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Cannabis and mental health: Prevalence of use and modes of cannabis administration by mental health status

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ABSTRACT

Background: Cannabis can have an adverse impact on some mental health conditions, while many consumers report using cannabis to manage or improve mental health. Little data exists on how patterns of cannabis use differ by mental health status. The current study examined the prevalence of cannabis use and modes of cannabis administration among consumers who experienced a mental health condition in the past 12-months.

Methods: Data came from the International Cannabis Policy Study (Wave 1). Online surveys were conducted from Aug – Oct 2018 with 25,747 respondents aged 16–65, recruited from commercial panels in Canada and the US. Multinomial and binary regression models examined differences in cannabis prevalence and use of nine cannabis product types among those with and without self-reported past 12-month experience of anxiety, depression, PTSD, bipolar disorder, and psychosis.

Results: Respondents with each of the five mental health conditions reported more frequent cannabis use than those without a mental health condition ($p < .01$). Past 12-month cannabis consumers who experienced mental health conditions were significantly more likely to use the most potent products (solid concentrates, THC vape oils, hash) ($p < .05$), with fewer differences for dried flower, edibles, and other forms. Patterns of use were similar across specific mental health conditions, with some differences among respondents reporting psychosis and bipolar disorder.

Conclusion: Individuals experiencing mental health conditions report more frequent cannabis use and use of more potent product types. These findings highlight the need to target use of specific high potency products in prevention, treatment, and harm reduction among these populations.

1. Introduction

Cannabis use is strongly associated with mental health status. Compared to the general population, regular cannabis use is substantially higher among individuals with schizophrenia, bipolar disorder, depressive and anxiety disorders, and post-traumatic stress disorder (PTSD) (Konefal et al., 2019; Lev-Ran et al., 2013). In addition, rates of substance use disorder and cannabis use disorder (CUD) are higher among individuals reporting any lifetime psychiatric disorders (APA, 2013; Khan, 2017; Lev-Ran et al., 2013). The acute and long-term effects on mental health depend on several factors including age of initiation, frequency, dose, and duration of cannabis use, product potency, and individual and genetic differences (Lowe et al., 2019). The self-medication hypothesis has been proposed to explain the relationship between mental health and substance use (Khantzian, 1997, 1985). It suggests that the presence of a mental health condition precedes substance use, and individuals use substances to alleviate distress and regulate symptoms associated with the condition (Khantzian, 1985). Alternatively, substance use can precipitate mental health conditions, as evidence has shown it can increase the risk of developing a condition, particularly with psychotic disorders (Mané et al., 2015; Moore et al., 2007). The shared-vulnerability hypothesis posits that substance use and mental health conditions may share common genetic or environmental risk factors that predispose individuals to both (Quello et al., 2005).

Cannabis is available in many forms, including dried herb, edibles, oils, hash, concentrates, drinks, and tinctures. These products differ in their modes of administration (e.g. smoked, vaporized, orally ingested), which influences the intensity of the high, duration of psychoactive effects, and potential adverse outcomes (Grotenhermen, 2003). Products

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also differ in their concentrations of THC and CBD. THC produces intoxicating effects, including a 'high', and can induce transient psychotic-like effects (e.g., hallucinations, delusions) and cognitive impairment. CBD does not produce any intoxicating effects at typical doses, and is associated with potential therapeutic effects, including the treatment of psychotic and substance use disorders (Freeman et al., 2020; Hurd et al., 2019; Leweke et al., 2012; McGuire et al., 2018). There has been a recent shift toward cannabis products with higher THC levels and greater potencies. For example, THC concentration of dried flower can range from less than 1% to 30%, whereas cannabis extract products such as oils can exceed 90% THC (Abrams, 2018; Chandra et al., 2019). CBD levels also vary across products, ranging from 'CBD-rich' products that contain little THC, to more 'balanced' products with similar concentrations. In Canada and the US, smoking dried flower remains the most common mode of administration; however, the prevalence of edibles, vaped and orally ingested oils is increasing, particularly among youth (Goodman et al., 2020).

Greater consumption of cannabis with high levels of THC has been associated with the risk of developing psychotic disorders (Di Forti et al., 2015; 2009). A multinational study across 11 sites revealed that daily users of cannabis with 10% THC or more had a five-fold increased risk of psychosis compared to controls, and the prevalence of high potency cannabis use in controls was positively associated with the incidence of psychosis across sites (Di Forti et al., 2019). Moreover, those who reported a lifetime diagnosis of anxiety and depression were more likely to use BHO (butane hash oil, a potent cannabis concentrate) than high potency herbal cannabis, and reported stronger negative effects (Chan et al., 2017). Currently, we are unaware of any studies that have examined product preferences by mental health status for the wide range of products now available on the cannabis market (Goodman et al., 2020). Several studies have found more severe symptoms of CUD with higher potency products; however, the extent to which consumers with mental health conditions self-select towards or away from these products remains unexplored (Craft et al., 2019; Freeman and Winstock, 2015; Hines et al., 2020; Meier, 2017).

Given the adverse outcomes associated with high potency products in relation to consumers with mental health conditions, there is a need for greater understanding of the patterns of cannabis use among these populations. A substantial amount of research exists investigating the potential link between cannabis use and the risk of developing or exacerbating symptoms related to certain mental health conditions. However, cannabis use among these groups appears to be common. There is little population-level data and a lack of evidence on key factors related to prevalence of cannabis use and products used among mental health sub-populations. As such, the current study sought to examine the prevalence of cannabis use and types of products used among those who experienced anxiety, depression, bipolar disorder, PTSD, and psychosis, compared to those without a condition. The study also examined the prevalence of cannabis use and product types used by number of psychiatric conditions experienced in the past 12-months. The study tested two primary hypotheses: 1) individuals who have experienced mental health conditions will report greater frequency of cannabis consumption; and 2) individuals who have experienced mental health conditions will report greater use of product types with higher levels of THC (vape oils, concentrates, hash or kief).

2. Methods

Cross-sectional data were examined from Wave 1 of the International Cannabis Policy Study (ICPS), conducted in Canada and the US. Data were collected via self-completed web-based surveys conducted from August 27- October 7, 2018. Participants were recruited by the Nielsen Consumer Insights Global Panel and their partners' panels, which consist of non-probability based commercial panels. Email invitations (with a unique link) were sent to a random sample of panelists (after targeting for age and country criteria); ineligible panelists were not invited (Goodman and Hammond, 2020). Surveys were conducted in English in the US and English/French in Canada. The AAPOR cooperation rate was 62.4%, calculated as the percentage of respondents who completed the survey (28,471) out of those eligible who accessed the survey link (44,364) (AAPOR, 2016). The ICPS study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#22392).

2.1. Participants

Wave 1 of the ICPS was conducted with participants aged 16–65 years living in Canada (n = 10,057) and the US (n = 17,112). For the current analysis, respondents were excluded if they either refused to answer or provided invalid responses to the questions of interest (n = 1,422).

Post-stratification sample weights were constructed for respondents from Canada (age-by-sex-by-province and education groups) and the US (age-by-sex-by-legal state, education, and region-by-race groups), using population estimates from Statistics Canada and the US Census Bureau (Statistics Canada, 2017, 2016; U.S. Census Bureau, 2018a, 2018b). A raking algorithm was applied to the full sample (n = 27,169) to compute weights that were calibrated to these groupings, and weights were rescaled to the final analytic sample size. A full profile of the ICPS sample and comparisons with national benchmark surveys is available in the ICPS Technical Report – Wave 1 (2018) and ICPS methodology paper (Goodman and Hammond, 2018; Hammond et al., 2020a). The ICPS sample provides comparable estimates of cannabis prevalence compared to national benchmark estimates in Canada, and moderately higher estimates than national estimates in the US National Survey on Drug Use and Health, with highly consistent estimates with respect to consumer patterns of frequency and type of products used (Hammond et al., 2020a).

2.2. Study measures

The ICPS survey included two measures to assess mental health: "past 12-month experience of a mental health condition" and "mental health diagnosis". Analyses were conducted to examine bivariate associations between these measures and the outcome variables, and the patterns were highly consistent for both. Given that mental health conditions can often go undiagnosed, the "past 12-month experience" measure was selected as the primary independent variable for this study. It also better aligns in temporality with the outcome measures, which were based on past 12-month cannabis use.

2.2.1. Past 12-month experience of mental health condition

Participants were asked "Have you experienced this/these mental health problem(s) in the past 12 months?" and could select any of the following: anxiety (including phobia, obsessive–compulsive disorder or panic disorder)/depression (including dysthymia)/post-traumatic stress disorder (PTSD)/bipolar disorder or mania/psychotic disorder (including schizophrenia)/ substance use disorder/other/never received a mental health diagnosis/don't know/refuse to answer. For the purpose of this study, substance use disorder and 'other' were excluded from the list of disorders being examined.

A categorical index variable for past 12-month experience of a mental condition was also created (called 'number of psychiatric conditions'), where responses were recoded to "experienced no mental health condition", "experienced one condition" and "experienced > 1 condition".

2.2.2. Frequency of cannabis use

Frequency of cannabis use was treated as a categorical variable and analyzed as follows: "no use in the past 12 months", "less than monthly use", "weekly or monthly use" and "daily use".

2.2.3. Cannabis product types

Participants were asked if they had used any of the following products within the past 12-months: dried herb (smoked or vaped)/cannabis oils or liquids taken orally (e.g., drops)/cannabis oils or liquids for vaping/edibles or foods/drinks (e.g., marijuana cola, tea or coffee)/concentrates (e.g., wax, shatter, budder)/hash or kief/tinctures/topical ointments (e.g., skin lotions)/other. This was treated as a categorical variable.

2.2.4. Covariates

The study included the following sociodemographic characteristics: sex at birth (male/female), age group (16–25/26–35/36–45/46–55/56–65), ethnicity (white/other), country (Canada/USA), and education (less than high school/high school or equivalent/some college or technical training/bachelor's degree or higher).

2.3. Analysis

All analyses were conducted using SAS Studio 9.4, using weighted data. Descriptive statistics were used to determine the prevalence of cannabis use and product types used by past 12-month experience of each mental health condition, as well as the 'number of psychiatric conditions' variable. Multinomial logistic regression models were fitted with frequency of cannabis use as the dependent variable (0 = No use in past 12-months, 1 = Less than monthly, 2 = Weekly or monthly, 3 = Daily). Each of the mental health conditions (0 = No experience, 1 = Past 12-month experience) and the 'number of psychiatric conditions' variable (0 = No condition, 1 = One condition, 2 = More than one condition) were treated as the independent variables, for which separate models were run. The full analytic sample was used for each model (n = 25,747) and all models were adjusted for sex, age, ethnicity, country, and education.

Binary logistic regression models were fitted with use of each of the nine cannabis product types as the dependent variable (e.g., 0 = No dried herb use in past 12-months, 1 = Used dried herb in past 12-months). Separate models were fitted with each of the mental health conditions (0 = No experience, 1 = Past 12-month experience) and the 'number of psychiatric conditions' variable (0 = No condition, 1 = One condition, 2 = More than one condition) being treated as the independent variables. The models only included respondents who reported consuming any cannabis in the past 12 months (n = 6,413), and were adjusted for sex, age, ethnicity, country, education, and past 12-month cannabis use. Unless otherwise indicated, adjusted odds ratios (AORs) are reported with 95% confidence intervals.

3. Results

3.1. Sample characteristics

Table 1 shows the weighted sample characteristics included in the current analyses from the ICPS 2018 (Wave 1).

3.2. Prevalence of cannabis use

Fig. 1 shows the prevalence of cannabis use by number of psychiatric conditions experienced in the past 12-months. As Table 2 indicates, frequency of cannabis use was positively associated with experience of a mental health condition. Compared to respondents who did not report a mental health condition, those reporting one condition were more likely to use cannabis daily, weekly/monthly and less than monthly (Table 2). The odds of reporting frequent cannabis use were greater among those who experienced > 1 condition, including daily, weekly/monthly, and less than monthly use (Table 2). Additionally, respondents who reported > 1 mental health condition were more likely to use cannabis daily than those only reporting one condition (17.4%: AOR = 1.72; 1.46–2.04).

Multinomial models were conducted to examine differences in cannabis use by specific mental health condition (Table 2). Compared to those who did not experience each condition, those who experienced anxiety, depression, PTSD, bipolar disorder, and psychosis were more likely to report more frequent cannabis use vs. no use in the past 12-months (Table 2).

3.3. Cannabis product types

Fig. 2 shows the type of products used among past 12-months cannabis consumers by number of psychiatric conditions. For most product types, prevalence was consistently higher among those who reported experiencing one or more conditions, with the exception of dried herb, where those with no condition and one condition reported similar use (Fig. 2). Supplemental Tables S1–S9 show the results of binary logistic regression models for each mental health condition. Compared to 'no mental health condition', those who experienced one condition were more likely to use the following: vaped oils, orally

Table 1
Weighted sample characteristics by past 12-month experience of mental health condition (n = 25,747).

	Total sample (n = 25,747) % (n)	Anxiety Yes (n = 6,500) % (n)	Depression Yes (n = 5,566) % (n)	PTSD Yes (n = 1,303) % (n)	Bipolar Yes (n = 795) % (n)	Psychosis Yes (n = 400) % (n)
Age group						
16–25	19.5 (5,021)	29.3 (1,472)	19.9 (998)	3.8 (193)	2.5 (126)	1.4 (70)
26–35	20.5 (5,272)	33.0 (1,739)	28.0 (1,475)	6.7 (355)	4.2 (222)	2.3 (122)
36–45	18.9 (4.870)	27.7 (1,350)	23.8 (1,161)	6.2 (302)	3.9 (190)	1.9 (91)
46–55	20.9 (5,378)	22.2 (1,194)	20.3 (1,094)	5.2 (278)	3.3 (180)	1.5 (81)
56–65	20.2 (5,206)	14.3 (745)	16.1 (838)	3.4 (175)	1.5 (76)	0.7 (36)
Sex						
Female	50.8 (13,074)	31.9 (4,170)	25.5 (3,336)	6.8 (895)	3.4 (449)	1.2 (152)
Male	49.2 (12,673)	18.4 (2,330)	17.6 (2,229)	1.2 (408)	2.7 (346)	2.0 (248)
Ethnicity						
White	77.4 (19,928)	26.8 (5,348)	22.0 (4.394)	5.0 (991)	3.1 (624)	1.3 (263)
Other	22.6 (5,819)	19.8 (1,152)	20.0 (1,172)	5.3 (311)	2.9 (171)	2.4 (137)
Education						
Less than high school	14.9 (3,837)	23.5 (901)	16.3 (626)	3.6 (136)	2.1 (81)	1.4 (54)
High school or equivalent	36.6 (5,580)	27.0 (1,507)	24.4 (1,362)	5.5 (307)	4.1 (228)	2.0 (114)
Some college, tech. training	37.1 (9,562)	20.9 (2,765)	25.8 (2,470)	6.7 (640)	3.9 (375)	1.8 (168)
Bachelor's or higher	26.3 (6,768)	19.6 (1,327)	16.4 (1,108)	3.2 (220)	1.6 (111)	0.9 (64)
Country						
Canada	36.7 (9,438)	24.0 (2,274)	19.3 (1,819)	4.4 (416)	1.8 (165)	1.3 (118)
US	63.3 (16,309)	25.9 (4,227)	23.0 (3,746)	5.4 (887)	3.9 (629)	1.7 (281)

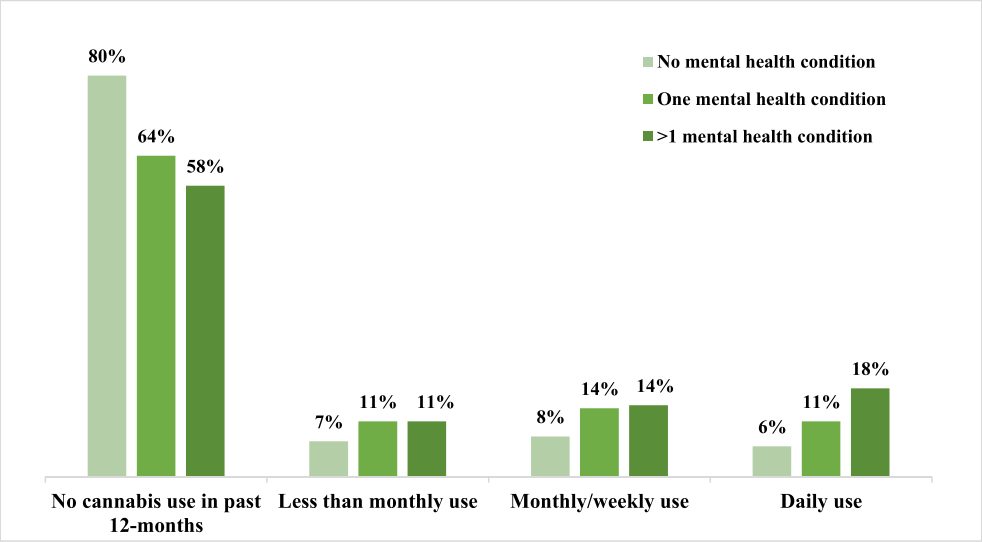

Fig. 1. Frequency of cannabis use among those who experienced no mental condition, one condition, and >1 condition in the past 12-months (n = 25,747).

Table 2
Multinomial regression results examining the association between past 12-month experience of mental health conditions and frequency of cannabis use* (n = 25,747).

	No use in past 12 months (ref)	Less than monthly cannabis use			Weekly/monthly cannabis use			Daily cannabis use		
	% (n)	% (n)	AOR	95% CI	% (n)	AOR	95% CI	% (n)	AOR	95% CI
No conditions	79.7 (13,642)	6.5 (1,119)	Ref		8.0 (1,376)	Ref		5.7 (973)	Ref	
One condition	64.3 (2,779)	11.1 (478)	1.97	(1.76–2.22)	14.0 (605)	2.17	(1.95–2.42)	10.6 (457)	2.33	(2.06–2.63)
>1 condition	57.6 (2,484)	10.6 (456)	2.06	(1.83–2.33)	13.9 (601)	2.46	(2.20–2.74)	18.0 (775)	4.15	(3.72–4.63)
No anxiety	78.2 (15,044)	5.1 (1,324)	Ref		6.4 (1,651)	Ref		6.4 (1,228)	Ref	
Anxiety	59.3 (3,861)	11.3 (732)	1.94	(1.75–2.15)	14.3 (913)	2.26	(2.06–2.47)	15.0 (977)	3.08	(2.80–3.40)
No depression	77.0 (15,547)	7.2 (1,460)	Ref		9.2 (1,850)	Ref		6.6 (1,324)	Ref	
Depression	60.3 (3,358)	10.7 (595)	1.79	(1.61–1.99)	13.1 (732)	1.83	(1.66–2.01)	15.8 (880)	2.86	(2.60–3.15)
No PTSD	74.5 (18,221)	7.9 (1,930)	Ref		9.7 (2,373)	Ref		7.9 (1,920)	Ref	
PTSD	52.5 (684)	9.6 (125)	1.66	(1.36–2.02)	16.0 (209)	2.49	(2.11–2.94)	21.8 (284)	3.72	(3.20–4.33)
No bipolar	74.1 (18,493)	8.0 (1,992)	Ref		9.8 (2,443)	Ref		8.1 (2,024)	Ref	
Bipolar	51.9 (413)	8.0 (63)	1.36	(1.04–1.78)	17.5 (139)	2.40	(1.97–2.94)	22.7 (180)	3.41	(2.83–4.11)
No psychosis	73.4 (18,680)	8.0 (2,016)	Ref		10.0 (2,527)	Ref		8.4 (2,123)	Ref	
Psychosis	56.3 (225)	9.8 (39)	1.52	(1.07–2.14)	13.6 (55)	1.50	(1.11–2.03)	20.3 (81)	2.54	(1.95–3.31)

*Models adjusted for age, sex at birth, ethnicity, education, country. Separate models run for each condition and 'number of psychiatric conditions' variable.

ingested oils, drinks, concentrates, hash, tinctures, topicals, and edibles ($p < .05$ for each product). Respondents reporting > 1 mental health condition were also more likely to report using each product type ($p < .01$ for each product).

Similar patterns were observed across specific mental health conditions for the past 12-month use of cannabis concentrates and hash/kief. Compared to those with no experience, those with a past 12-month experience of each condition of interest were more likely to use concentrates: anxiety (21.2%: AOR = 1.51; 1.31–1.75), depression (23.0%: AOR = 1.69; 1.46–1.95), PTSD (24.5%: AOR = 1.43; 1.15–1.78), bipolar disorder (28.7%: AOR = 1.63; 1.26–2.10), psychosis (30.5%: AOR = 1.71; 1.18–2.47), and hash/kief: anxiety (24.0%: AOR = 1.23; 1.08–1.42), depression (26.1%: AOR = 1.37; 1.20–1.57), PTSD (29.6%: AOR = 1.45; 1.18–1.78), bipolar disorder (28.8%: AOR = 1.69; 1.25–2.28), psychosis (35.3%: AOR = 1.62; 1.34–2.32).

Less consistent patterns emerged for the use of other cannabis products. Those who experienced anxiety were more likely to use the following products compared to those who did not: dried herb (83.4%: AOR = 1.20; 1.05–1.38), vaped oils (32.7%: AOR = 1.34; 1.18–1.51), orally ingested oils (26.6%: AOR = 1.48; 1.30–1.68), edibles (45.9%: AOR = 1.35; 1.21–1.50), tinctures (9.4%: AOR = 1.43; 1.17–1.74), and topicals (15.2%: AOR = 1.38; 1.18–1.62). Respondents who reported a past 12-month experience of depression were more likely to use the following products compared to those who did not: dried herb (85.2%: AOR = 1.42; 1.23–1.64), vaped oils (32.7%: AOR = 1.25; 1.11–1.42), orally ingested oils (26.9%: AOR = 1.41; 1.24–1.60), edibles (44.8%: AOR = 1.22; 1.09–1.36), drinks (11.2%: AOR = 1.36; 1.13–1.63), tinctures (9.5%: AOR = 1.37; 1.12–1.67) and topicals (16.2%: AOR = 1.50; 1.28–1.76).

Past 12-month experience of PTSD was associated with higher odds of using the following product types: vaped oils (36.6%: AOR = 1.37; 1.14–1.66), orally ingested oils (33.0%: AOR = 1.63; 1.34–2.00), drinks (14.1%: AOR = 1.70; 1.31–2.21), tinctures (12.2%: AOR = 1.59; 1.20–2.10), and topicals (20.3%: AOR = 1.67; 1.34–2.10). Compared to those without a past 12-month experience of bipolar disorder, those who reported an experience were more likely to use drinks (13.6%: AOR = 1.44; 1.04–2.00) and tinctures (14.6%: AOR = 1.94; 1.41–2.68). Lastly, respondents who experienced psychosis were more likely to use orally ingested oils (31.1%: AOR = 1.48; 1.01–2.10), drinks (25.2%: AOR = 3.00; 2.07–4.39), tinctures (25.4%: AOR = 2.07; 1.32–3.24), and topicals (23.3%: AOR = 2.25; 1.53–3.13), compared to those who did not experience psychosis. Given that bipolar disorder and psychosis are far less common than the other mental health conditions, it should be noted that the lack of statistically significant associations for these groups could be related to smaller samples sizes.

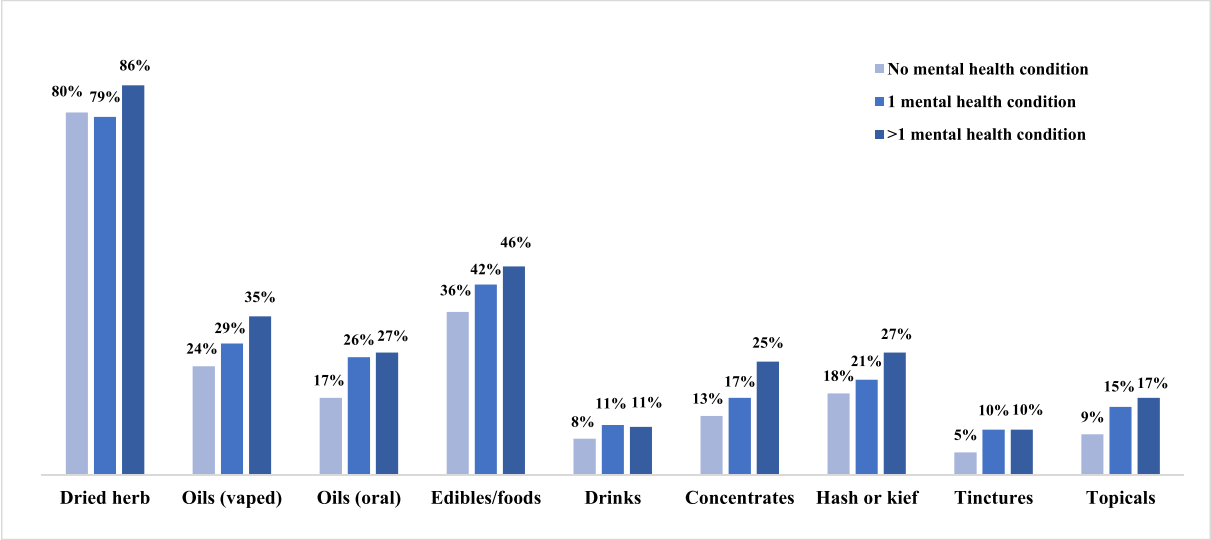

Fig. 2. Product types used among past 12-month cannabis consumers by past 12-month experience of mental health conditions (6,413).

4. Discussion

The current findings from population-based surveys in Canada and the US add to the evidence that cannabis use is more prevalent and frequent among those who experience mental health conditions. These findings align with existing evidence that regular cannabis use is twice as common among individuals with schizophrenia, bipolar, depressive and anxiety disorders, and PTSD, compared to the general population (Konefal et al., 2019). The findings are also consistent with the comorbidity of mental health conditions and substance use disorders (Kessler, 2004). Although the effects of cannabis use may differ by mental health condition, the rate of cannabis use was similar across all conditions examined in this study.

To our knowledge, the current study provides the most comprehensive assessment of how the types of cannabis products consumed differ by mental health condition. Most notably, high-potency products such as solid concentrates, THC vape oils, and hash, were more likely to be used by consumers reporting mental health conditions. This is consistent with a study which found that individuals with diagnoses of anxiety and depression were more likely to use potent cannabis products such as BHO (Chan et al., 2017).

Product preferences were similar across specific mental health conditions—particularly for dried herb, which is the most commonly used product type across all populations (CCS, 2019; Goodman et al., 2020). However, some differences were observed between conditions. Anxiety and PTSD presented very similar patterns of product use, which could be attributed to the fact that both conditions share overlapping symptoms and characteristics, and PTSD was categorized as being a form of anxiety disorder prior to the newer diagnostic criteria (APA, 2013; Zoellner et al., 2011). Past 12-month experiences of anxiety and depression were associated with the use of more product types compared to other conditions. Product preferences were also more similar for anxiety and depression, possibly reflecting the high comorbidity between these conditions. In contrast, bipolar disorder and psychosis presented no significant associations for more common modes of administration such as dried herb, vaped oils, and edibles.

The popularity of high potency cannabis products observed in this study reflects a general trend towards greater use of cannabis extracts and concentrates in the North American market. Whereas the average THC level of dried herb in the North American market is around 20%, products such as hash, vape oils, and solid concentrates have THC levels two to four times greater than dried herb. There are several potential factors that may account for the greater popularity of these products among consumers with mental health conditions. First, consumers may purposely select higher strength products to optimize the delivery of higher doses of THC, which may provide greater symptom relief (CCSA, 2019; Stith et al., 2019). Alternatively, frequent cannabis use may build tolerance, so higher strength products might be sought out in order to maintain the desired outcomes and intoxication levels from cannabis (Colizzi and Bhattacharyya, 2018). This trend may be of particular concern for those with psychosis, as substantial evidence suggests that greater consumption of cannabis products with high levels of THC is associated with the risk of developing a psychotic disorder (Di Forti et al., 2015; 2009). The extent to which higher THC products ameliorate or worsen the experience of mental health conditions has yet to be fully addressed; the existing evidence base highlights predominantly negative outcomes on mental health from higher THC products (Chan et al., 2017; Craft et al., 2019; Freeman and Winstock, 2015). A recent study found that high-potency cannabis use was associated with a significant increase in the likelihood of anxiety disorder (Hines et al., 2020). Overall, the use of high-potency cannabis products among consumers with mental health conditions warrants greater attention. A range of public health communications have sought to highlight the potential risks of cannabis, particularly among those susceptible to psychosis. For example, two of the rotating warnings mandated by Health Canada that appear on cannabis packages focus on mental health: “frequent and prolonged use of cannabis containing THC can contribute to mental health problems over time”, and “daily or near-daily use increases the risk of dependence and may bring on or worsen disorders related to anxiety and depression.” Despite these efforts, there is a need to better understand patterns of cannabis product use among those experiencing mental health conditions, including motivations for use and potential adverse and therapeutic effects.

4.1. Limitations

This study is subject to common limitations of survey research, including potential bias due to non-response. The ICPS sample was recruited using non-probability based sampling methods; therefore, the findings may not be nationally representative. As described elsewhere, the study uses post-stratification weights and comparisons with national benchmark surveys have been published (Hammond et al., 2020b).

The estimates are subject to self-report biases, including the measures of mental health status. The ICPS estimates for prevalence of

mental health diagnoses are generally lower compared to nationally representative surveys (CCHS, 2018; SAMHSA, 2018). Furthermore, compared to in-person surveys or telephone interviews, the online survey mode of the ICPS may provide greater anonymity and promote more truthful reporting on sensitive topics such as cannabis and mental health. Finally, the cross-sectional design of this study does not allow conclusions to be drawn about the existence or direction of causality. Thus, it is not possible to infer the temporal association between mental health and cannabis use.

5. Conclusion

Greater frequency of cannabis use and disproportionately higher use of more potent forms of cannabis were observed among consumers with mental health conditions. Despite important differences in the etiology of different mental health conditions, these patterns were largely consistent across the five conditions examined in this study. The findings emphasize the need to target use of specific high potency cannabis products in prevention, treatment, and harm reduction among people with mental health disorders.

6. Role of the funding source

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7. Author agreement

All authors have seen and approved the final version of the submitted manuscript. The article is the authors' original work; it has not received prior publication and is not under consideration for publication elsewhere.

CRediT authorship contribution statement

Jennifer Rup: Conceptualization, Formal analysis, Writing - original draft. **Tom P. Freeman:** Writing - review & editing. **Christopher Perlman:** Writing - review & editing. **David Hammond:** Conceptualization, Investigation, Funding acquisition, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2021.106991.

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