevel model using trait anxiety, craving, state anxiety, and day-level cannabis use to predict daily attention problems, craving and state anxiety were significant predictors ($p < .05$). In predicting daily concentration problems using the same set of variables, craving, state and trait anxiety were unique predictors ($p < .05$). Using withdrawal severity at baseline (instead of trait anxiety), and the same set of variables to predict daily attention and concentration problems (separate models), craving and state anxiety were statistically significant ($p < .05$). In a final model including both withdrawal and trait anxiety, with craving, state anxiety, and day-level cannabis use to predict daily attention and concentration problems (separate models), only state anxiety was significant ($p < .05$). Notably, day-level cannabis use was not uniquely associated with self-reported attention or concentration problems.

Conclusion: Results suggest the unique contribution of momentary anxiety, over and above trait anxiety, cannabis withdrawal, momentary craving, and day-level cannabis use, on self-reported daily mild attention and concentration problems. The temporal ordering of anxiety in relation to cannabis use and its effects on attention and concentration remain unclear, but suggest the potential for mindfulness training to reduce anxiety and increase attentional focus.

Cannabis Use Disorder Uniquely Predicts Educational Impairment in College Students Over and Above other Mental Health Disorders
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Background: Approximately 40% of college students report using cannabis in the past year (Scholenberg et al., 2020) and nearly 1 in 10 (9.4%) first-year college students meet criteria for a cannabis use disorder (CUD; Caldierra et al., 2008). The prevalence CUD is concerning as it is linked to greater number of skipped classes and failure to graduate from college (Arria et al., 2015; Hunt et al., 2010). In addition, CUD is often comorbid with other substance use and mental health symptoms that impact educational outcomes, including post-traumatic stress disorder (PTSD; Morissette et al., 2020), major depressive disorder (De Roma et al., 2009), and alcohol use disorder (AUD; Meda et al., 2017), yet the impact of CUD has not been examined within the larger context of these mental health problems. The aim of the current study was to examine the impact of CUD on education functioning and GPA within the context of co-occurring PTSD, MDD, and AUD. It was predicted that CUD, measured both continuously (CUD symptom severity) and dichotomously (presence/absence), would predict greater educational impairment and lower current overall GPA, even after taking into account age, gender, and presence of probable PTSD, MDD, and AUD. Method: College students (N = 210) who reported using cannabis within the past six months completed self-report questionnaires assessing trauma exposure (LEC-5), educational impairment (IPF-ES), CUD (CUDIT-R), PTSD (PCL-5), depression (PHQ-9), and AUD (AUDIT-

R). Overall GPA was retrieved from college transcripts.

Results: A series of hierarchical multiple regression analyses were conducted in SPSS version 25. In the continuous model, younger age ($\beta = -.13, p < .05$), presence of probable PTSD ($\beta = .26, p < .01$), and CUD symptom severity ($\beta = .20, p < .01$) significantly predicted educational impairment, with CUD symptom severity significantly improving model fit ($R^2 = .20$; $F(1, 203) = 10.13, p < .01$). In the dichotomous model, younger age ($\beta = -.13, p < .05$), male gender ($\beta = -.16, p < .05$), presence of probable MDD ($\beta = .17, p < .05$), probable PTSD ($\beta = .26, p < .01$), significantly predicted educational impairment, however probable CUD did not ($\beta = .01, p = .151$). Similar models for GPA indicated CUD symptom severity was the only significant predictor of low GPA ($\beta = -.15, p < .01$), yet presence of probable CUD was not significant ($\beta = -.09, p = .183$). Model fit was poor for both measurement types (Continuous Model: $R^2 = .01$; $F(1, 203) = 4.09, p < .05$; Dichotomous Model: $R^2 = .00, F(1, 203) = 1.78, p = .183$).

Conclusion: CUD symptom severity negatively predicted both educational impairment and GPA, whereas probable CUD did not predict either outcome. Importantly, CUD symptom severity predicted over and above other common mental health conditions among college students. In the context of rapid legalization of cannabis, these data suggest that university counseling centers may need to incorporate CUD into treatment planning, particularly when students are experiencing educational challenges.

Investigating predictors of problematic cannabis use in polysubstance users

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Introduction: Since its legalization in 2018, cannabis use has substantially increased in Canada. This increased use is concerning, as one in every eleven cannabis users will go on to develop a cannabis use disorder. Further, problematic cannabis use is often related to the use of additional substances, particularly nicotine and alcohol, and there is evidence to suggest that the degree of harms associated with cannabis use increases when cannabis is used in conjunction

with other substances. Additionally, personality is a known risk factor for problematic substance use, although to date problematic cannabis use has not been consistently linked to any specific personality trait. This study aimed to investigate the relationship between substance use, personality, and problematic cannabis use in a sample of cannabis using polysubstance users.

Method: A sample of 521 polysubstance users (past 30-day users of cannabis, alcohol, and nicotine) completed an online survey measuring their substance use, dependence, and personality. Levels of substance specific dependence was measured using the Cannabis Use Disorder Identification Test – Revised, the Alcohol Use Disorders Identification Test, and the Fagerström Tests for Cigarette and E-cigarette Dependence, while personality was measured using the Substance Use Risk Profile Scale (SURPS).

Results: Regression analyses showed that the top predictors for problematic cannabis use levels were levels of alcohol dependence, cigarette/e-cigarette dependence, impulsivity, and sensation seeking. Further analyses compared those who met the criteria for problematic cannabis use to those who did not; problematic cannabis users had significantly higher levels of alcohol and nicotine dependence, as well as higher levels of impulsivity and sensation seeking (all p 's <.001).

Discussion: This study identified strong relationships of problematic cannabis use with problematic alcohol and cigarette/e-cigarette use, and with sensation seeking and impulsivity. The findings have implications for screening, intervention, and policy. For example, the strong relations of problematic cannabis use with problematic alcohol use speak to the inadvisability of the co-location of cannabis and alcohol sales, as is the case in several jurisdictions.

Associations Between Number of Standard Doses of Tetrahydrocannabinol, Cannabis Use Motives and Cannabis-Related Negative Consequences

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Intro: Recently, the National Institutes of Health published a notice of information regarding the establishment of a standard unit of Tetrahydrocannabinol (THC) to be used in

research. To address this notice, the current study examined if associations would differ when using standard dose as a measure of cannabis use compared to cannabis use frequency. We hypothesized that there would be a positive significant relation between cannabis use motives and cannabis-related consequences. We also hypothesized a significant positive relation between motives and cannabis use as measured by standard dose. Finally, we hypothesized that the positive relation between motives and cannabis-related consequences would be partially mediated by cannabis use as measured by standard dose but not cannabis use frequency.

Method: We conducted five path analyses to test study hypotheses in a sample of individuals ($n=84$) who reported regular to heavy cannabis use.

Results: Coping motives significantly positively predicted cannabis-related consequences ($b=0.376$, $SE=0.136$, $p=0.006$), such that a one-unit increase in coping motives was expected to increase cannabis-related consequences by a factor of 1.45 (45%). Number of standard doses significantly positively predicted cannabis-related consequences ($b=0.24$, $SE=0.122$, $p=0.046$) such that a one-unit increase in number of standard doses was expected to increase cannabis-related negative consequences by a factor of 1.27. (27%). In the social motives model, social motives significantly positively predicted cannabis-related negative consequences ($b = .358$, $SE=.133$, $p=.007$) such that a one-unit increase in social motives was expected to increase cannabis related consequences by a factor of 1.43 (43%). Also, social motives significantly positively predicted number of standard doses ($b=0.3$, $SE=0.097$, $p=0.002$) such that a one-unit increase in sense social motives was expected to increase the number of standard doses by a factor of 1.349 (35%). Enhancement motives significantly positively predicted cannabis-related consequences ($b=0.406$, $SE=0.161$, $p=0.012$) and number of standard doses consumed ($b=0.2$, $SE=0.1$, $p=0.014$). Further, IRRs revealed that one unit increases in number of standard doses ingested predicted larger increases in cannabis-related negative consequences than did one unit increases in cannabis use frequency across all models with significant results. All indirect effects were not significant.

Discussion: Previous research has reported mixed findings on the relations between

cannabis use and motives and cannabis use and consequences. This is likely due to how cannabis was being measured, by frequency. Our results suggest that relations between cannabis use frequency or standard doses have with motives and cannabis-related consequences differ in significant ways and that, when measured in standard dose or cannabis use frequency, cannabis use is not a significant mediator of the relation between motives and consequences.

Development and Validation of the Cannabis-Dependent Appetite Measure

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The present study was a two-part investigation into the concept of, risk markers for, and original measure of Cannabis-Dependent Appetite (CDA). Cannabis-Dependent Appetite is a condition in which some prolonged heavy cannabis users develop disordered eating habits, marked by the increasing need for cannabis ingestion to stimulate appetite. Current literature is mainly focused on changes in appetite post-ingestion. However, it is imperative to differentiate changes in appetite solely after use and changes in appetite both during sober and intoxicated periods. This distinction targets the disordered eating habits characteristic of CDA. Participants (N = 60) were 18 years or older and were cannabis users. In the first portion of the study, 11 risk markers (family and personal history of mental health disorders, number of daily sessions, frequency, form quantity, anxiety, depression, anxiety sensitivity, affectivity, difficulty in emotion regulation, and age of onset) were analyzed as potential predictors of the development of CDA, which is measured using the Cannabis-Dependent Appetite Measure (CDAM). In the second portion, participants (N = 40) from the first portion who were daily cannabis users, had a smartphone, had access to reliable internet or data, and were willing to receive text messages from the research team were included in the daily collection of self-reported eating and cannabis use habits. Within-subject correlations between times when eating and cannabis use occurred were calculated and correlated with scores on the CDAM as a way to validate that the CDAM measures the behaviors aimed at assessing. It was hypothesized that individuals who use cannabis

more frequently (vs. less frequently) are more likely to develop Cannabis-Dependent Appetite (CDA) as potential risk markers (family and personal history of mental health disorder, number of daily sessions, frequency, form quantity, anxiety, depression, anxiety sensitivity, negative affectivity, and difficulty in emotion regulation) increase and others (age of onset and positive affectivity) decrease. Frequency ($r(55) = .49, p < .001, r^2 = .24$), average number of daily sessions ($r(55) = .45, p < .001, r^2 = .20$), and quantity of cannabis concentrates ($r(29) = .41, p = .024, r^2 = .16$) were significantly positively associated with Cannabis-Dependent Appetite. Both age of onset ($r(57) = -.29, p = .031, r^2 = .08$) and positive affectivity ($r(60) = -.44, p < .001, r^2 = .19$) were significantly negatively correlated with CDA. A significant positive correlation was found between being high and eating ($r(38) = .37, p = .018, r^2 = .14$). Data show the behavioral trends assessed using Ecological Momentary Assessment add validity to the CDAM.

Cannabis smoking and storage within the home: A cross-sectional survey of families with children

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Introduction: Child cannabis exposure has increased in recent years – a trend that parallels changes to cannabis legality. Yet, little is known about household cannabis practices in the US. To address this gap, this study aims to examine household cannabis practices among a geographically diverse sample of US women of reproductive age. We also examine variations in household cannabis practices across states with varying cannabis policies. Methods: The study sample (N=114) included pregnant women and women with children in their home. In Spring of 2021, participants completed a single cross-sectional online survey that included demographic information and asked about cannabis use, household cannabis practices (e.g., indoor smoking, cannabis storage), and cannabis use risk perceptions. We analyzed data in March 2022 using descriptive statistics. Results: A total of 69.23% and 42.98% of participants reported cannabis products were allowed in their home and

that smoking cannabis was permitted in one or more rooms of their home, respectively. Although not statistically significant, more women residing in states with recreational cannabis more frequently reported that smoking cannabis was allowed in one or more rooms of their home than women residing in states yet to legalize (47.73% vs. 40.00%, respectively). Conclusions: Amid rapidly shifting cannabis policies, further examination of household cannabis practices is needed. Public health efforts should focus on reducing in-home cannabis exposure and promote safe storage and smoking practices for families with children in the home.

Association between Cannabis use and Suicidal Ideation as moderated by Gender identity

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Cannabis is the most commonly used substance that remains federally illegal in the United States. With its rising legality in many states across the nation, it is important to understand the influence that cannabis can have on a user's physical and mental well-being. According to the Centers for Disease Control and Prevention (2022), suicide is among the top nine leading causes of death in the United States for individuals aged 10 to 64. Research suggests that individuals diagnosed with depression who experience suicidal ideation, plans, and attempts is positively correlated with both daily cannabis use and non-daily cannabis use and that this correlation is more significant in women than in men (Han et al., 2021). This study seeks to generalize this finding by investigating both the prevalence and intensity of 30-day cannabis use amongst individuals who endorse suicidal thoughts in the last 12 months and the moderating effect of gender identity on the relationship between 30-day cannabis use and suicidal thoughts in the last 12 months. This study will utilize a sample of college students who completed the American College Health Association-National College Health Assessment Survey sometime between the Fall academic semester of 2019 to the Spring academic semester of 2021. The survey was completed on campuses across the United States with data collected on students' health habits, behaviors, and

perceptions. This data set consists of 198,848 participants aged 18 to 98 years of age (M_{Age} = 23.16), with 66.27% of participants identifying as cisgender women and 30.83% identified as cisgender men. Within the dataset, 40.30% of participants endorsed thinking about or planning suicide in the last 12 months and 19.34% of participants reported using cannabis in the last 30 days. We anticipate that individuals who reported cannabis use in the last 30 days will show an increase in suicidal ideation in the last 12 months compared to individuals who reported never using cannabis. Similarly, we anticipate that gender identity will moderate and strengthen the relation between cannabis use and suicidal ideation in such that individual who identify as women will have a stronger and more significant correlation between cannabis use and suicidal ideations compared to individuals who identify as men. If these results are supported, future research will be warranted to further investigate how the nuanced interaction between gender identity and cannabis use increases our understanding of the upward trend in suicidality among individuals with and without mental health diagnoses.

Examining the Effects of Cannabis Use on Sleep Using Daily Diary Data

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BACKGROUND: College students in the United States widely report using alcohol and cannabis as a sleep aid. Given the prevalence of sleep problems and insufficient sleep in this population, the high incidence in use and co-use of cannabis and alcohol is unsurprising. Current evidence does not support alcohol as an effective sleep aid and research on the relationship of cannabis to sleep is limited and inconsistent. Furthermore, the majority of current cannabis and sleep studies are limited to retrospective, person-level analyses even though there is a wide range of individual

and day-level differences in reactivity to intoxication.

PURPOSE: The aim of this study is to examine cannabis and alcohol use and their associations with sleep at both the between-person level (i.e., between-subjects comparison of chronic use behaviors) and within-person level (i.e., day-level comparison of use behaviors).

METHOD: This study is a secondary analysis of longitudinal data obtained from a study characterizing the effects of simultaneous alcohol and cannabis use. Participants (n=341) completed surveys up to five times per day during two bursts of 4 weeks (54 days total) that occurred during two consecutive college semesters. Self-reported quantities of cannabis use (as number of uses) and alcohol use (as number of drinks), as well as bedtimes (night) and wake times (morning) were reported. Linear mixed models were conducted in SAS 9.4 to characterize between-person and within-person (person-mean centered) correlations of cannabis or alcohol use and sleep duration.

RESULTS: Significant main effects of within-person cannabis (Estimate: 0.019, SE: 0.007, $t=2.86$, $p=0.004$) and alcohol (Estimate: -0.0402, SE: 0.0076, $t=-5.28$, $p<0.001$) use were found, as was a between-person main effect of average cannabis use (Estimate: 0.038, SE: 0.012, $t=3.28$, $p=0.001$) across the full study period. The between-person main effect of average alcohol use was not significant.

CONCLUSIONS: The results suggested that generally heavier cannabis users sleep more than their non-using/generally light using counterparts and that they sleep more on nights following heavier use days. Interestingly, the relationship between alcohol and sleep differed between the between-person and within-person levels: alcohol use was dose-dependently associated with reduced sleep duration; however, in this sample, generally heavier alcohol users did not appear to differ in overall sleep duration compared to generally lighter alcohol users. Importantly, this sample included a wide range of substance users, none of whom were in treatment for a cannabis use disorder (CUD) or alcohol use disorder (AUD). Whether these patterns of dose-dependence would be observed over longer time periods or in individuals who meet criteria for CUD or AUD remains to be studied. Future studies will assess

the effects of alcohol and cannabis co-use patterns as well as timing of consumption.

Adolescent-Onset Cannabis Use Disorder Is Associated With Greater Self-Reported Apathy Among Adults Living with HIV in Florida

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INTRODUCTION Heavy cannabis use has been associated with increased self-reported apathy, or the reduction in motivation and goal-oriented behavior. Apathy is also prevalent in people living with HIV (PLWH). Cannabis use is prevalent among PLWH and has been associated with alterations in brain areas linked to motivation and reward. However, there is a paucity of studies directly examining heavy cannabis use as a predictor of apathy in this population. The current study focuses on age of initiating heavy use, as the neurobehavioral effects of chronic cannabis use may be intensified by early heavy use. We hypothesized that adolescent-onset heavy users would show greater apathy than adult-onset heavy users and that both groups would show greater apathy than never-heavy users and never-users.

METHODS Baseline data were taken from a larger study of marijuana use, cognition, and health in adults living with HIV; included participants had complete marijuana use data (N = 236). The Marin Apathy Evaluation Scale – Self (AES-S) was used to measure self-reported apathy. The marijuana section of the Substance Abuse Module (SAM-5) was administered. Participants were divided, based on age of first meeting criteria for Cannabis Use Disorder, into early-onset (<18) CUD, late-onset CUD, never-CUD, and never-user groups. To account for variations in cell size and outliers, a robust one-way ANOVA was conducted using the WRS2 R package, with age of onset of CUD as a predictor and AES-S total score as dependent variable; results were submitted to Hochberg post-hoc tests.

RESULTS The mean age of included participants was 49.81 years. 73% of participants identified as black/African American, and 54% were assigned male at birth. 8% of included participants had early-onset CUD; 29% had late-onset CUD; 43% never met criteria for CUD; and 20% never used marijuana. 71.6% of participants currently used marijuana at least once a week. The mean AES-S score was 29.81. Age of CUD onset predicted AES-S score, $F(3,48.5)=5.84$, $p = 0.002$. Post hoc tests revealed that the early-onset group (mean = 33.4) was significantly more apathetic than the never-user group (mean = 28.5) ($\Psi = 5.95$, $CI=1.73-10.16$, $p = 0.002$) and the never-CUD group (mean = 29.9) ($\Psi = 4.02$, $CI = 0.60-7.43$, $p = 0.013$). No difference was detected between late-onset (mean = 30.1), never-CUD, and never-user groups ($p >.05$).

DISCUSSION We observed that age of Cannabis Use Disorder onset is associated with AES-S score among adults living with HIV, such that adolescent-onset Cannabis Use Disorder predicted higher levels of apathy relative to groups with no history of Cannabis Use Disorder or cannabis use. Two interpretations of this finding may be advanced: first, that individuals predisposed to apathy are more likely to engage in heavy substance use; second, that early-onset substance use alters behavior and perhaps underlying reward circuitry. Limitations of this study include the absence of a control group without HIV and the cross-sectional nature of our data. Future directions include assessing the roles of current age, depression, and HIV viral suppression as potential covariates.

Do Cannabis PDMPs Change Physician Prescribing Behavior?

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As legal medical cannabis has become widespread in the United States, cannabis-related emergency department visits have increased. One reason for this increase is that physicians cannot prescribe medical cannabis, leading to a situation where physicians must rely on their patients to tell them whether they use medical cannabis. Patients may withhold their use of cannabis from their physician out of fear of judgment or fear of changes to their prescriptions. At the same time, almost 400 medications have moderate or severe

contraindications for use with cannabis, any of which could cause a poisoning severe enough to warrant hospitalization. To combat this problem of information asymmetry in patient cannabis use, about one-third of states with medical cannabis programs have added cannabis to their state Prescription Drug Monitoring Program (PDMP) over the past few years. This could lead to changes in the physician prescribing behavior, which may result in fewer accidental cannabis-related poisonings. I will explore this question through the application of robust difference-in-difference models to private and public insurance claims data as well as data from Electronic Medical Records.

Using Retailer Data and Subjective Resident Experience to Assess Legal Cannabis Access in Massachusetts

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Adult-use cannabis retail storefronts first opened in Massachusetts in November 2018. Forty months later, there are 366 cannabis retailers across the Commonwealth, but it remains unclear which areas have adequate access to safe, regulated (“legal”) cannabis products, and which areas are underserved. In this study, we use open census and retailer data and self-report surveys from Massachusetts residents to estimate access to legal cannabis across Massachusetts.

We used populations from the 2020 census and the Cannabis Control Commission’s Licensing data to approximate the cannabis retailer density per 100,000 people in each of Massachusetts’ fourteen counties. Counties were collapsed by Region to provide trend estimates by general geographic location. Cannabis retailer density were highest in Berkshire, Franklin, and Hampshire Counties (Western), and lowest in Norfolk (Southeast), with less than one retailer (0.7) per 100,000 people, followed by Barnstable (Southeast) and Suffolk (Northeast) counties.

Massachusetts resident data from the International Cannabis Policy Study (ICPS) for 2019 (N = 2,476) and 2020 (N = 2,207) were used to determine whether the subjective experiences and purchasing behaviors of residents support the results of our objective measure. Binomial regressions were run at the Region-level to lower

the risk of Type I error. Participants were first asked why they bought from an illegal rather than legal source, and comparisons were made between Regions based on the amount of individuals answering “Legal sources were too far away.” The Southeast region served as reference group, as it had the lowest retail density and was believed to have more people reporting dispensaries were too far away. Results show that only residents of the Central region [RR .52, CI(.28, .91), $p = .031$] were less likely to report that legal sources were too far away than Southeast residents. All other regions did not reach significance.

We asked participants where they were purchasing their cannabis products and compared the number of residents of each Region that reported purchasing from a “licensed recreational store.” We included Western as the reference group for this model as it was the Region with the highest retail density and was likely home to many residents buying from stores. Residents of Western Massachusetts were significantly more likely to purchase their products from legal stores than residents of the Central [.72, CI(.6, .87), $p < .001$], Northeast [.74, CI(.64, .86), $p < .001$], or Southeast [.81, CI(.7, .94), $p = .005$] Massachusetts. It has been six years since Massachusetts legalized cannabis, yet notable inequities still exist in residents’ access to legal, nonmedical, adult-use cannabis products. Western Massachusetts was the best-served region for cannabis consumers by our estimates, where Southeast Massachusetts remained largely underserved through 2020. These inequities may have implications for cannabis law enforcement in the state, as illicit sources of cannabis could flourish in the absence of easily accessible legal dispensaries. Future work should consider the scope of the illicit market(s) and whether individuals in underserved areas are at higher risk of committing cannabis-related offenses either at the state (distribution) or federal level (trafficking cannabis across state lines).

Absence of age verification for delivery of online purchases of CBD and Delta-8: implications for youth access to CBD and Delta-8 Products

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While marijuana is currently illegal in the United States (US) at the federal level and is a Schedule

I drug under the Controlled Substances Act of 1970, the 2018 Farm Bill exempted some products containing cannabinoids from the Drug Enforcement Agency’s controlled substance list. Under the 2018 Farm Bill, products containing $\leq 0.3\%$ tetrahydrocannabinol (THC) content, such as cannabidiol (CBD) and Delta-8 THC, would not be considered Schedule I controlled substances. Dependent on state law, individuals must be either 18+ or 21+ to purchase CBD and 21+ to purchase Delta-8. The proliferation of online CBD/Delta-8 shops and the shipment of these products from brick-and-mortar locations may contribute to youth access and use of these products in the absence of age verification checks. As part of a pilot study, we aimed to purchase a variety of CBD and Delta-8 product types (e.g., edible, flower, vape, etc.) from CBD shops located in 18 unique states throughout the US. We identified 18 states based on those that permitted the sale of CBD and Delta-8 products and represented all four Census regions of the US (i.e., West, Northeast, Midwest, and South). We searched for the top-rated CBD shops in the largest city in the selected state using Yelp. We selected the highest rated CBD/Delta-8 product available of the identified product type. If we were not able to purchase the product at the shop, we would search the next shop that was in the Yelp review. All products were ordered by someone over 21 years of age and were shipped to a residential address. We documented ability to purchase the product online, online age verification, and whether or not identification or a signature was required at the time of delivery. We had to visit different 26 CBD store websites to reach our goal of purchasing 20 CBD and Delta-8 products from 20 unique states across all four Census regions of the US. Of the websites we visited to purchase CBD products, 37.5% required the customer to verify their age prior to viewing products, and 70.0% of the websites we visited to purchase Delta-8 products required age verification. There were 6 shops that we were unable to purchase a product from. In most cases, this was due to a lack of shipping options, and one store required that the credit card used matched a valid ID which was not possible given our use of an university credit card. At the time of delivery, none of the products required an age identification check or contact with the customer. All deliveries were either left in the mailbox or on the porch. The

findings of our pilot study suggest that youth can obtain CBD and Delta-8 products from online sources without age verification. Efforts are needed to increase the utilization of age verification at the point of delivery by stores that ship CBD and Delta-8 products.

The Good, The Bad, and The Uncertain: A Systematic Review of the Impacts of Recreational Cannabis Legalization

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Background: Recreational cannabis legalization has become more prevalent over the past decade, with recreational cannabis now legal in 13 U.S. states and nationally in Uruguay, Canada, and Malta. At the same time, there is evidence for increasing rates of cannabis use and consequences from use (i.e., crime and motor vehicle accidents) among some age groups, particularly in North America. Thus, it is crucial to understand the role of recreational legalization on person-level outcomes, such as cannabis consumption and health-outcomes. Previous reviews have focused on outcomes in the U.S., but there remains a need for a broader international evaluation of the effect of legalization. Additionally, there is a dearth of reviews examining recreational cannabis legalization as past literature has focused more attention on medical cannabis legalization. The current review examined the role of recreational cannabis legalization on a variety of person-centered outcomes to understand if the consequences of legalization.

Method: A comprehensive systematic review was conducted in accordance with PRISMA guidelines.

Inclusion criteria involved: empirical quantitative research, article available in English, a research design evaluating the impact of recreational cannabis legalization (e.g., pre vs. post), and person-level cannabis use, and/or clinical outcomes included as dependent variables (opposed to outcomes such as changes in the price or potency of cannabis). Two individuals independently coded studies for eligibility and extracted information. The search revealed 69 studies that met criteria for inclusion.

Results: Our search revealed five main categories of outcomes associated with recreational cannabis legalization: cannabis and substance use behaviors, health-care impacts, attitudes surrounding cannabis, crime-related outcomes, and driving-related outcomes. The studies were predominantly cross-sectional designs and most took place within the U.S. The extant literature revealed inconsistencies surrounding the role of recreational legalization. In the case of cannabis use behaviours, there was mixed evidence for different subpopulations. For example, legalization was associated with increased cannabis use for college samples, but there were inconsistent findings for adolescents. Additionally, some studies pointed towards negative consequences associated with legalization, such as increased cannabis use in clinical populations and increased cannabis-related healthcare visits. Other studies suggested no impact of legalization through either no change in examined outcomes or heterogeneous conclusions (e.g., cannabis-related attitudes). Finally, there was also evidence of positive consequences for recreational legalization, such as decreased drug-related arrests and cigarette use.

Conclusions: Overall, the balance of research suggests there is no clear support for any large magnitude person-level impact of recreational cannabis legalization. This review indicates that more conclusive evidence regarding the impact of recreational legalization is still required and reveals a need for more longitudinal study designs with longer-term follow-ups as well as studies from a broader range of geographic jurisdictions. As recreational cannabis legalization becomes implemented globally, a systematic evaluation of the outcomes associated with enactment is of increasing relevance.

"You still have that fear": Policy constraints on informed decision making about legalized cannabis use during pregnancy and lactation

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Background: Cannabis is the most commonly used drug during pregnancy in the United States and use during pregnancy is increasing along with greater legal and social acceptance.

Methods: We conducted a qualitative content analysis of 23 in-depth interviews with pregnant and lactating people in Massachusetts, a state that legalized cannabis for adult use in 2016. Our aim was to explore how policy constrains or facilitates people's ability to make informed decisions about cannabis use during pregnancy and lactation. Our analysis was conducted using an ecosocial approach, recognizing that the implementation and interpretation of cannabis policy can be understood at multiple levels, which interact with each other and shape the health and experiences of individuals. Additionally, this analysis was informed by a harm reduction approach in which we acknowledge the complexity surrounding cannabis use during pregnancy and lactation, while attempting to identify ways to reduce potentially harmful consequences. **Results:** Findings revealed that, despite the legal status of cannabis, there continues to be a lack of clarity for pregnant and lactating people regarding the legal implications of cannabis use. Inconsistent state and institutional policies about drug testing of mothers and newborns leave a cloud of fear hanging over the experiences of cannabis users and inhibit their ability to obtain expert advice from healthcare providers.

Conclusion: Decision makers in public and institutional policy should work to clarify and update policies regarding substance use during pregnancy following legalization of a new substance, and ensure that pregnant and lactating people are afforded the same legal protections as the general population.

Impact of recreational cannabis legalization on cannabis use patterns in the NY metropolitan area: A longitudinal survey

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Introduction. In March of 2021, limited recreational cannabis use was legalized in New York (NY) State. The effects of this legalization on cannabis use patterns remain unclear. This study aims to assess changes in cannabis use patterns and the reasons behind those changes following legalization.

Methods. 646 cannabis users from the NY metropolitan area who completed a baseline online survey in 2018 on cannabis use patterns and related variables were contacted via email to complete a follow-up survey that included additional items related to legalization. 135 adults (F=56, M=75, T/O=4) have completed the survey in a 6-week recruitment period thus far. Respondents' mean age at the time of the current survey was 36.1 (SD=8.5). Most respondents reported being college-educated (68.1%) and employed (81.0%), and the racial/ethnic breakdown was as follows: White=53.3%; Hispanic=18.5%; mixed/other=17.4%; Black=7.4%; Asian=2.2%.

Results. Respondents reported using cannabis more for recreational than for medicinal purposes (48.46% vs 51.28% on a scale of 0 (fully recreational) -100 (fully medicinal); $p=0.011$) and reported spending \$10.96 more as a minimum ($p=0.031$) and \$49.61 more as a maximum ($p=0.008$) dollar amount, on average, on cannabis per week after legalization (relative to before legalization). Fewer participants reported vaping as a route of administration following legalization (48.9%) compared to pre-legalization (65.9%; $p=0.002$). The primary type of cannabis use differed from pre- to post-legalization ($p=0.020$), with primarily THC-composed cannabis seemingly increasing (73.3% vs 84.4%) relative to other cannabinoids following legalization. Finally, more participants reported hallucinogen use after

legalization relative to before legalization ($p=0.013$).

Conclusions. These data suggested that in a sample of regular cannabis users, some self-reported cannabis use patterns changed after legalization of recreational cannabis use in the NY metropolitan area. Cannabis use for recreational purposes increased relative to medicinal purposes, as did certain cannabis spend parameters, proportional THC use, and hallucinogen use. Reported vaping of cannabis decreased, which speculatively could be related to respiratory concerns associated with vaping interacting with the ongoing COVID-19 pandemic, rather than legalization per se. These results may inform policy and treatment initiatives regarding cannabis.

Responses to Recreational Cannabis Legalization among Non-Users, Cannabis Users without a License and Cannabis Users with a License

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Significance: With the changing cannabis legalization landscape, it is important to assess how people may respond to new cannabis legalization policies to inform the effectiveness of such policies that balance public health with consumer needs and interests. Recent research compared intentions to use legalized cannabis among young adult never and ever cannabis users (Leung et al., 2020) and found 59% of never users and 41% of ever users intended to try cannabis if it were legal. However, past research has not examined differences in cannabis use intentions among different groups who report using cannabis for medical reasons versus non-medical reasons, even though past research has demonstrated the importance of differentiating the two groups (Roy-Byrne et al., 2015). As such, the present study aims to assess the unique correlates of responses to cannabis legalization across non-users, cannabis users without a license and cannabis users with a license.

Method: Participants were adults living in Oklahoma (verified by self-reported zip code of residence) who participated in one wave of a 3-wave cross-sectional online survey ($N = 5,248$; 63.7%, non-past 30-day users, 15.8%, past 30-day cannabis users without a medical cannabis license, 17.8%, past 30-day cannabis users with a license) with an average age of 40.35 years. Participants were female (56.8%) and non-Hispanic White (70.3%). Participants completed measures related to past 30-day cannabis use, procession of a cannabis license, and were asked to “select all that apply” to a single item with 8 response options about how they would respond if recreational cannabis was legalized in their state. **Results:** Multivariable logistic regression models revealed significant differences in all 7 of the response options analyzed among non-users, cannabis users without a license and cannabis users with a license controlling for demographic characteristics ($ps < .05$; the 8th item “would use it less” was not assessed among non-users). Next, logistic regression models were examined in all 8 of the response options to compare cannabis users with a license and cannabis users without a license. Cannabis users with a license were more likely to report they would recommend cannabis to a friend or family member (AOR = 1.32, 95%CI: 1.04, 1.68), and they would use cannabis the same as they do now (AOR = 1.75, 95%CI: 1.43, 2.15). In contrast, cannabis users without a license were more likely to report they would use cannabis more than they do now (AOR = .44, 95%CI: 0.34, 0.57), they would use other types of cannabis (AOR = .62, 95%CI: 0.47, 0.80), and they would use cannabis more often to help treat their symptoms (AOR = .60, 95%CI: 0.47, 0.77).

Conclusion: Findings support evidence of differences in how groups would respond to non-medical cannabis legalization with cannabis users without a license intending to use more cannabis. This greater use could become problematic as cannabis strands become more potent with non-medical legalization (Shover & Humphreys, 2019). Future research should continue to examine responses to non-medical cannabis legalization to inform cannabis harm prevention and policy changes related to legalizing non-medical cannabis.

State marijuana and alcohol policies and co-use among adolescents

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Introduction. Liberalization of marijuana laws raises concerns regarding greater availability, more favorable norms, and increased use by adolescents. Previous studies have examined associations of marijuana laws with marijuana use by youth with mixed results, but few studies have investigated the effects of marijuana and alcohol laws on marijuana and alcohol co-use. A study in Oregon found an increase in marijuana and alcohol co-use among adolescents after recreational marijuana legalization in 2015, particularly in counties with greater retail marijuana and alcohol availability. No studies, however, have investigated the combined effects of state marijuana and alcohol policies on co-use. **Objective.** The goal was to examine associations between variations of state-level marijuana and alcohol policies restrictiveness and marijuana and alcohol co-use among adolescents. We hypothesized that youth living in states with more liberal policies will have higher rates of marijuana and alcohol co-use and that marijuana and alcohol policies will interact such that co-use would be significantly higher when both were less restrictive.

Method. We analyzed data from 13,702 students living in 25 states who participated in the 2019 Youth Risk Behavior Survey (YRBS). Students were asked about marijuana and alcohol use frequency in the past 30-days. Those who engaged in marijuana and alcohol use at least once in the past 30-days were classified as marijuana and alcohol co-users (1=yes, 0=no). We assessed the restrictiveness of state-level alcohol regulatory policy environments using the 2018 Alcohol Policy Scale (APS) and created an overall Marijuana Policy Score (MPS) for each state for 2018 with higher scores representing a more liberal marijuana policy environment. Policy domains in the MPS included recreational legalization (0=no, 4=yes), medical legalization (0=no, 1=CBD only, 2=no restriction), minimum legal age for medical marijuana use (0=21 years old, 2=18 years old), decriminalization (0=no, 2=yes), retail sales (0=no, 1=off-premise, 2=on/off-premise) and home deliveries (0=not allowed 1=with restrictions, 2=no restrictions). We performed multilevel mixed logistic regression analyses using Stata

version 17, accounting for nesting of schools within states and students within schools. Covariates included age, sex, ethnicity, and race. **Results.** Less restrictive policy environments were associated with a greater likelihood of marijuana and alcohol co-use (MPS OR=1.50, 95% CI: 1.21, 1.87; APS OR=1.03, 95% CI: 1.01, 1.05). The interaction of the state marijuana and alcohol policies showed that the least restrictive combination of these policies was marginally associated with lower odds of marijuana and alcohol co-use (OR=.99, 95% CI: 0.99, 1.00), but this association was not substantively meaningful beyond the independent effects of the two policy measures.

Conclusion. Our findings show that less restrictive state-level marijuana and alcohol policy environments, especially for marijuana policies, are associated with increased prevalence of marijuana and alcohol co-use among adolescents. These findings suggest that additional prevention efforts are needed as more states liberalize their marijuana laws. Future studies should consider other negative consequences associated with less restrictive policies and resulting from co-use, and changes in marijuana and alcohol co-use among adolescents over time.

Pharmacy Students' knowledge, Attitudes, and Awareness toward Marijuana use

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Introduction: This study aimed to assess the knowledge, attitudes, and awareness of pharmacy students toward marijuana use.

Methods: Pharmacy students were asked to complete a survey that assessed students' knowledge, attitudes, and awareness toward marijuana use. This study compared students' awareness about the harmful effects of marijuana in comparison with alcohol and smoking tobacco. Participants were asked about the possibilities of marijuana-induced cancer and addiction.

Results: Twenty-three percent of pharmacy students reported having used marijuana at some point in their lives. In comparison with tobacco and alcohol, most of the students agreed that tobacco (49%) and alcohol (42%) are more harmful than marijuana ($p < 0.0001$). More than sixty

percent of students considered marijuana as an addictive substance ($p < 0.02$). A 45% of students opposed the possibility of marijuana-induced cancer. Thirty-six percent of the students agreed that marijuana should be legalized for both medical and recreational use with a similar percentage of the students (30 – 32%) believing that marijuana should be legalized for medical use only.

Conclusion: Pharmacy schools need to consider coverage of marijuana use in different sections of their curriculum. This will allow pharmacy students to be better prepared for current and future practice regarding the increased prevalence of marijuana use.

Medicinal cannabis prescribing guidance documents: An evidence-based, best-practice framework based on the New South Wales experience

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Introduction: In 2018, the Australian Centre for Cannabinoid Clinical and Research Excellence (ACRE), a National Health and Medical Research Council (NHMRC) Centre of Research Excellence was funded to develop a suite of state-wide medicinal cannabis prescribing guidance documents. At this time, regulatory changes in Australia were enabling broader access to medicinal cannabis in a medical model. The initiative funded through the New South Wales (NSW) Government's Clinical Cannabis Medicines Program enabled the development of practical resources to support NSW medical practitioners in prescribing medicinal cannabis to patients for conditions where cannabinoids are perceived to have some benefit.

Aim: To provide interim guidance to support medical practitioners in the prescription of medicinal cannabis where they are perceived to have potential benefit.

Methods: A team of clinical pharmacologists, pharmacists and clinicians collaborated in the development of the first tranche of prescribing guidance documents. The suite of six medicinal

cannabis prescribing guidance documents covered the most common indications for which prescriptions for medicinal cannabis were being sought by NSW patients: dementia; anorexia and cachexia; nausea; chemotherapy-induced nausea and vomiting; spasticity; and chronic non-cancer pain. In 2019, the draft guidance documents underwent a comprehensive review and consultation process involving fifty key stakeholders before publication.

Results: The ACRE medicinal cannabis prescribing guidance documents have been widely adopted, both in NSW and around the world. The prescribing guidance documents are now recommended as a health professional educational resource by the Australian national medicines regulator the Therapeutic Goods Administration and state health departments. The prescribing guidance on epilepsy from the second tranche of guidance documents has recently been published in the British Journal of Clinical Pharmacology.

National medicinal cannabis prescribing pattern data and enquiries to the first-of-kind, state-government funded medicinal cannabis advisory service for medical practitioners informed the themes of the second tranche of six medicinal cannabis prescribing guidance documents being developed in 2022.

Conclusions: ACRE medicinal cannabis prescribing guidance documents delivered interim guidance to Australian medical practitioners on the evidence-based and best-practice prescription of medicinal cannabis. Prescribing guidance document themes align with Australian medicinal cannabis prescribing patterns and areas where medical practitioners are seeking further information and advice. It is anticipated that the prescribing guidance documents will be updated periodically as further evidence becomes available.

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New Kinds of [Hash]tags: An Interdisciplinary Examination of Semi-Synthetic Cannabinoid Products

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The rise of distinct subcultures of cannabinoid users and the proliferation of new psychoactive substances derived from the hemp plant reflects a dynamic relationship between the development of new cannabis products and the growth of the markets for these goods. This research combines social science and analytical chemistry framework to explore the historical, linguistic, and chemical developments of cannabis acetates and related products over time. Understanding the multiplicity of contexts that have influenced the trajectory of moieties like THC-O-Acetate is an attempt at detecting and identifying other new psychoactive substances with structural or functional similarities to Δ^9 -THC through an interdisciplinary lens.

Prevalence and Predictors of Simultaneous Cannabis and Alcohol Use Among Medical Cannabis Patients— Is one metric enough?

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Background: During the past two decades of cannabis legalization, the prevalence of medical cannabis (MC) use has increased and there has also been an upward trend in alcohol consumption. As less restricted cannabis laws generate more adult cannabis users, there is concern that more individuals may be simultaneously using medical cannabis with alcohol. A few studies have examined simultaneous use of medical cannabis with alcohol, but none of those studies also assessed patients' current or previous non-medical cannabis use. This paper explores simultaneous alcohol and medical cannabis use among medical cannabis patients with a specific focus on previous

history of cannabis use and current non-medical cannabis use.

Methods: A retrospective cohort study of MC patients (N=631) from four dispensaries located in New York state. Bivariate chi-square tests and multivariable logistic regression are used to estimate the extent to which sociodemographic and other factors were associated with simultaneous use.

Results: Approximately 29% of the sample engaged in simultaneous use and a large share of these users report previous (44%) or current (66%) use of cannabis for non-medical purposes. MC patients who either previously or currently use cannabis non-medicinally, men, and patients using MC to treat a pain-related condition, were significantly more likely to report simultaneous alcohol/MC use.

Conclusions: Results suggest that cannabis use does not fit into two mutually exclusive typologies, medical and non-medical ("recreational"), but exists along a continuum where patients' use and purposes shift to match their health and daily lives. Findings indicate that there may be differential risks related to alcohol/MC use prevalence, which should be considered by cannabis regulatory policies and prevention/treatment programs. If patients are using cannabis and/or alcohol to manage pain, clinicians should screen for both alcohol and cannabis use risk factors.

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