Research Article

Understanding the Relationships between ADHD Symptoms and Cannabis-Related Consequences among Young Adults

Cannabis
2025

researchmj.org
10.26828/cannabis/2025/000312

Claire Minister[1], Christian S. Hendershot[2,3], Matthew T. Keough[1], and Jeffrey D. Wardell[1,4, 5]

[1]Department of Psychology, York University
[2]Department of Population and Public Health Sciences, University of Southern California
[3]Institute for Addiction Science, University of Southern California
[4]Institute for Mental Health Policy Research, Centre for Addiction and Mental Health
[5]Department of Psychiatry, University of Toronto

ABSTRACT

Objective: The link between attention-deficit/hyperactivity disorder (ADHD) and cannabis-related problems is well documented, though research has primarily focused on cannabis use disorder (CUD) or cannabis consequences in aggregate. This study examined how inattentive (IN) versus hyperactive/impulsive (HI) ADHD symptoms relate to CUD symptoms as well as distinct domains of cannabis consequences (social-interpersonal consequences, impaired control, negative self-perception, self-care, risk behaviors, academic/occupational consequences, physical dependence, and blackout use) in young adults. Total amount of cannabis flower used over the past 90 days was explored as a potential mediator of these associations. **Method:** Young adults (N= 160; 41% male; ages 19-25, M= 22, SD= 2.06) with a history of regular cannabis use completed self-report measures of ADHD symptoms and cannabis consequences. Participants also completed a 90-day Timeline Follow Back assessing grams of cannabis flower consumed each day, along with a structured clinical interview for CUD. **Results:** IN symptoms were directly associated with cannabis-related occupational/academic consequences, self-care consequences, and blackouts/memory impairment, independent of quantity of cannabis consumption. HI symptoms showed positive indirect associations with physical dependence, impaired control, and CUD through greater amount of cannabis used. Conversely, IN symptoms had negative indirect associations with these outcomes, mediated by amount of cannabis used. **Conclusions:** Findings reveal distinct pathways through which IN and HI ADHD symptoms relate to cannabis problems in young adults. Findings highlight the need to consider ADHD symptom domains separately when assessing specific cannabis-related risks, which may have implications for tailoring interventions.

Key words: = cannabis; marijuana; ADHD; young adults; problems

Cannabis is one of the most widely used psychoactive substances in North America, with young adults representing the largest proportion of individuals who use cannabis compared to other age groups (Health Canada, 2024; Vidourek et al., 2022). The age ranges that encompass young adulthood vary from study to study, but often include individuals between the ages of 18 to 24 (Health Canada, 2024) or sometimes 18 to 29 (Arnett et al., 2014). According to a recent

Corresponding Author: Jeffrey Wardell, PhD, Department of Psychology, York University, 2700 Behavioural Sciences Building, 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada. E-mail address: jwardell@yorku.ca

population-based survey in Canada, where cannabis is fully legal for adult use, 23% of young adults who use cannabis reported having consumed cannabis daily or near daily (Health Canada, 2024). Frequent cannabis use during young adulthood is associated with a range of adverse health effects, including social impairments, physical dependence, difficulties in self-care, and an increased risk of motor vehicle collisions (Pearson et al., 2017; Rotermann, 2021). Additionally, as brain maturation continues into the mid-20s, young adults may be particularly susceptible to adverse neurocognitive effects of cannabis use (Blest-Hopley et al., 2020). Consequently, this age group has been identified as one of the most at-risk groups for experiencing cannabis-related adverse health outcomes (Campeny et al., 2020; Fischer et al., 2022). Of notable concern is the high rate of cannabis use and cannabis use disorder (CUD) among young adults with attention-deficit / hyperactivity disorder (ADHD), who have 1.46 to 2.88 times higher odds of developing CUD compared to their peers without ADHD (Agnew-Blais et al., 2016; Estévez et al., 2016; Fuller-Thomson et al., 2022).

ADHD, a neurodevelopmental condition that first presents in childhood and may continue through the lifespan, has an estimated global prevalence of 6.12% to 13.03% among young adults ages 18-24 (Song et al., 2021). ADHD is characterized by impairments in social, academic, and psychological functioning. The condition encompasses three clinical subtypes: inattention (IN; e.g., difficulty maintaining focus, disorganization), hyperactivity/impulsivity (HI; e.g., excessive motor activity or inner restlessness; engaging in hasty and potentially harmful behaviours), and combined presentation (American Psychiatric Association, 2013). Prospective research has demonstrated that a childhood diagnosis of ADHD predicts more prevalent cannabis use in adulthood (Charach et al., 2011; Lee et al., 2011; Sibley et al., 2014). Additionally, individuals with ADHD tend to initiate cannabis use at an earlier age relative to their peers without ADHD (Brandt et al., 2018; Charach et al., 2011; Dunne et al., 2014; Lee et al., 2011; Molina et al., 2013; Pingault et al., 2012). Further, a higher number of ADHD symptoms in both childhood and adulthood correlates with more severe cannabis-related problems, and risk of CUD is higher among young adults with persisting ADHD symptoms compared to those whose childhood symptoms have remitted (Agnew-Blais et al., 2016; Bidwell et al., 2014). Collectively, these findings suggest that ADHD symptoms may contribute to both the onset and maintenance of cannabis use and CUD.

Research indicates that individuals with ADHD frequently use cannabis to cope with the psychological and physical distress associated with the disorder (Asselin et al., 2022; Mitchell et al., 2016; Stueber & Cuttler, 2022). According to self-medication theory, the reduction of symptom-related distress serves as a powerful negative reinforcer, leading to increased substance use behaviours and associated problems over time (Khantzian, 1985, 1997). With regard to the use of cannabis to manage ADHD symptoms, recent findings indicate that regular cannabis use is perceived as beneficial for managing hyperactivity symptoms but not inattention and memory symptoms (Stueber & Cuttler, 2022). Given the association between self-medication motives and a higher risk of negative cannabis-related consequences (Beck et al., 2009; Hyman & Sinha, 2008; Vedelago et al., 2022), individuals with HI ADHD symptoms – who may be more inclined to use cannabis for symptom relief – could be at greater risk of developing CUD compared to those with IN symptoms. However, results of existing studies are mixed, with some finding that HI symptoms are more predictive of cannabis use frequency than IN symptoms, other studies finding the opposite, and still other studies finding no differences or that associations depend on moderating factors (Bidwell et al., 2014; Brandt et al., 2018; Capusan et al., 2019; Kolla et al., 2016; Looby et al, 2023; Petker et al., 2020; Upadhyaya & Carpenter, 2008).

Among the studies examining separate HI and IN symptoms in relation to cannabis outcomes, only a few have focused specifically on young adults (e.g., Bidwell et al., 2014; Looby et al, 2023; Upadhyaya & Carpenter, 2008). When examining self-reported ADHD symptoms among university students, Bidwell et al. (2014) found that current IN symptoms (but not HI symptoms) were independently associated with increased cannabis craving, frequency of use, and cannabis-related problems. IN also moderated the relationship between frequency of use and adverse cannabis outcomes, with higher IN associated with increased risk of dependence and cannabis-

related problems. Similarly, Upadhyaya and Carpenter (2008) found that only IN symptoms (and not HI symptoms) were associated with more frequent cannabis use in the past month; however, both IN and HI symptoms were associated with more frequent cannabis use in the past year. In contrast, Looby et al. (2023) found that only HI symptoms (and not IN symptoms) were positively associated with cannabis-related consequences after controlling for cannabis use and other covariates. Given these mixed findings, more research in the young adult population is needed to explore the unique relationships between IN and HI ADHD symptoms and cannabis use consequences.

Cannabis-related problems extend beyond dependence risk; they also encompass broader impacts, such as reduced psychosocial functioning (Meier, 2021), poorer academic performance (Arria et al., 2015; Volkow et al., 2014), job loss (Airagnes et al., 2019), and negative impacts on self-care, such as unhealthy eating habits (Gibson et al., 2023) and sleep disturbances (Edwards & Filbey, 2021). Additionally, cannabis use is linked to worsened self-perception and negative impacts on mood (Sorkhou et al., 2024) and increased engagement in risky behaviours like dangerous driving (Rogeberg & Elvik, 2016). However, studies investigating the relationship between adult ADHD subtypes and cannabis use problems have generally focused on CUD (Brandt et al., 2018, Capusan et al., 2019, Kolla et al., 2016, Loflin et al., 2014, Petker et al., 2020). Only two studies, to our knowledge, have examined the association of separate IN and HI ADHD symptoms with other cannabis use consequences beyond CUD (Bidwell et al., 2014; Looby et al., 2023); however, these studies used an aggregate measure that combined different domains of cannabis-related consequences, rather than examining domain-specific effects. While it is conceivable that IN or HI symptoms may be distinctly associated with different types of cannabis consequences, the evidence is currently unclear. For instance, individuals with higher IN ADHD symptoms may be more prone to outcomes such as poor academic performance (Jaekel et al., 2013), while those with HI symptoms may be at greater risk for engaging in risky behaviour when using cannabis (Shoham et al., 2021). Research is needed to examine whether individuals with IN and HI symptoms have differential vulnerabilities to certain types of cannabis-related problems.

The Current Study

The purpose of the current study was to examine differential associations of IN versus HI ADHD symptoms with CUD as well as distinct types of cannabis use problems (i.e., social-interpersonal consequences, impaired control, negative self-perception, self-care, risky behaviors, academic/occupational consequences, physical dependence, and blackout/memory consequences). We also aimed to examine the mediating role of amount of cannabis used in these relationships to assess the extent to which cannabis consequences are driven by greater cannabis consumption versus other factors, such as riskier cannabis use. We expected that different types of ADHD symptoms would uniquely heighten the risks of experiencing certain cannabis consequences. However, given mixed findings in the literature on associations between ADHD symptoms and cannabis outcomes, and given that no previous studies have examined the relationships of separate IN and HI ADHD symptoms with specific domains of negative cannabis consequences (as opposed to composite indices of overall consequences), the analysis was exploratory in nature.

Further, we included age and sex as covariates in our analyses given that the established show robust correlations with cannabis use and ADHD in the literature. For instance, research has demonstrated that rates of cannabis use and dependence are higher among males than females (Hawke et al., 2018, Leatherdale & Burkhalter, 2012; Pearson et al., 2013), and males also have higher prevalence of adult ADHD symptoms (Faheem et al., 2022). Additionally, cannabis use disorder varies with age, even among young adults (Leadbeater et al., 2019), and age-related changes in ADHD prevalence have also been noted (Vos & Hartman, 2022). Given the potential for age and sex to confound the association between ADHD symptoms and cannabis outcomes, we included these variables in all models.

METHODS

Participants

The data were collected as part of a larger study on cannabis use and cognitive functioning in young adulthood. Data from the larger study have been previously published (Coelho, Hendershot, Aston, et al., 2024; Coelho, Hendershot, Quilty, et al., 2024; Daros et al., 2022); however, the current analysis is the first from this dataset to examine measures of ADHD symptoms and domains of cannabis consequences. Participants were a community sample of 160 young adults (59% female) in Toronto, Canada, recruited via online ads and fliers posted in the community. Eligibility criteria included: 1) ages 19 – 25, 2) at least one period of regular cannabis use in their lifetime (i.e., ≥ twice per month for 6 months), 2) absence of current or prior treatment for alcohol or any substance use other than cannabis, 3) absence of regular (monthly) use of illicit substances other than cannabis, 4) no history of psychosis, mania, neurological disorder (e.g., epilepsy), or neurodevelopmental disorder (e.g., autism spectrum disorder), 5) not using cannabis exclusively for medical reasons, 6) fluency in English. 95% (n = 152) of participants reported consuming cannabis in the past 90 days, and participants consumed an average of 33.41 grams of cannabis flower during that time period (SD = 52.28). 53.8% (n = 86) of participants met criteria for cannabis use disorder over the past year according to a structured interview (see measures below). See Table 1 for participant characteristics.

Table 1. *Participant Demographics*

Demographics	*n*	%
Race/Ethnicity (check all that apply)[a]		
White/Caucasian	83	51.9
African Descent/African American	28	17.5
Asian	26	16.3
East Indian	16	10.0
Middle eastern	6	3.8
Caribbean	4	2.5
Pacific Islander	4	2.5
Native North American	1	0.6
Other	4	2.5
Student Status		
Nonstudent	54	33.8
Part-time student	16	10.0
Full-time student	90	56.3
Gender (check all that apply)[a]		
Man	65	40.6
Woman	92	57.5
Transgender	2	1.3
Non-binary	2	1.3
Other	1	0.6
Annual Household Income[b]		
0 - $9,999	22	13.8
$10,000 = $19,999	25	15.6
$20,000 - $49,999	37	23.1
$50,000 - $59,999	35	21.9
[3]$100,000	33	20.7
Current CUD[c]	86	53.8

Note. N = 160. [a]Participants were counted in all categories they endorsed. [b]8 participants were missing data on income. [c]CUD = cannabis use disorder; symptoms assessed using Structured Clinical Interview for DSM-5 (SCID-5) Cannabis Use Disorder module.

Procedure

Interested individuals completed an online eligibility screening survey, and eligible participants were scheduled for an in-person clinical and cognitive assessment. Given the aims of the larger study, participants were asked to abstain from alcohol and cannabis for 48 hours prior to the assessment and were rescheduled if they reported using either substance within 48 hours of the session or showed visible signs of intoxication. A breathalyzer test confirmed absence of recent alcohol use, and a urine drug screen confirmed absence of recent use of illicit drugs. Participants completed a computerized questionnaire during the assessment, which included measures of ADHD symptoms and cannabis consequences. Interview-based assessments of recent cannabis use and symptoms of cannabis use disorder also were administered.

Measures

World Health Organization adult ADHD Self-Report Scale. The ADHD Self-Report Scale (ASRS; Kessler et al., 2005) is an 18-item measure that assesses the frequency of ADHD symptoms over the past 6 months, with items rated on a scale from 0 = never to 4 = very often. The ASRS is shown to be valid and reliable for use as a screening instrument for ADHD in adults (Adler et al., 2006; Kessler et al., 2007; Silverstein et al., 2018). The ASRS comprises two subscales: inattention (9 items, e.g., "How often do you have difficulty keeping your attention when you are doing boring or repetitive work", Cronbach's α = .78[1]), and hyperactive/impulsivity (9 items, e.g., "How often do you feel overly active and compelled to do things, like you were driven by a motor?", Cronbach's α = .80). Responses to items were summed to derive separate IN and HI scores, with higher scores indicating greater symptom severity. Additionally, the scale includes a 6-item screening subtest (Cronbach's α = .65), where summed scores of ≥14 indicate a positive ADHD screen (Adler et al., 2006; Kessler et al., 2007; Silverstein et al., 2018).

Timeline Follow Back. The Timeline Follow Back (TLFB; Sobell & Sobell, 1992) interview was administered to collect information on cannabis use over the previous 90 days. Specifically, participants were asked to retrospectively self-report on the quantity of cannabis flower (in grams) used each day over the prior 90 days. To facilitate accurate reporting, a cannabis substitute (oregano) was used to provide examples of cannabis joints containing varying quantities of cannabis flower (Norberg et al., 2012). Use of other forms of cannabis (e.g., concentrates, oils, edibles) were also assessed for each day, but consumption quantities were not assessed for non-flower cannabis products and thus they were not incorporated into the index of cannabis consumption quantity. The TLFB has demonstrated reliability and validity as a retrospective measure of cannabis use against other self-report and biological measures (Hjorthøj et al., 2012; Robinson et al., 2012).

Marijuana Consequences Questionnaire. The 50-item Marijuana Consequences Questionnaire (MACQ; Simons et al., 2012) was used to measure eight domains of cannabis consequences: social-interpersonal consequences (6 items, α[2]= .80), impaired control (6 items, α = .90), negative self-perception (5 items, α = .90), self-care (9 items, a = .91), risk behaviors (8 items, α = .88), academic/occupational consequences (5 items, a = .93), physical dependence (4 items, α = .93), and blackout use (7 items, α = .82). Participants were asked to indicate whether they had experienced each negative consequence in the past six months either during or after using cannabis (0 = *no*; 1 = *yes*). Summed scores were calculated for each domain. The MACQ has demonstrated test-retest reliability as well as convergent and discriminant validity in a college student population (Simons et al., 2012) and has been cross-culturally validated (Bravo et al., 2017).

Structured Clinical Interview for DSM-5 (SCID-5). The Cannabis Use Disorder (CUD) module of the SCID-5 (First, 2015) was used to assess current and lifetime symptoms of CUD. Interviews were conducted by trained master's level research assistants who received regular supervision from the principal investigator (a licensed psychologist). For analyses, a continuous variable representing current (past year) CUD symptom count was calculated.

[1]Reliability estimates (alpha coefficients) for all reported measures were calculated based on data from the current sample.

[2]Because items are binary (yes/no), the tetrachoric correlation matrix was used to calculate coefficient alpha.

Data Analysis

Descriptive analyses were conducted, and variables were screened for extreme outliers (i.e., those that were > 3.29 SD above the mean and were disconnected from the rest of the datapoints; Tabachnick & Fidell, 2013); outliers were winsorized by recoding them to one unit greater than the next highest non-outlying value. To explore the relationships between ADHD symptoms, cannabis consumption, and cannabis-related outcomes, two path models were specified in Mplus v. 7.4 (Muthén & Muthén, 2017) using the maximum likelihood estimator: one model included CUD symptom count from the SCID (as an index of CUD severity) as the outcome, while the other model included the 8 domains of cannabis consequences from the MACQ as simultaneous outcomes. The outcomes were specified as count variables in Mplus using a negative binomial distribution, which provided a better fit to the data compared to the Poisson distribution (CUD model: ΔBIC = -25.10; consequences model: ΔBIC = -143.54). In each model, IN and HI ADHD symptom scales were specified as the independent variables, and cannabis consumption (measured as total grams of cannabis flower consumed over the past 90 days) as the mediator. In both models, each outcome variable and the mediator variable were regressed onto the covariates age and sex. As the cannabis consumption variable (total grams consumed over the past month) had a large variance, this variable was rescaled for the analysis by dividing by a constant of 10. For all estimates of direct and indirect associations in the path models, 95% bias-corrected bootstrapped confidence intervals were obtained (with 10,000 bootstrapped samples), with confidence intervals that did not contain zero providing support for the statistical significance of the estimate.

RESULTS

Descriptive Results

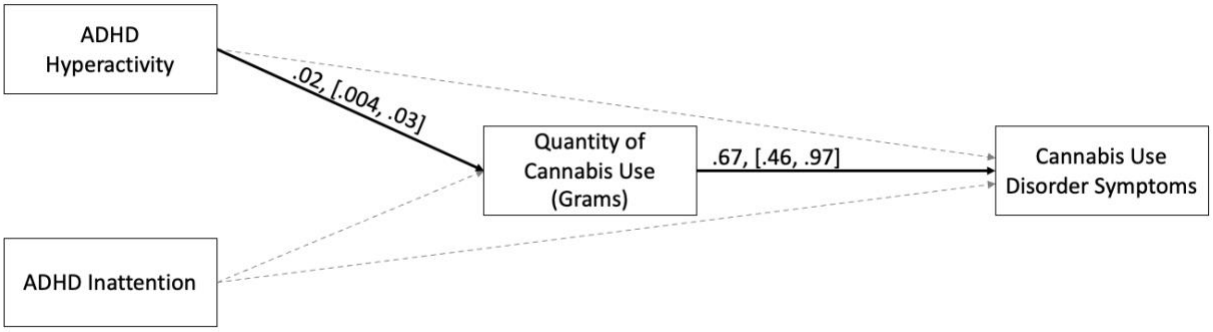
The mean scores for each ADHD subscale were comparable to one another (IN: M = 15.47, SD = 5.59; HI: M = 14.41, SD = 6.17) with a large observed range (IN range = 0.00-32.00; HI range = 0.00-33.00). Based on Part A of the ASRS, 17.5% of participants met the ≥14 clinical cut-off for a positive ADHD screen; see Supplementary Figure S1 for a histogram of ASRS screener scores. Across the eight cannabis consequences domains from the MACQ, the mean scores ranged from M = 5.88 (Risk Behaviours) to M = 22.13 (Self-Care). See Supplementary Table S1 for detailed means, standard deviations, and bivariate correlations of all variables included in the path models.

Path Model with Cannabis Use Disorder Symtoms

See Figure 1 for a schematic depiction of the results of the path analysis along with Supplementary Table S2 for the full set of path coefficients. Regarding direct paths, no significant direct relationship was observed between either IN or HI symptoms and CUD (95% CIs contained zero, see Table S2). HI symptoms were positively and directly associated with cannabis consumption, but no direct association was observed between IN symptoms and cannabis consumption (see Table S2). There was a significant direct association between total grams of cannabis flower consumed in the past 90 days and number of CUD symptoms (Table S2). With respect to indirect associations, greater amount of cannabis consumed mediated the positive indirect relationship between HI symptoms and CUD symptoms (b = .01, 95% CI = .003, .02), and lower amount of cannabis consumed mediated the negative indirect relationship between IN symptoms and CUD symptoms (b = -.01, 95% CI = -.03, -.001)[3]

[3]To investigate whether this negative association could be a result of a suppression effect owing to the correlation between IN and HI symptoms, the model was rerun without HI symptoms included. Results revealed that the negative indirect association between IN symptoms and CUD symptoms was no longer significant (b = -.003, 95% CI = -.021, .006), suggesting the presence of a suppression effect.

Figure 1. *Path Model of ADHD Symptoms, Quantity of Cannabis Consumed, and Cannabis Use Disorder Symptoms*

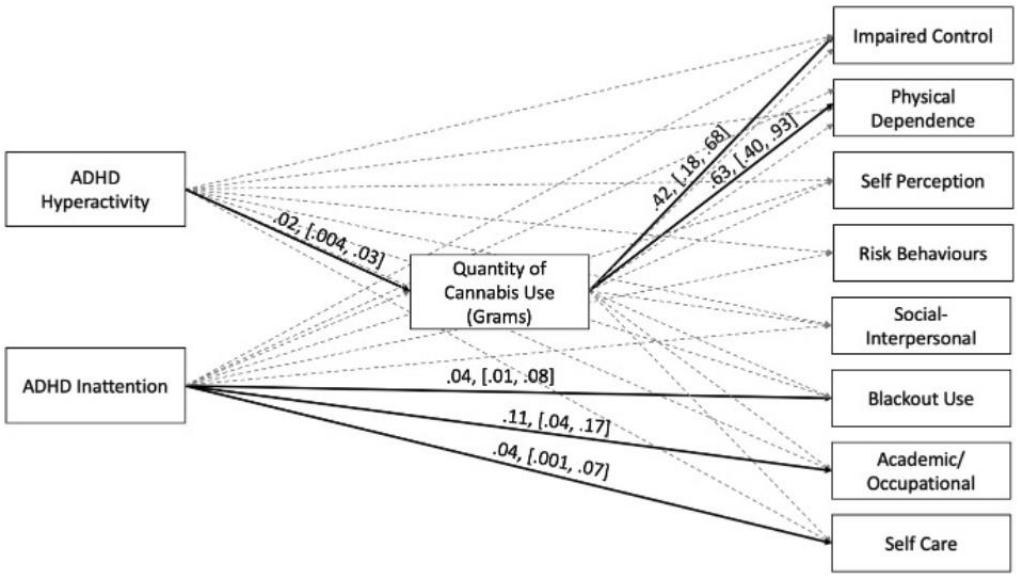


Note. Significant paths are highlighted in bold, while non-significant paths are depicted as grey dotted lines. The quantity of cannabis use variable (total grams of cannabis used in the past 90 days) was divided by a constant of 10 for analyses to facilitate model convergence. Covariates (age, sex) and non-significant coefficients have been omitted from the figure for clarity – see Supplementary S2 for additional results of path analysis.

Path Model for Domains of Negative Consequences

See Figure 2 for a schematic depiction of the path analysis results, and Tables 2 and Supplementary Table S3 for full results of the path analysis. In terms of direct paths, IN ADHD symptoms were directly associated with greater endorsement of cannabis use consequences in three out of eight domains: self-care, academic and occupational consequences, and blackout use (95% CIs did not contain zero; see Table S3). There were no significant direct associations between HI symptoms and any of the cannabis consequences domains. Additionally, total amount of cannabis flower consumed was directly associated with two of the cannabis consequences: increased impaired control and physical dependence (95% CIs did not contain zero; see Table S3).

Figure 2. *Path Model of ADHD Symptoms, Quantity of Cannabis Consumed, and Domains of Cannabis Consequences*



Note. Significant paths are highlighted in bold, while non-significant paths are depicted as grey dotted lines. The quantity of cannabis use variable (total grams of cannabis used in the past 90 days) was divided by a constant of 10 for analyses to facilitate model convergence. Covariates (age, sex) and non-significant coefficients have been omitted from the figure for clarity – see Tables 2 and Supplementary Table S3 for full results of path analysis.

With respect to indirect associations, a greater amount of cannabis consumed mediated the relationship between HI symptoms and two of the cannabis consequence domains: impaired control and physical dependence (95% CIs did not contain zero; see Table 2). In contrast, a lower amount of cannabis consumed mediated the negative indirect associations between IN symptoms and both impaired control and physical dependence (95% CIs did not contain zero; see Table 2)[4]

Table 2. *Indirect Associations from ADHD Symptoms to Domains of Cannabis Consequences via Quantity of Cannabis Consumed*

Variables	*b*	*Confidence Intervals*		*Rate Ratio*
		Lower 2.5%	*Upper 2.5%*	
Social-Interpersonal Consequences				
ADHD hyperactivity	.01	.000	.01	1.01
ADHD inattention	-.01	-.02	.000	0.99
Impaired Control				
ADHD hyperactivity	**.01**	**.002**	**.02**	1.01
ADHD inattention	**-.01**	**-.02**	**-.001**	0.99
Self-perception				
ADHD hyperactivity	.001	-.004	.01	1.00
ADHD inattention	-.001	-.01	.004	1.00
Self-Care				
ADHD hyperactivity	.004	.000	.01	1.00
ADHD inattention	-.004	-.01	.000	1.00
Risk Behaviors				
ADHD hyperactivity	.01	-.002	.02	1.01
ADHD inattention	-.01	-.02	.002	0.99
Academic/Occupational Consequences				
ADHD hyperactivity	.01	-.001	.02	1.01
ADHD inattention	-.01	-.02	.001	0.99
Physical Dependence				
ADHD hyperactivity	**.01**	**.003**	**.02**	1.01
ADHD inattention	**-.01**	**-.02**	**-.001**	0.99
Blackout Use				
ADHD hyperactivity	.002	-.002	.01	1.00
ADHD inattention	-.002	-.01	.002	1.00

Note. *b* = unstandardized regression coefficient (bolded if significant). The mediating variable (total grams of cannabis used in the past 90 days) was divided by a constant of 10 for analyses to facilitate model convergence.

Supplementary Analysis with Number of Cannabis Days as the Mediator

Because total grams of cannabis consumed excluded non-flower cannabis products, the models were re-run using number of cannabis use days (including any form of cannabis) as the mediator instead of total grams. Results differed in that HI symptoms were not associated with cannabis use frequency (*b* = .01, 95% *CI* = -.005, .015), unlike with total cannabis grams, nor were IN symptoms associated with cannabis frequency (*b* = -.01, 95% *CI* = -.016, .006). In turn, none of the indirect associations from ADHD symptoms to

[4]To investigate whether these negative associations could be a result of a suppression effect, the model was rerun without HI symptoms included. Results revealed that the negative indirect associations of IN symptoms with impaired control and physical dependence were no longer significant (95% CIs contained zero), suggesting the presence of a suppression effect.

consequences or CUD were significant (all 95% confidence intervals contained 0).

DISCUSSION

The present study aimed to investigate the distinct relationships of IN and HI ADHD symptoms with specific types of cannabis-related consequences in young adults, as well as explore whether these associations were mediated by quantity of cannabis consumption. Overall, our results confirm that ADHD symptoms are associated with cannabis consequences in this population (Bidwell et al., 2014; Fuller-Thomson et al., 2022; Looby et al., 2023; Goldstein et al., 2021), and also contribute to the mixed literature examining whether IN and HI ADHD symptoms have differential relationships with cannabis use patterns and use-related problems (Bidwell et al., 2014; Brandt et al., 2018; Capusan et al., 2019; De Alwis et al., 2014; Elkins et al., 2007, 2018; Kolla et al., 2016; Looby et al., 2023, Upadhyaya & Carpenter, 2008). Our study also extends prior research by demonstrating that IN and HI ADHD symptoms are each uniquely linked with specific types of cannabis consequences and by clarifying the mediating role of amount of cannabis consumed in these relationships. Finally, our findings reveal contrasting indirect relationships between IN and HI ADHD symptoms and CUD via cannabis consumption. The results of this study have implications for understanding the specificity of IN and HI ADHD symptoms in conferring risk for unique cannabis-related problems and indicate the potential need for tailored interventions.

This study builds on previous research that observed differing associations between HI and IN symptoms with general cannabis-related problems among young adults (Bidwell et al., 2014; Looby et al., 2023), offering new evidence that these distinct ADHD symptom profiles are associated, both directly and indirectly, with different types of cannabis consequences. For instance, our findings showed that individuals with a greater number of IN ADHD symptoms (but not HI symptoms) were more likely to experience negative cannabis consequences in areas requiring sustained attention, such as academic and occupational settings. IN ADHD is characterized by difficulties with tasks that demand mental effort, distractibility, and forgetfulness. Given that cannabis is known to impair cognitive performance (Bourque & Potvin, 2021), its use may worsen these challenges in individuals with IN ADHD symptoms, further impeding their ability to maintain concentration and process information effectively, potentially resulting in negative academic and occupational consequences.

Analyses also revealed that individuals with elevated IN ADHD symptoms were more prone to negative impacts of cannabis on self-care. The challenges associated with IN ADHD such as attention deficits, disorganization and lack of motivation can make it inherently difficult to maintain self-care routines (e.g., sleep, diet, physical activity). Cannabis use, which has been shown to diminish motivation (Petrucci et al., 2020) and is associated with impairments in self-care even in the general population (Simons et al., 2012), may potentially compound these difficulties for individuals with attentional struggles.

Moreover, results indicated that higher levels of IN ADHD symptoms were associated with a greater likelihood of experiencing blackout use (e.g., feeling dazed after cannabis consumption, forgetting periods of time during use). Cannabis has documented impairing effects on attention and memory (Dellazizzo et al., 2022), and the combined effects of cannabis-induced cognitive slowing and the attentional and memory deficits characteristic of IN ADHD may increase the risk of memory impairments, such as blackouts.

Notably, the relationships between IN ADHD symptoms and cannabis-related problems in academics/occupation, self-care, and blackouts were found to be independent of quantity of consumption (i.e., total grams of cannabis flower in the past 90 days), indicating that IN symptoms may heighten risk for these cannabis consequences irrespective of the amount of cannabis used. Furthermore, there was no direct association between IN ADHD symptoms and quantity of cannabis consumed; only HI ADHD symptoms were associated with heavier cannabis use. Interestingly, when controlling for the shared variance between IN and HI ADHD symptoms, IN symptoms were found to have a negative, indirect association with physical dependence, impaired control, and CUD through quantity of cannabis consumed (but no association through frequency of cannabis use). Notably, these findings differ

from those of Bidwell and colleagues (2014), who reported that IN symptoms had a stronger positive association with cannabis use frequency and cannabis-related problems when controlling for HI symptoms. This discrepancy may be due to differences in measurement instruments or populations (i.e., university students versus community sample including nonstudents). Considering the current findings alongside prior research suggesting that cannabis use was perceived as either ineffective or even exacerbating for inattentive symptoms (Stueber & Cuttler, 2022), it is conceivable that individuals with elevated IN ADHD symptoms avoid heavier cannabis use due to its associated cognitive impairments, which may worsen IN ADHD symptoms. Alternatively, individuals with higher IN ADHD symptoms may simply be less motivated to consume cannabis heavily if it does not alleviate their inattentive symptoms. It is also possible that the symptoms of IN ADHD may directly impact consumption amount by disrupting follow-through — for example, through distraction or forgetfulness when intending to use, leading to lower or no use.

However, that the negative indirect paths involving IN symptoms were only significant when including HI symptoms in the mediation models suggests the presence of a suppression effect, which occurs when the magnitude of the association among variables is strengthened by controlling for a correlated variable (MacKinnon et al., 2000). These types of suppression effects can be difficult to interpret – they can merely reflect a statistical artefact, or they can have a substantive interpretation (see MacKinnon et al., 2000). For example, perhaps the negative indirect associations between IN and certain cannabis consequences are obscured by IN's positive association with HI symptoms, which are also positively associated with cannabis consumption and consequences; only when holding HI symptoms constant might the negative associations for IN symptoms come into relief, such that an increase in IN symptoms will predict lower impaired control and physical dependence consequences at a given level of HI symptoms. Because of the complexities of such suppression effects, future research on the mechanisms explaining the differential associations of IN and HI ADHD with cannabis use and problems is needed.

Unlike IN ADHD, elevated HI ADHD symptoms were directly associated with increased quantity of cannabis use, which was in turn linked with cannabis consequences that typically only emerge with heavy consumption, such as physical dependence, impaired control, and CUD. Due to the unique association of HI symptoms with greater amount of cannabis use, HI symptoms indirectly influenced these negative outcomes via their relationship with higher quantity of consumption. Research shows that individuals with symptoms of HI ADHD are more likely to perceive cannabis as beneficial for improving hyperactivity (Stueber & Cuttler, 2022), and perhaps larger amounts of cannabis may be needed to alleviate symptoms such as arousal and restlessness. Consistent with self-medication theory (Khantzian, 1985, 1997), to the extent that individuals high on HI symptoms consume larger amounts of cannabis in attempts to alleviate their symptoms, they may in turn be at increased risk of developing cannabis dependence and CUD, a pathway that was supported in our data. Additionally, impulsivity, which is a hallmark of HI ADHD, may further contribute to difficulties in regulating cannabis use, leading to heavier consumption and associated consequences such as impaired control over use (Kearns et al., 2022; VanderVeen et al., 2016).

Our study has several limitations that warrant consideration. First, the cross-sectional design limits casual inference, as observed associations may be influenced by other factors, such as a generalized risk for externalizing traits (Johnson et al., 2020; Molinero & Hinckley, 2023; Pingault et al., 2012). While the study explored potential mediational pathways, longitudinal studies are needed to establish the temporal ordering of variables to provide stronger evidence for mediation. Second, the modest sample size and recruitment based at a single location limit generalizability of the findings, lead to low statistical power, and introduce potential sampling bias. Moreover, the sample size does not provide enough power to meaningfully examine interaction effects; future research with larger samples should consider examining interactions between HI and IN symptoms to determine if those high on both symptom types (e.g., combined ADHD subtype) are especially likely to experience certain consequences. The relatively small sample size also limited our ability to stratify results by

potentially relevant factors such as race or other demographic factors; this may be explored in future larger studies. Third, the study focuses on self-report ADHD symptomology without formal clinical diagnosis, and given that only a subsample of the participants scored positive on the ADHD screener, the current results cannot be generalized to a clinical sample of young adults with severe ADHD. Including clinical diagnoses in future studies would facilitate a more nuanced understanding of how ADHD, both diagnosed and subclinical, relates to cannabis use outcomes. Additionally, such studies should account for the potential effects of ADHD medications, which could alter cannabis use patterns or consequences. Further, our study focused exclusively on quantities of cannabis flower used and did not examine quantities of non-flower cannabis products, as retrospective interviews pose challenges in quantifying non-flower cannabis consumption. Future studies could employ methods such as ecological momentary assessment to capture more detailed data on all forms of cannabis used (Coelho et al., 2025). Finally, observed effect sizes of our significant associations were small (see Table 2). An increase of one unit on the HI hyperactivity scale was associated with an estimated 1% increase in the number of impaired control and physical dependence consequences, mediated through quantity of cannabis consumed, which translates to approximately a 6% increase in the number of consequences for every one standard deviation increase in HI symptoms. While these effects may be meaningful from a conceptual standpoint, their small size may limit their clinical implications.

Despite these limitations, this study elucidates the nuanced relationships between IN and HI symptoms of ADHD and specific cannabis-use problems among young adults, along with the mediating role of cannabis consumption amounts. Given increasingly liberal cannabis policies and the high prevalence of use among young adults with ADHD, the findings of this study underscore the importance of considering ADHD symptom dimensions separately when assessing cannabis-related risks in this population. Future research should examine the utility of tailoring interventions to better address the unique cannabis-related risks of young adults with different ADHD symptom profiles and may inform personalized prevention strategies that educate young adults on the potential impacts of using cannabis in the context of HI and IN symptoms.

REFERENCES

Adler, L. A., Spencer, T., Faraone, S. V., Kessler, R. C., Howes, M. J., Biederman, J., & Secnik, K. (2006). Validity of pilot Adult ADHD Self-Report Scale (ASRS) to rate adult ADHD symptoms. *Annals of Clinical Psychiatry*, *18*(3), 145–148. https://doi.org/10.1080/10401230600801077

Agnew-Blais, J. C., Polanczyk, G. V., Danese, A., Wertz, J., Moffitt, T. E., & Arseneault, L. (2016). Evaluation of the persistence, remission, and emergence of attention-deficit/hyperactivity disorder in young adulthood. *JAMA Psychiatry*, *73*(7), 713–720. https://doi.org/10.1001/jamapsychiatry.2016.0465

Airagnes, G., Lemogne, C., Meneton, P., Plessz, M., Goldberg, M., Hoertel, N., Roquelaure, Y., Limosin, F., & Zins, M. (2019). Alcohol, tobacco and cannabis use are associated with job loss at follow-up: Findings from the CONSTANCES cohort. *PLOS ONE*, *14*(9), e0222361. https://doi.org/10.1371/journal.pone.0222361

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed). American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Arnett, J. J., Žukauskienė, R., & Sugimura, K. (2014). The new life stage of emerging adulthood at ages 18-29 years: Implications for mental health. *The Lancet Psychiatry*, *1*(7), 569–576. https://doi.org/10.1016/S2215-0366(14)00080-7

Arria, A. M., Caldeira, K. M., Bugbee, B. A., Vincent, K. B., & O'Grady, K. E. (2015). The academic consequences of marijuana use during college. *Psychology of Addictive Behaviors*, *29*(3), 564–575. https://doi.org/10.1037/adb0000108

Asselin, A., Lamarre, O. B., Chamberland, R., McNeil, S.-J., Demers, E., & Zongo, A. (2022). A description of self-medication with cannabis among adults with legal access to cannabis in Quebec, Canada. *Journal of Cannabis*

Research, *4*(1), 26. https://doi.org/10.1186/s42238-022-00135-y

Beck, K. H., Caldeira, K. M., Vincent, K. B., O'Grady, K. E., Wish, E. D., & Arria, A. M. (2009). The social context of cannabis use: Relationship to cannabis use disorders and depressive symptoms among college students. *Addictive Behaviors*, *34*(9), 764–768. https://doi.org/10.1016/j.addbeh.2009.05.001

Bidwell, L. C., Henry, E. A., Willcutt, E. G., Kinnear, M. K., & Ito, T. A. (2014). Childhood and current ADHD symptom dimensions are associated with more severe cannabis outcomes in college students. *Drug and Alcohol Dependence*, *135*, 88–94. https://doi.org/10.1016/j.drugalcdep.2013.11.013

Blest-Hopley, G., Colizzi, M., Giampietro, V., & Bhattacharyya, S. (2020). Is the adolescent brain at greater vulnerability to the effects of cannabis? A narrative review of the evidence. *Frontiers in Psychiatry*, *11*, 859. https://doi.org/10.3389/fpsyt.2020.00859

Bourque, J., & Potvin, S. (2021). Cannabis and cognitive functioning: From acute to residual effects, from randomized controlled trials to prospective designs. *Frontiers in Psychiatry, 12,* 596601. https://doi.org/10.3389/fpsyt.2021.596601

Brandt, A., Rehm, J., & Lev-Ran, S. (2018). Clinical correlates of cannabis use among individuals with attention deficit hyperactivity disorder. *The Journal of Nervous and Mental Disease*, *206*(9), 726–732. https://doi.org/10.1097/NMD.0000000000000877

Bravo, A. J., Anthenien, A. M., Prince, M. A., & Pearson, M. R. (2017). Marijuana protective behavioral strategies as a moderator of the effects of risk/protective factors on marijuana-related outcomes. *Addictive Behaviors*, *69*, 14–21. https://doi.org/10.1016/j.addbeh.2017.01.007

Campeny, E., López-Pelayo, H., Nutt, D., Blithikioti, C., Oliveras, C., Nuño, L., Maldonado, R., Florez, G., Arias, F., Fernández-Artamendi, S., Villalbí, J. R., Sellarès, J., Ballbè, M., Rehm, J., Balcells-Olivero, M. M., & Gual, A. (2020). The blind men and the elephant: Systematic review of systematic reviews of cannabis use related health harms. *European Neuropsychopharmacology*, *33*, 1–35. https://doi.org/10.1016/j.euroneuro.2020.02.003

Capusan, A. J., Bendtsen, P., Marteinsdottir, I., & Larsson, H. (2019). Comorbidity of adult ADHD and its subtypes with substance use disorder in a large population-based epidemiological study. *Journal of Attention Disorders*, *23*(12), 1416–1426. https://doi.org/10.1177/1087054715626511

Charach, A., Yeung, E., Climans, T., & Lillie, E. (2011). Childhood attention-deficit/hyperactivity disorder and future substance use disorders: Comparative meta-analyses. *Journal of the American Academy of Child & Adolescent Psychiatry*, *50*(1), 9–21. https://doi.org/10.1016/j.jaac.2010.09.019

Coelho, S.G., Hendershot, C.S., Aston, E.R., Ruocco, A.C., Quilty, L.C., Tyndale, R.F., & Wardell, J.D. (2024). Executive functions and behavioural economic demand for cannabis among young adults: Indirect associations with cannabis consumption and cannabis use disorder. *Experimental and Clinical Psychopharmacology*, *32*, 305-315. https://doi.org/10.1037/pha0000678

Coelho, S.G., Hendershot, C.S., Quilty, L.C., & Wardell, J.D. (2024). Screening for cannabis use disorder among young adults: Sensitivity, specificity, and item-level performance of the Cannabis Use Disorders Identification Test – Revised. *Addictive Behaviors*, *148*, 107859. https://doi.org/10.1016/j.addbeh.2023.107859

Coelho, S. G., Rueda, S., & Wardell, J. D. (2025). Using ecological momentary assessment to quantify Δ-9-tetrahydrocannabinol and cannabidiol use across different forms of cannabis: Feasibility in a sample of Canadian young adults reporting frequent cannabis use. *Addiction*, *120*(6), 1167–1181. https://doi.org/10.1111/add.16768

Daros, A.R., Pereira, B.J., Khan, D., Ruocco, A.C., Quilty, L.C., & Wardell, J.D. (2022). Daily associations between cannabis use and alcohol use in young adults: The moderating role of self-report and behavioral measures of impulsivity. *Addiction Research & Theory*, *30*, 79-88. https://doi.org/10.1080/16066359.2021.1939314

De Alwis, D., Lynskey, M. T., Reiersen, A. M., & Agrawal, A. (2014). Attention-

deficit/hyperactivity disorder subtypes and substance use and use disorders in NESARC. *Addictive Behaviors*, *39*(8), 1278–1285. https://doi.org/10.1016/j.addbeh.2014.04.003

Dellazizzo, L., Potvin, S., Giguère, S., & Dumais, A. (2022). Evidence on the acute and residual neurocognitive effects of cannabis use in adolescents and adults: A systematic meta-review of meta-analyses. *Addiction*, *117*(7), 1857–1870. https://doi.org/10.1111/add.15764

Dunne, E. M., Hearn, L. E., Rose, J. J., & Latimer, W. W. (2014). ADHD as a risk factor for early onset and heightened adult problem severity of illicit substance use: An accelerated gateway model. *Addictive Behaviors*, *39*(12), 1755–1758. https://doi.org/10.1016/j.addbeh.2014.07.009

Edwards, D., & Filbey, F. M. (2021). Are sweet dreams made of these? Understanding the relationship between sleep and cannabis use. *Cannabis and Cannabinoid Research*, *6*(6), 462–473. https://doi.org/10.1089/can.2020.0174

Elkins, I. J., McGue, M., & Iacono, W. G. (2007). Prospective effects of attention-deficit/hyperactivity disorder, conduct disorder, and sex on adolescent substance use and abuse. *Archives of General Psychiatry*, *64*(10), 1145–1152. https://doi.org/10.1001/archpsyc.64.10.1145

Elkins, I. J., Saunders, G. R. B., Malone, S. M., Keyes, M. A., McGue, M., & Iacono, W. G. (2018). Associations between childhood ADHD, gender, and adolescent alcohol and marijuana involvement: A causally informative design. *Drug and Alcohol Dependence*, *184*, 33–41. https://doi.org/10.1016/j.drugalcdep.2017.11.011

Estévez, N., Dey, M., Eich-Höchli, D., Foster, S., Gmel, G., & Mohler-Kuo, M. (2016). Adult attention-deficit/hyperactivity disorder and its association with substance use and substance use disorders in young men. *Epidemiology and Psychiatric Sciences*, *25*(3), 255–266. https://doi.org/10.1017/S2045796015000360

Faheem, M., Akram, W., Akram, H., Khan, M. A., Siddiqui, F. A., & Majeed, I. (2022). Gender-based differences in prevalence and effects of ADHD in adults: A systematic review. *Asian Journal of Psychiatry*, *75*, 103205. https://doi.org/10.1016/j.ajp.2022.103205

First, M. B., Williams, J. B. W., Benjamin, L. S., & Spitzer, R. L. (2015). *Structured clinical interview for DSM-5—research version (SCID-5 for DSM-5 Research Version; SCID-5-RV)*. American Psychiatric Association. https://www.appi.org/getattachment/dd5e946b-09b0-4594-bd29-fc72cdd4dbf7/SCID-5-RV_Users_Guide.pdf

Fischer, B., Robinson, T., Bullen, C., Curran, V., Jutras-Aswad, D., Medina-Mora, M. E., Pacula, R. L., Rehm, J., Room, R., Brink, W. van den, & Hall, W. (2022). Lower-risk cannabis use guidelines (LRCUG) for reducing health harms from non-medical cannabis use: A comprehensive evidence and recommendations update. *International Journal of Drug Policy*, *99*, 103381. https://doi.org/10.1016/j.drugpo.2021.103381

Fuller-Thomson, E., Lewis, D. A., & Agbeyaka, S. (2022). Attention-deficit/hyperactivity disorder and alcohol and other substance use disorders in young adulthood: Findings from a Canadian nationally representative survey. *Alcohol and Alcoholism*, *57*(3), 385–395. https://doi.org/10.1093/alcalc/agab048

Gibson, L. P., Skrzynski, C. J., Giordano, G. R., & Bryan, A. D. (2023). A daily diary investigation of cannabis use and its diet and exercise correlates. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1217144

Goldstein, A. L., Shifrin, A., Katz, J. L., Iu, L. K., & Kofler, D. (2021). Exploring the relationship between ADHD symptoms and daily cannabis consequences in emerging adulthood: The role of cannabis motives. *Journal of Studies on Alcohol and Drugs*, *82*(2), 228–236. https://doi.org/10.15288/jsad.2021.82.228

Hawke, L. D., Koyama, E., & Henderson, J. (2018). Cannabis use, other substance use, and co-occurring mental health concerns among youth presenting for substance use treatment services: Sex and age differences. Journal of Substance Abuse Treatment, *91*, 12–19. https://doi.org/10.1016/j.jsat.2018.05.001

Health Canada. (2024, January 18). Canadian Cannabis Survey 2023: Summary. https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/canadian-cannabis-survey-2023-summary.html

Hjorthøj, C. R., Hjorthøj, A. R., & Nordentoft, M. (2012). Validity of timeline follow-back for self-reported use of cannabis and other illicit substances—Systematic review and meta-analysis. *Addictive Behaviors*, *37*(3), 225–233. https://doi.org/10.1016/j.addbeh.2011.11.025

Hyman, S., & Sinha, R. (2008). Stress-Related factors in cannabis use and misuse: Implications for prevention and treatment. *Journal of Substance Abuse Treatment*, *36*, 400–413. https://doi.org/10.1016/j.jsat.2008.08.005

Jaekel, J., Wolke, D., & Bartmann, P. (2013). Poor attention rather than hyperactivity/impulsivity predicts academic achievement in very preterm and full-term adolescents. *Psychological Medicine*, *43*(1), 183–196. https://doi.org/10.1017/S0033291712001031

Johnson, E. C., Demontis, D., Thorgeirsson, T. E., Walters, R. K., Polimanti, R., Hatoum, A. S., Sanchez-Roige, S., Paul, S. E., Wendt, F. R., Clarke, T.-K., Lai, D., Reginsson, G. W., Zhou, H., He, J., Baranger, D. A. A., Gudbjartsson, D. F., Wedow, R., Adkins, D. E., Adkins, A. E., … Agrawal, A. (2020). A large-scale genome-wide association study meta-analysis of cannabis use disorder. *The Lancet Psychiatry*, *7*(12), 1032–1045. https://doi.org/10.1016/S2215-0366(20)30339-4

Kearns, N. T., Gunn, R. L., Stevens, A. K., Berey, B. L., & Metrik, J. (2022). Longitudinal associations between impulsivity and alcohol and cannabis use frequency, quantity, and problems among military veterans. *Psychology of Addictive Behaviors*, *36*(7), 762–774. https://doi.org/10.1037/adb0000825

Kessler, R. C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M. J., Jin, R., Secnik, K., Spencer, T., Ustun, T. B., & Walters, E. E. (2005). The World Health Organization Adult ADHD Self-Report Scale (ASRS): A short screening scale for use in the general population. *Psychological Medicine*, *35*(2), 245–256. https://doi.org/10.1017/S0033291704002892

Kessler, R. C., Adler, L. A., Gruber, M. J., Sarawate, C. A., Spencer, T., & Van Brunt, D. L. (2007). Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) screener in a representative sample of health plan members. *International Journal of Methods in Psychiatric Research*, *16*(2), 52–65. https://doi.org/10.1002/mpr.208

Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *The American Journal of Psychiatry*, *142*(11), 1259–1264. https://doi.org/10.1176/ajp.142.11.1259

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry*, *4*(5), 231–244. https://doi.org/10.3109/10673229709030550

Kolla, N. J., van der Maas, M., Toplak, M. E., Erickson, P. G., Mann, R. E., Seeley, J., & Vingilis, E. (2016). Adult attention deficit hyperactivity disorder symptom profiles and concurrent problems with alcohol and cannabis: Sex differences in a representative, population survey. *BMC Psychiatry*, *16*(1), 50. https://doi.org/10.1186/s12888-016-0746-4

Leatherdale, S. T., & Burkhalter, R. (2012). The substance use profile of Canadian youth: exploring the prevalence of alcohol, drug and tobacco use by gender and grade. *Addictive Behaviors*, *37*(3), 318-322. https://doi.org/10.1016/j.addbeh.2011.10.007

Lee, S. S., Humphreys, K. L., Flory, K., Liu, R., & Glass, K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: A meta-analytic review. *Clinical Psychology Review*, *31*(3), 328–341. https://doi.org/10.1016/j.cpr.2011.01.006

Loflin, M., Earleywine, M., De Leo, J., & Hobkirk, A. (2014). Subtypes of attention deficit-hyperactivity disorder (ADHD) and cannabis use. *Substance Use & Misuse*, *49*(4), 427–434. https://doi.org/10.3109/10826084.2013.841251

Looby, A., Prince, M. A., Livingston, N. R., & Berry, K. A. (2023). An examination of the effects of ADHD symptoms and sex on the relation between cannabis protective behavioral strategies and cannabis consequences. *Addictive Behaviors*, *144*, 107718. https://doi.org/10.1016/j.addbeh.2023.107718

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science*, *1*(4), 173–181. https://doi.org/10.1023/A:1026595011371

Meier, M. H. (2021). Cannabis use and psychosocial functioning: Evidence from prospective longitudinal studies. *Current Opinion in Psychology*, *38*, 19–24. https://doi.org/10.1016/j.copsyc.2020.07.001

Mitchell, J. T., Sweitzer, M. M., Tunno, A. M., Kollins, S. H., & McClernon, F. J. (2016). "I use weed for my ADHD": A qualitative analysis of online forum discussions on cannabis use and ADHD. *PLOS ONE*, *11*(5), e0156614. https://doi.org/10.1371/journal.pone.0156614

Molina, B. S., Hinshaw, S. P., Arnold, L. E., Swanson, J. M., Pelham, W. E., Hechtman, L., Hoza, B., Epstein, J. N., Wigal, T., Abikoff, H. B., Greenhill, L. L., Jensen, P. S., Wells, K. C., Vitiello, B., Gibbons, R. D., Howard, A., Houck, P. R., Hur, K., Lu, B., & Marcus, S. (2013). Adolescent substance use in the multimodal treatment study of attention-deficit/hyperactivity disorder (ADHD) (MTA) as a function of childhood ADHD, random assignment to childhood treatments, and subsequent medication. *Journal of the American Academy of Child and Adolescent Psychiatry*, *52*(3), 250. https://doi.org/10.1016/j.jaac.2012.12.014

Molinero, K., & Hinckley, J. D. (2023). Adolescent cannabis use, comorbid attention-deficit/hyperactivity disorder, and other internalizing and externalizing disorders. *Child and Adolescent Psychiatric Clinics of North America*, *32*(1), 57–68. https://doi.org/10.1016/j.chc.2022.07.003

Muthén, L. K., & Muthén, B. O. (2017). *Mplus User's Guide* (8th ed.). Muthén & Muthén.

Norberg, M. M., Mackenzie, J., & Copeland, J. (2012). Quantifying cannabis use with the timeline followback approach: A psychometric evaluation. *Drug and Alcohol Dependence*, *121*(3), 247–252. https://doi.org/10.1016/j.drugalcdep.2011.09.007

Pearson, C., Janz, T., & Ali, J. (2013, September). *Mental and substance use disorders in Canada* (Statistics Canada Catalogue No. 82-624-X). Statistics Canada. https://www150.statcan.gc.ca/n1/pub/82-624-x/2013001/article/11855-eng.htm

Pearson, M. R., Liese, B. S., & Dvorak, R. D. (2017). College student marijuana involvement: Perceptions, use, and consequences across 11 college campuses. *Addictive Behaviors*, *66*, 83–89. https://doi.org/10.1016/j.addbeh.2016.10.019

Petker, T., DeJesus, J., Lee, A., Gillard, J., Owens, M. M., Balodis, I., Amlung, M., George, T., Oshri, A., Hall, G., Schmidt, L., & MacKillop, J. (2020). Cannabis use, cognitive performance, and symptoms of attention deficit/hyperactivity disorder in community adults. *Experimental and Clinical Psychopharmacology*, *28*(6), 638–648. https://doi-org/10.1037/pha0000354

Petrucci, A. S., LaFrance, E. M., & Cuttler, C. (2020). A comprehensive examination of the links between cannabis use and motivation. *Substance Use & Misuse*, *55*(7), 1155–1164. https://doi.org/10.1080/10826084.2020.1729203

Pingault, D. J.-B., Côté, D. S. M., Galéra, D. C., Genolini, D. C., Falissard, D. B., Vitaro, D. F., & Tremblay, D. R. E. (2012). Childhood trajectories of inattention, hyperactivity and oppositional behaviors and prediction of substance abuse/dependence: A 15-year longitudinal population-based study. *Molecular Psychiatry*, *18*(7), 806. https://doi.org/10.1038/mp.2012.87

Robinson, S., Sobell, L., Sobell, M., & Leo, G. (2012). Reliability of the timeline followback for cocaine, cannabis, and cigarette use. *Psychology of Addictive Behaviors*, *28*. https://doi.org/10.1037/a0030992

Rogeberg, O., & Elvik, R. (2016). The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction*, *111*(8), 1348–1359. https://doi.org/10.1111/add.13347

Rotermann, M. (2021). Looking back from 2020, how cannabis use and related behaviours changed in Canada. *Statistics Canada*, *32*(4), 1–14. https://www.doi.org/10.25318/82-003-x202100400001-eng

Shoham, R., Sonuga-Barke, E., Yaniv, I., & Pollak, Y. (2021). ADHD is associated with a widespread pattern of risky behavior across activity domains. *Journal of Attention Disorders*, *25*(7), 989–1000. https://doi.org/10.1177/1087054719875786

Sibley, M. H., Pelham, W. E., Molina, B. S. G., Coxe, S., Kipp, H., Gnagy, E. M., Meinzer, M., Ross, J. M., & Lahey, B. B. (2014). The role of early childhood ADHD and subsequent CD in the initiation and escalation of adolescent

cigarette, alcohol, and marijuana use. *Journal of Abnormal Psychology*, *123*(2), 362–374. https://doi.org/10.1037/a0036585

Simons, J. S., Dvorak, R. D., Merrill, J. E., & Read, J. P. (2012). Dimensions and severity of marijuana consequences: Development and validation of the marijuana consequences questionnaire (MACQ). *Addictive Behaviors*, *37*(5), 613–621. https://doi.org/10.1016/j.addbeh.2012.01.008

Silverstein, M. J., Alperin, S., Faraone, S. V., Kessler, R. C., & Adler, L. A. (2018). Test-retest reliability of the adult ADHD Self-Report Scale (ASRS) v1.1 Screener in non-ADHD controls from a primary care physician practice. *Family Practice*, *35*(3), 336–341. https://doi.org/10.1093/fampra/cmx115

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back: A technique for assessing self-reported alcohol consumption. In R. Z. Litten & J. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biological methods* (pp. 41–72). Humana Press.

Song, P., Zha, M., Yang, Q., Zhang, Y., Li, X., & Rudan, I. (2021). The prevalence of adult attention-deficit hyperactivity disorder: A global systematic review and meta-analysis. *Journal of Global Health*, *11*, 04009. https://doi.org/10.7189/jogh.11.04009

Sorkhou, M., Dent, E. L., & George, T. P. (2024). Cannabis use and mood disorders: A systematic review. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1346207

Stueber, A., & Cuttler, C. (2022). Self-reported effects of cannabis on ADHD symptoms, ADHD medication side effects, and ADHD-related executive dysfunction. *Journal of Attention Disorders*, *26*(6), 942–955. https://doi.org/10.1177/10870547211050949

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (Vol. 6, 497-516). Pearson Education.

Upadhyaya, H. P., & Carpenter, M. J. (2008). Is attention deficit hyperactivity disorder (ADHD) symptom severity associated with tobacco use? *The American Journal on Addictions*, *17*(3), 195–198. https://doi.org/10.1080/10550490802021937

VanderVeen, J. D., Hershberger, A. R., & Cyders, M. A. (2016). UPPS-P model impulsivity and marijuana use behaviors in adolescents: A meta-analysis. *Drug and Alcohol Dependence*, *168*, 181–190. https://doi.org/10.1016/j.drugalcdep.2016.09.016

Vedelago, L., Wardell, J. D., Kempe, T., Patel, H., Amlung, M., MacKillop, J., & Keough, M. T. (2022). Getting high to cope with COVID-19: Modelling the associations between cannabis demand, coping motives, and cannabis use and problems. *Addictive Behaviors*, *124*, 107092. https://doi.org/10.1016/j.addbeh.2021.107092

Vidourek, R. A., Yockey, R. A., King, K. A., & Oliver, A. (2022). Recent marijuana use among young adults, 2015–2018, USA. *International Journal of Mental Health and Addiction*, 20, 3075–3085. https://doi.org/10.1007/s11469-021-00566-3

Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. (2014). Adverse health effects of marijuana use. *The New England Journal of Medicine*, *370*(23), 2219–2227. http://dx.doi.orgpetk/10.1056/NEJMra1402309

Vos, M., & Hartman, C. A. (2022). The decreasing prevalence of ADHD across the adult lifespan confirmed. *Journal of Global Health*, *12*, 03024. https://doi.org/10.7189/jogh.12.03024

Funding and Acknowledgements: Data collection for this study was funded by the Caskey/Francis Family Award in Clinical Research awarded from the Centre for Addiction and Mental Health Foundation (PIs: Jeffrey D. Wardell and Christian S. Hendershot). The authors declare that they have no conflicts of interest.

Early View Publication Date: August 18, 2025