



Cannabis use, cannabis use disorder and mental health disorders among pregnant and postpartum women in the US: A nationally representative study

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ABSTRACT

Background: Cannabis use and cannabis use disorder (CUD) are associated with mental health disorders, however the extent of this matter among pregnant and recently postpartum (e.g., new moms) women in the US is unknown. Associations between cannabis use, DSM-5 CUD and DSM-5 mental health disorders (mood, anxiety, personality and post-traumatic stress disorders) were examined among a nationally representative sample of pregnant and postpartum women.

Methods: The 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions–III was used to examine associations between past-year cannabis use, CUD and mental health disorders. Weighted logistic regression models were used to estimate unadjusted and adjusted odds ratios (aORs). The sample (N=1316) included 414 pregnant and 902 postpartum women (pregnant in the past year), aged 18–44 years old.

Results: The prevalence of past-year cannabis use and CUD was 9.8% and 3.2%, respectively. The odds of cannabis use (aORs range 2.10–3.87, p-values<0.01) and CUD (aORs range 2.55–10.44, p-values< 0.01) were higher among women with versus without any past-year mood, anxiety or posttraumatic stress disorders or any lifetime personality disorder. aORs for the association of cannabis use with specific mood, anxiety or personality disorders ranged from 1.95 to 6.00 (p-values<0.05). aORs for the association of CUD with specific mood, anxiety or personality disorders ranged from 2.36 to 11.60 (p-values<0.05).

Conclusions: From pregnancy up to one year postpartum is a critical period where women may be particularly vulnerable to mental health disorders, cannabis use and CUD. Treatment and prevention are essential.

1. Introduction

Cannabis use is contraindicated during pregnancy and postpartum due to potential risks to maternal and child health (ACOG, 2017; Badowski and Smith, 2020; Brown et al., 2016; Calvigioni et al., 2014; Dong et al., 2018; El Marroun et al., 2018; Gabrhelik et al., 2021; Gunn et al., 2016; Haight et al., 2021; Kharbanda et al., 2020; Luke et al., 2019; Marchand et al., 2022; Mark et al., 2021; Meinhofer et al., 2022; Nguyen and Harley, 2022; Ordean and Kim, 2020; Paul et al., 2020; Ryan et al., 2018; U.S. Department of Health and Human Services, 2019;

Volkow et al., 2017; Young-Wolff et al., 2020). Despite public health messaging and recommendations from the ACOG and the American Academy of Pediatrics (AAP) that women abstain from cannabis use during pregnancy and postpartum (ACOG, 2017; Ryan et al., 2018), the prevalence of cannabis use in the US has increased more than 110% among pregnant women (increasing from 2.37% to 4.98% from 2002 to 2016 (Agrawal et al., 2019; Brown et al., 2017) and 47% among non-pregnant reproductive-age women (increasing from 6.29% to 9.27% from 2002 to 2014) (Brown et al., 2017). Additionally, rates of prenatal cannabis use disorder (CUD) have increased more than 5-fold in

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the US from 1993 to 2014, rising from 18.53 to 93.64 cases per 10,000 pregnancy-related delivery hospitalizations (Shi and Zhong, 2018). Moreover, in one US nationally representative study, the prevalence of CUD was significantly higher among pregnant women (18.1%) than non-pregnant reproductive-age women (11.4%) (Ko et al., 2015), indicating that pregnant women may be particularly vulnerable to CUD. Prior research illustrates that cannabis use and CUD are problematic during and around the time of pregnancy. However, it is unclear why women in the US are using cannabis during pregnancy and postpartum despite public health messaging to abstain. Nationally representative studies are needed to examine this.

Pregnant and postpartum women use cannabis to relieve stress, anxiety and cope with mental health symptoms (Barbosa-Leiker et al., 2020; Ko et al., 2020; Vanstone et al., 2021), which may indicate that they are self-medicating mental health conditions. However, little is known about the mental health correlates of cannabis use and CUD in nationally representative samples of pregnant and postpartum women. Prior research shows associations between prenatal cannabis use, CUD and mental health, but studies used patient-based data, were limited by geographic location, and/or had relatively small sample sizes (Chang et al., 2019; Emery et al., 2015; Latuskie et al., 2019; Mark et al., 2021; Meinhofer et al., 2022; Nagel et al., 2021; Young-Wolff et al., 2020), which may not be representative of the broader population making it impossible to determine whether the issues (i.e., positive associations between prenatal cannabis use, CUD and mental health) observed in smaller studies are issues at the national level. Extant nationally representative studies are limited in that they focused on prenatal cannabis use, not CUD, used older Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria or self-reported measures of mental health and focused on only anxiety and depression (Goodwin et al., 2020; Oh et al., 2017). The few studies examining cannabis use and mental health during postpartum have small sample sizes (Barbosa-Leiker et al., 2020; Vanstone et al., 2021). Extant research is dated, lacks generalizability and/or is limited in scope.

It is unknown what general classes (e.g., any mood disorder) or specific types of DSM-5 mental health disorders (e.g., major depressive disorder, persistent depressive disorder) are associated with cannabis use and CUD among pregnant and postpartum women in the US. Studies examining mental health correlates of cannabis use and CUD among the same population are needed to determine whether mental health correlates of cannabis use differ from those associated with CUD among pregnant and postpartum women. Moreover, examining both general classes and specific types of mental health disorders can provide a more complete understanding by elucidating potential differences in cannabis use or CUD by specific types of mental health disorders that would be missed in aggregate data. Comprehensive, generalizable research using up-to-date diagnostic criteria is needed to examine the relationship between cannabis use, CUD and mental health during pregnancy and postpartum to estimate the scope of this matter in the US, especially given the current sociopolitical landscape where the majority of states have legalized cannabis for medical or non-medical use (National Conference of State Legislatures (NCSL), 2023). Given the rapid legalization of cannabis use followed by an increase in access and availability of cannabis and the potential for misinformation regarding the safety of cannabis use during and around the time of pregnancy (Brown and Hasin, 2019), it is understandable why some women may be using cannabis for various reasons including to self-medicate mental health symptoms during pregnancy and postpartum. Prevention interventions aimed at reducing cannabis use, CUD and mental health issues among pregnant and postpartum women in the US should be based on nationally representative data. We therefore conducted the first nationally representative study of the relationship between mental health disorders, cannabis use and CUD among women pregnant in the past year (i.e., currently pregnant and recently postpartum women). We used data from the 2012 to 2013 National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III) to examine associations between

general classes and specific types of mental health disorders, cannabis use and CUD using DSM-5 criteria while controlling for covariates. Mood, anxiety, personality and post-traumatic stress disorders were examined as correlates of cannabis use and CUD.

2. Methods

2.1. Sample and procedures

The NESARC-III is a nationally representative, cross-sectional, face-to-face survey of 36,309 US adult civilians, 18 years and older living in households and select noninstitutionalized group quarters (Grant et al., 2014, 2015a; Hasin et al., 2015a). Respondents were randomly selected through multistage probability sampling. Hispanic, Black and Asian respondents were oversampled (Grant et al., 2014, 2015a; Hasin et al., 2015a). The overall response rate was 60.1%, comparable with other current US national surveys (Grant et al., 2014, 2015a; Hasin et al., 2015a). Data were adjusted for oversampling and nonresponse and weighted to represent the US civilian population based on the 2012 American Community Survey. Oral informed consent was recorded electronically and respondent remuneration was \$90.00. The National Institute on Alcohol Abuse and Alcoholism and Westat Institutional Review Boards approved the protocol and consent procedures (Grant et al., 2015a; Hasin et al., 2015a). The current analysis included reproductive-age women (e.g., people assigned female at birth) 18–44 years old who were currently pregnant ($n=414$) or recently postpartum in the past-year ($n=902$). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines were followed.

2.2. Measures

The Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-5 Version (AUDADIS-5) was used to assess non-medical cannabis use, CUD, psychiatric disorders and sociodemographic variables. The AUDADIS-5 is a computer-assisted, fully structured, valid and reliable diagnostic interview designed to assess DSM-5 alcohol, drug and mental health disorders (Grant et al., 2015b; Hasin et al., 2015b). The AUDADIS-5 only assessed CUD among NESARC-III respondents who reported using non-medical cannabis use. Outcomes for this study were non-medical cannabis use and CUD.

2.2.1. Outcomes

Nonmedical cannabis use: Past-year non-medical cannabis use was assessed by asking whether participants had ever used marijuana without a doctor's prescription or other than as prescribed (e.g., in greater amounts, more often, or for a different reason) (Wall et al., 2019). Those who ever used were asked if they had used in the last 12 months. Participants were also asked about medicinal cannabis use.

CUD: Participants were positive for past-year CUD if they endorsed 2 or more of the 11 DSM-5 CUD criteria occurring within the past 12 months. Test-retest reliability for AUDADIS-5 past-year CUD diagnoses ($\kappa=0.41$) was fair, while the test-retest reliability of the associated dimensional criteria scale (intraclass correlation coefficient [ICC]=0.70) was moderate (Grant et al., 2015b). Procedural validity was assessed in a large general population sample using a semi-structured, clinician-administered diagnostic interview (Hasin et al., 2014). Concordance between the AUDADIS-5 and the clinician-administered CUD diagnoses was moderate ($k=0.60$); while concordance between their dimensional (severity) criteria scales for past year CUD was good (ICC=0.79) (Hasin et al., 2014).

2.2.2. Mental health correlates

DSM-5 Mental health correlates included *any mood disorder (not substance or illness-induced)* in the past year (i.e., major depressive disorder [MDD]; persistent depressive disorder [PDD], or manic/hypomanic episode [e.g., bipolar disorder]); *any anxiety disorder (not*

substance or illness-induced) in the past year (i.e., specific phobia; social anxiety disorder, panic disorder, agoraphobia, or generalized anxiety disorder [GAD]); past-year post-traumatic stress disorder (PTSD); and any lifetime personality disorder (i.e., borderline, schizotypal, or antisocial personality disorder). Associations between general classes (e.g., any mood disorder; any anxiety disorder) and specific types (e.g., MDD; GAD) of mental health disorders and the study's outcome variables were examined. The test-retest reliability for AUDADIS-5 past-year MDD ($\kappa=0.40$) and PDD ($\kappa=0.39$) were fair and concordance on lifetime dimensional criteria symptoms for mania ($\text{ICC}=0.50$) was moderate (Grant et al., 2015b). A procedural validity study showed that concordance for past-year mood (κ s ranged from 0.35 to 0.40) and anxiety disorders (κ s ranged from 0.22 to 0.59) and PTSD ($\kappa=0.34$) was fair to moderate, while concordance on lifetime dimensional scales was moderate to good for depressive and anxiety disorders (except GAD [$\text{ICC}=0.19$]) and PTSD ($\text{ICC}=0.19-0.81$) (Hasin et al., 2015b).

2.2.3. Covariates

Based on previous research (Brown et al., 2017; Goodwin et al., 2020; Meinhofer et al., 2022; Metz et al., 2018; Skelton et al., 2020; Young-Wolff et al., 2022), we controlled for the following potential confounders: age (18–29 years, 30–44 years); past-year alcohol, tobacco and other drug (ATOD) use (non-medical use of prescription sedatives/tranquilizers, opioid painkillers, or stimulants, or any use of alcohol, tobacco, cocaine, club drugs, hallucinogen, solvent, heroin, or other illicit drugs), excluding cannabis use; and social determinants of health including race/ethnicity (Hispanic, non-Hispanic Black, non-Hispanic White, non-Hispanic Other), education (less than high school, high school, some college or more), poverty level (<100; 100–200; or >200 of the US Department of Agriculture poverty level), marital status (married or cohabitating, not married or cohabitating), health insurance (insured [any health insurance], uninsured), urbanicity (urban or rural area) and medical cannabis law (MCL) status (whether respondents' state of residence had a MCL by 2012) (Hasin et al., 2017).

2.3. Statistical analysis

Weighted prevalence estimates were used to evaluate cannabis use, CUD, mental health disorders, covariates and the frequency of cannabis use by CUD status. Weighted logistic regression models, unadjusted and adjusted for sociodemographic characteristics and past-year ATOD use, were used to estimate the association between mental health disorders and each cannabis-related outcome. For each mental health disorder, the reference group was those without that particular disorder or group of disorders. SUDAAN 11.0.3 software was used for analyses (RTI International, 2022). All tests were 2-tailed, with significance set at $p<0.05$. In post hoc analyses, sample descriptive characteristics were assessed among the overall sample of reproductive-age women (18–44 years; $N=10,121$) and by pregnancy status in the past year (yes=1316; no=8805) (Supplementary Table 1). Additionally, in post hoc analyses, multiplicative interaction terms were tested between pregnancy status and DSM-5 mental health disorders using logistic regression models to examine pregnancy status as a moderator of the observed relationships between mental health disorders, cannabis use and CUD. Results were stratified by pregnancy status. Estimates were weighted to reflect the US population.

3. Results

Descriptive characteristics are reported in Table 1. Twenty-three percent of women who used cannabis in the past year, but did not have CUD used cannabis daily or near daily compared to 66% of women with CUD (Table 2). Of the pregnant and postpartum women, 12 (0.7%, standard error [SE] =0.21) reported using cannabis medically, 9 of whom also used non-medically (0.6%, SE=0.23) and 3 who used

Table 1

Characteristics of pregnant and postpartum women in the US NESARC-III ($N=1316^a$), 2012–2013.

Characteristics	n	% (SE)
Age		
18–29	811	60.1 (1.65)
30–44	505	39.9 (1.65)
Race/Ethnicity		
Hispanic	358	20.4 (1.54)
Non-Hispanic Black	339	15.0 (1.14)
Non-Hispanic White	543	56.8 (1.61)
Non-Hispanic Other ^b	76	7.8 (1.06)
Education Level		
Less than high school	223	13.4 (1.06)
High school	325	21.1 (1.26)
Some college or more	768	65.5 (1.78)
Poverty Level		
<100% of USDA poverty level	323	23.4 (1.55)
100%–200% of USDA poverty level	250	20.3 (1.16)
>200% of USDA poverty level	743	56.4 (1.88)
Marital Status		
Married or cohabiting	834	73.0 (1.81)
Not married or cohabiting	482	27.0 (1.81)
Health Insurance Status		
Insured	1171	91.4 (0.84)
Uninsured	145	8.6 (0.84)
Urbanicity		
Urban	1153	84.0 (1.78)
Rural	163	16.0 (1.78)
Medical Cannabis Law (MCL)		
MCL passed by 2012 ^c	411	31.0 (2.39)
No MCL by 2012	905	69.0 (2.39)
Past-Year Substance-Related Variables		
Any nonmedical cannabis use		
Yes	133	9.8 (0.88)
No	1183	90.2 (0.88)
DSM-5 Cannabis use disorder		
Yes	42	3.2 (0.68)
No	1274	96.8 (0.68)
Any alcohol, tobacco or drug use (excluding cannabis)		
Yes	922	73.7 (1.65)
No	394	26.3 (1.65)
DSM-5 Mental Health Disorders		
Any DSM-5 Mental Health Disorder ^d		
Yes	466	36.7 (1.83)
No	850	63.3 (1.83)
Past-Year Mood Disorders		
Any mood disorder	251	19.4 (1.54)
Persistent depressive disorder	50	3.8 (0.70)
Major depressive disorder	218	17.1 (1.49)
Bipolar disorder	26	1.9 (0.39)
Past-Year Anxiety Disorders		
Any anxiety disorder	193	16.4 (1.31)
Specific phobia	93	8.4 (1.11)
Social anxiety disorder	48	3.4 (0.51)
Panic disorder	60	5.2 (0.76)
Agoraphobia	27	2.1 (0.48)
Generalized anxiety disorder	62	5.2 (0.75)
Lifetime Personality Disorders		
Any personality disorder	256	19.0 (1.60)
Anti-social personality disorder	58	4.7 (0.88)
Borderline personality disorder	187	14.5 (1.39)
Schizotypal personality disorder	99	6.7 (0.93)
Past-Year PTSD	101	8.4 (1.19)

Abbreviations: DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; USDA, US Department of Agriculture, PTSD, post-traumatic stress disorder.

^a The total sample ($N=1316$) includes women pregnant in the past year who were either pregnant at the time of the interview ($n=414$) or recently postpartum women ($n=902$).

^b The Non-Hispanic Other racial/ethnic group included American Indian, Alaska Native, Asian, Native Hawaiian, and Other Pacific Islander people.

^c States with MCLs by 2012 include: Arizona, California, Colorado, Connecticut, Hawaii, Maine, Maryland, Massachusetts, Michigan, Montana, Nevada, New Jersey, New Mexico, Oregon, Vermont, Washington.

^d Participants reporting any DSM-5 mood, anxiety, personality disorder or PTSD.

Table 2

Cannabis use frequency among pregnant and postpartum women in the US who used cannabis in the past year, NESARC-III (N=133), 2012–2013.

	Any past-year cannabis use (N=133)		Past year cannabis use, but not DSM-5 CUD (n=91)		DSM-5 CUD (n=42)	
	n	% (SE)	n	% (SE)	n	% (SE)
Daily/near daily use	56	37.0 (4.99)	27	23.0 (4.72)	29	65.6 (9.18)
1–4 times a week	15	14.5 (3.59)	7	12.1 (4.40)	8	19.2 (7.50)
1–3 times a month	24	18.0 (3.67)	22	24.4 (4.61)	2	4.8 (3.86)
1–11 times a year	37	30.2 (3.98)	34	39.9 (5.33)	3	10.4 (6.45)
missing	1	0.4 (0.38)	1	0.6 (0.57)	0	0 (ne)

Abbreviations: NESARC-III, National Epidemiologic Survey on Alcohol and Related Conditions-III; DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; CUD, cannabis use disorder; ne, not estimable.

medically-only (0.2%, SE=0.09). The odds of past-year cannabis use were significantly higher among those with any past-year DSM-5 mood disorder, anxiety disorder, PTSD or any lifetime history of personality disorder compared to those without the respective mental health disorder group. Adjusted odds ratios (aOR) ranged from 2.10 to 3.87 (Table 3). Similar results were observed for CUD, with aORs ranging from 2.55 to 10.44 (Table 3). Each specific DSM-5 past-year mood and lifetime personality disorder was significantly associated with increased odds of past-year cannabis use (Table 3). Among anxiety disorders, only past-year social anxiety (aOR=2.70) and panic (aOR=1.95) disorders were significant correlates of past-year cannabis use (Table 3). Each specific DSM-5 lifetime personality disorder was significantly associated with increased odds of past-year CUD (Table 3). Among past-year mood

Table 3

Associations between DSM-5 mental health disorders, cannabis use and CUD among pregnant and postpartum women in the US, NESARC-III (N=1316),^a 2012–2013.

DSM-5 Mental Health Disorders ^c	Past-Year Cannabis Use				Past-Year CUD			
	Unadjusted		Adjusted ^b		Unadjusted		Adjusted ^b	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Past-Year Mood Disorders								
Any past-year mood disorder ^d	3.02 (1.75, 5.21)	<0.001	2.23 (1.24, 4.03)	0.008	4.67 (2.17, 10.05)	<0.001	3.71 (1.52, 9.05)	0.004
Persistent depressive disorder	4.37 (2.15, 8.86)	<0.001	2.99 (1.25, 7.15)	0.01	7.75 (3.35, 17.91)	<0.001	5.24 (1.97, 13.92)	0.001
Major depressive disorder	2.76 (1.55, 4.92)	<0.001	2.03 (1.07, 3.84)	0.03	4.95 (2.26, 10.84)	<0.001	4.12 (1.63, 10.40)	0.003
Bipolar disorder	8.81 (3.98, 19.47)	<0.001	6.00 (2.71, 13.25)	<0.001	5.96 (2.53, 14.05)	<0.001	3.40 (0.90, 12.86)	0.07
Past-Year Anxiety Disorders								
Any past-year anxiety disorder ^e	2.36 (1.54, 3.62)	<0.001	2.10 (1.35, 3.27)	0.001	2.64 (1.38, 5.06)	0.004	2.55 (1.42, 4.58)	0.002
Specific phobia	2.21 (1.17, 4.18)	0.01	1.85 (0.99, 3.46)	0.06	2.88 (1.37, 6.06)	0.006	2.36 (1.19, 4.68)	0.01
Social anxiety disorder	3.68 (1.92, 7.04)	<0.001	2.70 (1.28, 5.70)	0.009	3.75 (1.57, 8.97)	0.003	2.79 (0.96, 8.10)	0.06
Panic disorder	2.66 (1.46, 4.84)	0.002	1.95 (1.04, 3.64)	0.04	1.80 (0.60, 5.37)	0.29	1.24 (0.35, 4.38)	0.73
Agoraphobia	2.89 (0.97, 8.59)	0.06	1.62 (0.42, 6.26)	0.48	7.62 (2.33, 24.96)	0.001	4.58 (0.93, 22.47)	0.06
Generalized anxiety disorder	1.40 (0.72, 2.72)	0.32	1.97 (0.95, 4.09)	0.07	1.29 (0.53, 3.16)	0.57	2.35 (0.84, 6.63)	0.10
Lifetime Personality Disorders								
Any lifetime personality disorder ^f	5.34 (3.66, 7.80)	<0.001	3.87 (2.63, 5.71)	<0.001	8.70 (4.06, 18.64)	<0.001	6.19 (2.78, 13.78)	<0.001
Anti-social personality disorder	4.24 (2.02, 8.90)	<0.001	2.64 (1.20, 5.81)	0.02	4.43 (1.42, 13.77)	0.01	3.34 (1.01, 11.07)	0.05 ^g
Borderline personality disorder	6.21 (4.13, 9.32)	<0.001	4.45 (2.94, 6.73)	<0.001	8.88 (4.57, 17.24)	<0.001	6.12 (3.01, 12.43)	<0.001
Schizotypal personality disorder	8.21 (4.75, 14.19)	<0.001	5.94 (3.41, 10.33)	<0.001	16.90 (8.48, 33.66)	<0.001	11.60 (5.20, 25.86)	<0.001
Past-year PTSD	4.87 (2.80, 8.49)	<0.001	3.03 (1.66, 5.52)	<0.001	13.11 (6.44, 26.66)	<0.001	10.44 (4.56, 23.91)	<0.001

Abbreviations: DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; CUD, cannabis use disorder; NESARC-III, National Epidemiologic Survey on Alcohol and Related Conditions-III Conditions; OR, odds ratio; CI, confidence interval; PTSD, post-traumatic stress disorder.

^a The total sample (N=1316) includes women pregnant in the past year who were either pregnant at the time of the interview (n=414) or recently postpartum women (n=902).

^b Adjusted for age, race/ethnicity, marital status, poverty level, education level, health insurance, urbanicity, and state medical cannabis law status and any past-year alcohol, tobacco or other drug use (except cannabis use), other drug use includes non-medical use of prescription sedatives/tranquilizers, opioid painkillers, stimulants, cocaine, club drugs, hallucinogens, solvents, heroin, or other illicit drugs

^c Reference group is all people pregnant in the past year without that specific mental health disorder or group of disorders

^d Includes the following non-substance or illness-induced disorders: major depressive disorder; persistent depressive disorder, mania, and hypomania

^e Includes the following non-substance or illness-induced disorders: specific phobia, social anxiety disorder, panic disorder, agoraphobia, and generalized anxiety disorder

^f includes borderline, schizotypal, and antisocial personality disorder

^g The unrounded p-value is statistically significant: p=0.0484.

and anxiety disorders, only PDD (aOR=5.24), MDD (aOR=4.12) and specific phobia (aOR=2.36) were significant correlates of past-year CUD (Table 3). In post hoc analysis, most associations between mental health disorders, cannabis use and CUD did not differ by pregnancy status except for the association between schizotypal personality disorder and cannabis use (pregnant in the past year: yes – [aOR=6.22, 95% CI=3.57, 10.84]; no – [aOR=2.89, 95% CI=2.15, 3.89]) and specific phobia and CUD (pregnant in the past year: yes – [aOR=2.28, 95% CI=1.17, 4.44]); no – [aOR=0.92, 95% CI=0.51, 1.68] (Tables 4 and 5).

4. Discussion

Most states have legalized cannabis use for medical or recreational purposes (NCSL, 2023). However, there is little evidenced-based health policy guidance regarding how information on the safety of prenatal and postpartum cannabis use should be conveyed to the public including how this information is displayed at cannabis dispensaries (e.g., via posted warning signs similar to alcohol policies adopted by some states), communicated by budtenders to pregnant and postpartum customers and reflected on cannabis product labels (Brown and Hasin, 2019; Drabble et al., 2014; Young-Wolff et al., 2021). Lacking such guidance, women may receive misinformation from internet sources and cannabis dispensaries regarding the safety of cannabis use during critical periods of reproductive health that contradicts medical advice (Brown and Hasin, 2019; Young-Wolff et al., 2021), which may lead to decisions to self-medicate mental health disorders. Therefore, we examined associations between general classes and specific types of mental health disorders, cannabis use and CUD among a nationally representative sample of pregnant and recently postpartum women. General classes of mental health disorders were significantly and positively associated with past-year cannabis use and CUD. Regarding specific disorders, each personality disorder, PDD and MDD were significantly and positively associated with cannabis use and CUD, while bipolar disorder was only

Table 4

Post hoc analysis of the association between DSM-5 mental health disorders and any past-year cannabis use among women of reproductive age by past-year pregnancy status, NESARC-III (N=10,121).^a

DSM-5 Mental Health Disorders ^c	Difference in association ^b between women pregnant or postpartum in the past year versus not		Pregnant or postpartum in the past year		Not pregnant or postpartum in the past year	
	Ratio of OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Past-Year Mood Disorders						
Any past-year mood disorder ^d	1.06 (0.61, 1.86)	0.8342	2.33 (1.34, 4.03)	0.0029	2.19 (1.76, 2.73)	0.0000
Persistent depressive disorder	1.23 (0.55, 2.73)	0.6114	2.47 (1.11, 5.54)	0.0277	2.02 (1.50, 2.71)	0.0000
Major depressive disorder	1.07 (0.59, 1.95)	0.8207	2.18 (1.21, 3.94)	0.0104	2.03 (1.64, 2.52)	0.0000
Bipolar disorder	1.55 (0.58, 4.13)	0.3811	6.33 (2.69, 14.90)	0.0000	4.09 (2.57, 6.53)	0.0000
Past-Year Anxiety Disorders						
Any past-year anxiety disorder ^e	1.11 (0.69, 1.80)	0.6625	1.95 (1.27, 2.98)	0.0025	1.75 (1.42, 2.16)	0.0000
Specific phobia	1.49 (0.78, 2.84)	0.2202	1.75 (0.95, 3.23)	0.0738	1.17 (0.87, 1.58)	0.2966
Social anxiety disorder	1.57 (0.70, 3.52)	0.2668	2.59 (1.27, 5.29)	0.0093	1.65 (1.16, 2.34)	0.0057
Panic disorder	0.98 (0.50, 1.91)	0.9493	1.87 (1.02, 3.46)	0.0447	1.91 (1.42, 2.58)	0.0000
Agoraphobia	0.64 (0.15, 2.73)	0.5426	1.59 (0.43, 5.86)	0.4836	2.48 (1.58, 3.92)	0.0001
General anxiety disorder	0.73 (0.33, 1.61)	0.4382	1.72 (0.81, 3.63)	0.1552	2.34 (1.82, 3.01)	0.0000
Lifetime Personality Disorders						
Any lifetime personality disorder ^f	1.35 (0.86, 2.11)	0.1964	4.01 (2.69, 5.98)	0.0000	2.98 (2.48, 3.59)	0.0000
Anti-social personality disorder	0.71 (0.27, 1.88)	0.4918	2.63 (1.15, 6.01)	0.0223	3.68 (2.52, 5.37)	0.0000
Borderline personality disorder	1.46 (0.89, 2.40)	0.1348	4.59 (2.99, 7.05)	0.0000	3.15 (2.51, 3.95)	0.0000
Schizotypal personality disorder	2.15 (1.18, 3.92)	0.0127	6.22 (3.57, 10.84)	0.0000	2.89 (2.15, 3.89)	0.0000
Past-year PTSD	1.29 (0.66, 2.50)	0.4529	3.03 (1.70, 5.39)	0.0002	2.35 (1.75, 3.16)	0.0000

Abbreviations: DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; NESARC-III, National Epidemiologic Survey on Alcohol and Related Conditions-III Conditions; OR, odds ratio; CI, confidence interval; PTSD, post-traumatic stress disorder.

Models were adjusted for age, race/ethnicity, marital status, poverty level, education level, health insurance, urbanicity, and state medical cannabis law status and any past-year alcohol, tobacco or other drug use (except cannabis use), other drug use includes non-medical use of prescription sedatives/

tranquilizers, opioid painkillers, stimulants, cocaine, club drugs, hallucinogens, solvents, heroin, or other illicit drugs.

The ORs among women pregnant in the past year in Table 4 differ slightly from the ORs in Table 3 because the covariate adjustments are being made across the entire sample of reproductive-age women (N = 10,121) as opposed to only women pregnant in the past year (n=1316).

^a The sample (N = 10,121) was derived from the 2012–2013 NESARC-III and included reproductive-age women 18–44 years old who were not missing data regarding past-year pregnancy status (n=1316 were pregnant in the past year; n = 8805 were not pregnant in the past year). Of the women pregnant in the past year, n=414 were pregnant at the time of the interview and n=902 were recently postpartum.

^b Difference is indicated by the ratio of the odds ratios: OR in those pregnant divided by the OR in those not pregnant.

^c Reference group is all people pregnant in the past year without that specific mental health disorder or group of disorders.

^d Includes the following non-substance or illness-induced disorders: major depressive disorder; persistent depressive disorder, mania, and hypomania.

^e Includes the following non-substance or illness-induced disorders: specific phobia, social anxiety disorder, panic disorder, agoraphobia, and generalized anxiety disorder.

^f includes borderline, schizotypal, and antisocial personality disorder.

associated with cannabis use, not CUD in adjusted models. Additionally, in adjusted models, social anxiety and panic disorders were associated with cannabis use and specific phobia was associated with CUD.

While there is limited comparative population-based research, our findings regarding the association between any mood disorder and past-year cannabis use (aOR=2.23; Table 3) and any anxiety disorder and past-year cannabis use (aOR=2.10; Table 3) are similar to a California-based, integrated health care study (N=196,022) that examined associations between prenatal cannabis use, anxiety disorders (aOR 1.90) and depressive disorders (aOR=2.25) during early pregnancy prenatal visits (Young-Wolff et al., 2020). Both studies indicate the need for better, more effective preventive interventions at the clinic- and population-levels. Moreover, in our study, the magnitude of association between CUD and each general class of mental health disorder (aORs ranging from 2.55 to 10.44; Table 3) was stronger than when these associations were examined among women (18 to over 45 years old) in this survey without subsetting on pregnancy status (aORs ranging from 0.8 to 3.1) (Kerridge et al., 2018). However, when compared to other non-pregnant reproductive-age women in this survey, association between general classes of mental health disorders and CUD did not differ by pregnancy status (Table 5). Results by pregnancy status were similar regarding associations between specific mental health disorders and cannabis use outcomes, except for schizotypal personality disorder and specific phobia (Tables 4 and 5). Poor sleep quality associated with pregnancy, parenting and/or being a new mom might help explain the differences between schizotypal personality disorder and cannabis use among women pregnant in the past year (OR = 6.22; p<0.0001) compared to those not pregnant in the past year (OR = 2.89; p-value <0.0001) (Table 4), as well as the differences between specific phobia and CUD among women pregnant in the past year (OR = 2.28; p=0.02) compared to women not pregnant in the past year (OR = 0.92; p=0.80) (Table 5). Poor sleep quality occurs during pregnancy and postpartum (Carlander et al., 2015; Sedov et al., 2018) and sleep duration (a component of sleep quality) (Nelson et al., 2022) is associated with both mental health disorders and drug use disorders in the general population (Geoffroy et al., 2020). People often report using cannabis to aid in sleep (Kuhathasan et al., 2019). It is plausible that poor sleep quality might mediate the relationship between mental health disorders and cannabis use related outcomes. This potential mediated pathway might be more salient for schizotypal personality disorder and specific phobia particularly during pregnancy and postpartum given the stronger association of these disorders with cannabis use and CUD, respectively, among women pregnant in the past year compared to women who were not pregnant in the past year (Tables 4 and 5). Future research should

Table 5

Post hoc analysis of the association between DSM-5 mental health disorders and past-year cannabis use disorder among women of reproductive age by past-year pregnancy status, NESARC-III (N=10,121).^a

DSM-5 Mental Health Disorders ^c	Difference in association ^b between women pregnant or postpartum in the past year versus not		Pregnant or postpartum in the past year		Not pregnant or postpartum in the past year	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Past-Year Mood Disorders						
Any past-year mood disorder ^d	1.01 (0.42, 2.40)	0.9821	3.59 (1.65, 7.83)	0.0015	3.55 (2.53, 4.99)	0.0000
Persistent depressive disorder	1.37 (0.54, 3.47)	0.4971	4.40 (1.77, 10.94)	0.0017	3.20 (1.85, 5.53)	0.0001
Major depression disorder	1.25 (0.51, 3.05)	0.6286	3.93 (1.78, 8.68)	0.0009	3.15 (2.21, 4.49)	0.0000
Manic episode	0.85 (0.23, 3.14)	0.8118	3.36 (1.17, 9.67)	0.0249	3.93 (2.19, 7.07)	0.0000
Past-Year Anxiety Disorders						
Any past-year anxiety disorder ^e	0.86 (0.43, 1.75)	0.6808	2.25 (1.24, 4.07)	0.0080	2.60 (1.84, 3.68)	0.0000
Specific phobia	2.46 (1.08, 5.61)	0.0324	2.28 (1.17, 4.44)	0.0161	0.92 (0.51, 1.68)	0.7968
Social anxiety disorder	1.83 (0.57, 5.93)	0.3095	2.63 (1.02, 6.82)	0.0459	1.44 (0.75, 2.77)	0.2737
Panic disorder	0.33 (0.10, 1.08)	0.0665	1.25 (0.39, 3.96)	0.7058	3.76 (2.34, 6.05)	0.0000
Agoraphobia	1.35 (0.24, 7.54)	0.7312	4.31 (1.01, 18.28)	0.0478	3.19 (1.72, 5.92)	0.0003
General anxiety disorder	0.40 (0.14, 1.15)	0.0891	1.81 (0.69, 4.75)	0.2229	4.52 (2.94, 6.94)	0.0000
Lifetime Personality Disorders						
Any lifetime personality disorder ^f	0.95 (0.40, 2.26)	0.9035	6.11 (2.80, 13.36)	0.0000	6.45 (4.62, 9.00)	0.0000
Anti-social personality disorder	0.41 (0.11, 1.49)	0.1736	2.64 (0.83, 8.44)	0.1001	6.46 (4.22, 9.88)	0.0000
Borderline personality disorder	1.08 (0.50, 2.31)	0.8512	6.10 (3.07, 12.10)	0.0000	5.67 (4.05, 7.95)	0.0000
Schizotypal personality disorder	2.11 (0.88, 5.07)	0.0954	11.34 (5.32, 24.18)	0.0000	5.38 (3.60, 8.06)	0.0000
Past-year PTSD	2.40 (0.99, 5.79)	0.0518	8.22 (3.90, 17.32)	0.0000	3.43 (2.15, 5.46)	0.0000

Abbreviations: DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; NESARC-III, National Epidemiologic Survey on Alcohol and Related Conditions-III Conditions; OR, odds ratio; CI, confidence interval; PTSD, post-traumatic stress disorder.

Models were adjusted for age, race/ethnicity, marital status, poverty level, education level, health insurance, urbanicity, and state medical cannabis law status and any past-year alcohol, tobacco or other drug use (except cannabis use), other drug use includes non-medical use of prescription sedatives/tranquilizers, opioid painkillers, stimulants, cocaine, club drugs, hallucinogens,

solvents, heroin, or other illicit drugs.

The ORs among women pregnant in the past year in Table 5 differ slightly from the ORs in Table 3 because the covariate adjustments are being made across the entire sample of reproductive-age women (N = 10,121) as opposed to only women pregnant in the past year (n=1316).

^a The sample (N = 10,121) was derived from the 2012–2013 NESARC-III and included reproductive-age women 18–44 years old who were not missing data regarding past-year pregnancy status (n=1316 were pregnant in the past year; n = 8805 were not pregnant in the past year). Of the women pregnant in the past year, n=414 were pregnant at the time of the interview and n=902 were recently postpartum.

^b Difference is indicated by the ratio of the odds ratios: OR in those pregnant divided by the OR in those not pregnant.

^c Reference group is all people pregnant in the past year without that specific mental health disorder or group of disorders.

^d Includes the following non-substance or illness-induced disorders: major depressive disorder; persistent depressive disorder, mania, and hypomania.

^e Includes the following non-substance or illness-induced disorders: specific phobia, social anxiety disorder, panic disorder, agoraphobia, and generalized anxiety disorder.

^f includes borderline, schizotypal, and antisocial personality disorder.

evaluate these potential mediated pathways.

Self-medicating with cannabis may be a growing concern among this population, which warrants public health attention. For example, pregnant and postpartum women reported using cannabis to relieve stress and anxiety (Barbosa-Leiker et al., 2020; Ko et al., 2020; Vanstone et al., 2021). However, extant research broadly defines stress and anxiety, while our study suggests that social anxiety and panic disorders may be driving the associations between anxiety and cannabis use, but not CUD (Table 3). This is consistent with prior research that shows that social anxiety/social phobia and panic disorders were not associated with CUD among women in the US general population without subsetting on pregnancy status (Kerridge et al., 2018). Moreover, the progression from cannabis use to CUD should be examined. For example, each lifetime personality disorder and two of the three mood disorders examined were associated with both cannabis use and CUD among pregnant and postpartum women. Cannabis use and CUD did not share common anxiety disorder correlates. From a vulnerability-stress perspective (Ingram and Luxton, 2005), pregnant and postpartum women with a specific mental health disorder that is a common correlate of both cannabis use and CUD may be at higher risk of progression from cannabis use to CUD. Future research should examine this and interactions between stress associated with pregnancy and/or parenting and mental health disorders (vulnerabilities) as mechanisms of progression to more problematic cannabis use and severity of CUD.

The growing acceptability of cannabis use among the US public (Gallup, 2020), decreased perceived risk of cannabis use among pregnant and non-pregnant reproductive-age women (Jarlenski et al., 2017) and the belief that cannabis use is safe and natural relative to prescription medication (Chang et al., 2019) might help explain why pregnant and postpartum women are using cannabis to alleviate stress and symptoms of mental health disorders. Given this, screening practices should be evaluated for effectiveness. Additionally, diagnostic overshadowing (i.e., the misattribution of new symptoms to a previous health condition), especially among patients with mental health or substance use disorders and/or disabilities (Raven, 2017; Iezzoni, 2019; Shefer et al., 2014) may also contribute to increased cannabis use and CUD among pregnant and postpartum women, particularly those with mental health disorders. Some symptoms (e.g., sleep and appetite fluctuations) associated with normative changes that occur during pregnancy and postpartum are similar to symptoms of mental health disorders (ACOG, 2018). Diagnostic overshadowing can occur when pregnancy- and postpartum-related symptoms are inadequately addressed and misattributed to an underlying mental health condition by healthcare providers, which might lead pregnant and postpartum women to self-medicate their symptoms with cannabis use. Healthcare

providers should be aware of these issues when treating pregnant and postpartum women with mental health and substance use disorders. Population-level public health messaging is also needed to counter misinformation regarding the safety of prenatal and postpartum cannabis use from dispensaries and the internet (Brown and Hasin, 2019; Dickson et al., 2018; Young-Wolff et al., 2021) and to provide access to valid health information to the pregnant and postpartum women with limited access to care.

4.1. Limitations and strengths

Study limitations include the cross-sectional design, which limits causal inference. Additionally, self-reported measures were used, which are subject to recall and social desirability bias. Moreover, the prevalence of CUD and certain mental health disorders was low, which limits the power to detect differences in CUD and cannabis use based on some specific mental health disorders. Low prevalence regarding certain disorders is unavoidable in data derived from general population samples. We excluded mental health disorders (e.g., psychotic disorders (Livne et al., 2022)) that had a low prevalence and were measured via self-report as opposed to by DSM-5 criteria. Future research is warranted in this area. Additionally, the survey does not ask specific questions regarding whether women stopped or increased their cannabis use after finding out they were pregnant or whether they terminated their pregnancy. This is important information to ascertain in future research. Furthermore, while we treated the covariates as potential confounders, future research with adequate statistical power and a priori hypotheses might examine these covariates as moderators and/or mediators. Lastly, the data are older and thus the prevalence of cannabis use, CUD and mental health disorders among pregnant and postpartum women may differ if examined in more recent data. These limitations should not overshadow study strengths. The NESARC-III is a rigorously designed nationally representative study that uses valid and reliable measures of cannabis use, CUD and importantly, includes more detailed measures of mental health disorders than any other nationally representative study. Moreover, this study contributes critical new knowledge to the field. First, this is the first nationally representative study to our knowledge to examine the relationship between cannabis use, CUD and general classes and specific types of mental health disorders among pregnant and postpartum women. Thus, findings are generalizable and provide insight on various mental health correlates of cannabis use and CUD during pregnancy and postpartum compared to narrowly focused extant literature. Second, this study provides insight into whether mental health correlates of cannabis use and CUD differ among pregnant and postpartum women, which can help inform tailored preventive interventions. Third, our examination of general classes and specific types of mental health disorders offers insight into which specific mental health disorders might be driving the association between general classes of mental health disorders, cannabis use and CUD among pregnant and postpartum women. This level of specificity is missed in studies that only examine aggregated, general classes of mental health disorders.

5. Conclusions

From pregnancy up to one year postpartum is a critical period where women may be particularly vulnerable to mental health disorders, cannabis use and CUD. Screening, treatment and clinic- and population-level prevention efforts are essential during this time, especially given that of the pregnant and postpartum women who used cannabis non-medically in the past year, more than 1 of 3 used daily or near daily (Table 2). While screening may be common practice among some healthcare providers, other providers face barriers to screening for prenatal cannabis use (e.g., lack of knowledge of health risks; balancing the need to develop rapport with patients versus state mandatory reporting policies regarding the reporting of prenatal substance use to

child protective services) (Brown and Hasin, 2019; El Marroun et al., 2018; Young-Wolff et al., 2021). These barriers can lead to missed opportunities for treatment and prevention of cannabis use, CUD and their correlates (e.g., mental health disorders).

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CRediT authorship contribution statement

Dr. Brown conceptualized and designed the study, developed the analysis plan and wrote the initial draft of the manuscript. Drs. Shmulewitz, Sarvet and Hasin provided consultation on design and analysis plan. Dr. Shmulewitz conducted the data analysis and had full access to all the data in the study. All authors made significant contributions to the writing and development of subsequent drafts of the manuscript, interpretation of the results and approved the final version of the manuscript. Drs. Brown and Shmulewitz take responsibility for the integrity of the data and the accuracy of the data analysis.

Declaration of Competing Interest

No conflict declared.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.drugalcdep.2023.109940](https://doi.org/10.1016/j.drugalcdep.2023.109940).

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