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## Serious psychological distress and daily cannabis use, 2008 to 2016: Potential implications for mental health?



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## ABSTRACT

**Background:** Daily cannabis use is increasing in the United States (US). Yet, it is not known whether daily cannabis use is disproportionately common, or whether it has increased differentially over time, by mental health status. This study estimated the prevalence of daily cannabis use among adults in the US with and without past-month serious psychological distress (SPD; measured by the Kessler Psychological Distress Scale (K6)) in 2016 and estimated trends in daily cannabis use by past-30-day SPD status from 2008 to 2016.

**Methods:** Data were drawn from adults age 18 and older in the 2008–2016 National Survey on Drug Use and Health (combined total analytic sample  $n = 356,413$ ). Linear time trends of daily cannabis use, stratified by SPD status, were assessed using logistic regression models with continuous year as the predictor.

**Results:** In 2016, past-month daily cannabis use was significantly more common among those with past-month SPD (8.07%), compared to those without past-month SPD (2.66%). Daily cannabis use increased significantly from 2008 to 2016 among those both with and without SPD although use among those with SPD was persistently higher than use among those without SPD over the time period studied.

**Conclusions:** Daily cannabis use is significantly more common among persons with serious psychological distress and is increasing in this group, as well as among those without. Given this increase and the high prevalence of cannabis use among those with SPD, it may be important to consider potential consequences of this increased use for those with mental health vulnerabilities.

### 1. Introduction

Cannabis is the most widely used illicit drug in the world (WHO, 2017) and frequent use of cannabis is associated with a range of negative health and social consequences (e.g., Fergusson and Boden, 2008; Guttmanova et al., 2017; Suerken et al., 2016; Volkow et al., 2014). Approximately a quarter of cannabis users in the United States (US), over 8 million individuals, use cannabis every day or nearly every day (Compton et al., 2016; Hasin et al., 2015) which reflects significant increases in daily use over the past 10 years (SAMHSA, 2014). Along

with the increase in daily cannabis use, there has been a concomitant increase in cannabis-related negative consequences (Azofeifa et al., 2016; Compton et al., 2016; Goodwin et al., 2018; Grucza et al., 2016; Hasin, 2018; Hasin et al., 2015; Mauro et al., 2018). These increases may be associated with the passage of more liberal legal restrictions on cannabis use (Hasin, 2018) as well as a decrease in the perception of risks associated with cannabis use (Azofeifa et al., 2016; Carliner et al., 2017; Compton et al., 2016; Johnston et al., 2016; Pacek et al., 2015). As the number of daily cannabis users increases, it is important to understand what groups are or might be disproportionately impacted by

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the negative consequences of daily use. For instance, persons who struggle with mental or behavioral health challenges may be more vulnerable to negative consequences of daily cannabis use (see [Cousijn et al., 2018](#); [National Academies of Sciences Engineering and Medicine, 2017](#) for reviews).

Serious psychological distress (SPD) is strongly associated with diagnoses of serious mental illness ([Kessler et al., 2003, 2010](#); [Payton, 2009](#)) and poorer mental health ([Payton, 2009](#)). SPD is characterized by feelings of nervousness, hopelessness, sadness, and/or worthlessness ([Furukawa et al., 2003](#); [Kessler et al., 2003, 2010](#)). SPD is reported by approximately 6 million US adults at any one time ([Muhuri, 2014](#)) and tends to become more persistent over time ([Jokela et al., 2011](#)). SPD is also associated with a large number of negative health indicators including higher prevalences of cigarette smoking, alcohol consumption, obesity, and other chronic health conditions; more emergency room visits; lower social support; greater cancer mortality; and greater overall mortality ([Alhussain et al., 2017](#); [Hamer et al., 2009](#); [Lin et al., 2012](#); [McGuire et al., 2009](#); [Muhuri, 2014](#); [Okoro et al., 2009](#); [Pratt et al., 2007](#); [Prochaska et al., 2012](#); [Sung et al., 2011](#)).

People using cannabis often report that they use cannabis in an attempt to decrease anxiety and other SPD-related symptoms and promote a feeling of well-being ([Lee et al., 2009](#); [Patrick et al., 2011, 2016](#)), but little is known about the relationship between SPD and daily cannabis use. A cross-sectional cohort study of Australian adults assessed in 1997 and 2007 found a significant relationship between psychological distress and cannabis dependence at both time points and a stronger relationship (i.e., greater odds ratio) between the two in 2007 than 1997 ([Mathews et al., 2011](#)). However, it is also possible that, based on the growing acceptance and popularity of cannabis use in the US, the strength of the relationship between SPD and cannabis use may weaken over time as cannabis use becomes more common among adults in the general population (i.e., as the base rate of cannabis use increases). In this scenario, the strength of the relationship between mental health problems (e.g., SPD) and cannabis use will be diminished. Additional US studies have suggested relations between symptoms and diagnoses of several mental disorders (e.g., anxiety and depression) and cannabis use ([Borodovsky and Budney, 2018](#); [Degenhardt et al., 2003](#); [Dierker et al., 2018](#); [Dutra et al., 2018](#); [Kedzior and Laeber, 2014](#); [Shi, 2014](#); [Twomey, 2017](#)). Further, a higher prevalence of serious mental illness (defined as one or more of the following: diagnoses of mood, anxiety, eating, substance use, or adjustment disorders; psychotic symptoms; psychotic symptoms; SPD) has recently been found in states that have legalized medical marijuana ([Dutra et al., 2018](#)). At present, however, the relationship between SPD and daily cannabis use and trends in the prevalence of daily cannabis use among people with SPD over time in the US remains unexplored. Little is also known about whether the relationship between SPD and cannabis use differs among demographic subgroups (e.g., by gender, race/ethnicity). Understanding the relationship between cannabis use and SPD could help inform the development of laws that regulate cannabis use in the current changing climate, identify groups who are at higher risk for daily cannabis use, understand whether daily cannabis use is increasing disproportionately among persons with SPD, and perhaps prepare prevention and intervention strategies for groups that may be in greatest need of prevention and/or clinical intervention in the wake of more liberal cannabis use regulations.

The goal of the current study was to investigate the prevalence of daily cannabis use among US adults with and without past-month SPD from 2008 to 2016. The first aim of the study was to examine the prevalence of daily cannabis use in 2016 among those with past-month SPD compared to those without SPD overall and by demographic subgroups. We hypothesized that the prevalence of daily cannabis use would be higher among those with SPD versus no SPD. Examining the relationship between SPD and cannabis use stratified by demographic subgroups was considered exploratory and no a priori hypotheses were specified. The second aim of the study was to examine trends in the

prevalence of daily cannabis use among those with and without past-month SPD from 2008 to 2016. We hypothesized that cannabis use would increase more rapidly among those with SPD given that the prevalence is higher in this group and that there seem to be a greater number of reasons for use.

## 2. Material and methods

### 2.1. Study population

Data for the current study came from the National Survey on Drug Use and Health (NSDUH) public use data files for the years 2008 to 2016. The NSDUH is sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA) and was designed to provide estimates of drug use. The survey employs a 50-state design with an independent multistage area probability sample for each of the 50 states and the District of Columbia. Though the NSDUH was designed to provide estimates of drug use in US community-based individuals age 12 and older, the present analysis only included persons age 18 and older because respondents under 18 were not administered the measure of SPD. The total sample for 2016 was  $n = 42,625$  and the combined total sample from 2008 to 2016 was  $n = 356,413$ .

Sampling weights for the NSDUH were computed to control for unit-level and individual-level non-response and were adjusted to ensure consistency with population estimates obtained from the US Census Bureau. In order to use the nine years of combined data, a new weight was created upon aggregating the nine datasets by dividing the original weight by the number of data sets combined. The analyses were based on de-identified publicly available data exempt from Institutional Review Board review. Additional details regarding the sampling methods and survey techniques for the NSDUH are found elsewhere ([Center for Behavioral Health Statistics and Quality, 2016, 2017](#)).

### 2.2. Measures

#### 2.2.1. Daily cannabis use

Respondents were classified as being daily cannabis users if they indicated using cannabis on at least 25 days out of the past 30, similar to other studies (e.g., [Budney et al., 2003](#); [Pacek et al., 2015](#); [Whitlow et al., 2004](#)).

#### 2.2.2. Serious psychological distress (SPD)

SPD was assessed using the Kessler Psychological Distress Scale (K6) screening instrument ([Furukawa et al., 2003](#); [Kessler et al., 2003, 2010](#)) which is a 6-item scale that assesses the frequency of feeling nervous; hopeless; restless or fidgety; sad or depressed; that everything is an effort; or feeling down on oneself, no good, or worthless. Items were measured on a 5-point Likert scale (0 = “none of the time”, 4 = “all of the time”) and responses were summed across the six items (range = 0–24). Scores of 13 or greater were classified as indicating SPD consistent with other research ([Cook et al., 2014](#); [Lawrence and Williams, 2016](#); [Weissman et al., 2015, 2018](#)). Respondents were then classified into one of two non-overlapping groups: 1) Past-month SPD – respondents who met criteria for SPD in the past month, and 2) No SPD – respondents who did not meet criteria for SPD in the past month.

#### 2.2.3. Covariates

Covariates for the analyses included gender (male, female), age (18–25, 26+), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Other), total annual family income (< \$20,000, \$20,000–\$74,999, \$75,000+), and heavy alcohol use (yes/no; i.e., drinking 5 or more drinks on the same occasion on each of 5 or more days in the past 30 days).

### 2.3. Statistical analyses

Data were weighted to reflect the complex design of the NSDUH sample and were analyzed with STATA SE version 13.0 software. We used Taylor series estimation methods (STATA “svy” commands) to obtain proper standard error estimates for the cross-tabulations. First, we examined the combined prevalence of daily cannabis use by past-month SPD status in survey year 2016 by demographic characteristics. Next, we examined the prevalence of daily cannabis use among individuals with and without past-month SPD, across time from 2008 to 2016.

Linear time trends of daily cannabis use were assessed using logistic regression models with continuous year as the predictor. Multivariable logistic regression was then used to adjust for demographics (gender, age, race/ethnicity, income) and heavy alcohol use. Within these analyses, odds ratios indicate the slope of the increase/decrease (i.e., rapidity of change) in daily cannabis use between 2008 and 2016. Furthermore, models with year-by-SPD status interaction terms, and F-tests to test the significance of these interactions, were used to assess differential time trends (i.e., differences in the rapidity of change between individuals with SPD versus without).

## 3. Results

### 3.1. The prevalence of SPD among US adults 2008 to 2016

The percentage of US adults who reported past-month SPD increased over the study period from 4.78% in 2008 to 5.55% in 2016. This linear trend was significant (aOR = 1.02, 95% CI = 1.01–1.03; adjusted for gender, age, race/ethnicity, total annual family income, and heavy alcohol use).

### 3.2. Daily cannabis use among those with and without SPD and associations with demographic characteristics

In 2016, the prevalence of daily cannabis use was significantly

higher among persons with past-month SPD versus those without past-month SPD (see Table 1). After adjusting for demographic characteristics, persons with past-month SPD were more than twice as likely to report daily cannabis use compared to persons without SPD (aOR = 2.38, 95% CI = 1.89, 3.01). There were significant associations such that SPD was associated with a significantly greater odds of daily cannabis use than no SPD among all demographic subgroups (OR range: 1.44–3.14; i.e., gender, age, marital status, income, race/ethnicity) except for non-Hispanic Black respondents. When associations between SPD and daily cannabis use were compared among demographic subgroups, there was a significant interaction of SPD and daily cannabis use for non-Hispanic White respondents compared to non-Hispanic Black respondents. Specifically, the association between past-month SPD and daily cannabis use was stronger for non-Hispanic White respondents (aOR = 2.68, 95% CI = 2.02, 3.55) than non-Hispanic Black respondents (aOR = 1.44, 95% CI = 0.87, 2.40). Other demographic subgroups did not significantly differ in the strength of the relationship between SPD and daily cannabis use.

### 3.3. Trends in daily cannabis use among those with and without SPD from 2008 to 2016

There were significant increases in the prevalence of past-month daily cannabis use among persons with and without past-month SPD (see Fig. 1 and Table 2). These increasing trends remained significant after adjusting for demographics and heavy alcohol use. There was no significant interaction of time and SPD status suggesting that the increase in daily cannabis use prevalence over time was similar among those with and without SPD. The prevalence of daily cannabis use among persons with past-month SPD was significantly higher than that among persons without SPD in every year of the study period ( $p$ 's < 0.001).

## 4. Discussion

Since 2008, persons with SPD in the US have been significantly

**Table 1**

The association between past-30-day daily cannabis use and past-month serious psychological distress in 2016 by demographic characteristics (National Survey on Drug Use and Health, adults age 18 and older).

Characteristic	Unadjusted prevalence of daily cannabis use		Past-month SPD vs. No SPD	
	No SPD wt% (SE)	Past-month SPD wt% (SE)	aOR <sup>a</sup> (95% CI)	P <sub>int</sub>
Total sample	2.66 (0.01)	8.07 (0.76)	2.38 (1.89, 3.01)	< 0.001
<i>Gender</i>				
Male	3.76 (0.17)	11.22 (1.43)	2.15 (1.59, 2.92)	Ref
Female	1.61 (0.09)	5.86 (0.64)	2.71 (2.08, 3.55)	0.138
<i>Age (years)</i>				
18–25	6.34 (0.33)	12.47 (1.21)	2.15 (1.66, 2.77)	Ref
26 +	2.09 (0.01)	6.37 (0.86)	2.55 (1.85, 3.51)	0.347
<i>Marital Status</i>				
Married	1.28 (0.09)	4.07 (1.04)	3.14 (1.82, 5.42)	Ref
Widowed/divorced/separated	1.98 (0.22)	5.02 (1.28)	2.90 (1.53, 5.51)	0.492
Never married	5.82 (0.27)	11.94 (1.25)	2.15 (1.65, 2.81)	0.120
<i>Total Annual Family Income</i>				
< \$20,000	3.73 (0.21)	7.82 (0.98)	2.05 (1.52, 2.77)	Ref
\$20,000–\$74,999	2.94 (0.15)	8.92 (1.10)	2.61 (1.92, 3.56)	0.193
\$75,000 +	1.87 (0.13)	6.54 (1.30)	2.46 (1.53, 3.95)	0.509
<i>Race/ethnicity</i>				
Non-Hispanic White	2.62 (0.11)	9.35 (1.01)	2.68 (2.02, 3.55)	Ref
Non-Hispanic Black	3.56 (0.28)	5.96 (1.34)	1.44 (0.87, 2.40)	0.003
Hispanic	2.34 (0.23)	5.61 (1.14)	1.89 (1.15, 3.13)	0.150
Non-Hispanic Other	2.25 (0.29)	6.54 (1.61)	2.50 (1.43, 4.37)	0.621

Key: aOR, adjusted odds ratio; CI, confidence interval; Ref, reference; SE, standard error; SPD, serious psychological distress; wt %, weighted percentage.

P<sub>int</sub> = p-value from  $t$ -test for product term beta = 0; test for multiplicative interaction.

<sup>a</sup> Adjusted for all other variables listed in the table.

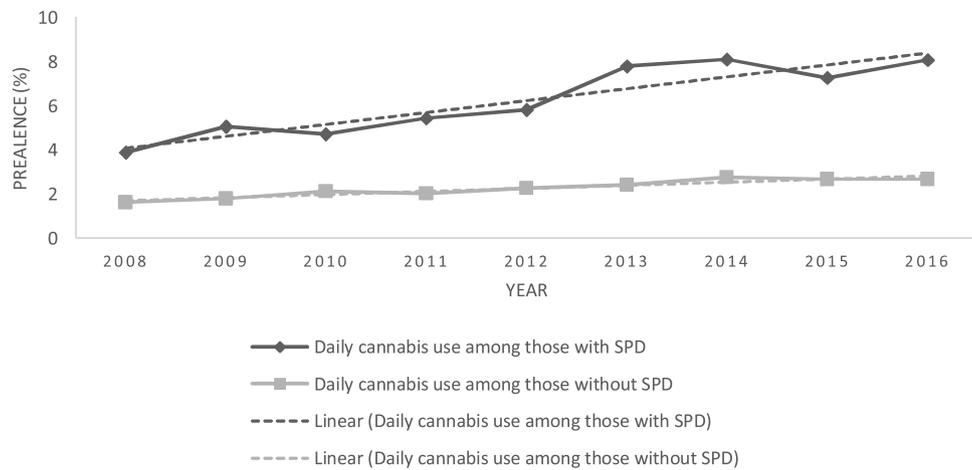


Fig. 1. Prevalence of daily cannabis use for those with and without serious psychological distress (SPD) from 2008 to 2016.

more likely to report using cannabis every day than persons without SPD. In 2008, the prevalence of cannabis use among persons with SPD was nearly two and half times that among persons without SPD. In 2016, this proportion increased to over three times that among persons without SPD. Among persons with SPD, daily cannabis use more than doubled from 2008 to 2016 while, in contrast, the increase over that time period for persons without SPD was much less. While there was no significant difference in the trajectory of daily use between 2008 and 2016 among those with and without SPD, cannabis use remained persistently more common among those with SPD than those without SPD in every year from 2008 to 2016. Moreover, all demographic subgroups with SPD had significantly greater odds of daily cannabis use compared to those without SPD. These relationships among subgroups did not differ with the exception of a stronger relationship between SPD and daily cannabis use for non-Hispanic White respondents compared to non-Hispanic Black respondents. Non-Hispanic White respondents with SPD were over twice as likely to report daily cannabis use compared to non-Hispanic White respondents without SPD while non-Hispanic Black respondents with SPD were approximately 1.5 times more likely to use cannabis daily compared to non-Hispanic Black respondents without SPD.

The mechanisms underlying the relationship between SPD and high prevalences of daily cannabis use are not yet clear. One possibility is that individuals with SPD use cannabis for its negative reinforcement effects, e.g., to reduce or remove distress-related symptoms, anxiety, or stress. For example, cannabis is frequently used as a coping strategy for stress (see Hyman and Sinha, 2009 for a review). A study of teenagers and young adults in Australia found that those with higher SPD were less likely than those with lower SPD to report that it would be harmful for someone to use cannabis to relax (Yap et al., 2011). Further, persons who report lower levels of distress tolerance also report greater cannabis-related dependence symptoms and cannabis-related problems and

these relationships are mediated by the report of using cannabis to cope with negative affect (Bujarski et al., 2012; Farris et al., 2016).

It is possible that the observed relationship is due to the daily use of cannabis for negative reinforcement effects related to SPD, but the reverse pathway may also be true. While cannabis use might ameliorate immediate symptoms of stress or distress, it might contribute to longer term persistence of symptomology. There is mounting evidence that use of cannabis, especially heavy cannabis use, is associated with the risk of incident psychotic symptoms (Borodovsky and Budney, 2018; Colizzi and Murray, 2018; Gage et al., 2016; Haney and Evins, 2016; Hanna et al., 2017; Marconi et al., 2016; Mustonen et al., 2018) as well as some evidence, though mixed, for a link between cannabis use and bipolar, depressive, anxiety, and posttraumatic stress disorder (Borodovsky and Budney, 2018; Haney and Evins, 2016; Hanna et al., 2017). There may also, of course, be a third variable or other risk factors that lead to concomitant cannabis use and SPD. More research is needed to understand biological and causal mechanisms for the association between SPD and cannabis use. This information is needed to inform intervention and treatment efforts as well as policy development efforts as cultural norms around cannabis use become more liberal.

The link between cannabis and SPD has implications for treating SPD among people who use cannabis and for treating cannabis use among people with SPD. Abstinence from cannabis is associated with improvements in mental health symptoms such as anxiety and depression (Hser et al., 2017; Jacobus et al., 2017; Moitra et al., 2016) while continued cannabis use is associated with poorer mental health outcomes for depression, bipolar disorder, and schizoaffective disorder (Bahorik et al., 2017, 2018; Borodovsky and Budney, 2018; Kim et al., 2015; Kvitland et al., 2015; Zorrilla et al., 2015). On the other hand, in order to improve cannabis treatment outcomes, it may be useful to assess and target SPD jointly with cannabis use especially as SPD has been associated with a lower likelihood of successfully quitting

Table 2

Prevalence of past-30-day daily cannabis use by serious psychological distress status (National Survey on Drug Use and Health, 2008–2016, adults age 18 and older).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Linear Trend				
	wt %										aOR <sup>a</sup> (95% CI);	p-value	aOR <sup>b</sup> (95% CI)	p-value
Full analytic sample	1.67	1.88	2.15	2.10	2.33	2.56	2.84	2.73	2.77	1.08 (1.06, 1.09)	< 0.001	1.09 (1.08, 1.10)	< 0.001	
No SPD	1.62	1.79	2.11	2.03	2.27	2.41	2.75	2.66	2.66	1.08 (1.06, 1.09)	< 0.001	1.09 (1.08, 1.11)	< 0.001	
Past-month SPD	3.89	5.06	4.72	5.44	5.81	7.78	8.09	7.26	8.07	1.10 (1.07, 1.12)	< 0.001	1.11 (1.08, 1.15)	< 0.001	
Differential time trend: year as continuous x past-year SPD status											F(1, 110) = 1.55	0.216	F(1, 110) = 1.42	0.235

Key: aOR, adjusted odds ratio; CI, confidence interval; SPD, serious psychological distress; wt %, weighted percentage.

<sup>a</sup> Adjusted for gender, age, race/ethnicity, and total annual family income.

<sup>b</sup> Adjusted for gender, age, race/ethnicity, total annual family income, and heavy alcohol use (i.e., drinking 5 or more drinks on the same occasion on each of 5 or more days in the past 30 days).

cannabis (Shi, 2014). There are promising pilot data suggesting that interventions can have an impact on SPD or cannabis use by persons with SPD. For example, participants with SPD and either cannabis or alcohol use who received a motivational interviewing intervention reported reduced psychological distress, alcohol use, and cannabis use compared to a control group (Hides et al., 2013). In another study, an internet-based intervention targeting cannabis and alcohol use among adolescents reduced SPD compared to a control group (Newton et al., 2014). More research is needed to understand the potential impact of interventions on cannabis and SPD consequences and outcomes.

Of note, the prevalence of daily cannabis use was significantly higher among persons with SPD compared to persons without SPD in nearly all demographic subgroups suggesting that all groups (e.g., all genders, all ages) should be targeted to address SPD and/or cannabis use among those with SPD. We found one significant difference in the relationship of SPD and daily cannabis use among demographic subgroups: a stronger relationship between SPD and daily cannabis use was observed among non-Hispanic White persons than among non-Hispanic Black persons. In fact, non-Hispanic Black respondents were the only demographic subgroup for which the prevalence of daily cannabis use did not significantly differ among persons with and without SPD. While the prevalence of daily cannabis use among non-Hispanic Black respondents with SPD was similar to Hispanic and non-Hispanic Other respondents with SPD, and lower than non-Hispanic White respondents with SPD, the prevalence of daily cannabis use was higher among non-Hispanic Black respondents without SPD compared to non-Hispanic White, Hispanic, and non-Hispanic Other respondents without SPD. Non-Hispanic Black persons report higher prevalences of cannabis use and cannabis use disorders and lower prevalences of SPD than non-Hispanic White persons (Pacek et al., 2015; Weissman et al., 2015; Wu et al., 2014, 2016). Of note, while non-Hispanic Black persons report a higher prevalence of cannabis use, more non-Hispanic Black persons than non-Hispanic White persons who use cannabis report that cannabis use is risky (Pacek et al., 2015). The current study was the first to examine relationships between daily cannabis use and SPD by race/ethnicity. Future research is needed to expand our knowledge of racial/ethnic differences in the relationship between cannabis use and SPD, including correlates of and mechanisms underlying the relationship. For example, perceived racial discrimination and racism is associated with a range of poorer health outcomes (Paradies et al., 2015; Simons et al., 2018; Williams and Mohammed, 2009) and drug use (Carliner et al., 2016; Clark et al., 2015; Gibbons et al., 2004) for Black individuals. It is possible that experiences or variables related to drug use that are shared by Black individuals with and without SPD (e.g., discrimination) would decrease the relationship between SPD and daily cannabis use for this demographic subgroup. A better understanding of racial/ethnic differences in SPD and cannabis use would also provide information needed to determine whether some racial/ethnic subgroups need additional or tailored clinical efforts to reduce the negative consequences of both SPD and daily cannabis use.

A number of limitations must be noted. The analytic sample included US adults ages 18 and older and future research should examine the relationship between cannabis use and SPD for other samples (e.g., adolescents, persons outside of the US). SPD and cannabis use were determined through self-report which may be impacted by a number of variables including underreporting (especially of illegal behaviors such as cannabis use), errors in memory, or biases in reporting. This study used annual cross-sectional data from representative samples of the US adult population. While the multiple years of data allowed us to examine trends in use, we could not follow individual trajectories in SPD or cannabis use. Studies with longitudinal data would be needed to examine changes in individuals over time. This study examined daily cannabis users and it may be useful for future studies, with more detailed information about cannabis use patterns, to examine the relationship of SPD and dimensions of daily cannabis use such as comparing frequency of use per day (e.g., once a day versus multiple times a

day). While this study was not able to examine the relationships of SPD and cannabis use at a state level, it would be useful for future research to investigate the relationship of SPD and cannabis use among US states with and without cannabis-related laws and to examine changes in the relationship of SPD and cannabis use over time within states that adopt or make changes to cannabis-related laws.

#### 4.1. Conclusions

Cannabis use is increasing over time and persons with SPD are significantly more likely to use cannabis every day than persons without SPD. Given the rapid legalization of medicinal and recreational use of cannabis in the US and the liberalization of social norms surrounding cannabis use, more research is needed to understand the impact of these changes on vulnerable groups such as those with mental and behavioral health problems.

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#### Contributors

Dr. Goodwin conceived the study and wrote sections of the manuscript. Dr. Weinberger helped to design the study, managed the literature searches, and wrote the first draft of the manuscript. Dr. Pacek undertook the statistical analyses. All authors contributed to and approved the final manuscript.

#### Conflicts of interest

No conflict declared.

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