Gender Compression Over Time in Measures of Cannabis Use by Age and Cohort in the United States

INTRODUCTION

Although there has been extensive research on the effect of gender on cannabis use, we know little about how the relationship between gender and cannabis use has changed by cohort as people age, despite its potential importance for population health. Several studies determined that cannabis use is more common among males than females (ter Bogt et al. 2014; Calakos et al. 2017; Hellemans et al. 2019; Hemsing and Greaves 2020), while others have suggested that this may not be the case among specific populations (Walls 2008). Gender differences have been found with regard to cannabis abuse and dependence or cannabis use disorder (Agrawal and Lynskey 2007; Sherman et al. 2016; Kroon et al. 2023) which suggests that attention to gender may be important when providing services. There is also evidence that females who use cannabis may be more at risk for certain negative outcomes than males (Preston 2006; Schepis et al. 2011; Buu et al. 2014; Calakos et al. 2017). Other studies have examined the impact of gender and cannabis use on specific health or mental health outcomes (McQueeny et al. 2011; Khan et al. 2013; Donoghue et al. 2014) as well as factors that contribute to problematic cannabis use such as social anxiety (Buckner et al. 2012).

However, greater attention to gender remains necessary in substance use research (Greaves and Hemsing 2020). Studies examining the gender gap between men and women in the U.S. have found mixed results, with some suggesting that the gender gap in cannabis consumption is closing (Hemsing and Greaves 2020; Yousufzai et al. 2022) and some suggesting that the gap is widening (Carliner et al. 2017). Thus, while clear differences using various metrics exist between men and women with regard to cannabis use, more research is needed on

cannabis use trends to identify changes over time.

METHODS

Data

We utilized National Survey on Drug Use and Health (NSDUH) data, a national survey of substance use conducted annually by the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA) since 1971. NSDUH represents the primary source of information for substance use prevalence in the U.S. Using a stratified, multistage area probability sampling design to produce representative national data, approximately 70,000 individuals aged 12 and older are surveyed annually. We used each publicly available annual dataset since the survey's redesign in 2002 through 2021, amounting to a total sample size of 1,096,348.

Variables

We analyzed the following measures of cannabis use: (1) whether the respondent ever used cannabis; (2) whether the respondent began using cannabis prior to age 18; (3) whether the respondent used cannabis in the past month; (4) whether the respondent used cannabis daily over the past year; (5) whether the respondent met the definition of cannabis dependence by DSM-IV criteria; and (6) whether the respondent considered smoking cannabis one to two times per week to be of "great risk". Gender includes the categories male and female (although with categories for biological sex, this variable is known as "gender" in the NSDUH). For most cannabis outcomes, age was coded into the following categories that represent the finest classification that the publicly available data contains: 12-13, 14-15, 16-17, 18-20, 21-25, 26-29, 30-34, 35-49, 50-64, and 65+. The youngest and/or oldest groups were removed from some analyses due to low cell counts. Survey year is also used as a variable.

Analysis

For all cannabis measures, we first ran logistic regressions including interactions of gender and year and display marginal predicted probabilities. These models and figures show the gender effect over time without consideration of age or cohort. To demonstrate the effect of age and cohort, we fit separate models for each survey year and include an age by gender interaction, again producing marginal predicted probabilities. For the sake of display and to highlight more long-term shifts, we show figures for 2002, 2011, and 2021 in order to demonstrate the changes over large periods. The measure of cannabis dependence ends in 2020, as the NSDUH switched to the much different DSM-V definition in 2021. The measure of use before age 18 was unavailable in 2002 and 2018. All analyses included the appropriate survey weights to adjust for the stratified sampling and create estimates that are nationally representative. The bars around estimates in figures represent the 95% confidence intervals.

RESULTS

We begin with ever having used cannabis in Figure 1, Panel A. In the first figure, we see that, with the exception of 2020 and 2021, the gender gap in having ever used cannabis is relatively consistent, although with rates increasing for both males and females. Turning to the age effects by year reveals a more nuanced story. In 2001 and 2011, while there are no differences among teenagers, males are more likely to have ever used cannabis across most other ages. However, by 2021, this gap disappears among all ages except those 65 and older. In addition, the marginal point estimate among teenage females now exceeds that of males, although not statistically different. Looking horizontally across years, much of this compression is due to females converging up to male use levels rather than an absolute change in male rates. Figure 1, Panel B shows that the gender gap in those saying they used cannabis prior to age 18 has also closed. We also note the large decline in the proportion for younger age cohorts and rise

for those 50-64. For both of the measures in Figure 1, much of the change in the gender gap represents the movement of cohorts into later ages given that these are lifetime measures. Next, we consider contemporaneous measures.

In Figure 2, Panel A, we see that the teenage compression and higher point estimates for females observed for lifetime use also occurs for past month cannabis use. For this measure, however, males largely remain significantly higher among older age groups in 2021. Still, in the leftmost figure showing only the temporal trend, we see that both genders' rates nearly doubled over time. Figure 2, Panel B shows the proportion using cannabis daily over the past year. The first figure shows dramatic increases over time for both males and females, although with a seemingly consistent gap. Examining the gender effect by year and incorporating age shows that by 2021, there are no longer any significant gaps for any age group except 35-49 year olds. Notably, male teenage use remained relatively stable, with teenage female rates of daily use rising to close the gap with similar point estimates. Among all other age groups except those 65 and older, the rates for both males and females have increased substantially. In the highest use group in 2021 among 26-29 year olds, over 9% of males and 7% of females used cannabis daily.

Figure 3, Panel A shows the trend for cannabis dependence. The temporal only trend shows a consistent gender gap with low prevalence of dependence. Examining by age group shows large gender gaps across 16-17 year olds through 26-29 year olds in 2002. By 2011, these gaps start to close; by 2020, there are no significant gender gaps except again for 35-49 year olds. This compression appears to be due to relatively steady rates of dependence for females and reduced rates of dependence for males amongst teenagers, combined with increased dependence among females in their twenties.

Finally, Figure 3, Panel B considers whether respondents consider smoking cannabis one

to two times per week to be of great risk. Here, there is an overall considerable decrease in the temporal only trend with a statistically significant reduction in the gender gap, decreasing from 15 percentage points to about 6 percentage points. The age group figures confirm this overall decrease in perceptions of great risk and gender compression. Unlike the remaining gap in the overall figure, most age groups experienced complete compression on this measure.

DISCUSSION

By paying specific attention to changes by age and cohort over time in a nationally representative sample in the U.S., we show how there has been substantial gender compression across nearly every metric of cannabis use – a conclusion that can be overlooked if simply looking at the trend over time without respect to age and cohort. While this compression over time is especially pronounced in adolescence and early adulthood, some degree of compression has occurred across all ages as cohorts progress. Our results suggest that some of the increase in indicators of cannabis use may be due to females converging on male rates of use rather than increases among males. The measure of great risk demonstrates that opinions on cannabis use have undoubtedly shifted.

The degree to which such perceptions are driven by factors such as cannabis policy change, and how policy and perceptions may underly the compression noted in indicators of use should be considered in future research. That is, formal social control through criminalization may act more on the behavior and perceptions of females than males. Nonetheless, we do not argue that such compression is grounds for reversal of cannabis liberalization. Rather, the degree of gender compression underscores that prevention and intervention efforts should incorporate gender-specific needs in the interest of improving population health. For example, the rise in use,

especially daily use, among females of childbearing age warrants consideration of tailored prevention strategies for those who are or may become pregnant.

There are also positive findings in our results. Specifically, teenage cannabis use has not risen to the degree as use in adulthood, and more recent cohorts of teenagers appear to be waiting until adulthood to use cannabis. While perhaps surprising given policy changes, if strategies for adolescent prevention continue to be successful, there will potentially be long-term age and gender reductions as these more recent cohort age into adulthood, as adolescent use is a strong predictor of later use of both cannabis and other substances.

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Figure 1: Marginal Predicted Probabilities of (A) Ever Used Cannabis and (B) Cannabis Use Before Age 18

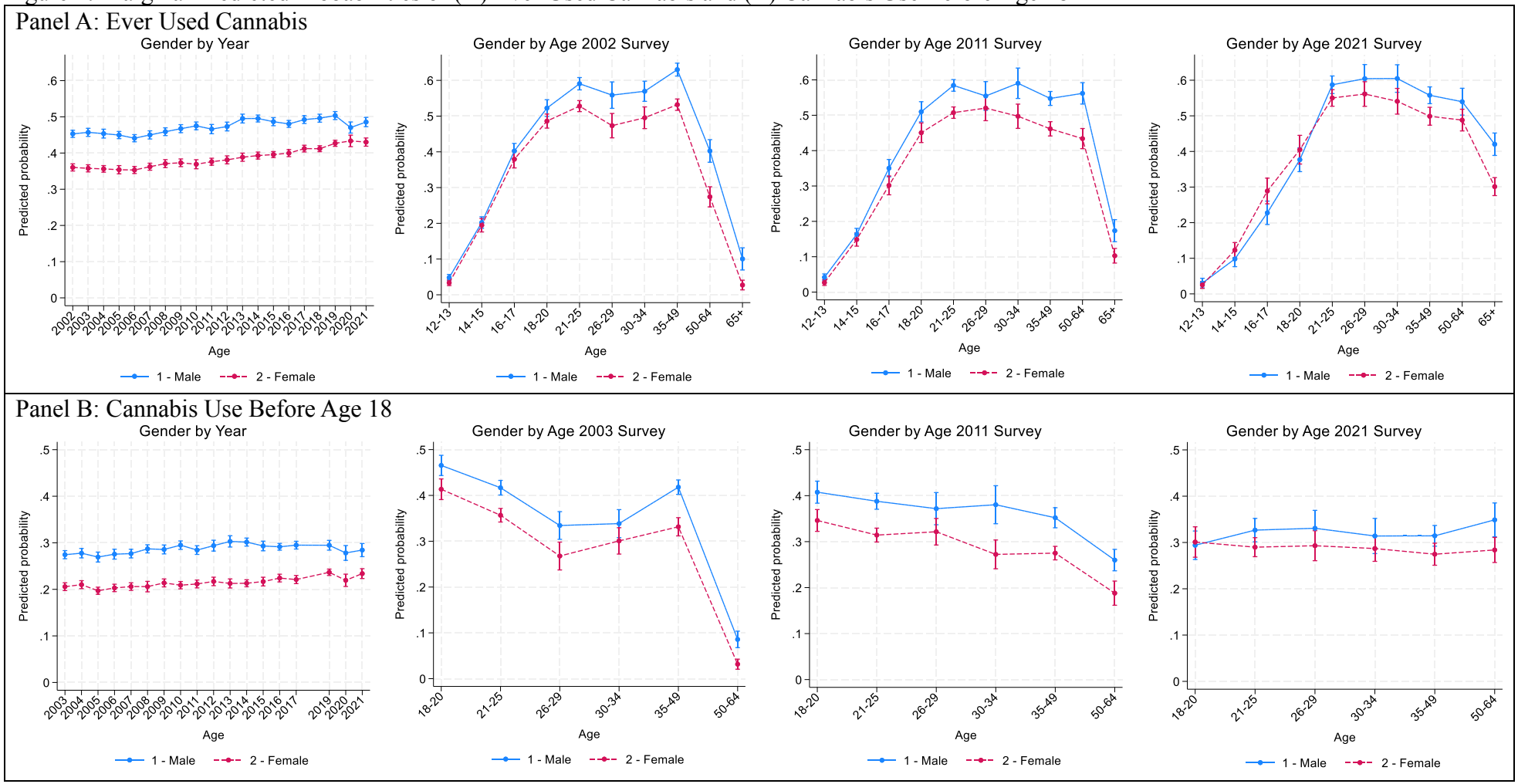

Figure 2: Marginal Predicted Probabilities of (A) Past Month Cannabis Use and (B) Past Year Daily Cannabis Use

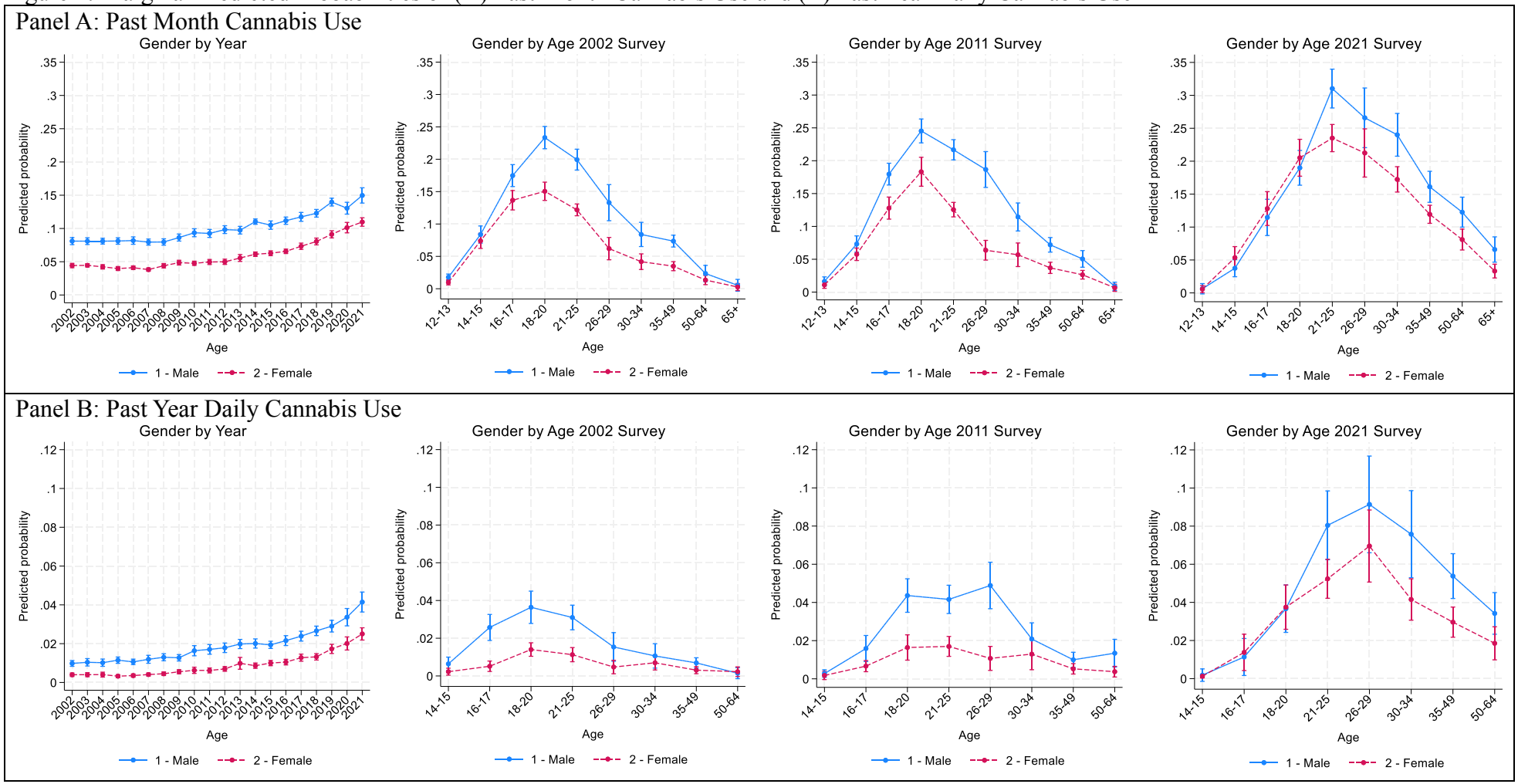

Figure 3: Marginal Predicted Probabilities of (A) Cannabis Dependence and (B) Cannabis Smoking One to Two Times Per Week of Great Risk