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Prevalence and health characteristics of prescription opioid use, misuse, and use disorders among US adolescents

Jasmin Carmona[a], **Jane Carlisle Maxwell**[b], **Ji-Yeun Park**[c], **Li-Tzy Wu**[a,d,e,f]

[a]Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, USA

[b]Addiction Research Institute, Steve Hicks School of Social Work, University of Texas at Austin

[c]Moores Cancer Center, University of California San Diego, San Diego, CA 92093, USA

[d]Department of Medicine, Division of General Internal Medicine, Duke University Medical Center, Durham, NC, USA

[e]Duke Clinical Research Institute, Duke University Medical Center, Durham, NC, USA

[f]Center for Child and Family Policy, Sanford School of Public Policy, Duke University, Durham, NC, USA

Abstract

Purpose: The prevalence of past-year prescription opioid use (POU), nonmedical prescription opioid use (NMPOU), prescription opioid use disorder (POUD) and their correlates were examined in a national sample of American adolescents (N=41,579).

Methods: This study utilized data from the public-use files of the 2015, 2016, and 2017 National Surveys on Drug Use and Health (NSDUH), which captured substance use and mental health problems among non-institutionalized individuals. Prevalence and specific types of prescription opioids and other substances used and misused in the past year were examined among adolescents. Logistic regression analyses were conducted to determine correlates (demographics, other substances used, past-year major depressive episode, school enrollment, 2-parent household, number of lifetime medical conditions, and survey year) of POU, NMPOU, and POUD.

Results: Multiple substance use was common within the past year. The most frequently used prescription opioids were hydrocodone, codeine, oxycodone, and other opioids among adolescents. Cannabis use disorder and alcohol use disorder were comparatively prevalent among

opioid misusers. Several correlates (demographics, other substances used, lifetime medical conditions, major depressive episode, and survey year) of POU, NMPOU, and POUD were found.

Conclusions: In this national sample, multiple substance use was common among adolescents with past-year POU and NMPOU. Clinical screening for opioid use problems, assessment, and treatment expansion for POUD can focus on persons with substance use, mental health and/or behavioral problems. Longitudinal studies are needed to better elucidate temporal associations between POU and NMPOU/POUD among adolescents, and more prevention and treatment research on rural residents and minority groups is needed.

Declared a public health emergency,[1] the opioid epidemic has gained public awareness within the past two decades, with nonmedical prescription opioid use (NMPOU) and prescription opioid use disorder (POUD: including DSM-IV prescription opioid abuse or dependence[2]) emerging as a national crisis. Understanding opioid prescribing practices and exposure is critical for adolescents. Adolescence is characterized by unique developments in brain and behavior that may contribute to more sensitivity in the rewarding properties and less sensitivity to the aversive properties of substances than adulthood.[3] Adolescents may be vulnerable to NMPOU due to inaccurate perceptions of risk,[4,5] which may increase opioid-related poison cases and emergency department visits.[5,6] NMPOU in adolescence has been a robust predictor and correlate of later opioid misuse and heroin use.[7,8,9] Moreover, McCabe et al[10] found that adolescents who reported both POU and NMPOU were likely to engage in POU before initiating NMPOU. In sum, adolescence may be a developmental period that contributes to the vulnerability for opioid-related health complications and long-term maladaptive behaviors for youth.

Several factors are associated with adolescents' opioid misuse and abuse/dependence. Prior data have shown that older age is associated with increased odds of adolescent NMPOU, but research on gender differences is mixed.[11,12] Adolescents who reported excellent health tend to have low odds of NMPOU[12] and multiple studies have found a relationship between adolescent NMPOU and prescription drug abuse/dependence.[11] Having a major depressive episode (MDE) has been associated with adolescent NMPOU.[13,14] Also, misusing prescription opioids is typically more common among Whites than non-Whites.[11] Drug- and opioid-involved overdose deaths have significantly differed across census region,[15] and research has suggested that rural and small urban adolescents have greater odds of NMPOU than urban peers.[16]

Effective prevention and treatment options are imperative for adolescent POUD. Medication assisted treatments (MATs), such as the buprenorphine/naloxone combination and extended release naltrexone, have been safely and effectively used with youth.[17,18] Yet, concerns about adolescent nonadherence, diversion, and safety of MATs have been reported.[19] Adolescents who misuse opioids tend to have high relapse rates, low treatment retention, and worse post-treatment outcomes than opioid nonusers.[17] Wu et al[20] found that most

adolescents with POUD did not receive any substance abuse services or treatment. The adolescents themselves did not perceive a need for treatment, suggesting a low likelihood of service utilization.[20]

These were the aims of this study: 1) Examine prescription opioid use (POU: using an opioid without misuse), nonmedical prescription opioid use (NMPOU: using an opioid in any way not directed by a doctor), and prescription opioid use disorder (POUD: including DSM-IV prescription opioid abuse or dependence[2]) by demographics among a nationally representative sample of adolescents aged 12-17 years. A second aim was to identify prevalence of specific types of prescription opioids used by adolescents with POU or NMPOU. A third aim was to examine other substances used and substance use disorders (SUDs) among adolescents with POU and NMPOU. The last aim was to identify correlates including demographics, other substances used, past-year MDE, school enrollment, living in a two-parent household, medical conditions, and survey year of POU, NMPOU, and POUD.

To increase generalizability, we utilized self-report data from the 2015-2017 National Surveys on Drug Use and Health (NSDUH).[21-23] Significant strengths of the NSDUH include a large sample size, utilizing computer-assisted self-administration interviewing, and providing electronic pictures of prescription drugs.[21-23] In 2015, the NSDUH revised prescription drug modules for opioids. Improvements to opioid use assessments include a new definition of prescription opioid misuse, a shift in questions from the lifetime period to the past year, and measures of the frequency of past-month misuse.[21-23]

Findings from this study extend prior research by utilizing recent data and revised NSDUH measures to ascertain a clearer understanding of prescription opioid use and misuse patterns than prior NSDUH years. While previous research has focused on adult POU and NMPOU, less is known on adolescent POU in relation to NMPOU and POUD.[10] The current study addresses this gap in the literature by examining the characteristics of prescription opioid use and misuse among adolescents.

Moreover, findings may yield clinical implications for enhancing screening, intervention, and treatment efforts targeting adolescent NMPOU and POUD.

Methods

Data source

This study utilized data from the public-use files of the 2015-2017 NSDUH. This study was considered exempt from the Duke Health Institutional Review Board because it used existing public use data. The NSDUH captures substance use and mental health problems among non-institutionalized individuals aged ≥ 12 years residing in the United States.[21-23] A coordinated 4-year sample design was used with multistage area probability sampling methods within each state and the District of Columbia. Respondents included household residents, civilians residing on military bases, and residents in temporary housing. Homeless people who do not use shelters and military personnel on active duty were not included in the NSDUH. Adolescents were oversampled. NSDUH field interviewers (FI) conducted the interviews in a private area in the home away from other household members. FI read survey

questions and entered respondents' answers into a computer. For sensitive topics, respondents read survey questions or listened to audio recorded questions and directly entered their responses into the computer. Confidentiality was stressed in all written and oral communications. Respondents received $30 for completing the interview. In total, 41,579 adolescents (aged 12-17 years) completed the NSDUH in 2015 (n = 13,585), 2016 (n = 14,272), and 2017 (n= 13,722). The weighted response rate for interviewing was *69.2%* in 2015, 68.4% in 2016, and 67.1% in 2017.[21-23]

Study variables

Sociodemographic variables.—Sociodemographic characteristics examined were age, sex, and race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic other). Total annual family income (under $50,000, $50,000-$74,999, and $75,000), health insurance status (yes/no), and population density of residence were examined because of potential associations with opioid use.[15,24] The NSDUH defined population density of residence based on the US Bureau of the Census's Core-Based Statistical Areas (CBSA): large metropolitan area (CBSA with 1 million persons), small metropolitan area (CBSA with <1 million persons), and non-metropolitan area (not in a CBSA).[21-23] Given that sex, age, race/ethnicity, living in a 2-parent household, and school enrollment have been associated with adolescent opioid use or misuse,[11,13] they were included as covariates. The survey year (2015, 2016 and 2017) was categorized and included in the logistic regression analysis as a variable.

Behavioral health, mental health, and medical conditions.—NSDUH defined prescription drug use as either the use of one's own prescription medication as directed by a doctor or the misuse of prescription drugs.[21-23] NSDUH defined prescription drug misuse as using a medication in any way not directed by a doctor, such as using without a prescription of one's own medication or using in greater amounts, more often, or longer than told.[21-23] In this study, POU was defined as adolescents using prescription opioids as directed by a doctor without misuse. In this study, NMPOU was defined as adolescents using prescription opioids as directed by a doctor and misusing the prescription opioids in any way not directed by a doctor. Among respondents who reported past-year use or misuse, additional substance-specific questions were administered to assess whether criteria were met for alcohol and drug-specific SUDs. Alcohol and drug-specific SUDs were based on abuse of or dependence on the substance-specific DSM-IV criteria.[2] To better understand patterns of opioids used, we examined the frequency, types, and number of categories of opioids used or misused. Past-year MDE was defined as experiencing at least five out of the nine criteria specified for MDE within the DSM-IV[2], where at least one of the criteria is a depressed mood or loss of interest or pleasure in daily activities. Based on prior research,[13,14,25] past-year MDE and self-reported lifetime medical conditions (heart condition, diabetes/sugar diabetes, bronchitis/COPD, liver cirrhosis, Hepatitis B or C, kidney disease, asthma, HIV or AIDS, cancer, and high blood pressure) were included as covariates.

Data analysis

First, past-year prevalence of POU, NMPOU, and POUD by respondents' demographics was produced. Next, prevalence of specific types of prescription opioids used among adolescents

with POU and NMPOU were examined. Prevalence of other substances used and SUDs were investigated among adolescents with POU and NMPOU. Finally, logistic regression analyses were conducted to identify correlates of POU, NMPOU, and POUD, respectively (demographics, other substances used, past-year MDE, school enrollment, 2-parent household, number of lifetime medical conditions, and survey year). Multinomial logistic regressions were used to predict adolescent risk behavior in prior research[26] and were conducted to determine the associations between variables and POU, NMPOU, and POUD in the current study. Given that POU has been a predictor for NMPOU among some adolescents,[9] identifying the correlates of POU may elucidate characteristics of adolescents who used opioids as directed by a doctor and may be a step towards better understanding the transition from POU to NMPOU. Analyses were conducted by SAS 9.4 and took into account the complex survey design of the NSDUH data (e.g., clustering effects).[27] Respondents who did not respond to certain questions were considered missing.

Results

Characteristics of the study sample (Table 1)

Demographics.—Of the adolescent sample aged 12-17 years (N = 41, 579), 22% used alcohol, 12% used cannabis, 4% used illicit drugs other than cannabis, and 11% used or misused other prescription drugs in the past year.

Prevalence of past-year POU, NMPOU, and POUD.—Compared with adolescents aged 12-13 years, adolescents aged 14-17 years had a higher prevalence of POU, NMPOU, and POUD. Females had a higher prevalence of POU and POUD than males. Non-Hispanic Asian/Native Hawaiian/Pacific Islander adolescents had a lower prevalence of POU and NMPOU than Non-Hispanic White peers. Compared with those residing in large metropolitan areas, those residing in small metropolitan areas and non-metropolitan areas had a higher prevalence of POU or NMPOU.

The prevalence of past-year POU, NMPOU, and POUD were higher among adolescents who used alcohol or cannabis compared to non-users. Individuals who used illicit drugs other than cannabis had a higher prevalence of POU (22.1% vs. 15.8%), NMPOU (23.9% vs. 2.5%) and POUD (5.4% vs. 0.2%) in the past year than their respective counterparts. Adolescents who reported other prescription drug use or misuse in the past year had a relatively higher prevalence of POU (30.2% vs. 14.4%), NMPOU (17% vs. 1.8%), and POUD (3.2% vs. 0.1%) than their respective counterparts.

Adolescents with ≥ 2 lifetime medical conditions had a higher prevalence of POU (22.4% vs. 15.3%), NMPOU (9% vs. 3.3%), and POUD (2.5% vs. 0.4%) than peers without medical conditions. Similarly, individuals who reported past-year MDE had a higher prevalence of POU (21.7% vs. 15.3%), NMPOU (8% vs. 2.8%), and POUD (2.1% vs. 0.2%) than individuals without past-year MDE. The prevalence of POU in the past year was lower in 2016-2017, and the prevalence of NMPOU was lower in 2017, than in 2015.

Patterns of POU among adolescents with past-year POU and NMPOU (Table 2)

Among adolescents with past-year POU, the three most commonly used prescription opioid groups included hydrocodone (22%), codeine (18.9%), and other prescription opioids (44.6%; use of any other prescription pain relievers besides the eleven specific prescription opioids listed in Table 2). Hydrocodone (44.9%), oxycodone (37.9%), and other prescription opioids (43.4%) were the most common prescription opioid groups among adolescents with past-year NMPOU. The prevalence of using 1 category of prescription opioids was 63.6%, followed by 15.6% for using 2 categories of prescription opioids and 6.6% for using 3 categories of prescription opioids among adolescents with POU. Among adolescents with NMPOU, the prevalence of using 1 category of prescription opioids was 39.7%, followed by 24.8% for using 2 categories of prescription opioids and 27.3% for using 3 categories of prescription opioids.

Substance use and SUDs among adolescents with past-year POU and NMPOU (Table 3)

Next, the prevalence of substance use and SUDs were examined among adolescents with past-year POU and NMPOU. Among adolescents who used opioids without misuse, the most prevalent substances used included alcohol (30.9%) and cannabis (15.2%). Among adolescents who used prescription opioids in any way not directed by a doctor, the prevalence for alcohol (63.4%), and cannabis (52.2%) was relatively high. For both adolescents with POU and NMPOU, the most common past-year SUD was cannabis use disorder, while the second most common past-year SUD was alcohol use disorder (AUD).

Correlates of past-year POU, NMPOU, and POUD (Table 4)

We conducted multinomial logistic regression to determine correlates of prescription opioid use status (no use, Rx opioid use, Rx opioid misuse without disorder, and Rx opioid misuse with disorder). Relative to no use, the odds of POU, NMPOU (Rx opioid misuse without disorder), and POUD (Rx opioid misuse with disorder) were higher among adolescents with alcohol use, illicit drug use other than cannabis (inhalants, hallucinogens, cocaine, heroin, or methamphetamine), other Rx drug use or misuse (tranquilizers, sedatives, or stimulants), and MDE in the past year.

Relative to no use, the odds of POU, NMPOU (Rx opioid misuse without disorder) and POUD (Rx opioid misuse with disorder) differed by several characteristics. Adolescents aged 14-17 years, Non-Hispanic Blacks, those with a father-only household, and residents in non-metropolitan areas had increased odds of POU and NMPOU but not POUD than their respective counterparts. Similarly, the odds of POU and NMPOU were lower during years 2016-2017 than year 2015, but the relationship was not significant for POUD. Hispanics and adolescents with 2 medical conditions had increased odds of NMPOU and POUD but not POU than their respective counterparts. The odds of NMPOU and POUD were higher among adolescents with past-year cannabis use, but the odds of POU were lower among adolescents with past-year cannabis use. Adolescents with only one medical condition had higher odds of POU only, and females had higher odds of POU and POUD but not NMPOU.

Discussion

Given the potential for long-term and detrimental consequences of prescription opioid misuse,[6,7] it is imperative to identify the scope and correlates of prescription opioids used and misused among adolescents. Using a national sample, we identified the prevalence of past-year prescription opioid use (POU), nonmedical prescription opioid use (NMPOU), and prescription opioid use disorder (POUD) and correlates among adolescents (aged 12-17 years). Results revealed use of multiple substances within the past year, including hydrocodone, codeine, oxycodone, and other opioids, was common among adolescents. Variations in correlates of POU, NMPOU, and POUD were found. Clarifying the prevalence, types, and correlates of opioids may provide guidance for prevention and intervention efforts aimed at reducing consequences from opioid misuse.

These findings from a large national sample revealed that use of multiple substances (alcohol and cannabis) was common in the past year among adolescents. Approximately 31% of adolescents with POU and 63% of adolescents with NMPOU used alcohol in the past year, and 15% of adolescents with POU and 52% of adolescents with NMPOU used cannabis in the past year. Frank et al.[28] found that initial NMPOU often occurred during adolescence and in combination with cannabis and alcohol. Our findings and prior study findings[28] suggest that intervention efforts should address multiple substance use rather than NMPOU only. Frank et al[28] recommended that outreach workers understand the uniqueness of multiple substance use at a local-level to develop tailored interventions. Given the potential for dangerous drug interactions between prescription opioids and other substances,[29] more research on effectively treating multiple substance use is warranted.

This study's findings suggested that use of hydrocodone, codeine, oxycodone, and other prescription opioids were common among adolescents with POU and NMPOU. One study found that hydrocodone and oxycodone were among the top five most frequently misused or abused drugs among adolescents.[30] Voepel-Lewis et al[31] found that children and adolescents received less than 50% of their prescribed doses for hydrocodone, codeine, and oxycodone, which increased the likelihood of misuse of the unused opioids and suggested a mismatch between opioids prescribed and used. Binswanger and Glanz (2015)[32] recommended that parents store their prescription opioids in a portable lock box or locked medicine cabinet installed in the home. Thus, parental monitoring on the dosage, secure storage, and diversion of prescribed opioids may be instrumental for preventing adolescent POU from increasing in severity to NMPOU.[11,32-33]

Several correlates of adolescent POU and NMPOU were identified. Age was positively associated with past-year POU and NMPOU, which mirrored prior data that adolescent NMPOU increases with age.[11] Non-Hispanic Blacks were more likely to report past-year POU and NMPOU than Non-Hispanic Whites. Ford and Rigg[34] suggested that the demographic shift in NMPOU among Black adolescents may be due to prevention efforts having more success in reaching White adolescents than Black adolescents. Residents in non-metropolitan areas were found to have a higher likelihood of NMPOU than residents in large metropolitan areas. Rural adolescents have been more likely to engage in NMPOU than urban counterparts, perhaps due to cultural, structural, and social factors unique to rural

life.[13] Finally, the prevalence of POU and NMPOU decreased in 2016 and 2017 compared with 2015, mirroring other studies[10,35] that suggested a downward trend in opioid prescribing and misuse among adolescents. Hu et al[35] suggested that the downward trend may be due to the increase of prescription drug monitoring programs, policies targeting POU for chronic pain, and media attention on addiction.

The results of correlates of adolescent NMPOU and POUD have implications for identifying subgroups of adolescents for targeted treatment efforts. Hispanics were more likely to report NMPOU and POUD than Non-Hispanic Whites. Perhaps treatment services may benefit from cultural adaptations given that minority groups typically underutilize treatment for opioid use disorder.[20] Females were found to have a higher likelihood of reporting past-year POUD than males. Research has suggested that females are more likely to use prescription opioids to cope with negative emotions; experience more stigma; and are less likely to enter treatment than males.[36] The findings by our study and prior research[36] suggest that gender differences should be considered in treatment engagement and retention efforts.

Consistent with prior research,[25] adolescents with two or more lifetime medical conditions were found to have increased odds of NMPOU and POUD than peers without medical conditions. School-based prevention programs that include non-pharmacological strategies for coping with medical conditions may benefit adolescents likely to self-medicate with prescription opioids.[37] Also, high schools and community-based settings should provide naloxone and overdose prevention/response education to youth.[28] Dodington et al[38] suggested for parents and other individuals in the home to receive training on overdose response and using naloxone.

Moreover, adolescents who reported past-year MDE were found to have higher odds of POU, NMPOU, and POUD. Edlund et al14 found MDE as often preceding NMPOU, possibly suggesting that MDE may be a risk factor for adolescent NMPOU. Effective screening for POUD among adolescents with a history of MDE may be paramount for early intervention efforts.

Limitations

These results should be interpreted within the limitations of the data source. The NSDUH utilizes a cross-sectional design, and causality between study variables cannot be determined. NSDUH data are based on self-reports, and responder bias may occur due to the sensitive nature of questions. For example, underreporting of NMPOU or POUD may have occurred due to perceived social undesirability of misusing medications or having a SUD. Data collection procedures precluded analyses on whether respondents who misused prescription opioids also used prescription opioids medically. This study did not examine the motivations for misusing or abusing opioids. Prior studies have suggested social factors (parental bonding, attitudes toward drug use, peer drug use, and religiosity)[11,16] that influence adolescent NMPOU, but future research should examine these factors in the transition from POU to NMPOU/POUD.

Conclusion and clinical implications

In this national sample, multiple substance use was common among adolescents with past-year POU and NMPOU. Elevated odds of NMPOU were noted among adolescents aged14-17 years, Non-Hispanic Blacks, Hispanics, users of alcohol or cannabis, and residents in non-metropolitan areas. Similarly, adolescents who reported having father-only households, past-year MDE, and two or more medical problems had elevated odds of NMPOU. These demographic, mental health, and substance use characteristics could be the target for prevention efforts thwarting the progress to drug-involved overdose or drug use disorder. Female and Hispanic adolescents had elevated odds of POUD, and adolescents with past-year cannabis use, past-year MDE, and a history of two or more medical problems had elevated odds of POUD. Thus, clinical screening for opioid use problems, assessment, and treatment expansion efforts for POUD can focus on persons with substance use and/or multiple health problems.

Elevated odds of POU also were noted among adolescents aged 14-17 years, females, Non-Hispanic Blacks, users of alcohol, and residents in small and non-metropolitan areas. Adolescents with father-only households, a MDE, and a medical problem had elevated odds of POU. Longitudinal studies are needed to better define temporal associations between POU and NMPOU/POUD among adolescents to inform clinically useful prevention strategies. There is a need for more prevention and treatment research to focus on rural residents and minority groups. For example, physicians with waivers to prescribe buprenorphine could deliver office-based treatment for POUD in rural areas.[39] Finally, our study's findings indicate a need for prevention and treatment efforts to target multiple substance and increase parental monitoring and parent education about adolescent NMPOU/POUD.[11,28,32]

Acknowledgments

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Implications and Contribution

Prevention efforts thwarting drug-involved overdose or addiction should target behavioral health problems among adolescents. Screening for opioid misuse may focus on adolescents with substance use or mental health problems. Findings indicate a need for prevention and treatment efforts to screen and intervene for multiple substance use in medical settings.

Table 1.

Past-year prevalence of prescription opioid use, misuse, and use disorder among U.S. adolescents aged 12-17 years

Characteristic	Adolescents (N=41,579)	Prevalence of Rx opioid use or misuse	Prevalence of Rx opioid use	Prevalence of Rx opioid misuse	Prevalence of Rx opioid use disorder
Overall % (95% CI)		19.67 (19.14-20.19)	16.14 (15.62-16.66)	3.52 (3.30-3.75)	0.52 (0.43-0.61)
Prevalence	n (Column %)	Row % (95% CI)	Row % (95% CI)	Row % (95% CI)	Row % (95% CI)
Age, years					
12-13 [†]	13,222 (31.28%)	13.71 (12.93-14.49)	12.13 (11.38-12.88)	1.58 (1.33-1.84)	0.21 (0.11-0.32)
14-15	14,314 (34.59%)	**19.67 (18.77-20.57)**	**16.26 (15.40-17.13)**	**3.41 (3.06-3.75)**	**0.65 (0.43-0.87)**
16-17	14,043 (34.13%)	**25.12 (24.13-26.11)**	**19.70 (18.85-20.54)**	**5.42 (4.93-5.92)**	**0.66 (0.52-0.81)**
Sex					
Male [†]	21,246 (50.94%)	18.46 (17.76-19.17)	15.21 (14.57-15.84)	3.26 (2.93-3.58)	0.34 (0.24-0.44)
Female	20,333 (49.06%)	**20.92 (20.19-21.64)**	**17.11 (16.37-17.86)**	3.80 (3.49-4.12)	**0.70 (0.57-0.84)**
Race/ethnicity					
Non-Hispanic White [†]	22,182 (53.18%)	19.98 (19.23-20.74)	16.62 (15.98-17.26)	3.36 (3.04-3.68)	0.45 (0.33-0.57)
Non-Hispanic Black	5,438 (13.74%)	20.97 (19.39-22.56)	17.17 (15.65-18.68)	3.81 (3.27-4.34)	0.43 (0.24-0.62)
Hispanic	9,182 (23.51%)	19.19 (18.04-20.34)	15.25 (14.17-16.33)	3.94 (3.53-4.35)	0.70 (0.51-0.89)
Non-Hispanic Asian/ Native Hawaiian/Pacific Islander	1,806 (5.71%)	**15.17 (12.89-17.46)**	**13.16 (10.98-15.34)**	**2.02 (1.27-2.76)**	0.41 (0.06-0.75)
Non-Hispanic Other	2,971 (3.86%)	20.22 (18.24-22.19)	15.74 (13.88-17.60)	4.48 (3.37-5.58)	0.80 (0.30-1.29)
Family income					
<$49,999	18,839 (43.82%)	20.04 (19.29-20.78)	16.11 (15.42-16.81)	3.92 (3.58-4.26)	0.63 (0.51-0.75)
$50,000-$74,999	6,276 (14.43%)	20.05 (18.83-21.26)	16.85 (15.77-17.93)	3.20 (2.58-3.82)	0.48 (0.19-0.76)
$75,000 [†]	16,464 (41.74%)	19.15 (18.39-19.91)	15.93 (15.21-16.65)	3.22 (2.81-3.63)	0.41 (0.30-0.53)
Insurance status					
Yes	40,029 (95.55%)	19.70 (19.15-20.25)	16.20 (15.67-16.74)	3.50 (3.27-3.73)	0.52 (0.42-0.61)
No [†]	1,550 (4.45%)	18.95 (16.09-21.80)	14.87 (12.25-17.49)	4.08 (2.90-5.25)	0.56 (0.08-1.05)
Population density					
In a CBSA with 1 million persons [†]	17,753 (54.92%)	18.73 (18.05-19.41)	15.33 (14.62-16.04)	3.40 (3.09-3.71)	0.47 (0.33-0.61)
In a CBSA with < 1 million persons	20,244 (39.30%)	**20.43 (19.55-21.31)**	16.81 (15.98-17.65)	3.62 (3.25-3.98)	0.59 (0.42-0.76)
Not in a CBSA	3,582 (5.79%)	**23.40 (21.21-25.58)**	**19.31 (17.27-21.35)**	4.09 (3.07-5.10)	0.46 (0.19-0.74)
Past-year alcohol use					
No [†]	32,160 (77.61%)	16.04 (15.52-16.55)	14.38 (13.82-14.93)	1.66 (1.45-1.87)	0.20 (0.13-0.27)
Yes	9,419 (22.39%)	**32.25 (30.94-33.55)**	**22.27 (21.22-23.32)**	**9.98 (9.31-10.65)**	**1.62 (1.29-1.96)**
Past-year cannabis use					
No [†]	36,134 (87.58%)	17.56 (17.09-18.03)	15.64 (15.14-16.13)	1.92 (1.73-2.11)	0.23 (0.15-0.30)
Yes	5,445 (12.42%)	**34.54 (32.78-36.30)**	**19.72 (18.14-21.30)**	**14.82 (13.61-16.03)**	**2.58 (2.04-3.12)**

Characteristic	Adolescents (N=41,579)	Prevalence of Rx opioid use or misuse	Prevalence of Rx opioid use	Prevalence of Rx opioid misuse	Prevalence of Rx opioid use disorder
Past-year illicit drug use other than cannabis[a]					
No [†]	39,609 (95.54%)	18.43 (17.95-18.92)	15.86 (15.37-16.36)	2.57 (2.34-2.80)	0.29 (0.20-0.38)
Yes	1,970 (4.46%)	**46.04 (43.06-49.03)**	**22.12 (19.63-24.60)**	**23.92 (21.86-25.99)**	**5.42 (4.29-6.56)**
Past-year other Rx drug use or misuse[b]					
No [†]	36,836 (88.95%)	16.24 (15.73-16.75)	14.40 (13.90-14.89)	1.84 (1.68-2.01)	0.18 (0.12-0.24)
Yes	4,743 (11.05%)	**47.25 (45.36-49.14)**	**30.20 (28.45-31.95)**	**17.05 (15.73-18.38)**	**3.22 (2.60-3.84)**
Self-rated lifetime medical conditions					
None [†]	33,345 (80.50%)	18.73 (18.13-19.33)	15.34 (14.74-15.93)	3.39 (3.15-3.64)	0.45 (0.35-0.54)
1	6,733 (15.88%)	**22.47 (21.28-23.66)**	**18.81 (17.72-19.91)**	3.66 (3.17-4.15)	0.71 (0.47-0.95)
2 or more	541 (1.26%)	**31.53 (26.03-37.03)**	**22.44 (17.46-27.42)**	**9.09 (6.18-12.01)**	**2.51 (0.58-4.44)**
Missing	960 (2.35%)	**26.41 (23.27-29.56)**	**22.32 (19.44-25.20)**	4.09 (2.40-5.79)	0.55 (0.12-0.97)
Past-year Major Depressive Episode					
Yes	5,354 (12.56%)	**29.76 (27.99-31.54)**	**21.76 (19.97-23.54)**	**8.01 (7.08-8.94)**	**2.13 (1.57-2.68)**
No [†]	35,064 (84.69%)	18.13 (17.54-18.73)	15.32 (14.76-15.87)	2.82 (2.61-3.03)	0.27 (0.20-0.35)
Missing	1,161 (2.75%)	20.73 (17.33-24.14)	15.98 (13.26-18.71)	**4.75 (3.17-6.33)**	0.76 (0.18-1.33)
Household composition					
Dual-parent	28,125 (69.74%)	18.93 (18.32-19.54)	15.66 (15.04-16.28)	3.27 (3.00-3.54)	0.49 (0.37-0.61)
Mother-only	9,877 (21.89%)	21.08 (19.96-22.20)	17.10 (16.11-18.09)	3.98 (3.53-4.44)	0.59 (0.41-0.78)
Father-only	1,865 (4.19%)	23.83 (21.50-26.16)	19.27 (17.06-21.48)	4.56 (3.54-5.57)	0.68 (0.21-1.15)
Neither [†]	1,672 (4.06%)	20.68 (18.45-22.91)	16.33 (13.96-18.71)	4.34 (3.44-5.25)	0.47 (0.12-0.83)
Missing	40 (0.12%)	10.38 (0.00-21.55)	6.48 (0.00-14.99)	3.90 (0.00-11.61)	0.00
Past-year School enrollment					
Yes [†]	39,335 (94.60%)	19.56 (19.01-20.10)	16.06 (15.53-16.58)	3.50 (3.25-3.75)	0.53 (0.43-0.63)
No	1,862 (4.50%)	20.57 (18.19-22.95)	16.77 (14.17-19.36)	3.80 (2.80-4.80)	0.22 (0.00-0.49)
Missing	382 (0.91%)	**26.52 (21.80-31.24)**	**21.95 (17.99-25.90)**	4.58 (1.99-7.17)	0.88 (0.01-1.75)
Survey year					
2015 [†]	13,585 (33.31%)	22.90 (22.01-23.80)	18.90 (18.00-19.80)	4.01 (3.59-4.43)	0.49 (0.34-0.65)
2016	14,272 (33.31%)	**19.06 (18.29-19.84)**	15.55 (14.82-16.29)	3.51 (3.14-3.87)	0.64 (0.45-0.83)
2017	0.43 (0.31-0.54)	13,722 (33.38%)	**17.04 (16.26-17.82)**	**13.98 (13.26-14.70)**	**3.06 (2.73-3.39)**

Note. The sample size is unweighted, and all results are weighted estimates. CBSA= The US Bureau of the Census's Core-Based Statistical Areas.

[†]:Reference group

Bold: Estimated prevalence is significantly different compared to reference group.

[a]Past-year illicit drug use other than cannabis was defined as using any one of the following illicit drugs: inhalants, hallucinogens, cocaine, heroin, or methamphetamine.

[b]Past-year other Rx drug use or misuse was defined as using or misusing any one of the following prescription drugs: tranquilizers, sedatives, or stimulants.

Table 2.

Prevalence of specific types of opioids used among adolescents aged 12-17 with past-year prescription opioid use: by use status

	Adolescents with Rx opioid use or misuse (N=8,260)	Adolescents with Rx opioid use (N=6,754)	Adolescents with Rx opioid misuse (N=1,506)
Past-year use or misuse of pain reliever products, % (95% CI)			
Hydrocodone	26.17 (24.82-27.53)	22.08 (20.52-23.64)	44.94 (41.39-48.49)
Oxycodone	18.96 (18.00-19.92)	14.81 (13.69-15.94)	37.96 (34.70-41.23)
Tramadol	7.95 (7.21-8.70)	6.42 (5.70-7.14)	14.96 (12.76-17.17)
Morphine	8.13 (7.30-8.95)	7.44 (6.56-8.33)	11.25 (9.30-13.20)
Fentanyl	1.17 (0.86-1.47)	0.91 (0.56-1.25)	2.36 (1.27-3.46)
Buprenorphine	1.33 (1.04-1.63)	0.87 (0.55-1.18)	3.46 (2.29-4.64)
Oxymorphone	1.64 (1.32-1.97)	0.98 (0.68-1.27)	4.69 (3.35-6.03)
Demerol	0.79 (0.60-0.98)	0.72 (0.51-0.92)	1.13 (0.59-1.68)
Hydromorphone	0.75 (0.49-1.02)	0.50 (0.27-0.73)	1.91 (0.89-2.93)
Methadone	0.94 (0.68-1.21)	0.38 (0.21-0.56)	3.50 (2.23-4.77)
Other[a]	44.44 (43.15-45.74)	44.66 (43.22-46.09)	43.47 (40.15-46.79)
Codeine[b]	20.89 (19.63-22.15)	18.93 (17.59-20.26)	29.90 (27.41-32.39)
Missing (n, %)	3,109 (38.79%)	2,569 (38.99%)	540 (37.87%)
Number of categories of pain reliever products used, % (95% CI)[1]			
1	59.31 (58.08-60.54)	63.58 (62.13-65.04)	39.71 (36.61-42.82)
2	17.23 (15.96-18.50)	15.57 (14.29-16.86)	24.82 (22.36-27.28)
3 or more	10.34 (9.59-11.08)	6.64 (5.89-7.39)	27.25 (24.77-29.73)
missing (n, %)	1,050 (13.13%)	948 (14.20%)	102 (8.21%)
Frequency of opioid misuse in past month, % (95% CI)			
1-2 days	2.68 (2.22-3.15)	-	14.98 (12.63-17.33)
3-5 days	1.46 (1.13-1.78)	-	8.13 (6.33-9.94)
6-19 days	0.88 (0.60-1.17)	-	4.93 (3.40-6.45)
20-30 days	0.19 (0.09-0.28)	-	1.04 (0.50-1.58)
Non user or No past-month misuse	94.79 (94.20-95.38)	100	70.92 (68.20-73.63)
Mean of days misusing opioids in the past month, Mean (95% CI)[2]			
	4.55 (3.89-5.21)	N/A	4.55 (3.89-5.21)

Note. The sample size is unweighted, and all results are weighted estimates.

[a]Any other prescription pain relievers: In addition to the specific prescription opioids, the NSDUH asked about any use of other prescription pain relievers.

[b]Questionnaire changes since 2016: Any past-year Codeine products includes any past-year use of Codeine, Tylenol with Codeine 3 or 4, or past-year misuse of other pain relievers that contain codeine.

[1]The results are based on individuals with the information available about pain reliever products used: Rx opioid users or misusers (n=7,210), Rx opioid users (n=5,806), and Rx opioid misusers (n=1,404).

[2]The results are based on individuals with the information available about opioid misuse in the past month: Rx opioid users or misusers (n=436) and Rx opioid misusers (n=436).

Table 3.

Past-year prevalence of other substance use/misuse and substance use disorders among adolescents aged 12-17 with past-year

	Adolescents with Rx opioid use or misuse (N=8,260)	Adolescents with Rx opioid use (N=6,754)	Adolescents with Rx opioid misuse (N=1,506)
Past-year substance use, % (95% CI)			
Alcohol use	36.72 (35.33-38.11)	30.89 (29.53-32.25)	63.42 (59.88-66.95)
Cannabis use	21.81 (20.82-22.80)	15.17 (14.11-16.23)	52.23 (48.88-55.57)
Cocaine use	2.06 (1.67-2.45)	0.58 (0.40-0.76)	8.84 (6.94-10.74)
Heroin use	0.22 (0.13-0.32)	0.10 (0.01-0.19)	0.78 (0.43-1.12)
Hallucinogen use	5.90 (5.27-6.54)	2.68 (2.20-3.16)	20.68 (18.16-23.19)
Inhalant use	4.69 (4.09-5.28)	3.42 (2.83-4.02)	10.48 (7.98-12.97)
Tranquilizer misuse[a]	6.03 (5.43-6.62)	1.84 (1.52-2.16)	25.22 (22.57-27.88)
Stimulant misuse[a]	5.64 (4.95-6.32)	2.05 (1.62-2.48)	22.07 (19.21-24.93)
Sedative misuse[a]	1.43 (1.06-1.81)	0.51 (0.25-0.77)	5.63 (3.80-7.46)
Methamphetamine use	0.59 (0.40-0.79)	0.06 (0.01-0.12)	3.03 (2.00-4.06)
Alcohol, or illicit/prescription drugs[a]	47.80 (46.40-49.21)	36.41 (34.93-37.88)	100
Alcohol or illicit/prescription drugs[a] other than Rx opioids	42.81 (41.45-44.18)	36.41 (34.93-37.88)	72.14 (68.94-75.34)
Past-year substance use disorder, % (95% CI)			
Alcohol	5.47 (4.63-6.31)	2.74 (2.18-3.30)	18.00 (15.06-20.94)
Cannabis	5.76 (5.22-6.30)	2.85 (2.38-3.32)	19.11 (16.98-21.24)
Cocaine	0.35 (0.19-0.51)	0.05 (0.00-0.10)	1.74 (0.86-2.62)
Heroin	0.05 (0.02-0.09)	0.01 (0.00-0.04)	0.24 (0.09-0.39)
Hallucinogens	0.93 (0.67-1.18)	0.22 (0.07-0.37)	4.16 (2.88-5.45)
Inhalants	0.49 (0.30-0.69)	0.27 (0.12-0.43)	1.52 (0.82-2.22)
Tranquilizers	1.33 (1.02-1.64)	0.30 (0.13-0.47)	6.03 (4.64-7.41)
Stimulants	0.78 (0.58-0.99)	0.24 (0.11-0.38)	3.26 (2.03-4.49)
Sedatives	0.43 (0.21-0.66)	0.13 (0.00-0.25)	1.83 (0.73-2.94)
Methamphetamine	0.26 (0.12-0.40)	0.02 (0.00-0.05)	1.36 (0.57-2.15)
Alcohol or illicit/prescription drugs	11.33 (10.39-12.27)	5.59 (4.75-6.42)	37.64 (34.57-40.71)
Alcohol or illicit/prescription drugs other than Rx opioids	10.35 (9.42-11.27)	5.59 (4.75-6.42)	32.16 (29.33-34.98)

[a]Rx prescription drug misuse only.

Table 4.

Adjusted multinomial logistic regression of prescription opioid misuse and use disorder among U.S. adolescents aged 12-17

	Adjusted Odds Ratio (95% CI)		
	Rx opioid use vs. none (ref.)	**Rx opioid misuse without disorder vs. none (ref.)**	**Rx opioid misuse with disorder vs. none (ref.)**
Age (ref.=12-13)			
14-15	**1.34 (1.21-1.48)**	**1.35 (1.04-1.73)**	1.60 (0.84-3.06)
16-17	**1.56 (1.41-1.73)**	**1.48 (1.16-1.91)**	0.99 (0.56-1.75)
Sex (ref.=male)			
Female	**1.13 (1.05-1.22)**	1.02 (0.87-1.21)	**1.66 (1.13-2.46)**
Race/ethnicity (ref.= Non-Hispanic White)			
Non-Hispanic Black	**1.20 (1.07-1.34)**	**1.89 (1.49-2.40)**	1.94 (0.98-3.85)
Hispanic	1.04 (0.93-1.15)	**1.42 (1.13-1.77)**	**1.93 (1.21-3.07)**
Non-Hispanic Asian/Native Hawaiian/Pacific Islander	0.89 (0.74-1.08)	0.71 (0.45-1.12)	1.44 (0.61-3.39)
Non-Hispanic other	0.94 (0.80-1.10)	1.04 (0.71-1.52)	1.48 (0.73-2.97)
Family income (ref.= $75,000)			
<$49,999	0.98 (0.90-1.08)	1.14 (0.89-1.46)	1.49 (0.96-2.32)
$50,000-$74,999	1.03 (0.94-1.13)	0.95 (0.72-1.24)	1.13 (0.57-2.23)
Insurance status (ref.=No)			
Yes	1.08 (0.87-1.35)	0.96 (0.66-1.40)	0.87 (0.33-2.25)
Population density (ref.= In a CBSA with 1 million persons)			
In a CBSA with < 1 million persons	**1.11 (1.02-1.21)**	1.06 (0.92-1.21)	1.26 (0.83-1.90)
Not in a CBSA	**1.39 (1.21-1.59)**	**1.54 (1.17-2.04)**	1.57 (0.79-3.12)
Past-year alcohol use (ref.=No)			
Yes	**1.49 (1.36-1.65)**	**2.41 (1.91-3.03)**	**2.02 (1.18-3.46)**
Past-year cannabis use (ref.=No)			
Yes	**0.83 (0.72-0.96)**	**2.28 (1.85-2.81)**	**2.76 (1.83-4.15)**
Past-year illicit drug use other than cannabis[a] (ref.=No)			
Yes	**1.43 (1.22-1.67)**	**3.42 (2.88-4.06)**	**6.22 (3.89-9.96)**
Past-year other Rx drug use or misuse[b] (ref.=No)			
Yes	**2.84 (2.62-3.09)**	**6.60 (5.61-7.77)**	**10.43 (7.52-14.45)**
Self-rated lifetime medical conditions (ref.=None)			
1	**1.21 (1.11-1.31)**	0.91 (0.76-1.10)	1.32 (0.90-1.93)
2 or more	1.33 (0.97-1.83)	**1.64 (1.05-2.57)**	**2.58 (1.22-5.44)**
Past-year Major Depressive Episode (ref.=No)			
Yes	**1.28 (1.14-1.45)**	**1.43 (1.15-1.78)**	**3.37 (2.20-5.15)**
Household composition (ref. Neither)			
Dual-parent	1.08 (0.91-1.27)	1.23 (0.94-1.59)	2.37 (0.95-5.90)
Mother-only	1.13 (0.95-1.35)	1.09 (0.81-1.46)	1.86 (0.77-4.46)

	Adjusted Odds Ratio (95% CI)		
	Rx opioid use vs. none (ref.)	Rx opioid misuse without disorder vs. none (ref.)	Rx opioid misuse with disorder vs. none (ref.)
Father-only	**1.36 (1.10-1.68)**	**1.51 (1.03-2.23)**	2.38 (0.74-7.67)
Past-year School enrollment (ref.=No)			
Yes	0.92 (0.76-1.11)	**0.66 (0.48-0.91)**	1.79 (0.43-7.48)
Survey year (ref.=2015)			
2016	**0.77 (0.72-0.84)**	**0.74 (0.61-0.91)**	1.09 (0.69-1.71)
2017	**0.67 (0.62-0.72)**	**0.63 (0.51-0.76)**	0.66 (0.42-1.02)

Note. The sample size is unweighted, and all results are weighted estimates. CBSA=The US Bureau of the Census's Core-Based Statistical Areas. Multinomial logistic regression was conducted for multiple possible outcomes (none, Rx opioid use, Rx opioid misuse without disorder, and Rx opioid misuse with disorder), adjusting for all covariates listed in the first column.

Bold: statistically significant at .05 level.

[a] Past-year illicit drug use other than cannabis was defined as using any one of the following illicit drugs: inhalants, hallucinogens, cocaine, heroin, or methamphetamine.

[b] Past-year other prescription drug use or misuse was defined as using or misusing any one of the following prescription drugs: tranquilizers, sedatives, or stimulants.