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Narrowing and Reversing Sex Gaps in Cannabis Use and Cannabis Use Disorder Among Adolescents and Young Adults

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Abstract

Background: Historically, cannabis use and cannabis use disorder (CUD) have been more prevalent among males. However, emerging evidence suggests cannabis use may be increasing faster among females in younger age groups. This study characterized changes in female versus male differences in cannabis use and CUD across age groups and time.

Methods: Annual data from the 2014–2023 National Surveys on Drug Use and Health (NSDUH) were analyzed by age groups (12–17 [adolescents], 18–25 years, and 26 years or older) for past-month cannabis use, past-year daily/near-daily cannabis use (300 or more days) and past-year CUD. Prevalence differences (PDs) in percentage points between females and males were evaluated using generalized linear models.

Results: From 2014 to 2023, the prevalence of cannabis use (past-month and daily/near daily) and CUD increased among adults, with shifts in PDs across age groups. In 2022, adolescent females surpassed males in past-month cannabis use (PD = 2.3; 95% confidence interval [CI]: 1.0, 3.6). By 2023, both daily/near daily use and CUD prevalence were higher among adolescent females (e.g., CUD PD = 2.4; 95% CI: 1.4, 3.4). Among adults aged 18–25, all outcomes remained lower among females, but PDs narrowed over the study period. In adults aged 26 years or older, females consistently had lower prevalence across all outcomes.

Conclusion: Results showed reversals in female versus male differences among adolescents and narrowing gaps among younger adults. Tailored interventions considering sex and age may prevent and reduce CUD. Further research is needed to understand reasons behind these shifts.

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CRediT authorship contribution statement

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Keywords

Cannabis; Marijuana; Cannabis use disorder; Sex

Introduction

Cannabis is the most commonly used federally illegal drug in the United States, with 21.8% of people aged 12 years or older reporting past-year use and 15.4% reporting past-month use in 2023 (Substance Abuse and Mental Health Services Administration, 2024) — figures that have steadily increased over time (Caulkins, 2024; Mattingly et al., 2024; Substance Abuse and Mental Health Services Administration, 2024). Cannabis use disorder (CUD) is characterized by a persistent pattern of use despite physical, psychological, or social problems associated with consumption (American Psychiatric Association, 2022), with higher cannabis use frequency increasing risk of developing CUD (Connor et al., 2021). In 2021, nearly 31% of adults aged 18–64 who used cannabis met criteria for CUD (Compton et al., 2024). Increases in cannabis use and subsequent CUD may be influenced by the expansion of cannabis legalization and a declining perception of the risks associated with regular use (Han et al., 2021; Terry-McElrath et al., 2025; Waddell, 2022).

Adolescents appear particularly vulnerable to the negative effects of cannabis use. Cannabis use during this developmental stage is associated with an increased likelihood of various adverse psychosocial outcomes, including major depressive episodes, suicidal ideation, cognitive impairments, poor academic performance, and aggression (Sultan et al., 2023). An earlier age of cannabis initiation has been linked to developing CUD later in life, especially among adolescents. For instance, one study examining adolescents and emerging adults found the adjusted 12-month prevalence of CUD among adolescents with lifetime cannabis use was 10.9% in the first year after starting cannabis use, 15.3% in the second year, 17.7% in the third year and 20.6% in the fourth year and beyond, figures that were consistently higher than their emerging adult counterparts (Han et al., 2019). Furthermore, cannabis use has been linked to the onset of acute psychosis, with risks increasing for those who start using at a younger age, use frequently, or consume high-potency cannabis (Volkow et al., 2016).

Research has shown there are differences between males and females in adverse outcomes associated with cannabis use (Matheson & Le Foll, 2023; Ritz & Greaves, 2022). For instance, females may progress more rapidly from initial cannabis use to developing CUD compared to males (Greaves & Hemsing, 2020; Matheson & Le Foll, 2023). Furthermore, cannabis use is associated with an earlier onset of psychosis among females compared with males (Allegri et al., 2013; Bassir Nia et al., 2018).

Historically, cannabis use and CUD were more prevalent among males than females across both adolescents and adults (Bassir Nia et al., 2018; Carliner et al., 2017; Hasin et al., 2019). However, emerging evidence from large-scale U.S. surveys suggests gaps in these outcomes are narrowing, especially among adolescents and younger adults (Chapman et al., 2017; Esie & Ta, 2024; Goodwin & Silverman, 2024; Hasin et al., 2022; Hoots et al., 2023). For instance, national data from the Youth Risk Behavior Survey show that

among students in grades 9–12, cannabis use prevalence decreased among males between 2009 to 2021 and was more common among females by 2021 (Goodwin & Silverman, 2024). Similarly, a separate systematic review and meta-regression found evidence that the prevalence of cannabis use is converging among males and females born in more recent cohorts, suggesting that sex-based differences in cannabis use are diminishing over time (Chapman et al., 2017), carrying important implications for health policy and practice.

Despite these shifting patterns, limited research has explored how sex-based differences have evolved in the wake of the COVID-19 pandemic, a period characterized by increases in availability and diversity of cannabis products in communities, increases in cannabis use among adults (Compton et al., 2023) and declines among adolescents (Hoots et al., 2023). Notably, to our knowledge, no study has specifically examined sex-based differences in cannabis use or CUD among adults, or CUD among adolescents, during this time. It is possible that pandemic-related stress and alterations to daily routines may have had differential effects by sex. For example, women may have been more likely to use cannabis to manage increased psychosocial burden, whereas consumption among men could have been driven more by shifts in workplace and social contexts. The present study aims to address this gap by examining female versus male differences in cannabis use and CUD prevalence over a ten-year period, using U.S. national data from 2014 to 2023.

Methods

Data source

Data were from the public use data files of the National Survey on Drug Use and Health (NSDUH) for the years 2014 to 2023. Our sample includes both adolescents (aged 12–17) and adults (aged 18 or older). The survey, sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA), provides annual estimates on substance use and mental health among the US civilian, noninstitutionalized population aged 12 or older. NSDUH uses a nationally representative multistage probability design with quarterly data collection. Starting in quarter 4 of 2020, NSDUH implemented multimodal data collection methods to accommodate COVID-19 safety protocols, offering both in-person and web-based surveys. Consequently, person-level analysis weights were recalibrated to account for mode-specific response patterns. Because of these changes in survey methodology, data from 2020 should not be compared to data from any other year and data from 2021–2023 are only comparable with each other (Center for Behavioral Health Statistics and Quality, 2024). Given these methodological considerations, this analysis summarizes results across three distinct periods: 2014 to 2019, 2020, and 2021 to 2023.

Measures

We assessed three cannabis outcomes: (1) past-month cannabis use; (2) past-year daily/near-daily cannabis use (use on 300 or more days in the past year); and (3) past-year Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) CUD. Prior to 2020, NSDUH collected analogous 4th edition DSM (DSM-IV) measures, cannabis dependence and abuse. For 2014–2019, we used a proxy for DSM-5 CUD by mapping DSM-IV items to DSM-5 criteria following a previously published method (Compton et al., 2019), which

reclassifies symptoms of dependence and abuse into a unified set of DSM-5 criteria based on symptom count thresholds. Sex (female, male) was determined using the binary “IRSEX” variable across all survey years, which is intended to reflect sex assigned at birth.

Data analysis

We used generalized linear models with a binomial distribution and identity link to estimate female–male prevalence differences (PDs) for each study year and present results stratified by age group (12–17, 18–25, and 26 or older). Because we estimated female–male prevalence differences separately for each year without pooling across survey periods, our descriptive comparisons are less likely to conflate methodological changes with sex differences. Significance of PDs was evaluated at an alpha level of 0.05, with 95% confidence intervals (CIs) provided; if the CI included 0, the female–male PD was not considered statistically significant. Positive PDs indicate higher prevalence among females, while negative values indicate higher prevalence among males. All analyses incorporated complex survey weights and were conducted using R version 4.4.0.

Results

Past-month cannabis use

From 2014 to 2019, past-month cannabis use among adolescents aged 12–17 years was similar for both females and males, with females generally reporting slightly lower prevalence (Figure 1A, Supplemental Table 1). In 2020, the difference remained non-significant. However, from 2021 to 2023, patterns reversed, with female prevalence surpassing that of males. By 2022, the female-male PD reached 2.3 percentage points (95% CI: 1.0, 3.6), followed by a non-significant PD in 2023 (PD = 1.3; 95% CI: –0.1, 2.7).

Between 2014 and 2019 among adults aged 18–25 years, past-month cannabis use prevalence steadily increased for both females and males, with the PDs narrowing from –7.4 percentage points (95% CI: –9.4, –5.4) in 2014 to –3.4 (95% CI: –5.2, –1.6) in 2019 (Figure 1A, Supplemental Table 1). In 2020, there was no significant difference between females and males (PD = –0.5; 95% CI: –3.9, 2.8). From 2021 to 2023, prevalence continued to increase for both females and males, with PDs further narrowing from –3.8 percentage points (95% CI: –6.7, –1.0) in 2021 to –1.7 (–4.1, 0.8) in 2023.

For adults aged 26 and older, past-month cannabis use prevalence increased steadily for females and males from 2014 to 2019 and 2021 to 2023 (Figure 1A, Supplemental Table 1). Females consistently reported significantly lower prevalence than males. Notably, from 2021 to 2023 the gap widened and peaked at –5.5 percentage points (95% CI: –6.7, –4.3) in 2023.

Past-year daily/near daily cannabis use

From 2014 to 2019, past-year daily/near daily cannabis use prevalence among adolescents aged 12–17 years remained low for both females and males, with females generally reporting lower prevalence than males (Figure 1B, Supplemental Table 2). However, in 2022, patterns reversed, with females reporting slightly higher prevalence compared to males, although the difference was not statistically significant (PD = 0.2; 95% CI: –0.4, 0.8).

In 2023, the gap widened further, with females reporting significantly higher prevalence (PD = 0.5; 95% CI: 0.0, 1.1).

Between 2014 and 2019 among adults aged 18–25 years, past-year daily/near daily cannabis use increased slightly for both females and males, and PDs remained stable around –3.7 percentage points during this period and in 2020 (Figure 1B, Supplemental Table 2). After 2020, PDs narrowed to –1.3 percentage points in 2022, which was not statistically significant (95% CI: –2.7, 0.2). In 2023, the PD widened to –2.9 percentage points (95% CI: –4.6, –1.1), indicating a statistically significant difference.

For adults aged 26 and older, prevalence of past-year daily/near daily cannabis use increased steadily from 2014 to 2019 for females and males, with females consistently reporting lower prevalence (e.g., PD = –1.9 in 2019; Figure B, Supplemental Table 2). After 2020, prevalence continued to increase; the PD peaked at –3.2 percentage points in 2022 (95% CI: –4.2, –2.2) before narrowing to –2.5 in 2023 (95% CI: –3.1, –1.8).

Past-year cannabis use disorder

From 2014 to 2019 among adolescents 12–17 years, past-year CUD prevalence for both females and males remained relatively stable, with females consistently reporting similar prevalence compared with males (e.g., PD = –0.7 [95% CI: –1.6, 0.2] in 2019; Figure 1C, Supplemental Table 3). However, this started to shift in 2020, and from 2021 to 2023, the gap steadily increased, reaching a PD of 2.4 percentage points (95% CI: 1.4, 3.4) in 2023.

Between 2014 and 2019 among adults aged 18–25 years, past-year CUD prevalence steadily increased for females and remained relatively stable for males, resulting in narrowing PDs from –6.3 percentage points (95% CI: –7.7, –4.9) in 2014 to –3.5 (95% CI: –5.0, –2.1) in 2019 (Figure 1C, Supplemental Table 3). After 2020, the PD narrowed to a low of –1.8 percentage points (95% CI: –3.8, 0.1) in 2022 as prevalence increased for females more than males. However, the PD widened in 2023 to –3.5 (95% CI: –5.8, –1.2) as male prevalence increased while female prevalence slightly decreased.

For adults aged 26 years and older, past-year CUD prevalence generally increased from 2014 to 2019, with females consistently reporting lower prevalence (e.g., PD = –1.4 [95% CI: –1.8, –1.0] in 2019; Figure 1C, Supplemental Table 3). After 2020, prevalence increased for both females and males, but to a larger degree for males, resulting in widening PDs of –3.1 percentage points in both 2022 and 2023.

Estimated population counts (in thousands) that underlie all prevalence calculations are provided in Supplemental Table 4.

Discussion

Cannabis use and CUD patterns continue to shift in the U.S. From 2014 to 2023, patterns varied by age group and sex. Among adolescents aged 12–17 years, past-month use remained stable for females but declined for males, leading to females surpassing males in prevalence by 2022 — a reversal of prior patterns. Female adolescents also had significantly higher past-year CUD prevalence than male adolescents in 2022 and 2023. Among younger

adults aged 18–25 years, all outcomes — past-month use, past-year daily/near daily use, and past-year CUD — increased for both females and males, with narrowing PDs over time. Among adults aged 26 years and older, all outcomes increased for both groups, with females consistently reporting lower prevalences than males.

Given evidence of declines in perceived risk related to cannabis use (Han et al., 2021; Terry-McElrath et al., 2025; Waddell, 2022), our findings might suggest important behavioral and cultural shifts influencing cannabis use and CUD prevalence, especially among adolescents and young adults. Three hypotheses merit future study. First, females might be more vulnerable to the negative effects of cannabis. This aligns with prior studies indicating that females tend to progress more quickly from initial use to developing CUD compared to males (Greaves & Hemsing, 2020; Matheson & Le Foll, 2023). Second, differential reporting might be at play. Women are more likely than men to frame their cannabis use as medical, e.g., for anxiety, sleep, or migraine relief (Kurtzman & Young-Wolff, 2021; Leung et al., 2022). Actively monitoring symptoms for therapeutic reasons could possibly make women more attuned to, and thus more willing to endorse, DSM-5 CUD criteria when surveyed. Empirical work, however, is needed to test this possibility. Third, route of administration might matter. While smoking remains the most common route, females report a higher prevalence of ingestion methods, such as edibles (Quader et al., in press). Edibles can be easier to overconsume compared to traditional smoking methods, partly due to delayed and often unpredictable effect onset (Allen et al., 2017; Matheson & Le Foll, 2020). Edibles may also appeal to younger populations, who often perceive smoking or vaping as more harmful (Reboussin et al., 2019), and may also appeal more to females due to being more discreet and easier to consume in certain settings (Cuttler et al., 2016). Examples of future work include testing whether these factors may help explain the emerging sex differences reported.

Furthermore, data show women are more likely than men to report using cannabis use for medical purposes (Kurtzman & Young-Wolff, 2021). In a separate study which assessed reasons for medical use, women often cited conditions like sleep disorders, headaches or migraines, and anxiety, whereas men more frequently reported using cannabis for conditions such as cancer, bipolar disorder, and substance-related issues (Leung et al., 2022). In addition, the enactment of nonmedical cannabis use laws has been associated with greater increases in cannabis use among women compared to men (Segura et al., 2024). This suggests that policy changes might disproportionately impact cannabis use behaviors in women, potentially due to reduced stigma or increased accessibility (Hemsing & Greaves, 2020). As societal acceptance of cannabis increases, younger females could increasingly turn to it as a means of managing mental health challenges, particularly anxiety and stress.

Limitations

NSDUH relies on self-reported data which may introduce reporting biases. For example, increased legalization and normalization of cannabis use could make individuals more willing to disclose their consumption than in previous years. The survey also does not account for hemp-derived cannabis products or cannabis potency, factors that are critical for understanding the rising prevalence of CUD and observed sex-based differences.

These omissions limit the ability to fully capture evolving cannabis use patterns and their implications. Additionally, methodological changes to NSDUH in 2020 and 2021, including a transition to multimodal data collection due to the COVID-19 pandemic, complicate comparisons across the full study period. However, we do not believe these changes explain the observed sex-based patterns. Sex differences were estimated separately for each year, and the narrowing gap among 18–25-year-olds began before 2020 and continued afterward; a similar convergence among adolescents appears in other national surveys such as the YRBS. Lastly, approximating DSM-5 CUD criteria from DSM-IV items for the years 2014–2019 (Compton et al., 2019), may introduce inconsistencies when comparing estimates across years due to differences in diagnostic criteria. However, because estimates were generated separately for each year using the same method for both sexes, these inconsistencies are unlikely to explain the observed changes in sex differences over time.

Conclusion

The reversal of historical female versus male patterns in adolescent cannabis use, including higher CUD prevalence among adolescent females, and narrowing gaps among younger adults highlight the need for interventions addressing emerging sex-based disparities in cannabis use and mitigating associated risks like CUD. These could address specific motivations for use, such as mental health management, and consider consumption methods like the growing appeal of edibles. As cannabis legalization and normalization continue, it is critical that public health prevention and treatment efforts prioritize addressing the increasing prevalence of CUD. Lastly, more research is needed to understand the underlying reasons for these shifts and to inform effective intervention strategies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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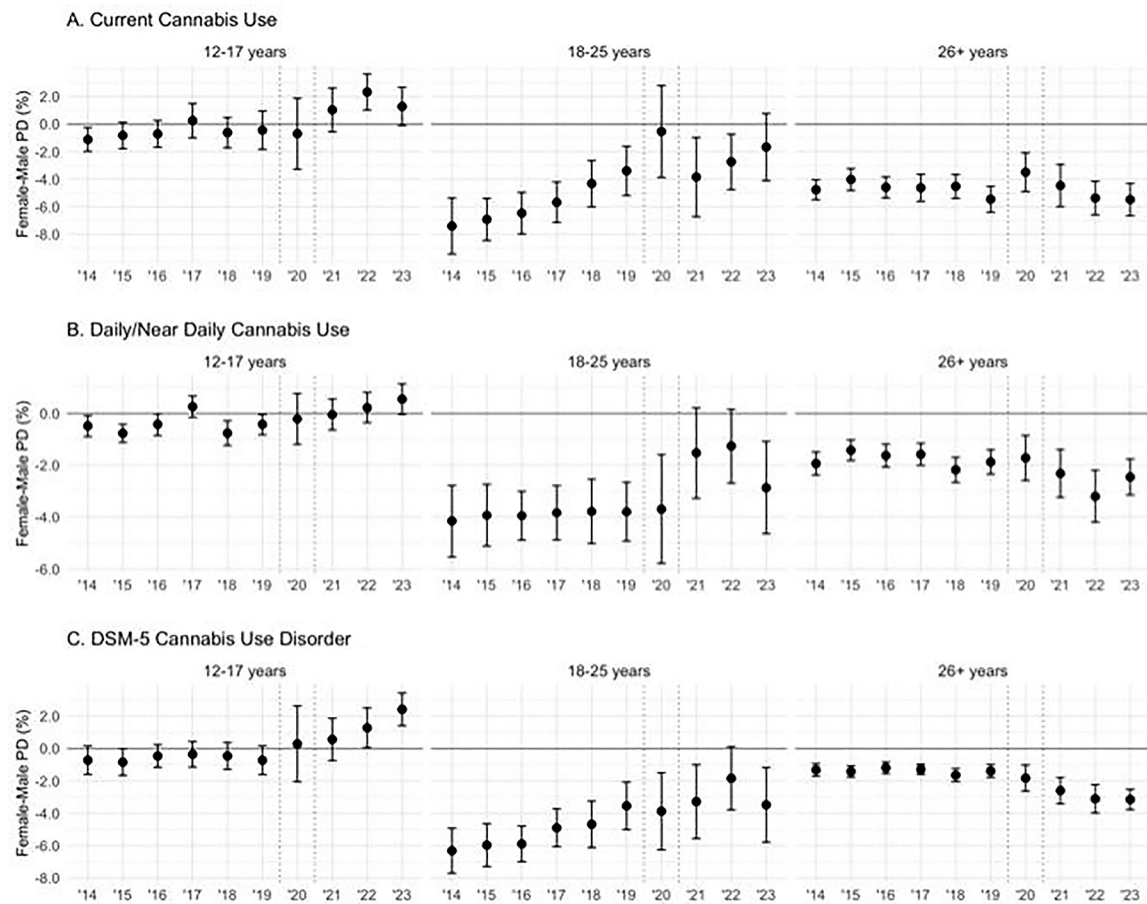


Figure 1. Female-male prevalence differences (PDs) and 95% CIs of (A) past-month cannabis use, (B) past-year daily/near daily cannabis use (300 or more days), and (C) past-year DSM-5 cannabis use disorder by age group, NSDUH 2014–2023

Note: Values above 0 indicate higher female prevalence, values below 0 indicate higher male prevalence, and values at 0 indicate no difference in prevalence. For 2014–2019, a proxy for DSM-5 cannabis use disorder was constructed by mapping DSM-IV items to DSM-5 criteria. Due to changes in survey methodology, data from 2020 should not be compared with data from any other year. Data from 2021–2023 are only comparable with each other.