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Substance Use Patterns and Characteristics Using Real World Data from Adolescents Assessed for Substance Use and Treatment Planning-United States, 2017–2021

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Abstract

Background: Although substance use rates among adolescents have decreased, drug overdose deaths among adolescents have increased since 2020, driven largely by illegally made fentanyl (IMF). This study explores substance use patterns and characteristics of adolescents who were assessed for substance use disorder (SUD) treatment to inform prevention and response strategies.

Methods: A convenience sample of adolescents aged 10–18 years assessed for SUD treatment from September 2017 to December 2021 was analyzed using the Comprehensive Health Assessment for Teens. The percentage of lifetime and past 30-day substance use was examined. Adolescent characteristics (e.g., demographics, history of overdoses or hospital visits due to drug/alcohol use) were analyzed by lifetime substances used.

Results: Among 5,377 assessments, most were male (58.7%), aged 16–18 years (50.5%), non-Hispanic White (43.1%), enrolled in school (87.3%), and living with their parent(s) (72.4%). The most commonly reported lifetime substances used were marijuana (68.0%), alcohol (54.2%), and prescription opioid misuse (13.6%). The most common past 30-day substance use combination was alcohol and marijuana (35.6%). The percentage of assessments indicating past-year overdoses

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Authors' Contribution

Xinyi Jiang came up with the initial study idea, conducted the study design, analysis, and manuscript drafting. Gery P. Guy Jr. developed the research design, provided subject matter expertise, assisted in data preparation, reviewed/revised the manuscript, and interpreted the results. Kristine Schmit provided subject matter expertise, reviewed/revised the manuscript, and interpreted the results. Brooke Hoots provided subject matter expertise, developed the research design, reviewed/revised the manuscript, and interpreted the results. Douglas R. Roehler provided subject matter expertise, developed the research design, reviewed/revised the manuscript, and interpreted the results. Taryn Dailey Govoni provided subject matter expertise, developed the research design, reviewed/revised the manuscript, and interpreted the results. Vanessa Mallory provided subject matter expertise, reviewed/revised the manuscript and interpreted the results. Jody L. Green provided subject matter expertise, developed the research design, reviewed/revised the manuscript, and interpreted the results. All authors have contributed to and approved the finial manuscript.

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Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

or hospital visits due to drug/alcohol use was greatest among those who reported lifetime use of IMF (24.0%), followed by heroin (21.4%) and cocaine (15.3%). Overall, 2.3% reported lifetime IMF use and 0.6% thought IMF was causing them the most problems.

Conclusions: Findings inform opportunities to address substance use and increased IMF-involved overdose among adolescents. Continued overdose prevention and response strategies such as evidence-based education campaigns, naloxone distribution and harm reduction efforts, and evidence-based SUD treatment expansion are needed.

Keywords

Adolescents; substance use; overdose; illegally made fentanyl; cannabis; alcohol

Introduction

Drug overdose deaths continue to increase, negatively affecting communities throughout the United States. This rise in drug overdose deaths has increasingly been driven by synthetic opioids such as illegally made fentanyl and fentanyl analogs (referred to as IMF hereafter), particularly since 2013 (CDC, 2023a). In 2021, 106,699 drug overdose deaths occurred, a 14% increase in the age-adjusted rate from 2020 (Spencer et al., 2022). Adolescents are among those impacted by this overdose crisis. Overdose deaths increased 94% from 2019 to 2020 among adolescents, and 20% from 2020 to 2021, a greater increase than observed among the overall population (Friedman et al., 2022). In 2021, 77% of overdose deaths among adolescents involved IMF, mirroring the rapid proliferation of IMF into the illicit drug supply (DEA, 2022a; Friedman et al., 2022; Jiang et al., 2021).

Although there is no standard defined age range, adolescence is the phase of life between childhood and adulthood and is frequently a period of engaging in risky behaviors such as substance use (Sawyer et al., 2018; Frey and Roxanne, 2020; Simon et al., 2022; WHO, 2024). While adolescent substance use is of particular concern during the ongoing opioid epidemic, it is also associated with negative consequences such as delinquency, academic underachievement, sexual risk behaviors, sexually transmitted diseases, experiencing violence, injuries, and mental health conditions (Clayton et al., 2019; CDC, 2023b; DuPont et al., 2018; Nelson et al., 2017; Steinberg, 2007). Although adolescent substance use rates have stayed level or even decreased nationally (Miech et al., 2023), surveillance data show that substance use remains common among adolescents (CDC, 2023b). Among high school students, approximately 23% reported current alcohol use, 16% reported current marijuana use, and 12% reported lifetime prescription opioid misuse in 2021 (CDC, 2023b). Initiating substance use during adolescence could increase the risk of substance use later in adulthood and increase the risk of a substance use disorder (SUD) (Grant & Dawson, 1998; Kehinde et al., 2019; Luciana & Ewing, 2015).

Although prior research has examined patterns in substance use among specific adolescent populations (e.g., secondary or high school students, adolescents aged 12–17 years, students at risk of dropping out of school, and street-living, homeless adolescents in SUD treatment) including analyses by demographic factors (Rainone, 1993; Smart & Ogborne, 1994; Jones et al., 2020; SAMHSA, 2022a; Miech et al., 2023; Hoots et al., 2023), little

research has focused on recent substance use patterns including IMF among adolescents assessed for SUD treatment in the United States. Assessment of adolescents' substance use to facilitate early intervention and access to evidence-based SUD treatment such as buprenorphine is a comprehensive public health approach to delivering care and could reduce their risk of overdose and overdose death (Thoele et al., 2021; Terranella et al., 2024). Although prior research used validated screening instruments for adolescent SUD treatment planning (Sterling et al., 2015; Levy et al., 2016; Thoele et al., 2021; NIDA, 2023), these instruments did not capture specific substances or medications beyond a drug class due to the intentional brevity of screening. To improve the understanding of substance use patterns and characteristics among adolescents assessed for SUD treatment reporting lifetime substance use, particularly IMF, this study focused on real world data derived from the National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT) between September 2017 and December 2021 and aimed to examine (1) patterns in lifetime substance use by substance overall and by demographic characteristics, (2) frequency of overdoses or hospital visits due to drug/alcohol use, (3) frequency of substances reported as causing the most problems, (4) frequency of substances reported as preferred substances, and (5) patterns in past 30-day substance use and substance use combinations.

Methods

Data

The NAVIPPRO CHAT is a validated, computer-delivered, self-administered substance use assessment which captures real world data on a convenience sample of geographically diverse adolescents assessed for substance use problems for clinical treatment planning and triage purposes in the United States (Lord et al., 2011; Vosburg et al., 2021). Assessment sites administering the CHAT assessment tools included residential/inpatient programs, outpatient programs, methadone maintenance programs, buprenorphine/naloxone programs, school-based programs*, medical-based programs, criminal justice programs, drug courts, welfare programs, national guard and reserve initiatives, homeless services and other programs. Adolescents who came into the assessment site and were assessed for SUD treatment were administered the CHAT assessment as part of a standard intake process (Vosburg et al., 2021). The assessment sites and clinicians administrating the CHAT had to comply with state, local, and federal laws pertaining to assessment and treatment of minors, including those pertaining to consent of parents/guardians. CHAT collects extensive information on each adolescent primarily for clinical purpose†, including data on demographics, physical health, legal issues, employment status, and biopsychosocial content areas including emotional/psychological health, family relationships, friend/peer

*School-based programs administer the CHAT assessment to students on an as-needed basis (i.e., if SUD treatment and treatment planning is indicated); this does not mean that every student coming into a participating assessment site's nurse's office is assessed with the CHAT. The CHAT is utilized in school programs among at-risk students.

†CHAT data are collected primarily for clinical purposes. Adolescents who complete a CHAT are assigned the assessment by their clinician to guide their treatment planning. The CHAT was not intended for research purposes, and the administration of CHAT assessments to adolescents is not for research purposes. Any analysis conducted using CHAT data constitutes secondary research of real world data. Once adolescents complete the CHAT assessment, their data is de-identified and electronically uploaded to a central server where it is available for analysis.

relationships, alcohol use, tobacco use, and drug use (Lord et al., 2011; Vosburg et al., 2021). Questions regarding IMF use were added to CHAT on September 17, 2017. Thus, our study period covers September 17, 2017, through December 31, 2021.

Based on responses to the targeted questions, CHAT calculates past 30-day composite scores for the above six biopsychosocial content areas. These scores help clinicians better understand a patient's history and the need for assistance across each of these areas. Interpretation of composite scores are as follows: 0–47, within normal range; 48–49, possible risk; 50–59, slight problem; 60–69, moderate problem; 70–79, considerable problem; and >79, extreme problem.[§] A composite score of ≥60 is considered moderate to extremely severe and is indicative of a need for treatment or greater assistance in that content area, while a composite score of 0–59 is considered less severe, where the treatment is not indicated or probably not necessary (Lord et al., 2011; Vosburg et al., 2021). More information about CHAT (such as the reliability and validity of the CHAT assessment) has been documented elsewhere (Lord et al., 2011).

Study design

This cross-sectional study includes a convenience sample of US adolescents aged 10–18 years assessed for SUD treatment. Adolescents could be assessed at multiple times throughout the study period. To capture comprehensive information related to adolescent substance use, increase the study sample size, and maintain consistency with previous papers using the NAVIPPRO dataset (Jiang et al., 2021; Kacha-Ochana et al., 2022; Pickens et al., 2023; Jiang et al., 2024), this study regarded each assessment as the unit of analysis.

The following ten categories of lifetime substance use were analyzed: (1) IMF (The definition of IMF in the CHAT was "Street fentanyl (illegal fentanyl, carfentanil-sometimes combined with other drugs such as heroin or cocaine)"), (2) heroin, (3) prescription opioid misuse (including but not limited to Oxycontin, Vicodin, and Percocet), (4) marijuana, (5) alcohol, (6) prescription sedative or tranquilizer misuse (including but not limited to Valium, Xanax, and Klonopin), (7) prescription stimulant misuse (including but not limited to Ritalin, Adderall, and Dexedrine), (8) methamphetamine, (9) cocaine, and (10) no reported substances. Prescription drug misuse (i.e., misuse of prescription opioids, stimulants, sedatives, or tranquilizers) is defined as using prescription drugs not as prescribed, or to get high (Vosburg et al., 2021).

We calculated the percentage of adolescents reporting each category of lifetime substance use overall and by demographic characteristics (e.g., sex, age, race/ethnicity, current living situation, school status, medical history, and history of criminal justice involvement[¶]) among all assessments. We analyzed lifetime substance use by composite scores on the six biopsychosocial content areas. We also examined the percentage of adolescents reporting past-year and past 30-day overdose or hospital visit due to drug/alcohol use within each category of substance use over the lifetime among all assessments.

[§]In this analysis, the range of composite scores for emotional/psychological health was 41 to 95, for family relationships was 41 to 90, for friend/peer relationships was 37 to 158, for alcohol use was 46 to 242, for tobacco use was 46 to 89, and for drug use was 47 to 103. There is no definition of "problem" in the CHAT data.

[¶]History of criminal justice involvement is defined as individuals reported that they have ever been in trouble with the law or arrested.

We examined the percentage of substances that adolescents reported caused the most problems**for them, and the percentage of substances that adolescents reported as their preferred substances (up to three substances could be selected as the preferred substances) [††] among all assessments. The choice of substances included the first nine substance categories above as well as: cough sirups, hallucinogens, inhalants, ecstasy, methadone or buprenorphine, phencyclidine or ketamine, Gamma-Hydroxybutyric acid or Rohypnol, and some other substance.[§§] Finally, past 30-day substance use and substance use combinations were analyzed. We calculated the percentage of past 30-day substance use for each substance among those who reported any substance use[¶¶] in the past 30 days. We also calculated the percentage of past 30-day substance use for each substance combination among those who reported use of more than one substance*** in the past 30 days. Use of more than one substance does not necessarily represent use of substances simultaneously.

This study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (Appendix 1). The STROBE Statement offers authors guidance on enhancing the reporting of observational studies, enabling reviewers, journal editors, and readers to critically appraise and interpret this study (Vandenbroucke et al., 2014).

Statistical analyses

To be consistent with previous papers using the NAVIPPRO dataset (Jiang et al., 2021; Kacha-Ochana et al., 2022), Pearson's chi-square tests were used to compare the distribution of demographic characteristics among assessments in which adolescents who reported lifetime use of a substance versus assessments among those that did not. Unknown or no response categories for each demographic characteristic were excluded from chi-square tests. A $p$value of <0.05 indicates that there is a statistical significance between adolescents who reported lifetime use of a substance versus those that did not in terms of a specific distribution of demographic characteristic.

We also conducted a sensitivity analysis to examine the robustness of our findings at the individual level, rather than the assessment level. We used the last assessment if multiple assessments were performed on the same day (given more complete data), and the first assessment for individuals with multiple assessments on different days (Jiang et at., 2021).

Since CHAT data are collected primarily for clinical purposes, analyses of de-identified aggregate data for research purposes have been determined to be exempt from human-

**There is no definition of "problem" in the CHAT data. Each substance reported causing the most problems was mutually exclusive.
††Adolescents were asked "which drug or drugs do you like the most? You can select up to three." in the CHAT data. There was no rank among the selected preferred substances. Each substance reported as the preferred substance was NOT mutually exclusive.
§§"Methadone or buprenorphine", "phencyclidine or ketamine", and "Gamma-Hydroxybutyric acid or Rohypnol" were listed as three drug groups in the CHAT when presented to adolescents.
¶¶Any substance use in the past 30-day includes past 30-day use (or prescription medication misuse) of the following: alcohol, marijuana, heroin, illegally made fentanyl, prescription opioid misuse, prescription sedative or tranquilizer misuse, prescription stimulant misuse, cocaine, methamphetamine, hallucinogens, inhalants, ecstasy, gamma hydroxybutyrate/Rohypnol, phencyclidine/ketamine, cough sirup, and other unspecified drugs.
***Use of more than one substance in the past 30-day includes past 30-day use (or prescription medication misuse) of at least two of the following: alcohol, marijuana, heroin, illegally made fentanyl, prescription opioid misuse, prescription sedative or tranquilizer misuse, prescription stimulant misuse, cocaine, methamphetamine, hallucinogens, inhalants, ecstasy, gamma hydroxybutyrate/Rohypnol, phencyclidine/ketamine, cough sirup, and other unspecified drugs.

subject regulations and institutional review board approval (Vosburg et al., 2021). All analyses were conducted using SAS (version 9.4; SAS Institute, Cary, NC).

Results

Results below are organized by the study's research questions.

Patterns in lifetime substance use by substance overall and by demographic characteristics

During the study period, 5,377 assessments of US adolescents were completed from 143 assessment sites located in 29 states (3.3% of adolescents were administered the CHAT multiple times and contributed more than one assessment throughout the study period. †††). Among 5,377 assessments, the majority were male (58.7%), aged 16–18 years (50.5%), non-Hispanic White (43.1%), and had Medicare/Medicaid insurance (57.3%). Most of those assessed lived in the South (59.7%), lived in metropolitan assessment sites (63.9%), resided with their parent(s) (72.4%), were enrolled in school (87.3%), had never had counseling or treatment for their alcohol/drug use (75.6%), and had a history of criminal justice involvement (59.0%) (Tables 1 and 2). The mean age of initiation by substance ranged from 12.9 years for marijuana to 14.7 years for cocaine (Table 2).

Most demographic characteristics were different between adolescent assessments reporting lifetime use of each substance and those not reporting use ($p$value < 0.05). No statistically significant difference was found between adolescent assessments reporting lifetime use of certain substances and those not reporting use in terms of sex (prescription opioid misuse, alcohol, prescription sedative or tranquilizer misuse, prescription stimulant misuse), urban-rural status (IMF, heroin, cocaine), and currently on probation status (heroin). For example, there was no differences in urban-rural status between adolescent assessments reporting lifetime use of IMF and those that did not ($p$value = 0.26) (Tables 1 and 2).

The most commonly reported substances used in their lifetime across assessments were marijuana (68.0%), followed by alcohol (54.2%), prescription opioid misuse (13.6%), prescription sedative or tranquilizer misuse (12.6%), cocaine (9.9%), prescription stimulant misuse (9.5%), methamphetamine (7.6%), heroin (2.9%), and IMF (2.3%). Overall, 23.1% of all assessments indicated no reported substance use in their lifetime. Males reported higher lifetime use of marijuana (73.2% versus 60.6%), alcohol (54.7% versus 53.5%), prescription opioid misuse (14.1% versus 12.9%), prescription sedative or tranquilizer misuse (13.4% versus 11.5%), and prescription stimulant misuse (10.1% versus 8.8%) compared to females; females reported higher lifetime use of IMF (3.0% versus 1.8% in males), heroin (4.2% versus 1.9%), methamphetamine (9.5% versus 6.3%), and cocaine (11.0% versus 9.1%). Adolescents aged 16–18 years reported higher lifetime use of all substances (range: 3.2% to 80.5%) compared to other age groups (Table 1).

†††Among the 5,377 CHAT assessments, there were 5,190 unique adolescents. Among 5,190 unique adolescents, 5,017 (96.7%) were assessed for one time; 159 (3.0%) were assessed for twice, and 14 (0.3%) were assessed for three times. 3.5% of all assessments were completed by adolescents who had already completed one assessment during the study period.

In terms of race and ethnicity, non-Hispanic White adolescents also reported higher lifetime use of all substances (range: 3.1% to 72.4%) compared with other race/ethnicity groups. On the other hand, non-Hispanic Black adolescents reported the lowest lifetime use of all substances (range: 0.67% to 58.0%). In terms of geographic location by comparing the percentage of lifetime substance use reported in each of the four US Census Bureau regions, the percentages of IMF use (3.3%), heroin use (4.6%), methamphetamine use (12.3%), and cocaine use (15.8%) were highest at assessment sites in the West, whereas the percentages of prescription opioid misuse (20.5%), marijuana use (88.6%), prescription sedative or tranquilizer misuse (19.6%), and prescription stimulant misuse (15.0%) were highest at assessment sites in the Northeast. Lifetime alcohol use (71.8%) was highest at assessment sites in the Midwest (Table 1).

Compared to other living situations, adolescents who lived with friends, a partner or spouse, or lived alone (these three were combined as one category; this category only accounted for 1.5% of the total assessments) had higher percentages of lifetime substance use for all substances assessed (range: 8.4% to 89.2%). Adolescents not currently enrolled in school also reported higher lifetime use of all substances (range: 5.3% to 84.0%) compared with those enrolled in school (range: 1.9% to 65.7%) (Table 1). Although only 1.7% of all assessments reported injection drug use behaviors, assessments that indicated injection drug use showed much higher lifetime use of all substances except for marijuana (range: 41.1% to 88.9%) compared to those with other routes of administration (range: 2.5% to 72.6%). Adolescents with a history of criminal justice involvement reported percentages of all lifetime substance use except for alcohol (range: 3.3% to 86.8%) at least twice as high as those without a history of criminal justice involvement (range: 0.9% to 41.0%) (Table 2).

Among the biopsychosocial content areas measured, 28.1% of adolescent assessments reported moderate to extreme severity of problems with emotional/psychological health, followed by drug use (20.1%), friend/peer relationships (18.3%), family relationships (15.0%), tobacco use (14.6%), and alcohol use (7.8%) in the past 30 days. In any biopsychosocial content area, assessments reporting moderate to extreme severity of problems had higher percentages of all lifetime substance use compared to those reporting less severe problems (Table 2).

Frequency of overdoses or hospital visits due to drug/alcohol use

Among all assessments, the percentage of adolescents reporting *past-year* overdose or hospital visit due to drug/alcohol use was greatest among those who reported lifetime use of IMF (24.0%), followed by heroin (21.4%), cocaine (15.3%), methamphetamine (15.2%), prescription stimulant misuse (14.8%), prescription sedative or tranquilizer misuse (13.6%), prescription opioid misuse (12.3%), alcohol (6.5%), and marijuana (5.1%). Similarly, those who reported lifetime IMF use had the greatest percentage of assessments reporting *past 30-day* overdose or hospital visit due to drug/alcohol use (7.2%), followed by heroin (6.5%) and prescription stimulant misuse (6.2%) (Figure 1).

Frequency of substances reported as causing the most problems, or as preferred substances

Among all assessments, 55.5% reported that they did not have a problem with any substance, while 18.1% thought marijuana was causing them the most problems, followed by alcohol (12.7%) and methamphetamine (3.6%). 0.6% thought IMF was causing them the most problems (Supplemental Figure 1). In terms of preferred substances, 50.1% of all assessments reported marijuana as the preferred substance, followed by no preference (43.7%), and alcohol (13.5%). Overall, 0.3% reported IMF as the preferred substance (Supplemental Figure 2).

Patterns in past 30-day substance use and substance use combinations

Among all assessments, 47.4% and 23.9% reported substance use as well as substance use combinations during the past 30 days, respectively. The most commonly reported substances among those reporting any substance use in the past 30 days were marijuana (83.6%), followed by alcohol (46.4%), and other unspecified drug (18.1%) (Figure 2). The most common combinations among those reporting use of more than one substance in the past 30 days were alcohol and marijuana (35.6%), followed by marijuana and other unspecified drug (14.0%) and alcohol, marijuana, and other unspecified drug (7.6%) (Figure 3).

Results of the sensitivity analysis for each study's research question were consistent with the main analysis (Appendix 2).[§§§]

Discussion

This cross-sectional study examined the substance use patterns, demographic characteristics, and past-year and past 30-day overdoses or hospital visits due to substance use using real world data from a convenience sample of US adolescents aged 10–18 years assessed for SUD treatment from 2017 through 2021. Findings showed that marijuana was the most commonly reported substance used during the lifetime (68.0%), followed by alcohol (54.2%), misuse of prescription opioids (13.6%), and misuse of prescription sedatives or tranquilizers (12.6%). Our results, derived from a convenience sample of adolescents aged 10–18 years assessed for SUD treatment, are higher than those derived from the nationally representative data focusing on US secondary or high school students, or adolescents aged 12–17 years in 2021 (Miech et al., 2022; Hoots et al., 2023; SAMHSA, 2022b). For example, the Monitoring the Future (MTF) survey estimated that lifetime prevalence use of alcohol and marijuana among US students in 8th, 10th, and 12th grades was 36.3% and 23.1% in 2021, respectively[¶¶¶] (Miech et al., 2022). The Youth Risk Behavior Survey (YRBS) estimated that alcohol (47.4%), marijuana (27.8%), and prescription opioid misuse (12.2%) were the most commonly reported lifetime substances used by US high school

[§§§]Two results from the sensitivity analysis are slightly different from the main analysis, In Appendix 2A, the *p*value for the insurance category among the lifetime methamphetamine users changes from significant ($p = 0.0412$) to nonsignificant ($p = 0.0699$). In Appendix 2E, the percentage of marijuana and hallucinogen combinations was <1% (sensitivity analysis: 0.97%; main analysis: 1.09%), so it is no longer listed in the figure.

[¶¶¶]The 2021 MTF did not measure the lifetime prevalence of prescription opioid misuse among US students in 8th, 10th, and 12th grades combined. MTF measured the *narcotics other than heroin* (most of which are opioids) only for 12th grade due to concerns about the validity of reports of these substances from the US students in lower grades. https://monitoringthefuture.org/wp-content/uploads/2022/08/mtf-vol1_2021.pdf

students in 2021 (Hoots et al., 2023). Additionally, the 2021 National Survey on Drug Use and Health (NSDUH) data estimated that 22.9% and 13.2% adolescents aged 12–17 years used alcohol and marijuana in the lifetime, respectively**** (SAMHSA, 2022b). Differences in results among these studies are likely due to different adolescent populations, data collection processes, or outcomes measured. Adolescents assessed for SUD treatment in the CHAT are likely to have more severe substance use than the general population of secondary and high school students or adolescents aged 12–17 years in the United States.

In this study, approximately one in four assessments reported the use of multiple substances over the past 30 days, with alcohol and marijuana being the most commonly reported combination (35.6%). Notably, most substance use combinations involved either marijuana or alcohol or both. This result is similar to the findings derived from the 2021 YRBS, which found that alcohol and marijuana were the most commonly past 30-day co-used substances among those who reported past 30-day alcohol use, marijuana use, or prescription opioid misuse, with 30.2% reporting co-use (Hoots et al., 2023). High rates of alcohol and marijuana use among adolescents are concerning. An abundance of research has shown that marijuana and alcohol are associated with an increased risk of other substance use, mental health conditions, the development of a SUD later in life, and other negative consequences (CDC, 2021a; DuPont et al., 2018; NIDA, 2021a; Olfson et al., 2018). These findings emphasize the importance of comprehensive prevention strategies that focus on reducing risk factors and strengthening protective factors related to adolescent substance use (Hawkins et al., 1992; Hawkins et al., 2016). For instance, promoting programs that prevent adverse childhood experiences has the potential to reduce adolescent substance use (CDC, 2019; Tanz et al., 2022a). CDC, through the Drug-Free Communities Program, is providing funding and support to community coalitions in their work to prevent and reduce adolescent substance use (CDC, 2022a). In addition, school-based programs integrating social competence and social influence approaches have shown protective effects in preventing marijuana and other substances use (Faggiano et al., 2014). Moreover, education about the safe storage of marijuana and safe storage and disposal of prescription drugs may reduce substance-related morbidity among adolescents (Achana et al., 2015; de la Cruz et al., 2017; Roehler et al., 2022; Thomas et al., 2019). Further, evidence-based prevention policies such as increased alcohol taxes and prescription drug monitoring programs have been shown to reduce adolescent alcohol use and overdose deaths involving prescription opioids (Dowell et al., 2016; Elder et al., 2010; Esser et al., 2022; Pardo, 2017). More research is needed to evaluate whether policies used to reduce alcohol use among adolescents are effective in reducing adolescent marijuana use.

Our study only represents adolescents who reported knowingly using IMF. Tanz et al found that approximately 84% of overdose deaths involved IMF among persons aged 10–19 years between July 2019–December 2021 (Tanz et al., 2022a), our result that IMF was the least reported substance used among adolescents, with 2.3% of all assessments reporting lifetime use, thus is likely underestimated. Notably, only 0.3% of all assessments reported IMF as their preferred substance, and 0.6% thought that IMF caused them the most problems.

****The 2021 NSDUH did not measure the lifetime percentage of prescription opioid misuse among people aged 12–17 years. https://www.samhsa.gov/data/report/2021-nsduh-detailed-tables

Nevertheless, with the high potency of IMF, increased availability of counterfeit pills resembling prescription drugs containing IMF, and frequent contamination of some illicit drugs with IMF (e.g., heroin, cocaine), adolescents exposed to substances with IMF are at high risk for fatal overdose (Joynt & Wang, 2021; NIDA, 2021b; Tanz et al., 2022a). In fact, consistent with earlier research focusing on adults assessed for SUD treatment (Jiang et al., 2021), our study indicated that a higher percentage of assessments completed by adolescents assessed for SUD treatment that reported IMF use over the lifetime also included past-year/past 30-day overdose or hospital visits due to drug/alcohol use compared to assessments with other categories of lifetime substances reported. Additionally, our study indicated that 10–14% of assessments reported misusing prescription opioids, prescription sedatives/tranquilizers, and prescription stimulants over the lifetime. The most common sources of those prescription drugs among adolescents aged 10–18 years could be from family/friends, dealers, or others (Jiang et al., 2024). It is unclear how many of those prescription drugs are counterfeit pills that could contain IMF or other illicit drugs. Counterfeit pills are easy to purchase through social media and e-commerce platforms, which poses a severe danger to adolescents (DEA, 2022b; Tanz et al., 2022a). Given the missed opportunities for interventions within the health systems (Follman et al., 2019; Schoenfeld et al., 2020; Tanz et al., 2022b; Wilson et al., 2018), continued overdose prevention, treatment, and response strategies are needed to address rising rates of IMF-involved overdose among adolescents. Education in schools on IMF and counterfeit pills and improving adolescents' awareness about their risk is important (Tanz et al., 2022a; DEA, 2023). Naloxone distribution expansion, robust overdose education, linkage to evidence-based treatment for SUD, and harm reduction services such as use of fentanyl test strips and syringe services programs are also needed (CDC, 2022b; Hadland, 2019; Peiper et al., 2019).

Another notable finding was the high percentages of substance use reported among adolescents either living with friends, a partner or spouse, or living alone, and those not currently enrolled in school. Previous research has stressed the importance of family environment, peer influence, and school attachment on an adolescent's life (Moore et al., 2018; Saladino et al., 2020; Schuler et al., 2019; Valkov, 2018). Research suggests it is important that substance use prevention efforts that seek to address peer influence begin prior to middle school and are sustained throughout high school (Schuler et al., 2019). In addition, early school disengagement assessment and prevention may play an important role in preventing school dropout and substance use among adolescents (Henry et al., 2012; Valkov, 2018; Rainone, 1993). Further, our study found high percentages of substance use among adolescents with a history of criminal justice involvement. This finding aligns with a robust set of research which has shown a correlation between adolescents' criminal justice system involvement and substance use (Christeson et al., 2008; Maynard et al., 2015; Salcedo et al., 2021). This finding underscores the importance of evidence-based interventions (e.g., family counseling in the early stages of delinquency), and importance of building partnerships through multiple public health and public safety collaborations to strengthen and improve efforts to reduce drug overdoses (Young et al., 2007; CDC, 2021b). Taken together, these findings highlight the complex nature of substance use among adolescents, and the interplay between substance use, families, peers, schools, and the criminal justice system. More research is warranted to help develop tailored prevention

messages and interventions at different layers of environmental influence (Moore et al., 2018).

This study also identified noteworthy patient-level characteristics and patterns in substance use among adolescents. Specifically, almost one in three adolescent assessments had a past 30-day moderate to extreme severity in the emotional/psychological health content area. These adolescent assessments reported a higher percentage of use of all substances compared with those with less severity in the emotional/psychological health content area. This is consistent with previous research documenting that mental health conditions and substance use are tightly linked among adolescents (CMI, 2019; NIDA, 2020). Additionally, we found that only 24.1% of adolescent assessments reported receiving counseling or treatment for their alcohol or drug use. Stigma concerning SUD treatment could partially explain the low engagement in care (Bagley et al., 2022; CMI, 2019). Potential intervention opportunities such as decreasing stigma, screening for co-occurring mental health conditions and SUD, and treating mental health conditions concomitantly with SUD treatment in integrated care (i.e., combining primary care, mental health, and substance use services) can help to improve care (Bagley et al., 2022; CMI, 2019; Zhang et al., 2022). Moreover, we found heterogeneity in most substances use by sex, race/ethnicity, location of the assessment site, and route of administration. Notably, although nearly one-third of the females did not report any lifetime substance used among all assessments, 3–11% of them reported substantially higher lifetime use of IMF, heroin, methamphetamine, and cocaine compared to males. In our study, lifetime substance use patterns by sex differed from those identified in MTF, YRBS, and NSDUH (Miech et al., 2022; Hoots et al., 2023; SAMHSA, 2022b). For example, these surveys revealed a higher prevalence of lifetime marijuana use among adolescent females compared to adolescent males in 2021 (Miech et al., 2022; Hoots et al., 2023; SAMHSA, 2022b). This pattern, highlighted by MTF, is considered unusual since, in past years, more adolescent males reported lifetime marijuana use (Miech et al., 2022). Together with our findings, these findings underscore the importance of designing tailored prevention strategies to address substance use and related harms among different adolescent populations (Simon et al., 2022).

Finally, many of the validated screening instruments, including CHAT, allow for identification of adolescents' risky behaviors and substance use (Sterling et al., 2015; Levy et al., 2016; Thoele et al., 2021; NIDA, 2023). These instruments can facilitate the Screening, Brief Intervention, and Referral to Treatment (SBIRT) model among adolescents (Sterling et al., 2015; Levy et al., 2016; Thoele et al., 2021; NIDA, 2023). However, due to the intentional brevity of screening instruments, none capture specific substances or medications beyond a drug class, nor do they measure related conditions such as current living situation, school, psychiatric/medical history, justice system involvement, and peer/familial relationships among adolescents. These additional measures are collected in CHAT which lead to the clinician's ability to develop wholistic treatment plans and research opportunity to better understand the needs of adolescents.

Our findings are subject to at least seven limitations. First, CHAT data are self-reported and thus subject to reporting bias and recall error. Nearly one-quarter of the assessments completed by adolescents reported no lifetime substance use, which may have impacted the

results. Second, our study only represents adolescents who reported knowingly using IMF. CHAT data did not collect information on whether the respondent deliberately sought out IMF, nor if they believed they were usually sold/given IMF or whether they confirmed IMF with fentanyl test strips (Ciccarone, 2017; Jiang et al., 2021; Morales et al., 2019). Third, CHAT data did not collect the main reason why adolescents were at the assessment sites and being administered the CHAT assessment. Fourth, as CHAT data are a convenience sample and are not nationally representative, our results may not be generalizable to all US adolescents being assessed for SUD treatment or to US adolescents who use substances but are not assessed for SUD treatment. Fifth, we analyzed the study at the assessment-level rather than individual-level. Nevertheless, our sensitivity analysis at the individual-level is consistent with the main analysis because of the low percentage of repeated assessments (i.e., 3.5% of all assessments were completed by adolescents who had already completed one assessment during the study period). Results from the sensitivity analysis, derived from a convenience sample of adolescents aged 10–18 years assessed for SUD treatment, are still higher than those from the 2021 nationally representative data focusing on US secondary or high school students or adolescents aged 12–17 years (Miech et al., 2022; Hoots et al., 2023; SAMHSA, 2022b). Sixth, our study period included the COVID-19 pandemic which may impact adolescent substance use patterns. More research is needed to understand how adolescent substance use changed during the COVID-19 pandemic. Finally, CHAT did not collect information about specific drug-related overdose or hospital visit; thus, we are not able to differentiate whether adolescents experienced a specific drug overdose, visited the hospital for a drug-related health problem, or visited the hospital for an alcohol-related health problem.

Conclusion

This study highlights the substance use patterns and characteristics using real world data from US adolescents assessed for SUD treatment and informs opportunities to address substance use among adolescents. Tailored strategies such as preventing adverse childhood experiences, promoting school-based substance use prevention programs, expanding evidence-based prevention policies, and screening for and treating co-occurring mental health conditions and SUDs are needed to reduce harms related to adolescent substance use.

This study also provides new insights into adolescents who report IMF use. In the context of increasing IMF-involved overdose deaths among adolescents cited in other studies, continued overdose prevention and response strategies such as evidence-based education on IMF and counterfeit pills, use of fentanyl test strips, naloxone distribution, and evidence-based SUD treatment expansion are needed to address rising rates of IMF-involved overdose among adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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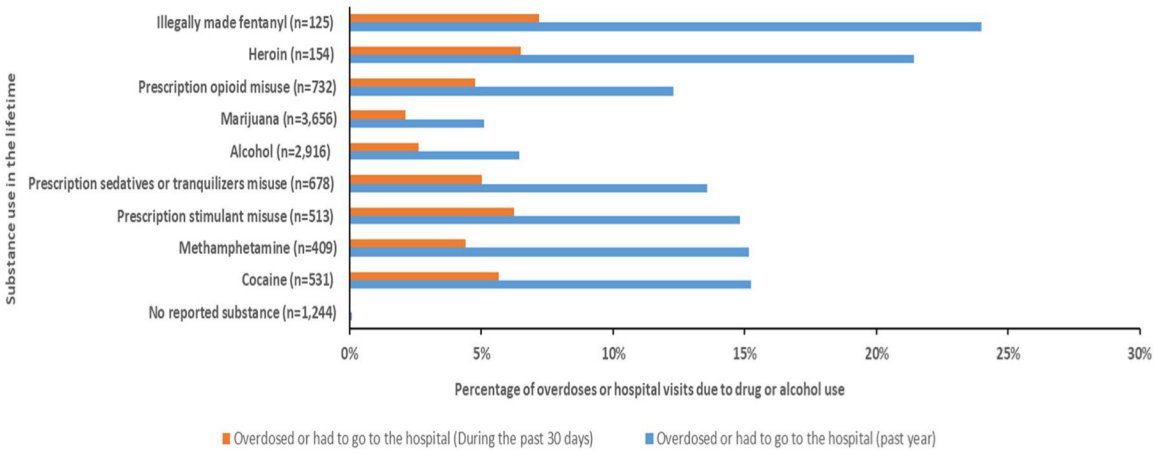

Figure 1.

Within each category of lifetime substance use, percentage of adolescents reporting past-year (and past 30-day) overdoses or hospital visits due to drug/alcohol use among all assessments.

Data Source: The National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT). The unit of analysis was each assessment.

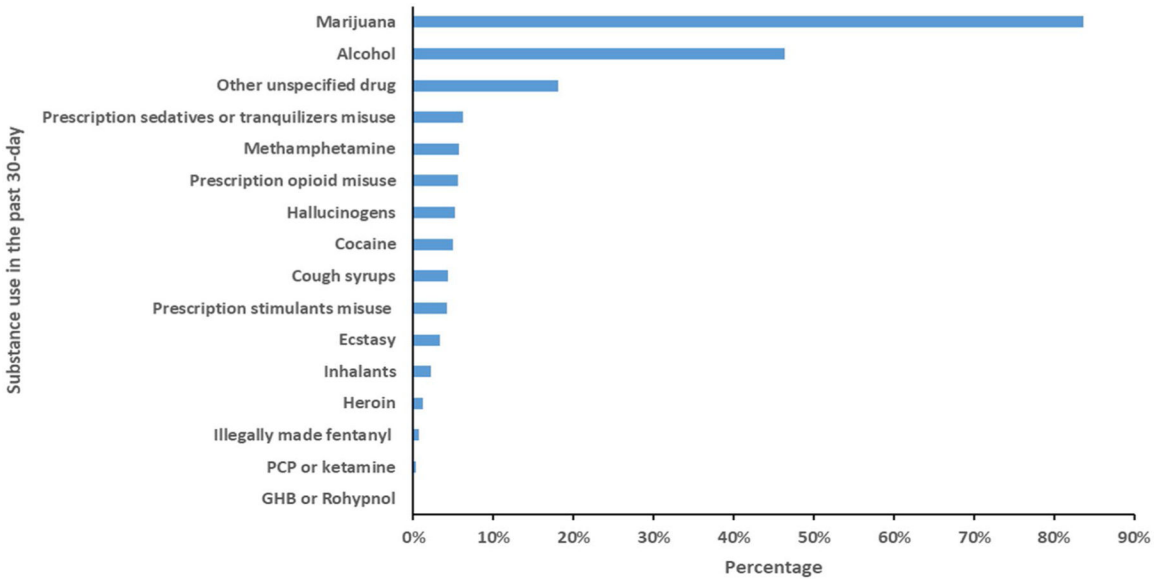

Figure 2.

Most common substance used in the past 30 days among assessments completed by adolescents aged between 10 and 18 years reporting any substance use in the past 30 days[a] (*N* = 2,550), 2017–2021[b].

Abbreviations: PCP, phencyclidine; GHB, Gamma-Hydroxybutyric acid.

Data Source: The National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT). The unit of analysis was each assessment.

[a]Any substance use in the past 30-day includes past 30-day use (or prescription medication misuse) of the following: alcohol, marijuana, heroin, illegally made fentanyl, prescription opioid misuse, prescription sedative or tranquilizer misuse, prescription stimulant misuse, cocaine, methamphetamine, hallucinogens, inhalants, ecstasy, Gamma-Hydroxybutyric acid/ Rohypnol, phencyclidine/ketamine, cough sirup, and other unspecified drugs.

[b]Data represents 47.4% of all 9.17.2017–12.31.2021 adolescent CHAT assessments that reported using the listed substances during the past 30 days.

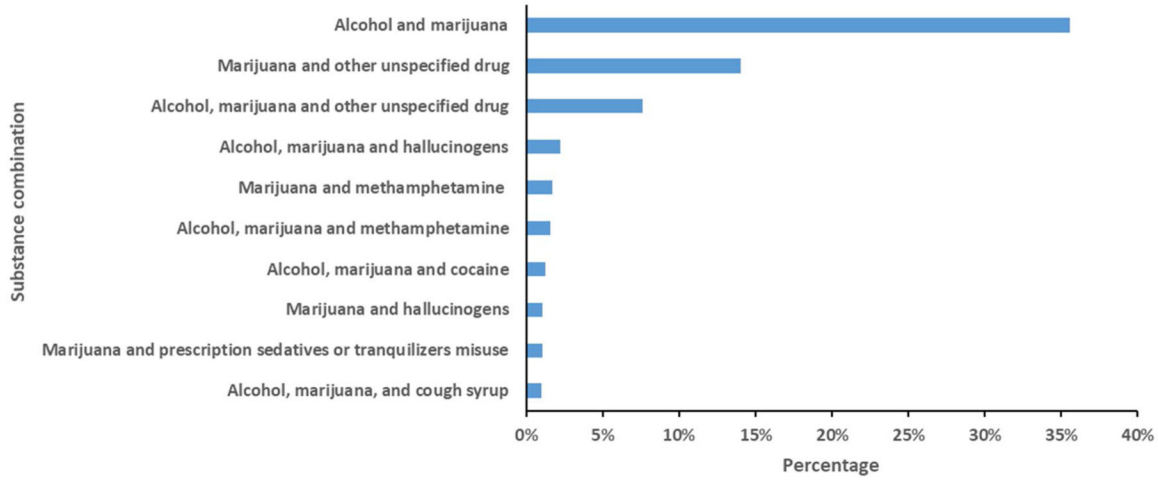

Figure 3.

Most common substance combinations reported among assessments completed by adolescents aged 10–18 years reporting use of more than one substance in the past 30 days[a] (*N* = 1,284), 2017–2021[b].

Data Source: The National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT). The unit of analysis was each assessment.

[a]Use of more than one substance in the past 30-day includes past 30-day use (or prescription medication misuse) of at least two of the following: alcohol, marijuana, heroin, illegally made fentanyl, prescription opioid misuse, prescription sedative or tranquilizer misuse, prescription stimulant misuse, cocaine, methamphetamine, hallucinogens, inhalants, ecstasy, Gamma-Hydroxybutyric acid/Rohypnol, phencyclidine/ketamine, cough sirup, and other unspecified drugs. The remaining unique substance combinations each represented <1% of all combinations among assessments reporting use of more than one substance during the past 30 days. Use of more than one substance as displayed in this figure does not necessarily represent use of substances simultaneously.

[b]Data represents 23.9% of all 9.17.2017–12.31.2021 adolescent CHAT assessments that reported using more than one substance during the past 30 days.

Table 1.

Percentage of reported substances used in the lifetime on assessments completed by adolescents aged 10–18 years who were assessed for substance use treatment, by demographic characteristics, 2017–2021.

	% Substances used during the lifetime										
Characteristic	**Total assessments, % (*N* = 5,377)**	**Illegally made fentanyl (*n* = 125)**	**Heroin (*n* = 154)**	**Prescription opioid misuse (*n* = 732)**	**Marijuana (*n* = 3,656)**	**Alcohol (*n* = 2,916)**	**Prescription sedative or tranquilizer misuse (*n* = 678)**	**Prescription stimulant misuse (*n* = 513)**	**Methamphetamine (*n* = 409)**	**Cocaine (*n* = 531)**	**No reported substance[a] (*n* = 1,244)**
Overall		2.32	2.86	13.61	67.99	54.23	12.61	9.54	7.61	9.88	23.14
DEMOGRAPHICS											
Sex											
Male	58.66	1.84	1.93	14.14	73.21	54.72	13.41	10.05	6.25	9.07	18.93
Female	41.34	3.01	4.18	12.87	60.59	53.53	11.47	8.82	9.54	11.02	29.10
P-value		0.0049	<.0001	0.3398	<.0001	0.6405	0.1012	0.3056	<.0001	0.0181	<.0001
AGE GROUPS, YEARS											
10–12	5.34	0	0.35	1.39	14.29	12.20	1.74	1.05	1.05	0.35	74.22
13–15	44.19	1.60	1.22	10.94	60.23	45.92	10.27	7.41	5.18	5.98	29.59
16–18	50.47	3.21	4.57	17.24	80.47	65.95	15.81	12.31	10.43	14.30	12.09
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
RACE/ETHNICITY											
Non-Hispanic White	43.11	3.11	4.10	17.99	72.35	65.10	16.65	13.81	11.00	13.03	18.85
Hispanic/Latino	22.82	2.20	2.44	11.17	70.25	55.58	11.49	7.33	7.25	11.74	21.52
Non-Hispanic Black	22.32	0.67	0.67	6.67	58.00	32.58	5.08	3.25	0.92	1.83	32.17
Other[b]	11.75	2.85	3.32	15.51	66.61	52.85	14.24	10.13	8.54	9.97	24.84
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Insurance											
Medicare/ Medicaid[c]	57.26	1.57	2.37	11.96	60.51	46.05	10.85	8.05	7.46	7.37	30.06
Other[d]	28.12	4.13	4.35	17.42	80.14	65.55	16.50	12.61	8.79	14.82	12.30
Self-pay	8.56	2.34	2.52	14.21	82.91	72.12	12.77	10.97	7.91	12.77	8.63

Characteristic	Total assessments, % (*N* = 5,377)	% Substances used during the lifetime									
		Illegally made fentanyl (*n* = 125)	Heroin (*n* = 154)	Prescription opioid misuse (*n* = 732)	Marijuana (*n* = 3,656)	Alcohol (*n* = 2,916)	Prescription sedative or tranquilizer misuse (*n* = 678)	Prescription stimulant misuse (*n* = 513)	Methamphetamine (*n* = 409)	Cocaine (*n* = 531)	No reported substance[a] (*n* = 1,244)
Commercial payer	3.69	1.96	1.31	15.03	77.78	63.40	16.34	9.80	1.96	9.80	18.30
Uninsured/ Exhausted benefits	1.69	3.00	3.00	12.00	53.00	56.00	11.00	11.00	4.00	10.00	31.00
Medicare only	0.69	6.67	6.67	13.33	73.33	66.67	20.00	0.00	6.67	13.33	6.67
P-value		<.0001	0.0080	0.0006	<.0001	<.0001	0.0002	0.0003	0.0412	<.0001	<.0001
US CENSUS BUREAU REGIONS (CHAT ASSESSMENT SITES)											
South	59.66	1.84	2.09	10.44	56.89	42.86	10.38	7.39	5.14	7.39	32.48
Midwest	18.21	2.76	3.68	20.02	87.84	71.81	17.57	14.91	11.95	11.75	7.46
West	18.04	3.30	4.64	16.08	80.00	71.44	13.40	10.00	12.27	15.77	12.06
Northeast	4.09	3.18	2.73	20.45	88.64	65.91	19.55	15.00	3.64	11.82	5.45
P-value		0.0306	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
URBAN-RURAL STATUS (CHAT ASSESSMENT SITES)											
Metropolitan	63.92	2.53	2.82	12.37	62.87	48.71	12.19	8.64	6.84	9.98	27.58
Micropolitan[e]	26.84	2.15	3.05	17.05	75.61	61.88	14.76	11.71	9.77	9.84	16.91
Rural	9.24	1.41	2.62	12.27	81.29	70.22	9.26	9.46	6.64	9.26	10.46
P-value		0.2617	0.8566	0.0003	<.0001	<.0001	0.0050	0.0037	0.0014	0.8788	<.0001
CURRENT LIVING SITUATION (MUTUALLY EXCLUSIVE CATEGORIES)											
One or both biological or adoptive parents	72.42	1.90	2.05	12.97	66.15	53.26	11.89	8.60	5.96	8.83	24.96
Legal guardian	9.73	1.91	3.63	13.58	70.55	52.01	11.85	8.80	9.18	11.66	19.89
Other relatives	8.29	4.04	4.26	14.13	74.44	56.95	14.35	12.11	10.54	8.52	17.26
Other	5.11	4.36	6.18	14.18	72.36	57.45	14.18	12.73	12.00	13.82	21.45
Foster family	2.90	2.56	3.85	17.95	67.95	58.33	19.23	14.74	16.67	16.03	17.31
Friends, a partner/spouse, or alone	1.53	8.43	15.66	31.33	89.16	80.72	24.10	24.10	27.71	30.12	6.02
P-value		<.0001	<.0001	0.0004	<.0001	0.0001	0.0056	0.0001	<.0001	<.0001	<.0001
SCHOOL											

Characteristic	% Substances used during the lifetime										
	Total assessments, % (*N* = 5,377)	Illegally made fentanyl (*n* = 125)	Heroin (*n* = 154)	Prescription opioid misuse (*n* = 732)	Marijuana (*n* = 3,656)	Alcohol (*n* = 2,916)	Prescription sedative or tranquilizer misuse (*n* = 678)	Prescription stimulant misuse (*n* = 513)	Methamphetamine (*n* = 409)	Cocaine (*n* = 531)	No reported substance[a] (*n* = 1,244)
CURRENTLY ENROLLED IN SCHOOL (INCLUDES TECHNICAL, VOCATIONAL, TRADE, AND BEAUTY SCHOOLS, TREATMENT CENTER SCHOOLS, AND GENERAL EDUCATIONAL DEVELOPMENT PROGRAMS)											
Yes	87.33	1.90	2.34	12.05	65.67	52.45	11.37	8.52	6.09	8.65	25.15
No	12.67	5.29	6.46	24.38	83.99	66.52	21.15	16.59	18.06	18.36	9.25
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
DURING THE PAST YEAR, INVOLVED IN ACTIVITIES[f] SUCH AS SPORTS TEAM, SCHOOL CLUBS											
Yes	64.63	1.96	2.24	11.86	64.66	51.40	10.88	8.40	5.84	8.03	25.38
No	35.06	2.97	4.03	16.92	74.43	59.68	15.86	11.67	10.88	13.37	18.89
Unknown/No response	0.32	5.88	0.00	5.88	35.29	29.41	5.88	5.88	5.88	0.00	35.29
P-value		0.0391	0.0007	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
MEDICAL HISTORY											
DURING THE PAST 12 MONTHS, ADMITTED TO THE HOSPITAL OR THE EMERGENCY ROOM FOR MEDICAL REASON [g]											
Yes	31.21	4.47	5.07	19.67	72.88	64.90	18.53	15.20	10.85	15.44	16.03
No	68.33	1.31	1.82	10.86	65.90	49.51	9.93	7.00	6.12	7.38	26.35
Unknown/No response	0.46	8.00	8.00	12.00	48.00	32.00	8.00	4.00	8.00	4.00	28.00
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CURRENTLY TAKING MEDICATION FOR ANY EMOTIONAL, BEHAVIORAL, OR LEARNING PROBLEMS											
Yes	33.29	3.69	4.25	17.60	67.04	58.44	18.21	14.86	10.34	13.85	22.91
No	66.52	1.62	2.18	11.66	68.63	52.22	9.84	6.91	6.26	7.91	23.20
Unknown/No response	0.19	10.00	0.00	0.00	10.00	20.00	0.00	0.00	0.00	0.00	40.00
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.4356
IN INPATIENT CONTROLLED ENVIRONMENT[h] DURING THE PAST 30-DAY											
Yes	12.42	5.99	6.59	24.40	80.39	68.11	24.85	20.96	15.27	20.21	12.28
No	87.58	1.81	2.34	12.08	66.23	52.26	10.87	7.92	6.52	8.41	24.68
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Abbreviations: CHAT, Comprehensive Health Assessment for Teens.

Data Source: The National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT). The unit of analysis was each assessment.

[a]No reported substance was defined as respondents did not report alcohol use, marijuana use, heroin use, illegally made fentanyl use, prescription opioid misuse, prescription sedative or tranquilizer misuse, prescription stimulant misuse, cocaine use, methamphetamine use, hallucinogens use, inhalants use, ecstasy use, Gamma-Hydroxybutyric acid/Rohypnol use, phencyclidine/ketamine use, cough sirup use, methadone/buprenorphine use, cigarettes use, or other unspecified drugs use in the lifetime.

[b]Others include those who selected Asian, American Indian/Alaskan Native, Pacific Islander/Native Hawaiian, Middle Eastern, as well as those who selected multiple races.

[c]"Medicare/Medicaid" option is a mix of those who had dual eligibility as well as those who had Medicaid only.

[d]"Other" includes New Mexico Behavioral Health Services Division (BHSD), access to recovery, methamphetamine initiative, New Mexico Children's Code (NMCC), New Mexico Probation and Pretrial (NMPP), Temporary Assistance for Needy Families Substance Abuse Services (TANF SA Services), Income Support Division/New Mexico Works (ISD/NM Works), New Mexico Total Community Approach (TCA), other and unassigned.

[e]Micropolitan statistical areas consist of the county or counties (or equivalent entities) associated with at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent counties having a high degree of social and economic integration with the core as measured through commuting ties.

[f]Activities include sports team, school clubs or organizations, for example, newspaper, government, yearbook, music, art, acting, or dance, clubs or organizations not connected to school, for example, boy scouts, girl scouts, Young Men's Christian Association, or Young Women's Christian Association, after school programs, lessons for example, music, art, dance, or karate, community volunteering, for example, at a shelter, food kitchen, hospital, or community center, religious or spiritual activities, for example, going to church, mosque, temple, or being part of a youth group, other.

[g]Medical reasons for admission to the hospital or the emergency room include drug reaction, overdose, or alcohol poisoning; suicide attempt; harming self on purpose; broken bone; car, bicycle, or another kind of accident; sexual assault or other physical attack; headaches or concussion; pneumonia or other physical illness; and other serious illness.

[h]Inpatient controlled environment include inpatient alcohol or drug treatment, inpatient medical hospital, and inpatient psychiatric or mental health treatment.

Table 2.

Percentage of reported substances used in the lifetime on assessments completed by adolescents aged 10–18 years who were assessed for substance use treatment, by other demographic characteristics, 2017–2021.

	% Substances used during the lifetime										
Characteristic	**Total assessments, % (*N* = 5,377)**	**Illegally made fentanyl (*n* = 125)**	**Heroin (*n* = 154)**	**Prescription opioid misuse (*n* = 732)**	**Marijuana (*n* = 3,656)**	**Alcohol (*n* = 2,916)**	**Prescription sedative or tranquilizer misuse (*n* = 678)**	**Prescription stimulant misuse (*n* = 513)**	**Methamphetamine (*n* = 409)**	**Cocaine (*n* = 531)**	**No reported substance (*n* = 1,244)**
Overall		2.86	13.61	67.99	54.23	12.61	9.54	7.61	9.88	23.14	2.86
SUBSTANCE USE AND TREATMENT HISTORY											
For those who use the corresponding substance, mean age of initiation (Standard Deviation)[a], years		14.30 (2.46)	14.36 (2.39)	13.69 (2.74)	12.90 (2.22)	12.99 (2.64)	14.05 (2.13)	13.53 (3.05)	14.35 (1.95)	14.65 (2.01)	NA
ROUTE OF ADMINISTRATION FOR ANY SUBSTANCE USED DURING THE LIFETIME											
No injection drug use (swallowed, snorted, smoked or other method[b] were reported)	63.03	2.54	2.66	19.09	97.34	72.56	18.32	13.25	9.59	13.66	0
Injection drug use (swallowed, snorted, smoked or other method may also be reported)	1.67	41.11	67.78	71.11	96.67	88.89	61.11	51.11	82.22	65.56	0
Missing	35.30	0.11	0.16	1.11	14.23	19.86	0.11	0.95	0.53	0.47	65.54
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
EVER ATTENDED ALCOHOLICS ANONYMOUS, MARIJUANA ANONYMOUS, COCAINE ANONYMOUS, NARCOTICS ANONYMOUS, OR ANY OTHER KIND OF GROUP FOR RESPONDERS' ALCOHOL OR DRUG USE											
Yes	13.76	7.97	10.00	37.16	95.41	81.22	33.65	26.89	22.57	29.05	0.95
No	85.88	1.43	1.73	9.85	63.69	49.98	9.25	6.78	5.24	6.82	26.66
Unknown/No response	0.35	0.00	0.00	10.53	47.37	36.84	10.53	5.26	0.00	5.26	31.58

Characteristic	% Substances used during the lifetime										
	Total assessments, % (*N* = 5,377)	**Illegally made fentanyl (*n* = 125)**	**Heroin (*n* = 154)**	**Prescription opioid misuse (*n* = 732)**	**Marijuana (*n* = 3,656)**	**Alcohol (*n* = 2,916)**	**Prescription sedative or tranquilizer misuse (*n* = 678)**	**Prescription stimulant misuse (*n* = 513)**	**Methamphetamine (*n* = 409)**	**Cocaine (*n* = 531)**	**No reported substance (*n* = 1,244)**
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
EVER HAD COUNSELING OR TREATMENT[c] FOR RESPONDERS' ALCOHOL/DRUG USE											
Yes	24.12	5.94	7.63	30.61	96.14	80.19	27.29	22.59	18.66	23.28	0.62
No	75.56	1.18	1.35	8.15	59.12	46.00	7.93	5.39	4.11	5.61	30.35
Unknown/ response	0.32	0.00	0.00	23.53	41.18	41.18	11.76	5.88	0.00	5.88	17.65
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
RECEIVED TREATMENT AS PART OF AN OFFICIAL MEDICATIONS FOR SUBSTANCE USE DISORDERS PROGRAM IN THE PAST 30 DAYS [d]											
Yes	5.52	6.73	6.40	24.24	89.23	64.65	21.21	18.18	16.50	17.17	2.69
No	92.37	2.09	2.68	13.01	67.36	54.10	12.22	9.10	7.15	9.56	23.94
Unknown/ response	2.10	0.88	1.77	12.39	39.82	32.74	7.08	6.19	4.42	4.42	41.59
P-value		<.0001	0.0007	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001<.0001	
HISTORY OF INVOLVEMENT WITH THE JUSTICE SYSTEM											
HISTORY OF CRIMINAL JUSTICE INVOLVEMENT [e]											
Yes	58.99	3.31	4.10	18.92	86.79	66.39	17.09	12.93	11.07	14.38	7.41
No	40.93	0.91	1.09	5.95	40.98	36.76	6.18	4.63	2.64	3.41	45.84
Unknown/ response	0.07	0.00	0.00	25.00	25.00	25.00	0.00	25.00	0.00	0.00	0.00
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CURRENTLY ON PROBATION											
Yes	37.98	3.18	3.53	18.22	88.93	66.50	16.70	11.70	10.38	14.10	5.68
No	61.99	1.80	2.46	10.80	55.21	46.74	10.11	8.22	5.91	7.29	33.84
Unknown/ response	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-value		0.0047	0.0732	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
IN THE CONTROLLED ENVIRONMENT (JUSTICE-SYSTEM)[f] DURING THE PAST 30-DAY											
Yes	21.80	3.84	5.12	22.53	87.71	68.77	20.65	13.99	13.57	17.15	7.08
No	78.20	1.90	2.24	11.13	62.50	50.18	10.37	8.30	5.95	7.85	27.61

Characteristic	Total assessments, % (*N* = 5,377)	% Substances used during the lifetime: Illegally made fentanyl (*n* = 125)	Heroin (*n* = 154)	Prescription opioid misuse (*n* = 732)	Marijuana (*n* = 3,656)	Alcohol (*n* = 2,916)	Prescription sedative or tranquilizer misuse (*n* = 678)	Prescription stimulant misuse (*n* = 513)	Methamphetamine (*n* = 409)	Cocaine (*n* = 531)	No reported substance (*n* = 1,244)
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
MODERATE TO EXTREME SEVERITY IN THE PAST 30-DAY FOR BIOPSYCHOSOCIAL CONTENT AREAS											
EMOTIONAL/PSYCHOLOGICAL HEALTH											
Yes	28.10	4.37	4.83	21.58	68.50	64.00	20.52	16.41	11.05	15.16	21.77
No	70.95	1.49	2.10	10.54	68.23	50.62	9.59	6.92	6.29	7.86	23.43
Unknown/No response	0.95	3.92	1.96	7.84	35.29	35.29	3.92	1.96	3.92	3.92	41.18
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0039
FAMILY RELATIONSHIPS											
Yes	14.97	3.98	5.96	20.62	73.91	65.09	20.62	15.90	11.06	15.28	18.14
No	82.63	2.09	2.39	12.47	67.50	52.71	11.32	8.53	7.09	9.00	23.77
Unknown/ response	2.40	0.00	0.00	9.30	48.06	38.76	6.98	4.65	3.88	6.20	32.56
P-value		0.0010	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001
FRIEND/PEER RELATIONSHIPS											
Yes	18.34	6.80	8.22	28.90	82.66	73.73	25.76	22.52	18.15	23.23	10.45
No	79.47	1.36	1.71	10.18	65.18	50.18	9.69	6.60	5.24	6.90	25.74
Unknown/ response	2.19	0.00	0.00	10.17	47.46	38.14	8.47	7.63	5.08	5.93	34.75
P-value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001
ALCOHOL USE											
Yes	7.76	6.47	6.47	36.21	95.20	100.00	32.85	29.98	18.71	30.94	0.00
No	91.76	1.97	2.57	11.71	65.77	50.28	10.96	7.84	6.67	8.09	25.21
Unknown/ response	0.48	3.85	0.00	11.54	53.85	69.23	0.00	3.85	7.69	11.54	0.00
P-value		0.0161	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
TOBACCO USE											
Yes	14.56	6.90	10.34	36.40	97.70	87.87	33.72	28.10	25.54	31.55	0.00
No	84.94	1.51	1.60	9.70	63.02	48.48	9.00	6.35	4.55	6.17	27.24

Characteristic	% Substances used during the lifetime										
	Total assessments, % (*N* = 5,377)	**Illegally made fentanyl (*n* = 125)**	**Heroin (*n* = 154)**	**Prescription opioid misuse (*n* = 732)**	**Marijuana (*n* = 3,656)**	**Alcohol (*n* = 2,916)**	**Prescription sedative or tranquilizer misuse (*n* = 678)**	**Prescription stimulant misuse (*n* = 513)**	**Methamphetamine (*n* = 409)**	**Cocaine (*n* = 531)**	**No reported substance (*n* = 1,244)**
Unknown/ response	0.50	7.41	0.00	14.81	48.15	51.85	11.11	11.11	3.70	7.41	0.00
P-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
DRUG USE											
Yes	20.10	5.74	7.40	31.73	97.87	81.13	29.69	23.59	17.58	25.07	0.19
No	76.94	1.45	1.76	8.99	60.87	47.69	8.17	5.99	5.20	6.19	28.79
Unknown/ response	2.96	1.89	0.63	10.69	50.31	41.51	11.95	6.29	2.52	2.52	32.08
P-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Data Source: The National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Comprehensive Health Assessment for Teens (CHAT). The unit of analysis was each assessment.

[a]For calculating the mean age of initiation of the corresponding substance, we excluded those with 0 and other missing cases (−1, −2), and excluded those who reported that the age of initiation is greater than the respondents' current age.

[b]Swallow doesn't include legitimate medical use (obtained from a prescription ONLY and used only as directed). Other method includes dissolving the substance in mouth like a cough drop, drinking it after it dissolved in liquid, or other unspecified method.

[c]Treatment may include therapy with a counselor, inpatient rehabilitation, or residential treatment.

[d]Official medications for SUD program (previously referred to medication-assisted therapy program in the CHAT) included a methadone maintenance program, buprenorphine or Suboxone® treatment, or Vivitrol® or naltrexone treatment for alcohol/drugs.

[e]History of criminal justice involvement is defined as individuals reported that they have ever been in trouble with the law or arrested.

[f]Controlled environment (justice-system) include juvenile justice center, detention center, jail, prison, or other residential setting such as a group home or residential program.

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