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Cannabis use disorder risk among midlife adults reporting medical and nonmedical cannabis use, 2019–2024

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ABSTRACT

Background: High-frequency cannabis use is a key cannabis use disorder (CUD) risk factor that also is associated with medical (vs. nonmedical) use. This analysis examined overall and sex- and age-stratified associations between medical cannabis use, use frequency, and CUD outcomes among midlife adults.

Methods: Monitoring the Future Longitudinal Panel study data from 5454 US adults ages 40–60 reporting past 12-month use surveyed in 2019–2024 were used. Logistic regression models examined overall and sex- and age-stratified associations between medical cannabis use and self-reported CUD symptom prevalence, severity, and criteria before and after controlling for use frequency.

Results: Among adults using cannabis, prevalence of any and moderate/severe CUD symptoms was 23.9% and 9.4%, respectively; among those using near-daily (20 + occasions in past 30 days), 49.7% had CUD symptoms. Medical (vs. nonmedical) use was associated with any CUD symptoms (33.8% vs. 22.5%; $p < .001$), moderate/severe symptoms (15.1% vs. 8.7%; $p < .001$), and 10 of the 11 individual CUD criteria ($p = 0.037$ to $<.001$). Controlling for use frequency explained all overall medical (vs. nonmedical) use and CUD associations. Stratification models showed medical use remained associated with tolerance among females but not males ($p = 0.017$ vs. 0.981), and range of CUD outcomes among those ages 55–60 (but not 40–50), including tolerance ($p = 0.007$ vs. 0.826) and moderate/severe CUD symptoms ($p = 0.012$ vs. 0.118).

Discussion: Overall, high-frequency cannabis use—medical or nonmedical—is associated with CUD risk. Even after controlling for use frequency, medical use is associated with tolerance among females and older adults, and moderate/severe CUD symptoms among older adults.

1. Introduction

The prevalence of cannabis use disorder (CUD) in the U.S. has been increasing (Haley et al., 2025; Hasin et al., 2019; Jayawardhana and Hou, 2025; Patrick et al., 2025; Substance Abuse and Mental Health Services Administration, 2025). In 2024, 13.8 million U.S. adults age 26 or older were estimated to have had past-year CUD, 45.6% of whom had moderate to severe disorder (Substance Abuse and Mental Health Services Administration, 2025). There are eleven diagnostic criteria (grouped into four main topic areas) for CUD; these criteria include major impairment and negative consequences experienced by individuals from their own use (American Psychiatric Association, 2022). Those with CUD also have higher risk of additional negative outcomes such as longer in-hospital lengths of stay and medical complications for conditions not related to cannabis use (Jain et al., 2022), as well as increased mortality risk (Myran et al., 2025). Such negative consequences and outcomes meaningfully impact the public (Fischer, et al., 2023) through factors such as increased healthcare utilization and associated costs (Li et al., 2023), workplace absenteeism (Yang et al., 2024), and risk of motor vehicle accidents (Els et al., 2019). Given the personal and public costs of CUD, it is important to understand risk factors associated with CUD such as high-frequency cannabis use.

High-frequency cannabis use is associated with increased risk for a range of negative outcomes including CUD (Gutkind et al., 2023, 2022; Livne et al., 2025). CUD risk is particularly high for those reporting weekly or daily use (Leung et al., 2020). Prevalence of daily or near-daily use (20 + occasions in the past 30 days) among U.S. adults—particularly those ages 35–50—is at historic highs (Patrick, 2025). Daily or near-daily use was reported by 8.2% and 3.7% of age 35–50 and age 55–65 U.S. adults in 2024 (Patrick et al., 2025). National data have consistently shown high-frequency cannabis use is more likely among those reporting medical (vs. nonmedical) cannabis use (Compton

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et al., 2017; Han et al., 2025; Terry-McElrath and Patrick, 2026). In fact, medical cannabis dosing recommendations for some conditions (such as chronic pain) involve daily use (Jugl et al., 2023). Thus, higher-frequency use can be considered an expected characteristic of medical use. This raises the question of whether CUD risk is higher among those reporting medical use compared to those reporting nonmedical use, and—if so—whether higher use frequency fully explains the increased risk.

Associations between greater use frequency and higher CUD risk have been observed among those reporting medical use (e.g., national sample of US adults ages 18 + in 2013–2015, Han et al., 2018), but findings are mixed regarding the degree to which CUD prevalence, severity, or criteria are associated with using for medical versus nonmedical use reasons. Results from a 2019 study of adult health system patients in Washington State that did not control for use frequency found CUD prevalence did not differ between those reporting medical and nonmedical use (Lapham et al., 2023). National data from an online 2022 convenience sample of adults reporting past-week cannabis use found that, controlling for typical daily milligrams of THC consumed, more CUD criteria were endorsed among those reporting nonmedical use, with no differences between medical-only and medical-+nonmedical use (Livne et al., 2025). Results from adults ages 18–49 from the 2021–2022 National Survey on Drug Use and Health found CUD prevalence and severity were higher among those reporting medical (vs. nonmedical) use, but analyses did not control for use frequency (Han et al., 2025). Available data show significant historical increases in medical cannabis use in states where such use is legal (Terry-McElrath and Patrick, 2026), as well as historical increases in CUD among U.S. adults (Haley et al., 2025; Hasin et al., 2019; Jayawardhana and Hou, 2025; Patrick et al., 2025; Substance Abuse and Mental Health Services Administration, 2025). An increased understanding of connections between medical cannabis use and CUD prevalence, severity, and criteria endorsement among the national general population is important from a public health perspective, as well as for providing context for medical providers and patients considering treatment with medical cannabis.

Sex is known to be associated with the likelihood of adult cannabis use overall, medical (vs. nonmedical) use, and CUD likelihood. Adult males report higher cannabis use prevalence and frequency than do females (Patrick et al., 2025), and have higher odds of reporting medical use (Terry-McElrath and Patrick, 2026). Some studies find CUD prevalence is higher among males than females (Hasin et al., 2019; Kozak et al., 2021); others find no sex differences in disordered use prevalence (although females are more likely to report no use, and males are more likely to report nondisordered use; Patrick et al., 2025). After controlling for use frequency, CUD prevalence and severity were not associated with sex in the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III; Gutkind et al., 2023). However, some sex differences in the types of problems associated with CUD have been observed, with females more likely than males to report interpersonal problems associated with use (Gutkind et al., 2023) and a stronger desire to use again (Cooper and Craft, 2018).

Overall, cannabis prevalence and frequency decrease with age across adulthood (Patrick et al., 2025). While CUD is most prevalent in early midlife (Patrick et al., 2025), prevalence among those ages 50 and older has been increasing (Charilaou et al., 2017). Research on adult age differences in medical versus nonmedical use has found medical use prevalence increased across ages 18–30, 35–45, and 50–65 among those reporting past-12-month use (Terry-McElrath and Patrick, 2026), but—among those reporting past-week use—medical use was more likely among those ages 50–64 than 18–49 or 65 and older (Livne et al., 2025). Age also is a critical factor for vulnerability to the negative effects of cannabis use. Risk for a range of cannabis-related harms increases with age (Choi et al., 2018; Health Canada, 2018; Meier et al., 2022; Shin et al., 2024), and cannabis use can exacerbate the risk for outcomes such as falls and other injuries associated with normal aging (Workman et al., 2021). Given that adults currently in midlife have historically high prevalence levels of frequent use (Patrick et al., 2025), CUD risk (Patrick et al., 2025), and medical cannabis use (Livne et al., 2025; Terry-McElrath and Patrick, 2026), the current research is particularly timely.

Table 1
Descriptive statistics.

	n	%/Mean	(SE) Range
Cannabis use disorder (CUD) outcomes			
Risky use criteria topic area	5848	31.5	(0.75)
Use where physically hazardous criterion	5826	3.1	(0.28)
Physical or psychological problems criterion	5848	30.9	(0.74)
Pharmacological criteria topic area	5848	17.2	(0.60)
Tolerance criterion	5818	15.8	(0.59)
Withdrawal criterion	5846	4.0	(0.31)
Social impairment criteria topic area	5848	19.5	(0.64)
Failure in major role obligations criterion	5837	4.9	(0.35)
Social or interpersonal problems criterion	5848	6.4	(0.39)
Activities given up criterion	5827	15.5	(0.58)
Impaired control criteria topic area	5848	13.3	(0.56)
Use more or longer than intended criterion	5830	9.1	(0.47)
Unsuccessful in cutting down criterion	5837	5.6	(0.38)
Significant time spent related to use criterion	5832	2.6	(0.28)
Craving/strong desire to use criterion	5832	5.5	(0.35)
CUD symptom prevalence	5848		
Non-disordered use (0–1 criterion)		76.1	(0.68)
Disordered use symptoms (2 + criteria)		23.9	(0.68)
CUD symptom severity	5848		
Non-disordered use (0–1 criterion)		76.1	(0.68)
Mild (2–3 criteria)		14.4	(0.54)
Moderate (4–5 criteria)		5.5	(0.37)
Severe (6 + criteria)		3.9	(0.31)
Moderate or severe (4 + criteria)		9.4	(0.48)
Covariates	5848		
Medical use (past 12 months)			
Medical (with or without nonmedical use)		11.7	(0.52)
Nonmedical		88.3	(0.52)
Past 30-day cannabis use frequency			
Mean use		10.7	(0.24) 0–40
Non-daily use (0–19 occasions)		75.9	(0.71)
Near-daily use (20 + occasions)		24.1	(0.71)
Sex			
Female		45.1	(0.82)
Male		54.9	(0.82)
Age			
40		23.4	(0.68)
45		23.5	(0.67)
50		18.0	(0.60)
55		17.4	(0.57)
60		17.7	(0.54)
55–60[a]		35.1	(0.75)

Notes: SE = standard error.
[a] 55–60 indicates the combined ages of 55–60.

The current study examined the extent to which CUD prevalence, severity, and specific criteria were reported by U.S. early and later midlife adults aged 40–60 who reported past 12-month cannabis use. Research questions were: (1) To what extent did midlife adults report CUD outcomes, and were there differences based on medical versus nonmedical cannabis use? (2) To what extent were observed differences explained by use frequency? (3) Were CUD and medical use associations different for adults when stratified by sex or age?

2. Methods

2.1. Sample

Data were obtained from the Monitoring the Future (MTF) Longitudinal Panel study (Patrick et al., 2025). The MTF study surveys new nationally-representative samples of U.S. 12th grade students each year (Miech et al., 2025). Approximately 2450 individuals are selected from each annual 12th grade national sample for the MTF Longitudinal Panel study; the oldest respondents have been surveyed at age 65. Six surveys

are collected during young adulthood (defined as ages 19–30); starting at age 35, surveys are collected every five years (ages 35, 40, 45, 50, 55, 60, 65). A University of Michigan institutional review board approved the study.

The current study used data collected from midlife adults at ages 40, 45, 50, 55, and 60 from 2019 to 2024. Age 35 was not included due to having a different timeframe for CUD symptom indicators; age 65 was not included as those surveys first began in 2023. Due to the 5-year survey timing, respondents who participated in 2019 could also participate in 2024 (see 2.3. for adjusting for multiple cases per respondent; Supplement Table 1 for sample description). Average wave-to-wave response rate for these ages and years of data collection was 96.6% (range 88.1%-102.0%); the average original sample response rate was 41.6% (range 34.7%-55.9%) (Patrick et al., 2025). A total of 25,039 respondents participated at these ages and years, providing 28,177 cases. Of these cases, 21,277 (77.2%) reported no past 12-month cannabis use and 465 (1.7%) had missing data on 12-month use and were thus ineligible for analysis; 6435 (22.8%) reported past 12-month cannabis use and formed the basis of the analytic sample. Of the 6435, non-missing data on CUD symptoms were available for 6059 (94.2% of 6435); 70 (1.1% of 6435) cases had missing data on 30-day cannabis use, and another 141 (2.2% of 6435) had missing data on medical use, leaving 5848 cases (90.9% of 6435) from 5454 individuals for analysis. Of these cases, 45.1% were female and 54.9% male.

2.2. Measures

2.2.1. CUD outcomes

Detailed information on MTF *CUD outcomes* can be found in Terry-McElrath and Patrick (2025). Briefly, the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition Text Revision* or DSM-5-TR (American Psychiatric Association, 2022) lists 11 CUD criteria (grouped into four topic areas; see Table 1 for criteria and topic areas). According to the DSM-5-TR, the number of CUD criteria met should be summed (ranging from 0 to 11), and then, using recommended cutoffs, the resulting sum can be coded to indicate any use disorder (2 + criteria) versus non-disordered use (0–1 criteria), as well as to code use disorder severity: no disorder (0–1 criteria), mild (2–3 criteria), moderate (4–5 criteria), or severe (6 + criteria).

In MTF midlife surveys, if respondents reported cannabis use in the past 12 months, they were asked, "Think back over the last 12 months. Did your use of marijuana cause you any of the following problems?" After this was a listing of CUD symptom indicators such as, "Hurt your performance on the job" with response options of no, a little, some, or a lot (recoded to any vs. none). MTF CUD symptom indicators were coded to match DSM-5-TR CUD criteria; the number of criteria met were summed and then coded as recommended in the DSM-5-TR. The specific CUD outcomes used in the current study are shown in Table 1: any CUD symptoms (yes/no); moderate or severe CUD symptoms (yes/no); dichotomous yes/no measures for each of the four CUD criteria topic areas; and dichotomous yes/no measures for each of the 11 individual CUD criteria. MTF CUD outcomes are not equivalent to clinical diagnoses, but indicate the extent to which the nonclinical MTF Longitudinal Panel sample self-reports CUD symptoms.

2.2.2. Predictors

Respondents were asked the number of occasions they used cannabis[1] in the last 12 months and the last 30 days; response options included 0, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more. If respondents reported any 12-month use, they were asked how much of the cannabis they used in the past 12 months came from their own written recommendation/prescription. *Medical use* (vs. nonmedical use) was defined as using any cannabis from one's own medical recommendation/prescription. *Past 30-day frequency* was coded both as a continuous measure (0, 1.5, 4, 7.5, 14.5, 29.5, 40) and as a dichotomous near-daily use measure (20 + occasions vs. 0–19 occasions). At age 18, respondents self-reported *sex* (female, male). Age was coded as a continuous 1–5 measure (1 =40, 2 =45, 3 =50, 4 =55, 5 =60) and a dichotomous indicator of ages 40–50 versus 55–60 for age-stratified models (see Supplement Appendix).

Table 2
Prevalence of cannabis use disorder (CUD) outcomes by medical (vs. nonmedical) use.

CUD Outcomes	Medical Use		Nonmedical Use		Model 1[a] (bivariate)	Model 2[b]
	%	(SE)	%	(SE)	*p*	*p*
Any disordered use symptoms (2 + criteria)	33.8	(2.15)	22.5	(0.71)	**< .001**	0.861
Moderate or severe symptoms (4 + criteria)	15.1	(1.62)	8.7	(0.50)	**< .001**	0.842
Risky use criteria topic area	40.5	(2.31)	30.3	(0.79)	**< .001**	0.745
Use where physically hazardous	3.2	(0.76)	3.1	(0.30)	0.960	0.213
Physical or psychological problems	40.0	(2.31)	29.7	(0.78)	**< .001**	0.719
Pharmacological criteria topic area	29.3	(2.07)	15.6	(0.62)	**< .001**	0.187
Tolerance	27.7	(2.04)	14.3	(0.60)	**< .001**	0.191
Withdrawal	6.0	(1.07)	3.7	(0.32)	**0.015**	0.685
Social impairment criteria topic area	26.2	(1.97)	18.6	(0.67)	**< .001**	0.815
Failure in major role obligations	8.2	(1.19)	4.5	(0.37)	**< .001**	0.717
Social or interpersonal problems	8.5	(1.24)	6.1	(0.41)	**0.037**	0.845
Activities given up	21.6	(1.84)	14.6	(0.61)	**< .001**	0.889
Impaired control criteria topic area	20.5	(1.86)	12.4	(0.58)	**< .001**	0.878
Use more or longer than intended	14.7	(1.62)	8.3	(0.48)	**< .001**	0.424
Unsuccessful in cutting down	8.3	(1.25)	5.3	(0.40)	**0.008**	0.456
Significant time spent related to use	4.3	(0.98)	2.3	(0.29)	**0.019**	0.410
Craving/strong desire to use	9.0	(1.25)	5.0	(0.36)	**< .001**	0.806

Notes: SE = standard error. Bold font indicates $p < .05$ or stronger.
[a] Model 1 reports bivariate comparisons; *p*-values comparing prevalence between medical and nonmedical use groups from Rao-Scott chi square tests.
[b] Model 2 reports associations from logistic regression models controlling for 30-day cannabis use frequency; $p < .001$ for cannabis use frequency for all CUD outcomes, with higher use frequency predicting higher odds of CUD outcomes.

2.3. Analysis

All analyses were conducted using SAS v9.4 (SAS Institute, Inc., Cary, NC) and weighted using MTF Panel analysis weights to adjust for sampling and nonresponse (Patrick et al., 2022). PROC GENMOD was used to test for age differences in 30-day frequency using the Poisson distribution and clustering by respondent using the repeated statement. All other analyses used Survey procedures adjusted for multiple cases per respondent by using the cluster statement. Descriptive statistics used SURVEYFREQ and SURVEYMEANS procedures. Testing differences in 30-day frequency by medical use and sex used SURVEYMEANS. To examine CUD outcome prevalence by medical use before and after

[1] From 1976–2021, all MTF cannabis-related measures used the word "marijuana." Starting in 2022, both "cannabis" and "marijuana" were used in all surveys.

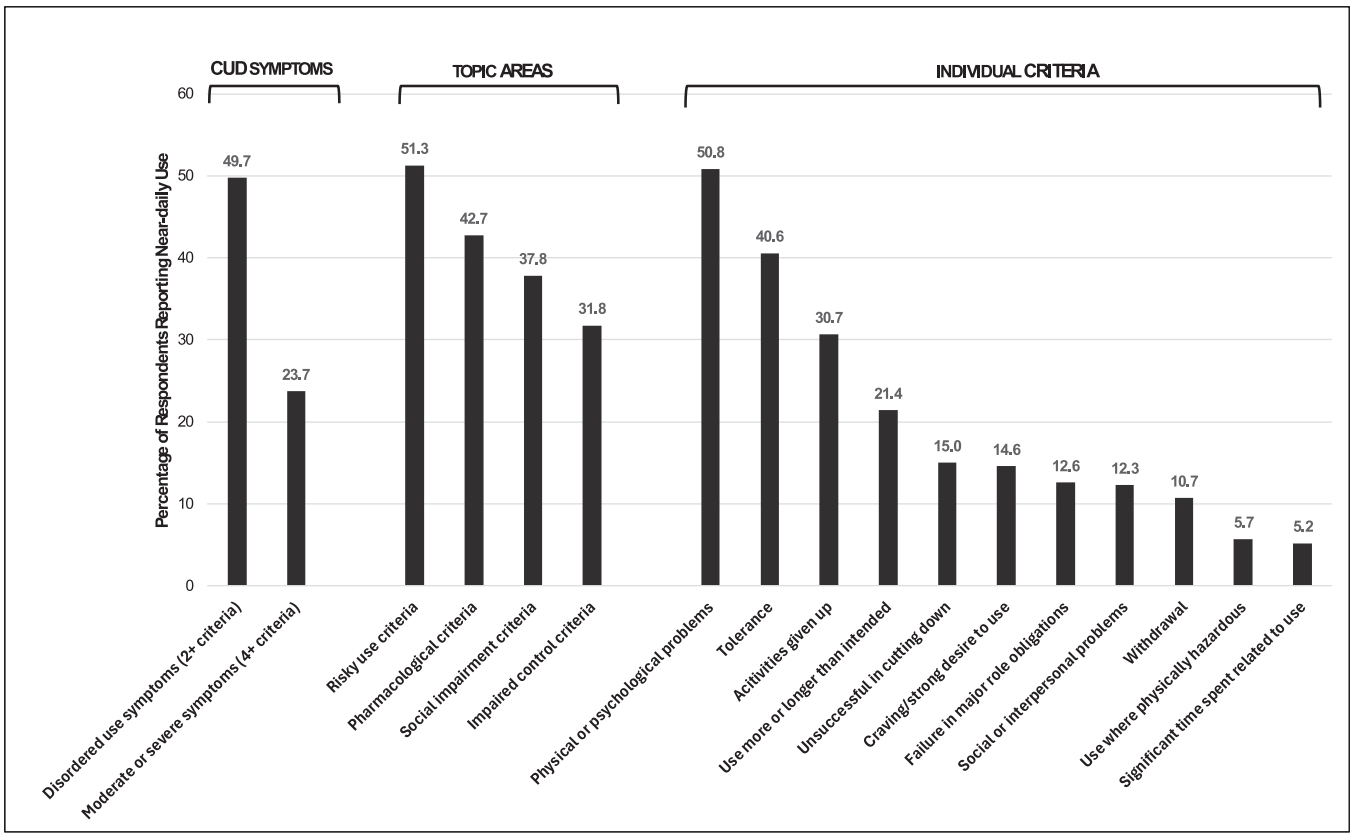

Fig. 1. Prevalence of cannabis use disorder (CUD) outcomes among those reporting near-daily cannabis use. *Notes*: Near-daily use defined as 20 + occasions in the past 30 days. No significant differences in CUD outcome prevalence by medical (vs. nonmedical) use were observed among those reporting near-daily use.

controlling for use frequency, prevalence and bivariate comparisons were obtained using SURVEYFREQ with Rao Scott chi-square tests, followed by SURVEYLOGSTIC models including medical use and use frequency. For stratification by sex (male, female) and then age group (40–50 vs. 55–60), SURVEYLOGISTIC models were conducted separately by subgroups, with models simultaneously including medical use, either sex or age (based on stratification), use frequency, and year. Marginal predicted probabilities were obtained using the LSMEANS statement. See Supplemental Appendix for discussion of multiple testing.

3. Results

CUD symptoms were reported by 23.9% of adult respondents who reported 12-month cannabis use (see Table 1 for descriptive statistics). Among respondents reporting near-daily use, 49.7% [SE= 1.65] reported CUD symptoms (data not tabled). Regarding use type, 11.7% reported medical use, while 88.3% reported nonmedical use. Overall mean 30-day cannabis use frequency was 10.7 occasions; mean frequency was 19.6 occasions [SE= 0.77] for medical use versus 9.5 occasions for nonmedical use [SE= 0.24] ($p < .001$) (data not tabled). Among those reporting medical use, mean frequency did not differ significantly by either sex ($p = 0.090$) or age ($p = 0.811$). Among those reporting nonmedical use, mean frequency was higher for males than females (10.1 [SE=0.33] vs. 8.8 [SE=0.35], $p = 0.008$) but did not differ by age ($p = 0.446$) (data not tabled).

3.1. CUD outcome prevalence and differences by medical (vs. nonmedical) use

As shown in Table 2, Model 1, before controlling for use frequency, any CUD symptom prevalence was estimated at 33.8% and 22.5% among those reporting medical versus nonmedical use, respectively ($p < .001$). The prevalence of moderate/severe symptoms also was higher among those reporting medical (vs. nonmedical) use: 15.1% versus 8.7% ($p < .001$). Prevalence estimates for all four CUD criteria topic areas, as well as 10 of the 11 individual criteria (all except "physically hazardous") were higher among those reporting medical versus nonmedical use (p-values 0.037 to <.001). Individual criteria showing the strongest differences between medical and nonmedical use included "use more or longer than intended," "time spent related to use," "craving/strong desire to use," "failure in major role obligations," and "tolerance."

3.2. Explanatory role of use frequency in medical (vs. nonmedical) use associations with CUD outcome prevalence

Results in Table 2, Model 2 show that after controlling for use frequency, no significant differences by medical vs. nonmedical use remained for any CUD outcomes. Fig. 1 presents CUD outcome prevalence among respondents reporting near-daily use (no significant differences by medical versus nonmedical use were observed in this group). Among those reporting near-daily use, any CUD symptoms were reported by 49.7% [SE= 1.65]; moderate/severe symptoms were reported by 23.7% [SE= 1.41]. The three most prevalent individual criteria among those reporting near-daily use were "physical or psychological problems" (50.8% [SE=1.66]), "tolerance" (40.6% [SE=1.60]), and "activities given up" (30.7% [SE=1.55]).

3.3. Relevance of sex and age for associations between medical (vs. nonmedical) use and CUD outcomes

3.3.1. Direct associations between sex, age, and CUD outcomes

Table 3 reports associations between sex, age, and CUD outcomes,

Table 3
Multivariable associations with cannabis use disorder (CUD) outcomes.

CUD Outcomes	Female (vs. Male)	Age[a]	Medical use (vs. nonmedical)	Use frequency (continuous)
	AOR (95% CI) *p*	AOR (95% CI) *p*	AOR (95% CI) *p*	AOR (95% CI) *p*
Disordered use symptoms (2 + criteria)	**0.72 (0.61, 0.84) < .001**	**0.91 (0.86, 0.96) 0.001**	0.98 (0.76, 1.27) 0.870	**1.06 (1.06, 1.07) < .001**
Moderate/severe symptoms (4 + criteria)	**0.72 (0.57, 0.92) 0.007**	**0.83 (0.76, 0.91) < .001**	1.03 (0.74, 1.43) 0.858	**1.06 (1.06, 1.07) < .001**
Risky use criteria topic area	**0.85 (0.74, 0.98) 0.027**	**0.95 (0.90, 1.00) 0.038**	1.04 (0.83, 1.31) 0.722	**1.04 (1.04, 1.05) < .001**
Use where physically hazardous	0.71 (0.49, 1.04) 0.080	0.95 (0.84, 1.07) 0.383	0.72 (0.42, 1.24) 0.238	**1.04 (1.02, 1.05) < .001**
Physical or psychological problems	**0.86 (0.75, 0.99) 0.042**	**0.95 (0.90, 1.00) 0.037**	1.05 (0.83, 1.32) 0.706	**1.04 (1.04, 1.05) < .001**
Pharmacological criteria topic area	**0.74 (0.61, 0.90) 0.002**	**0.83 (0.77, 0.89) < .001**	1.20 (0.91, 1.58) 0.209	**1.07 (1.07, 1.08) < .001**
Tolerance	**0.75 (0.62, 0.92) 0.006**	**0.84 (0.78, 0.90) < .001**	1.19 (0.90, 1.59) 0.223	**1.08 (1.07, 1.08) < .001**
Withdrawal	0.77 (0.55, 1.07) 0.125	**0.83 (0.73, 0.94) 0.003**	0.91 (0.58, 1.41) 0.661	**1.06 (1.05, 1.07) < .001**
Social impairment criteria topic area	**0.70 (0.59, 0.82) < .001**	**0.93 (0.88, 0.99) 0.015**	0.98 (0.76, 1.26) 0.870	**1.05 (1.04, 1.05) < .001**
Failure in major role obligations	**0.58 (0.42, 0.79) 0.001**	**0.81 (0.72, 0.91) < .001**	1.07 (0.72, 1.60) 0.731	**1.06 (1.05, 1.07) < .001**
Social or interpersonal problems	**0.55 (0.42, 0.72) < .001**	**0.88 (0.80, 0.96) 0.005**	0.98 (0.69, 1.41) 0.929	**1.04 (1.03, 1.05) < .001**
Activities given up	**0.77 (0.64, 0.92) 0.005**	0.94 (0.88, 1.00) 0.050	1.01 (0.78, 1.33) 0.925	**1.05 (1.04, 1.05) < .001**
Impaired control criteria topic area	**0.70 (0.57, 0.86) 0.001**	**0.88 (0.82, 0.95) 0.001**	1.04 (0.77, 1.39) 0.816	**1.06 (1.05, 1.07) < .001**
Use more or longer than intended	**0.67 (0.52, 0.84) 0.001**	**0.86 (0.79, 0.93) < .001**	1.14 (0.83, 1.57) 0.421	**1.05 (1.05, 1.06) < .001**
Unsuccessful in cutting down	**0.68 (0.50, 0.93) 0.015**	**0.88 (0.79, 0.99) 0.026**	0.86 (0.57, 1.29) 0.465	**1.07 (1.06, 1.08) < .001**
Significant time spent related to use	**0.56 (0.36, 0.88) 0.012**	**0.81 (0.68, 0.96) 0.017**	1.25 (0.72, 2.16) 0.435	**1.04 (1.03, 1.05) < .001**
Craving/strong desire to use	**0.71 (0.53, 0.94) 0.017**	**0.84 (0.77, 0.93) 0.001**	1.05 (0.72, 1.52) 0.819	**1.06 (1.05, 1.07) < .001**

Notes: AOR = adjusted odds ratio; CI = confidence interval. Models also included year (using dummy indicators). Bold font indicates $p < .05$ or stronger.
[a] Age measured in 5-year increments.

controlling for medical use, use frequency, and year. Females had lower odds than males of any CUD symptoms ($p < .001$), moderate/severe symptoms ($p < .001$), all four criteria topic areas (*p*-values 0.002 to <.001), and nine of the 11 criteria (*p*-values 0.042 to <.001); no sex differences were observed for "physically hazardous" or "withdrawal." Regarding age associations, the odds of the following significantly decreased with age: any CUD symptoms ($p = 0.001$), moderate/severe symptoms ($p < .001$), all four criteria topic areas (*p*-values 0.038 to <.001), and nine of 11 criteria (*p*-values 0.037 to <.001). No age differences were observed for "physically hazardous" and "activities given up."

3.3.2. *Medical use associations stratified by sex and age group*

Multivariable models were run stratified by sex and age group. In multivariable models controlling for use frequency and stratified by sex (see Supplement Table 2), no significant associations between medical use and CUD outcomes were observed among males. Among females, medical use was not associated with CUD symptom prevalence or severity; topic areas/criteria related to risky use, social impairment, or impaired control; or the "withdrawal" criterion. However, medical (vs. nonmedical) use was significantly associated with higher odds of the pharmacological criteria topic area ($p = 0.010$) and two individual criteria: "tolerance" ($p = 0.017$) and "use more or longer than intended" ($p = 0.009$). Fig. 2 presents predicted probabilities by sex for these three measures where mean 30-day use frequency was set at 19.6 (mean frequency observed among the medical use group). Among females, the predicted probability for "tolerance" was 47% higher among those in the medical (vs. nonmedical) use group: 0.234 versus 0.159. Similarly, the predicted probability for "use more or longer than intended" was 74% higher among females in the medical versus nonmedical use group: 0.137 versus 0.079.

In multivariable models controlling for use frequency and stratified by age group (see Supplement Table 3), no significant associations between medical use and CUD outcomes were observed among those ages 40–50. Among those ages 55–60, medical use was not associated with any CUD symptom prevalence, the impaired control criteria topic area, or individual criteria of "use where physically hazardous", "withdrawal", "social or interpersonal problems", "significant time spent related to use", or "craving/strong desire to use". However, medical (vs. nonmedical) use was significantly associated with higher odds of moderate/severe CUD symptoms ($p = 0.012$); topic areas of risky use ($p = 0.035$), pharmacological criteria [$p = 0.002$], and social impairment [$p = 0.028$]); and five individual criteria: "physical or psychological problems" ($p = 0.033$), "tolerance" ($p = 0.007$), "failure in major role obligations" ($p = 0.034$), "activities given up" ($p = 0.022$), and "use more or longer than intended" ($p = 0.047$). Fig. 3 presents predicted probabilities by age group for these CUD outcomes where mean 30-day use frequency was set at 19.6 (mean frequency observed among the medical use group). Among those ages 55–60, the predicted probability for moderate/severe CUD symptoms was 74% higher among those reporting medical (vs. nonmedical) use: 0.148 versus 0.085. Similarly, the probability for "tolerance" was 62% higher among those in the medical (vs. nonmedical) use group: 0.233 versus 0.143.

4. Discussion

The current study examined CUD risk among U.S. midlife adults aged 40–60 who used cannabis in the past 12 months, the degree to which CUD risk differences by medical (vs. nonmedical) use were explained by use frequency, and differences in association patterns across sex and age. Results showed the overall likelihood of reporting CUD outcomes was primarily related to 30-day use frequency (regardless of medical versus

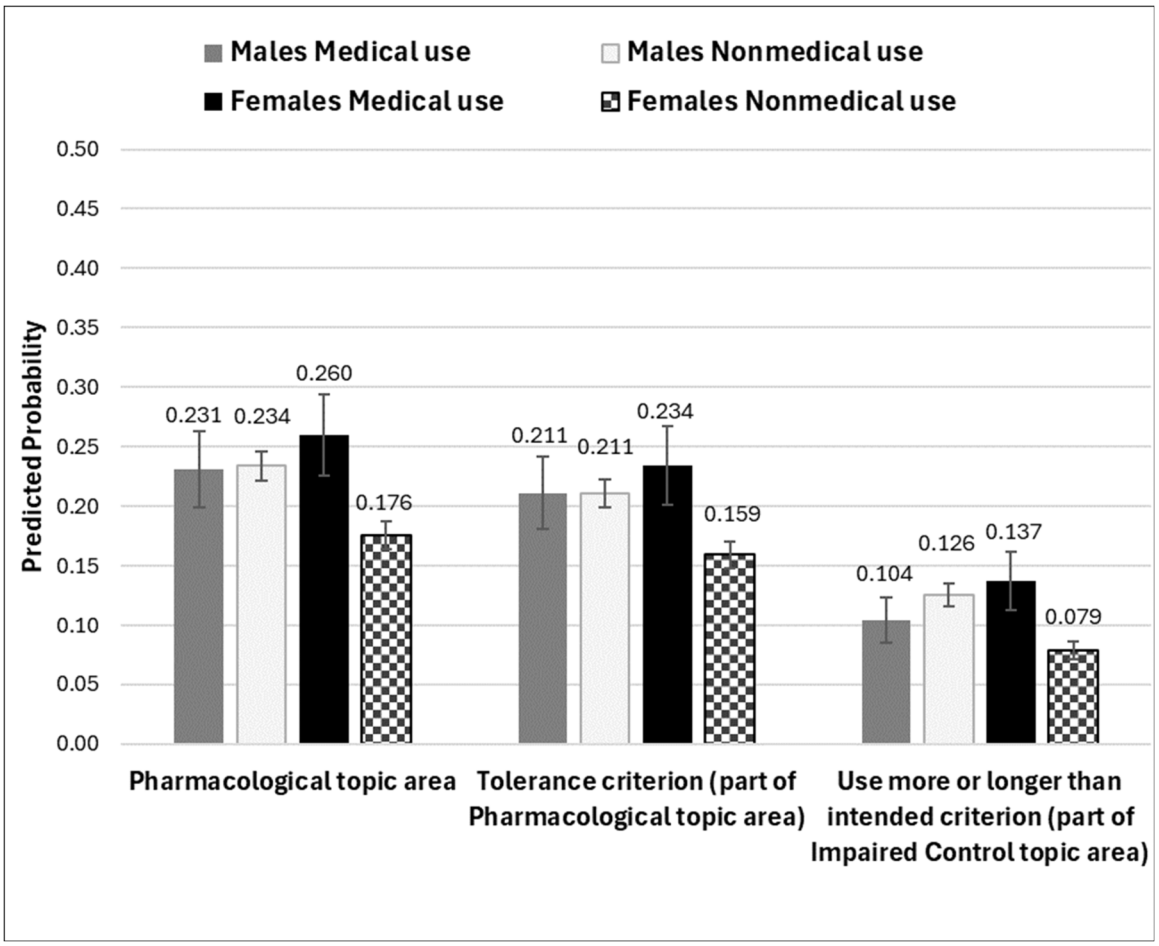

Fig. 2. Predicted probabilities of CUD outcomes with significant medical (vs. nonmedical) use associations in sex-stratified models. *Notes*: Predicted probabilities obtained from models simultaneously including medical use, age, use frequency, and year. Mean use frequency was set at the mean observed among all respondents in the medical use subgroup (19.6 occasions). Only CUD outcomes with significant use type associations in sex-stratified models shown.

nonmedical use purposes). However, even after controlling for use frequency, medical (vs. nonmedical) use was associated with higher risk for specific CUD outcomes among females and later midlife adults. Attention to the high risks for CUD among those engaging in high-frequency cannabis use is needed.

The current study highlights risks associated with high-frequency cannabis use. Observed higher likelihoods for the majority of CUD outcomes among those reporting medical (vs. nonmedical) use were accounted for by use frequency in the overall sample. While it was not surprising that medical use was associated with significantly higher use frequency than nonmedical use (a finding supported by several prior national studies; Compton et al., 2017; Han et al., 2025; Terry-McElrath and Patrick, 2026), it was notable that mean frequency in the medical use subgroup reached near-daily use (19.6 occasions), with no significant differences by sex or age. This was more than twice the average of 9.5 occasions reported among those in the nonmedical use subgroup. The high prevalence of CUD symptoms among those reporting near-daily use is cause for concern. Near-daily use is risky—even among those using for medical purposes. Not all medical or nonmedical use subgroup respondents reporting high-frequency use also reported CUD symptoms (although it is important to note that such risk varies over time; there is a possibility those reporting high-frequency use may develop CUD symptoms later). Risk for CUD is not inevitable with near-daily use, but is significantly more likely. Near-daily cannabis use also is associated with a wide range of negative outcomes beyond CUD including increased risk of anxiety, depression, psychosis and schizophrenia (Health Canada, 2025); impaired short- and long-term memory (Health Canada, 2025); and adverse cardiovascular outcomes (Jeffers et al., 2024). Since medical cannabis dosing recommendations include daily use for some conditions such as chronic pain (Jugl et al., 2023), there is a need to help those using cannabis for medical purposes to lower their risk for negative outcomes such as CUD. Mode of administration (e.g., smoking, vaping, edibles, etc.) and potency are known to be differentially associated with specific health outcomes (Muheriwa-Matemba et al., 2024), time to effect, and effect duration (Lopez, 2023). Research has called for using the lowest medical cannabis dose that produces therapeutic benefit, and attention to which modes of administration and potency levels are most appropriate (MacCallum and Russo, 2018). Research is needed to increase knowledge of factors that are protective against or increase risk of progression to CUD among individuals who require higher treatment dosage/frequency levels of medical cannabis.

After controlling for use frequency, no significant associations between medical use and CUD outcomes were observed among males, and only three were observed among females. However, results may have important implications for CUD risk likelihood. While medical (vs. nonmedical) use was associated with high use frequency for both males and females, among females, medical use was associated with higher risk of pharmacological criteria topic area; "tolerance" and "use more or longer than intended" criteria. Preclinical and clinical research indicates females accelerate to problematic cannabis use at a faster rate and at lower THC doses than males (Cooper and Craft, 2018), as well as develop cannabis tolerance faster than males and have more sensitivity to cannabis effects due to hormonal differences and body fat (Marusich

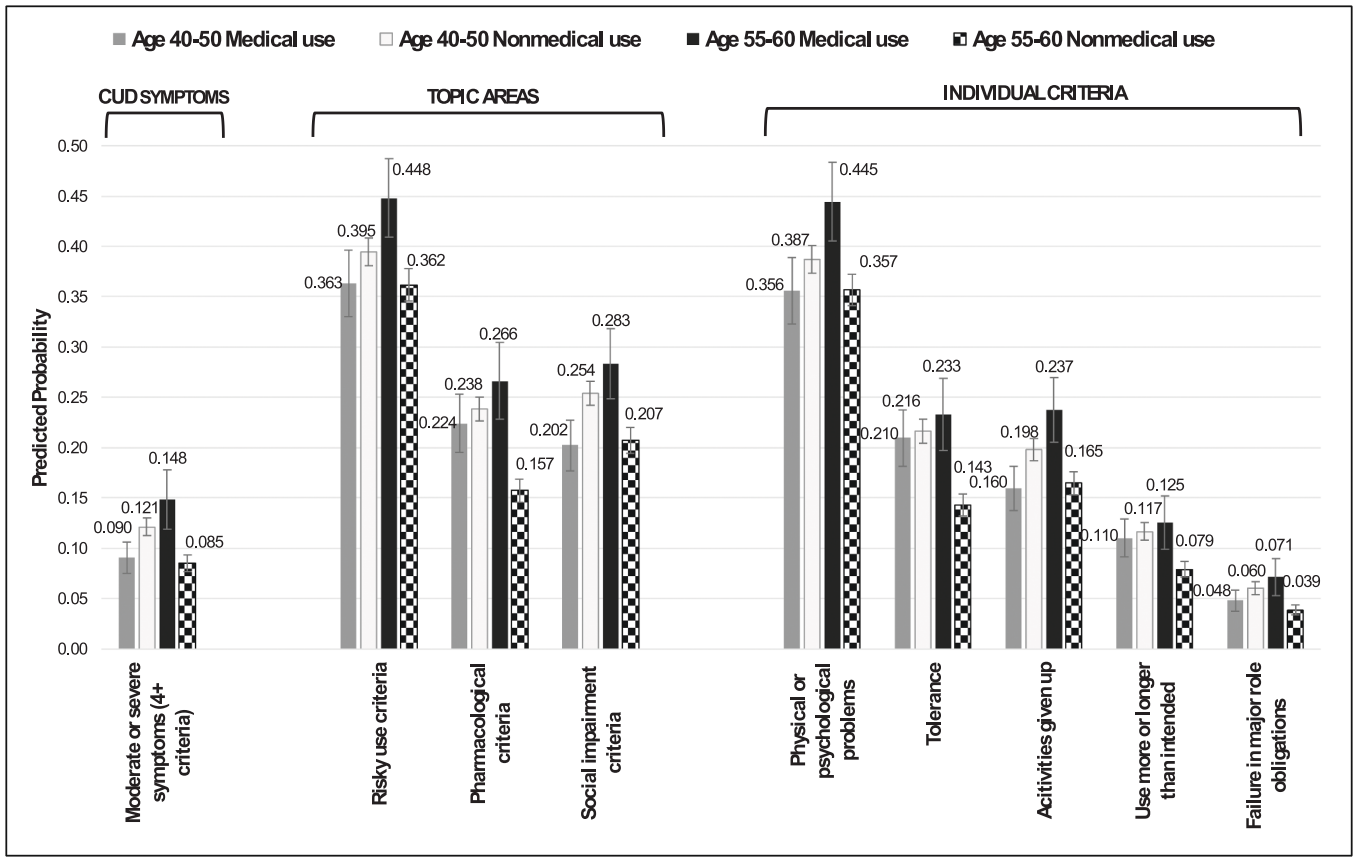

Fig. 3. Predicted probabilities of CUD outcomes with significant medical (vs. nonmedical) use associations in age-group stratified models. *Notes*: Predicted probabilities obtained from models simultaneously including medical use, sex, use frequency, and year. Mean use frequency was set at the mean observed among all respondents in the medical use subgroup (19.6 occasions). Only CUD outcomes with significant use type associations in age group-stratified models shown.

et al., 2014, 2015; Rothman, 2024). In addition to such biological differences, prior research on self-reported reasons for cannabis use found that by late adolescence, females were more likely than males to report coping-related cannabis use reasons (Patrick et al., 2024). Reporting coping reasons during adolescence and early young adulthood has been associated with higher CUD symptom risk in early midlife (Patrick et al., 2011, 2016). Sex differences also have been found in the types of medical conditions for which adults report using cannabis; for example, females are more likely than males to report medical use for anxiety (Azcarate et al., 2020; Sajdeya et al., 2024), and cannabis is frequently used for chronic pelvic pain conditions that are more common among women and comorbid symptoms (Sinclair et al., 2023). Among females (vs. males), high use frequency combined with increased biological vulnerability for cannabis tolerance (Cooper and Craft, 2018), higher risk for coping-related use reasons (Patrick et al., 2024), and differences in specific health conditions for which medical use is often considered (Azcarate et al., 2020; Sajdeya et al., 2024; Sinclair et al., 2023) may act as potential mechanisms contributing to increasing the risk of both "tolerance" and "using more than intended."

Use frequency explained all associations between medical use and CUD among early midlife adults but not among those ages 55–60. Medical cannabis use may pose a particularly high risk for CUD among older midlife adults. Prior research has found age differences in the health reasons reported for medical cannabis use, with those ages 31–50 more likely to report using for insomnia, while those ages 51–72 were more likely to use for chronic medical conditions such as cancer (Haug et al., 2017). A higher likelihood of using medical cannabis for chronic health conditions may increase the likelihood of long-term frequent use. The age-related increases in biological susceptibility to cannabis include changes in brain volume and neurotransmitter receptors, increases in adipose tissue (cannabinoids may accumulate more in the elderly due to increased adipose tissue), and decreases in the liver's ability to metabolize consumed substances (which may slow the elimination of cannabis and increase the likelihood of adverse effects) (Health Canada, 2018). Among those ages 55–60, high use frequency associated with medical use combined with age-related biological vulnerability to cannabis may act as potential mechanisms contributing to a higher likelihood of experiencing issues such "physical or psychological problems", "tolerance", and "using more or longer than intended", as well as cognitive issues; all of these issues may increase "failure in major role obligations" and "activities given up". Research also finds that older adults often report perceiving significant social stigma surrounding cannabis use (Dahlke et al., 2024; Thayer et al., 2026; Wang et al., 2023). Such stigma may result in older adults' pulling back from social interactions ("activities given up"; Dahlke et al., 2024) or concealing medical use from family, friends, or healthcare providers (Dahlke et al., 2024; Thayer et al., 2026; Wang et al., 2023). Social isolation is associated directly with higher risk for frequent cannabis use (Gutkind et al., 2022), as well as with CUD both directly and indirectly through a higher likelihood of developing depression (Ma, 2025). Concealing use may lead to higher risk for adverse outcomes across CUD criteria topics combined with an inability for others—including health providers—to help prevent or address negative use consequences. Taken together, both biological and social/behavioral factors may combine to make older midlife adults who use cannabis for medical purposes at higher risk for experiencing CUD, including moderate/severe CUD symptoms.

4.1. Limitations

These findings are subject to limitations. Data are based on

nationally-representative U.S. 12th-grade student samples followed into midlife; those who did not attend school in 12th grade were not included. As not completing high school is associated with cannabis use (Bachman et al., 2008; Davis et al., 2023), the sample may underrepresent adult cannabis use. CUD outcomes were obtained from self-report symptoms and are not equivalent to clinical diagnoses. Future research could explore more detailed medical (vs. nonmedical) cannabis use measures including use type-specific frequency and quantity consumed, as well as confounders such as psychiatric and medical conditions. Future research also is needed on specific social, behavioral, and biological mechanisms underlying sex and age-group differences in CUD.

5. Conclusion

Overall, CUD risk appears to be associated with high-frequency use, regardless of whether such use is for medical or nonmedical purposes. Near-daily cannabis use is risky—even among those using for medical purposes. Tolerance, in particular, was more strongly associated with medical use for both females and older adults. Medical use may pose a greater risk for moderate/severe CUD symptoms among older adults.

CRediT authorship contribution statement

Yvonne M. Terry-McElrath: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Megan E. Patrick:** Writing – review & editing, Supervision, Resources, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

The authors did not use any generative AI tools or services in the preparation of this work. Nothing to disclose.

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Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.drugalcdep.2026.113178.

Data availability

The U.S. Monitoring the Future Longitudinal Panel study makes all data publicly available. Data are available through the National Addiction and Health Data Archive Program (NAHDAP).

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