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Article

Demographic trends of alcohol and marijuana co-use: examining age, gender, and race/ethnicity trends

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SUMMARY

Substance use and abuse are critical public health concerns affecting diverse communities. This study examined how demographic factors—particularly race/ethnicity, age, and gender—relate to co-occurring patterns of substance consumption, with particular attention to alcohol and marijuana use. We hypothesized that certain demographic factors, such as age, can be significant predictors of substance use patterns. Drawing on information gathered by the National Survey on Drug Use and Health (NSDUH) spanning 2012 to 2022, we conducted statistical analyses to investigate our hypothesis. Our results indicate that young adults (18–25) show the highest prevalence of alcohol and marijuana co-use, with significant differences across gender and racial groups. Our logistic regression analysis also revealed significant demographic differences across groups. Individuals aged 26–34 and 35+ had significantly higher odds of substance use compared with adolescents. We also observed racial and ethnic differences, with White and Native Hawaiian/Pacific Islander respondents showing significantly higher odds of substance use compared with Asian respondents, who had the lowest prevalence. These findings emphasize the need for targeted prevention strategies for specific demographic groups.

INTRODUCTION

Substance use and abuse are pressing public health concerns impacting individuals and communities across demographic groups, as approximately 61.4 million people aged 12 or older reported using illicit drugs in the past year, representing about 21.9% of the U.S. population (1). The consumption of alcohol, marijuana, or other drugs is referred to as substance use, which sometimes leads to misuse or substance use disorders (SUDs) (2). In contrast, substance abuse is typically characterized by frequent or excessive consumption that impairs mental and physical health, relationships, or work performance (3). Patterns of excessive use, like weekly binge drinking or frequent marijuana use, are often signs of a shift from occasional use to abuse (1).

Substance abuse is particularly concerning due to the severe health complications it can cause. Co-occurring substance use, when individuals use multiple drugs simultaneously, exacerbates health risks, increasing the likelihood of addiction and raising the risk for complications such as liver disease, cardiovascular issues, mental health disorders, and overdose (4). It can also lead to heightened toxicity and more severe effects on the brain and other vital organs (5). The prevalence of co-occurring substance use has been rising in recent years, reflecting a concerning trend (6). According to recent National Survey on Drug Use and Health (NSDUH) data, approximately 20% of individuals with substance use disorders report using more than one substance, with alcohol and marijuana being among the most frequently co-used drugs (3). This pattern is partly driven by the combined effects of substances; for example, individuals may mix substances like alcohol and marijuana to enhance euphoria or to counterbalance the effects of one drug with another (7). However, this behavior increases the risk of abuse, as using substances together can create stronger dependencies and amplify withdrawal symptoms (8).

Substance use patterns differ widely across populations. They are influenced by variables like race/ethnicity, age, and gender, all of which shape behavioral tendencies, social vulnerabilities, and access to support networks (1). Furthermore, studies suggest that substance use prevalence varies significantly across racial groups (9). For instance, research has shown that Native American populations report the highest levels of substance use, including alcohol and marijuana, followed by White and Black populations, with lower prevalence rates observed among Asian Americans and Hispanic groups (10). Research indicates that younger people, especially adolescents and young adults, are more inclined to experiment with substances, whereas older individuals may engage in use driven by health or stress-related issues (4, 6). Gender also influences usage trends, with males typically reporting greater consumption of alcohol and marijuana compared to females (11). Gaining a clear understanding of demographic variations is crucial to designing targeted and effective prevention and intervention approaches.

However, existing studies often fall short in capturing the full complexity of substance use across intersecting demographics. For instance, a previous study primarily examines alcohol and marijuana use but does not fully explore the concurrent use of these substances or how factors such as socioeconomic status intersect with gender and age to impact substance use patterns (6). Similarly, researchers have explored gender differences but do not account for cultural influences or structural inequalities that may affect substance use among different racial or ethnic groups (12). Researchers focused on racial and ethnic disparities in adolescent substance-related disorders, but their work did not evaluate co-use patterns across adulthood or consider age-by-gender interaction effects (8). Studies such as the Surgeon General's Report, Facing Addiction in America, provide comprehensive national prevalence data but do not model demographic

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predictors simultaneously within multivariate frameworks (11). By focusing on narrow demographics or single substances, these studies risk missing broader interactions between demographic factors and substance use patterns.

By addressing demographic-specific factors, this study aimed to shed light on the co-use patterns in which these subgroups engage and provide insights for more targeted public health interventions. This research sets out to fill existing knowledge gaps by investigating the influence of age, gender, and race/ethnicity on patterns of co-occurring substance use. Although broader structural factors such as socioeconomic status were beyond the scope of the present analysis, this study advances understanding by modeling intersecting demographic influences on co-occurring alcohol and marijuana use across a nationally representative sample. Using data from the NSDUH spanning 2012–2022, this research examined demographic predictors of alcohol and marijuana use, highlighting variations across groups and identifying high-risk profiles. NSDUH delivers detailed demographic information and spans a wide range of substance use behaviors, making it a strong source for studying links between demographic variables and substance use patterns. We hypothesized that gender, age, and race/ethnicity are significant predictors of alcohol and marijuana use, with each demographic factor independently contributing to substance use patterns. This research aimed to provide a more detailed perspective on how demographic characteristics—particularly race/ethnicity, age, and gender—are linked to substance use behaviors, including cases involving co-use. Consistent with our hypothesis, age, gender, and race/ethnicity emerged as significant predictors of alcohol and marijuana co-use in multivariate analyses. In particular, co-use was most elevated among young adults, while patterns also varied across racial/ethnic groups and gender categories. These findings highlight the need for prevention efforts that are targeted toward demographic groups with higher observed risk rather than broad, one-size-fits-all interventions.

RESULTS

We obtained data on alcohol and marijuana use across various demographics from the NSDUH (1). We then used logistic regression and prevalence analysis to determine if age, gender, or race/ethnicity were predictors of alcohol and marijuana use. Additionally, we conducted logistic regression to evaluate the extent to which age and race/ethnicity predicted the likelihood of past-year co-use.

Using adolescents aged 12–17 as the reference category, age emerged as a strong and significant predictor of co-use (**Table 1**). Compared to adolescents, individuals aged 18–25 did not differ significantly in their likelihood of use (B = 0.074, p = 0.614, OR = 1.077; **Table 1**). Adults aged 26–34, however, were significantly more likely to report substance use (B =

Statistic	B	S.E.	Wald	df	Sig.	Exp(B)
Age: 12–17	-	-	113.435	4	<0.001	-
Age: 18–25	0.074	0.146	0.255	1	0.614	1.077
Age: 26–34	0.916	0.117	60.862	1	<0.001	2.499
Age: 35+	0.572	0.119	23.124	1	<0.001	1.771
Race/Ethnicity: White	0.286	0.064	19.566	1	<0.001	1.331
Race/Ethnicity: Black or African American	0.023	0.175	0.017	1	0.897	1.023
Race/Ethnicity: Hispanic	0.307	0.331	0.331	1	0.353	1.36
Race/Ethnicity: Asian	-7.48	0.398	19.581	1	<0.001	0.473
Race/Ethnicity: NH/PI	0.273	0.098	7.79	1	0.005	1.313
Race/Ethnicity: Other/Mixed Races	0.017	0.061	0.081	1	0.775	1.018
Constant	-38.112	280.16	0.019	1	0.892	0

Table 1. Variables in logistic regression. This table presents logistic regression results for factors associated with the co-use of marijuana and alcohol. Age, past-year substance use, and race/ethnicity were included as predictors. Missing values indicate reference groups. B = unstandardized coefficient; S.E. = standard error; Wald = Wald chi-square test statistic; df = degrees of freedom; Sig. = significance level; Exp(B) = odds ratio. RC = reference category.

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Demographic Group	Alcohol – Past Year Use (%)	Marijuana – Past Year Use (%)
Age: 12–17	17.8	12.8
Age: 18–25	66	37.1
Age: 26–34	75.1	33.7
Age: 35+	67.8	20.8
Gender: Male	56.9	25.6
Gender: Female	59.5	24.8
Race/Ethnicity: White	65.1	26.6
Race/Ethnicity: Black/African American	49.8	26.6
Race/Ethnicity: NA/AN	38.9	27.9
Race/Ethnicity: Asian	46.9	11.4
Race/Ethnicity: NH/PI	42.2	20.7
Race/Ethnicity: Hispanic	51.3	21.9

Table 2. Past-year alcohol and marijuana use by demographic group. This table presents past-year alcohol and marijuana use percentages across age, gender, and racial/ethnic groups. These descriptive statistics highlight demographic patterns in substance use prevalence. NH/PI = Native Hawaiian or Pacific Islander; NA/AN = Native American or Alaska Native.

0.916, $p < 0.001$, $OR = 2.499$; **Table 1**). Those aged 35 and older also demonstrated significantly higher odds of use relative to adolescents ($B = 0.572$, $p < 0.001$; $OR = 1.771$).

Race and ethnicity also contributed meaningful predictive value to alcohol and marijuana use (**Table 1**). Using Asian respondents as the reference group (because their B coefficient was negative and highly significant), several racial groups showed significantly different likelihood of substance use. White participants ($B = 0.286$, $p < 0.001$, $OR = 1.331$) were significantly more likely to use marijuana and alcohol compared to Asians ($B = 0.286$, $p < 0.001$; **Table 1**), indicating 33% greater odds. Black or African American ($B = 0.023$, $p = 0.897$, $OR = 1.023$) individuals did not differ significantly from Asians (**Table 1**). Hispanic participants also did not differ significantly from the Asian reference group ($B = 0.307$, $p = 0.353$; $OR = 1.360$; **Table 1**). Native Hawaiian/Pacific Islander participants showed significantly higher odds of use ($B = 0.273$, $p = 0.005$; $OR = 1.313$; **Table 1**), meaning they were about 31% more likely to engage in substance use compared to Asians. Those categorized as "Other or Mixed Race" did not significantly differ from Asians ($B = 0.017$, $p = 0.775$; $OR = 1.018$; **Table 1**). Finally, the constant term was not statistically significant ($B = –38.112$, $p = 0.892$; **Table 1**), which is typical for models with categorical predictors and does not affect interpretation of the individual predictors.

Our prevalence analysis revealed significant associations between demographic variables and individual substance use outcomes. Age group was significantly related to both past-year alcohol and past-year marijuana use. Adolescents (12–17) had the lowest rates of alcohol (17.8%) and marijuana (12.8%) consumption, while the highest rate was observed among young adults aged 18–25 (66.0% for alcohol and 37.1% for marijuana) (**Table 2**). Gender differences were also significant, although the direction differed from expected patterns; females reported slightly higher rates of alcohol use compared to males (59.5% *vs.* 56.9%), whereas males showed marginally higher rates of marijuana use than females (25.6% *vs.* 24.8%) (**Table 2**). Racial/ethnic disparities were also evident, with White participants showing the highest prevalence of alcohol use (65.1%) (**Table 2**). Meanwhile, marijuana use was highest among Black (26.6%) and Native American/Alaska Native (27.9%) participants, and Asian Americans had the lowest rates for both alcohol (46.9%) and marijuana use (11.4%) (**Table 2**).

We tested longitudinal trends from 2012 to 2022 of alcohol and marijuana co-use to evaluate whether prevalence patterns have shifted over time, particularly in the context of increasing marijuana legalization, evolving social norms, and changing public perceptions of substance use during the past decade. The frequency of co-use exhibited year-to-year fluctuations, with percentages shifting between a low of 4.4% in 2015 and a peak of 5.7% by 2022 (**Figure 1**). A notable increase was observed after 2018, with consistent growth through 2022 (**Figure 1**). This suggests a gradual rise in the prevalence of marijuana and alcohol co-use since 2016, following a period of relative stability in earlier years.

We then examined the breakdown of racial representation in co-use. White individuals had the highest co-use percentage (45.2%), followed by Hispanic individuals (18.6%), the Asian subgroup (17.3%), and Other/Mixed Races (16.5%). In contrast, Black or African American individuals (1.4%) and Native Hawaiian or Other Pacific Islander individuals (1.0%) had notably lower co-usage percentages (**Figure 2A**). Age-related prevalence increased from adolescents

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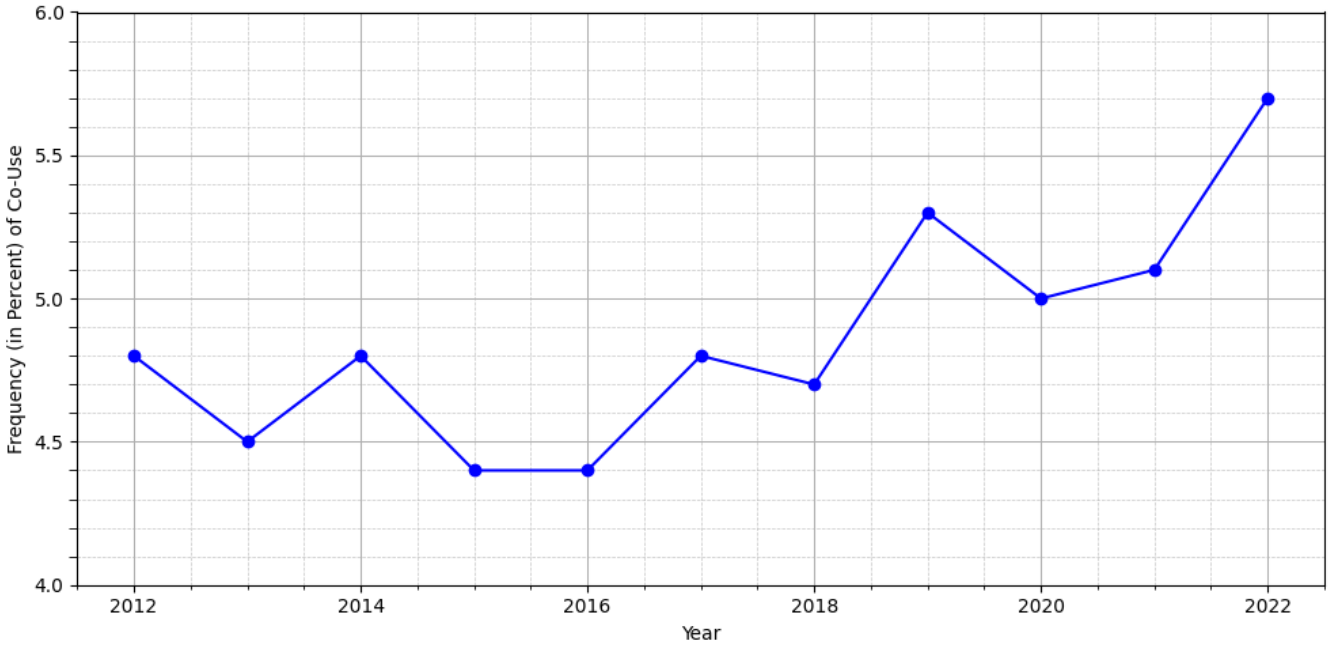

Figure 1. The trend in marijuana and alcohol co-use from 2012–2022. Line graph showing the percentage of National Survey on Drug Use and Health (NSDUH) respondents reporting concurrent marijuana and alcohol use from 2012 to 2022. Data points represent annual frequencies of co-use. The Y-axis indicates the percentage of co-users, ranging from 4.4% (lowest in 2015) to 5.7% (highest in 2022). Axes are labeled with increments of 0.5 for clarity.

(12–17 years, 16.4%) to young adults (18–25 years, 38.1%), then declined among adults (26–34 years, 28%), and older adults (35+ years, 17.6%) (**Figure 2B**). Gender difference was also observed: females (66.4%) exhibiting higher prevalence than males (33.6%) (**Figure 2C**). Although we reported the distribution of demographics among individuals who reported co-use, these percentages primarily reflect the underlying demographic composition of the NSDUH sample rather than true differences in risk. Because groups that are more represented in the dataset naturally contribute to a larger share of co-users, raw percentages alone may not meaningful indicators of which racial or ethnic groups are more likely to engage in co-use. Therefore, our logistic regression provided valuable insights into the significance of the predictors.

DISCUSSION

The purpose of this study was to examine whether age and race/ethnicity predict past-year alcohol and marijuana co-use

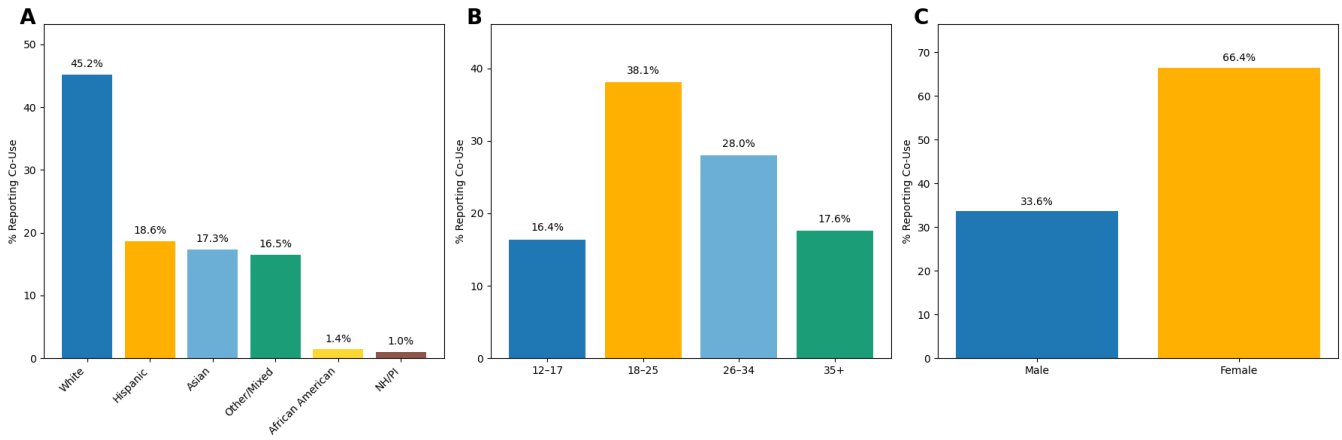

Figure 2. Co-Use of alcohol and marijuana by race/ethnicity/gender/age. Three-panel figure displaying estimated prevalence of marijuana–alcohol co-use across demographic groups. A) Racial and ethnic disparities: White individuals had the highest co-use percentage (45.2%), followed by Hispanic individuals (18.6%), Asian individuals (17.3%), and Other/Mixed Races (16.5%). Black or African American individuals (1.4%) and Native Hawaiian or Other Pacific Islander (NH/PI) individuals (1.0%) had the lowest contributions. B) Age-related prevalence, increasing from adolescents (12–17 years, 16.4%) to young adults (18–25 years, 38.1%), adults (26–34 years, 28%), and older adults (35+ years, 17.6%). C) Gender differences, with females (66.4%) exhibiting higher prevalence than males (33.6%). Percentages were determined from NSDUH data collected between 2012 and 2022.

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using NSDUH data from 2012–2022. Overall, demographic factors significantly predicted co-use patterns, with age emerging as the strongest predictor. The final regression model explained a substantial proportion of the variance in substance use outcomes, with demographic factors including age and race/ethnicity, collectively accounting for a significant portion of observed differences. Key findings highlight the strong influence of age, with young adults being at the highest risk for both alcohol and marijuana use, as well as significant disparities across gender and racial/ethnic groups. Young adults are a particularly important group to target for inventions because early substance use can contribute to prolonged usage, raise the likelihood of addiction, and increase the chances of transitioning to other substances (4). Results highlight several significant trends, some of which confirm prior literature, showing that young adults are more prone to risk-taking behaviors, peer influence, and transitional life stressors, all of which contribute to increased substance use, and others that extend knowledge in new ways on co-occurring substance use behaviors. These patterns underscore how crucial it is to implement focused interventions aimed at reducing alcohol and marijuana co-use among high-risk populations. The results are consistent with earlier studies indicating young adults are especially vulnerable to peer pressure, life changes, and risk-taking tendencies (13). By providing a comprehensive view of how demographic factors interact with substance use patterns, this study contributes valuable insights into the need for targeted public health strategies to reduce substance use.

We also observed gender-based differences in the prevalence analysis. In the descriptive results, females showed slightly higher past-year alcohol use than males, while males showed slightly higher past-year marijuana use than females (**Table 2**). In the co-use prevalence analysis, females also represented a higher proportion of alcohol and marijuana co-use than males (**Figure 2C**). These findings suggest that gender-related patterns may differ depending on whether substance use is examined as alcohol use, marijuana use, or co-use. Women show other risks, such as the trend of increasing alcohol consumption with age, and they are more vulnerable to mental health disorders related to substance use (14). These gender-specific trends suggest that interventions should be tailored to address both biological and social differences in substance use between women and men.

Increased prevalence in the co-occurring use of alcohol and marijuana presents significant public health risks. Co-use habits are linked to higher levels of toxicity, dependence, and even chronic mental and physical health issues (15). One of the most alarming consequences of alcohol and marijuana co-use is the increased toxicity and risk of overdose. Together, these drugs intensify their effects, impairing motor abilities, slowing reaction times, and increasing the likelihood of accidents, especially auto accidents (1, 16). Additionally, the medical complication of co-use includes Cannabinoid hyperemesis syndrome (CHS) which can result in severe dehydration and necessitate medical attention (17). Furthermore, the relaxing effects of marijuana might conceal the signs of excessive alcohol use, thus raising the risk of alcohol poisoning (18). Because of the combined effects, this can result in higher cognitive deficits, including decreased memory and concentration, as well as increased risks of addiction (6). Physical health hazards like liver damage, cardiovascular strain, and respiratory problems are also more likely with co-use; mental health issues like anxiety and depression may also worsen (6). Therefore, age-appropriate, gender-sensitive, and culturally competent public health initiatives are needed to raise awareness about the dangers of co-use and to implement harm reduction measures that reduce related health and safety risks.

Although the study offers important insights into alcohol and marijuana co-use, it is not without limitations. Due to the cross-sectional nature of NSDUH data, we cannot infer causality or temporal relationships between demographic factors and substance use behaviors. Relying on self-reported data from NSDUH can also introduce response bias, which has the potential to result in over- or under-estimation of substance use behavior. The study's scope was also limited to alcohol and marijuana, excluding other substances that may contribute to co-occurring patterns. Native American respondents could not be analyzed separately because of sample size limitations within the publicly available dataset. To build on these findings, future research should include a wider variety of substances and examine the impact of socioeconomic and mental health factors. Investigating emerging trends, such as the effects of marijuana legalization and its interaction with alcohol use, could further inform policy and intervention strategies. For instance, culturally-competent education campaigns may reduce how frequently substance use occurs among high-risk racial and ethnic groups, while age-appropriate prevention strategies for young adults may focus on various developmental and social factors affecting their substance-use behaviors (19). This study underscores the importance of targeted public health approaches for high-risk groups. Gender-sensitive interventions that consider biological and social disparities may also enhance public health responses, and gender transformative interventions can alter gender norms contributing to substance use, especially for males (20). Policymakers and healthcare providers should use evidence-based approaches to regulate substance use and promote well-being across diverse populations. By identifying demographic patterns in the co-use of marijuana and alcohol, our study underscores the need for policymakers and healthcare providers to use evidence-based approaches to regulate substance use and promote well-being across diverse populations.

MATERIALS AND METHODS

This study used data collected from the National Survey on Drug Use and Health (NSDUH), a comprehensive and nationally representative dataset that focuses on substance use and related health behaviors among residents of the U.S. (3). Data from various survey years (2012–2022) were combined to boost sample size and improve the reliability of the findings.

Participants in the sample were 12 years of age or older, and the data included demographic details such as age, gender, and racial/ethnic background. Participants were grouped by categories including age (e.g., 12–17, 18–25, 26–34, 35+), gender (male, female), and race/ethnicity (e.g.,

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White, Black or African American, Hispanic, Asian, Native Hawaiian or Other Pacific Islander, Other/Mixed Races).

To analyze trends in the co-use of marijuana and alcohol, data spanning the years 2012 to 2022 were collected. The primary outcome variables included whether participants had used alcohol or marijuana within the past year. Both of these outcomes were dichotomously coded (1 = use within the past year, 0 = no use during the past year). Key independent variables included age (categorized into specific age groups), gender (male, female), and race/ethnicity

To analyze the data, both prevalence analysis and logistic regression were used to explore relationships and estimate the probability of substance use based on demographic characteristics. Statistical analysis for independence helped determine initial links between categorical demographic variables (age, gender, and race/ethnicity) and substance use outcomes. Logistic regression models were then applied to calculate the odds of past-year alcohol use, as well as marijuana use, with demographic variables serving as predictors. The model used race/ethnicity to evaluate how these factors influenced substance use patterns. Odds ratios (Exp(B)) and p-values were used to assess both the strength and statistical significance of these associations.

All analyses were conducted using Statistical Package for Social Sciences (SPSS) software, with significance levels set at $p < 0.05$ for initial analyses and $p < 0.001$ for key variables in the regression models to account for potential multiple testing issues (21). Variables with a Wald statistic that did not reach significance were removed in a stepwise manner, allowing the model to focus on the most predictive factors.

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