# Nonmedical Opioid Use and Heroin Use in a Nationally Representative Sample of US High School Seniors[*]

**Joseph J. Palamar**[1,2,3], **Jenni A. Shearston**[1,4], **Eric W. Dawson**[1], **Pedro Mateu-Gelabert**[2,5], and **Danielle C. Ompad**[2,3,4]

[1]New York University Langone Medical Center, Department of Population Health, New York, NY, USA

[2]Center for Drug Use and HIV Research, New York University College of Nursing, New York, NY, USA

[3]Center for Health, Identity, Behavior, and Prevention Studies, New York University, New York, NY, USA

[4]College of Global Public Health, New York University, New York, NY, USA

[5]National Development and Research Institutes, New York, NY, USA

## Abstract

**Background**—Nonmedical use of opioids has become increasingly problematic in recent years with increases in overdoses, treatment admissions, and deaths. Use also appears to be contributing to heroin initiation, which has increased in recent years. Further research is needed to examine which adolescents are at highest risk for nonmedical use of opioids and heroin and to explore potential links between nonmedical opioid use and heroin use.

**Methods**—Data were analyzed from a nationally representative sample of American high school seniors in the Monitoring the Future study (2009–2013, Weighted $N = 67,822$). We examined associations between frequency and recency of nonmedical use of opioids and heroin. Sociodemographic correlates of use of each drug were also examined.

**Results**—12.4% of students reported lifetime nonmedical opioid use and 1.2% reported lifetime heroin use. As frequency of lifetime nonmedical opioid use increased, so too did the odds for

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reporting heroin use, with over three-quarters (77.3%) of heroin users reporting lifetime nonmedical opioid use. Recent (30-day) nonmedical opioid use was a robust risk factor for heroin use and almost a quarter (23.2%) of students who reported using opioids 40 times reported lifetime heroin use. Black and Hispanic students were less likely to report nonmedical opioid or heroin use than white students, but they were more likely to report heroin use in absence of nonmedical opioid use.

**Discussion—**Recent and frequent nonmedical opioid use are risk factors for heroin use among adolescents. Prevention needs to be targeted to those at highest risk.

### Keywords

heroin; opioids; analgesics; nonmedical drug use; adolescents

## 1. INTRODUCTION

Nonmedical use of prescription opioids (i.e., narcotics, analgesics, pain killers) has become increasingly problematic in the US over the last decade. Although results from national surveys suggest prevalence of use has begun to decrease in recent years (Miech et al., 2015; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014a), overdoses, emergency department (ED) visits, treatment admissions, and deaths related to use have increased (Centers for Disease Control and Prevention [CDC], 2012; Chen et al., 2014; SAMHSA, 2013, 2014b). However, a new concern is that a subset of opioid users may be transitioning to heroin, which is often more likely to lead to deleterious outcomes. Research is needed to help identify adolescents at risk for nonmedical opioid and/or heroin use, and to delineate which opioid users are at highest risk for heroin use.

While medical use of opioids tends to be efficacious when used as prescribed to treat pain, nonmedical use—often through overprescribing or diversion from doctors (Wang et al, 2014; Shei et al., 2015)—has become a major public health issue. From 2004 to 2011, ED visits involving prescription opioids increased by 183% (SAMHSA, 2013) and opioid-related admissions to substance abuse treatment centers increased from 2% in 2002 to 10% in 2012 (SAMHSA, 2014b). Results from National Vital Statistics demonstrate that the rate of opioid overdose deaths nearly quadrupled from 1999 to 2011, growing from 1.4 per 100,000 to 5.4 per 100,000 (Chen et al, 2014), and according to the CDC (2012), almost three out of every four prescription medication overdoses were associated with opioids. While the rate of increase in overdoses has slowed somewhat since 2006 (Chen et al., 2014), there is now concern that these decelerating rates of opioid-related deaths may be related to recent increases in heroin use, as individuals dependent on prescription opioids may be transitioning to heroin, which tends to be less expensive and more freely available (Cicero et al., 2014; Kanouse and Compton, 2015; Mateu-Gelabert et al., 2015). Heroin is among the most dangerous illicit drugs (Nutt et al., 2007; Gable, 2004) and use is associated with high rates of dependence, overdose, death, transmission of pathogens such as HIV and HCV, and social marginalization (Demaret et al., 2013; Hser et al., 2015; Hosztafi, 2011; Brown, 2015; Zhou et al., 2015). Heroin overdose deaths have increased since 2002, rising from 0.7 deaths per 100,000 to 2.7 deaths per 100,000 in 2013 (Jones et al., 2015). This rise was particularly dramatic from 2011–2013, when rates almost doubled.

Heroin user demographics appear to be shifting in the US. While rates of heroin initiation were similar between whites and non-whites decades ago (Cicero et al., 2014), now whites are at a higher risk for nonmedical prescription opioid use, as well as heroin use (Cicero et al., 2014; Fischer et al., 2008; Peavy et al., 2012; Pollini et al., 2011). While women previously used at substantially lower rates than men (Cicero et al., 2014), their use of opioids and transition to heroin is increasing, with prescription opioids appearing to serve as a stepping stone (Cotto et al., 2010). Furthermore, use of heroin is increasing (Cicero et al., 2015), particularly among individuals living in non-urban areas, whereas it used to be a predominantly urban phenomenon (Cicero et al., 2014). A recent analysis of the National Surveys on Drug Use and Health (NSDUH), a nationally representative sample of non-institutionalized individuals in the US, compared data from 2002–2004 to 2008–2010, and found that past-year heroin use increased among many sociodemographic groups, including whites, those with higher income and those with health insurance (Jones et al., 2015). Whites, young adults (age 18–25), and those with opioid abuse/dependence were also found to be at high risk for heroin use/dependence. Alarmingly, this recent study found that between 2002 and 2013 there was a 138% increase in heroin use among nonmedical opioid users. Other studies have also found that many heroin users moved onto heroin after nonmedical opioid use (Lankeneu et al., 2012; Peavy et al., 2012; Mateu-Gelabert et al., 2015). Nonmedical opioid users have been found to transition to heroin as they considered heroin more "practical" as it is reportedly less expensive and easier to acquire (Cicero et al., 2014; Mars et al., 2014), especially as availability is reduced due to abuse-deterrent formulations and prescription monitoring programs (Cassidy et al., 2014; Worley, 2012).

Nonmedical opioid use is associated with poor health outcomes such as opioid dependency, sexual violence, overdose, and death (Jamison and Mao, 2015; Frank et al. 2015; Jessell at al., 2015); however, moving onto heroin from prescription opioids appears to be a dangerous (and understudied) emerging pattern among younger populations. While studies focusing on national data have begun to examine associations between nonmedical opioid use and heroin use and dependence, more information is needed regarding frequency and recency of nonmedical opioid use as it relates to heroin use in—both a bivariable and multivariable manner. Assessing the risk factors associated with nonmedical opioid use, and how its use may increase risk for heroin use is critical to developing appropriate prevention, intervention, and harm reduction programming geared toward adolescents at highest risk. An examination of a nationally representative sample of adolescents allows us to determine which subgroups of high school students are at highest risk for nonmedical opioid use and heroin use. This study examines the correlates of nonmedical use of opioids and heroin and examines how frequency and recency of opioid use relates to heroin use in a nationally representative sample of high school seniors.

## 2. METHODS

### 2.1. Procedure

Monitoring the Future (MTF) is a nationally representative cross-sectional study of US high school students. Approximately 15,000 high school seniors (12th graders) are surveyed every year from approximately 130 public and private schools throughout 48 states. MTF uses a

multi-stage random sampling procedure: geographic areas are selected, then schools within areas are selected, and then classes within schools are selected. Since the main outcome (heroin use) is rare, in order to have adequate power, this analysis focused on aggregated data collected from the five most recent cohorts with available data (2009–2013). MTF protocols were approved by the University of Michigan Institutional Review Board (IRB) and the authors' IRB deemed this secondary data analysis exempt from review.

## 2.2. Drug Use

Students were asked about lifetime heroin use, and answer options were use on 1) 0 occasions, 2) 1–2 occasions, 3) 3–5 occasions, 4) 6–9 occasions, 5) 10–19 occasions, 6) 20–39 occasions, and 7) 40 or more occasions. Students were also asked about nonmedical use of opioids ("narcotics other than heroin"). They were first informed that, "There are a number of narcotics other than heroin, such as methadone, opium, morphine, codeine, Demerol, Vicodin, OxyContin, and Percocet. These are sometimes prescribed by doctors." They were then asked, "On how many occasions (if any) have you taken narcotics other than heroin on your own--that is, without a doctor telling you to take them in your lifetime?" They were also asked the same question with regard to use in the last 12 months and the last 30 days, with the same ordinal response options.

In order to examine frequency of use of opioids and heroin, we created a series of dichotomous variables indicating lifetime use (ever used; 1 times), and use 6 times, 10 times, and 40 times. Ordinal cutoffs were based on previous MTF studies that focused on use of other drugs (Boyd et al., 2015; Palamar and Acosta, 2015; Palamar et al., 2014; Palamar et al., 2015a,b). In order to examine recency of use, for both opioids and heroin we also created categorical variables (which were also examined as indicator variables) with the following categories: 1) no use, 2) lifetime use, but not 12-month use, 3) 12-month use, but not 30-day use, and 4) 30-day use.

## 2.3. Sociodemographic Variables

Students reported their sex, age (public data predefined by MTF as <18, 18 years) and race/ethnicity (i.e., black, white, Hispanic). Population density of students' residences were defined as non-, small-, or large-metropolitan statistical areas (MSAs). Small MSAs are counties or groups of counties with at least one city of 50,000 inhabitants and the 24 largest MSAs are defined as large MSAs. Non-MSAs are the remaining areas. Level of religiosity was assessed via two ordinal items asking about level of religious attendance and importance. We computed these items into a composite and divided it into tertiles to indicate low (1.0–2.0), moderate (2.5–3.0) and high (3.5–4.0) religiosity. To assess family composition, we examined the number of parents students resided with. Answers were coded into two parents vs. no parents or one. Students were also asked about level of educational attainment of each parent and answer options were 1) grade school, 2) some high school, 3) high school graduate, 4) some college, 5) college graduate, and 6) graduate school. A mean score for both parents (or a raw score if only one parent) was coded into tertiles to represent low (1.0–3.0), medium (3.5–4.0), and high (4.5–6.0) education. Students were asked how much money they earn during the average week from 1) a job or other work, and 2) from other sources. Responses for each of these two items were coded into $10

or less, \$11–50, or \$51 or more. Coding of sociodemographic variables was based on previous MTF analyses that focused largely on socioeconomic status (SES; Palamar et al., 2014a; Palamar and Ompad, 2014; Wallace et al., 2009).

### 2.4. Statistical Analyses

Analyses focused on students with complete opioid and heroin use data (Weighted $N$ = 67,822; Unweighted $N$ = 67,896). We first examined descriptive statistics for all variables. We then examined how lifetime opioid use related to lifetime heroin use in a bivariable manner using Rao-Scott $\chi^2$ tests (Rao and Scott, 1984). We examined potential differences between opioid frequency and recency and whether lifetime heroin use was reported (yes/no). We then repeated these computations, but to examine potential differences by heroin use ≥6 times, ≥10 times, and ≥40 times. To test if and how each level of opioid use relates to lifetime heroin use, we constructed two separate logistic regression models, controlling for all sociodemographic variables. Thus, each level of opioid use in both models was compared to never-use. The bivariable tests were then repeated, but with the recency of heroin use variable as the outcome. Multivariable statistics were not possible with any heroin categories other than overall lifetime use as rates of more frequent or more recent use were very rare (≤ 0.5%).

To further investigate correlates of use of opioids and heroin, we fit all sociodemographic variables into a multivariable logistic regression model to determine conditional associations (controlling for all variables in the model) between each variable and lifetime opioid use. The same model was repeated with 1) frequent opioid use (used ≥40 times), and 2) lifetime heroin use as the outcome. We considered lifetime opioid use and heroin use non-independent outcomes; therefore, we applied a Bonferroni correction ($\alpha$=.05/2=.025) in order to reduce potential Type I Error. These models resulted in an adjusted odds ratio (AOR) for each covariate (in each model). Finally, within the heroin-using subsample we repeated this logistic regression model to examine potential correlates of the 22.7% who did *not* report nonmedical opioid use.

We controlled for potential cohort and/or secular trends in all multivariable models by entering indicator variables for cohort (with 2009 as the comparison). In addition, missing data indicators were entered into multivariable models for covariates with missing data instead of deleting these cases. For example, for the 14.4% who were missing race, an additional indicator was included to account for missing race (Palamar and Ompad, 2014; Terry-McElrath et al., 2013). Retaining these cases allowed us to maintain power and allowed rates to match published nationally representative MTF rates (Miech et al., 2015). All analyses were design-based for survey data (Heeringa et al., 2010) and sample weights were included. We used SAS 9.3 software (SAS Institute, 2011) for all analyses.

## 3. RESULTS

Sample characteristics are presented in Table 1. Nonmedical opioid and heroin use are presented in Table 2. About 12% of the sample reported using opioids at least once and using it 1–2 times was most common among users. About one out of 100 students reported lifetime use of heroin.

Table 3 presents associations between level of lifetime opioid use and heroin use. We found that 7.5% of nonmedical opioid users reported ever using heroin, and the higher the frequency of opioid use, the higher the odds of reporting lifetime heroin use (with all else being equal). A dose-response was observed, with more frequent use being highly associated with heroin use. Using opioids 40 times was associated with an extreme increase in odds for lifetime heroin use (AOR = 88.05). With regard to recency of opioid use, more recent use (within the last 30 days) was most highly associated with lifetime heroin use (AOR = 44.01). Although we could not model more frequent heroin use, the raw percentages (displayed in Supplemental Table 1[1]) suggest that more frequent and recent opioid use is also associated with more frequent heroin use (e.g., 3.3% of opioid users who reported using 40 times also reported using heroin 40 times). Supplemental Table 2[2] presents the same opioid variables, but by recency of heroin use. More frequent opioid use was associated with increases in all levels of recency of heroin use. More recent opioid use (specifically, 30-day use) was associated with recent (12-month or 30-day) use of heroin; 6.9% of those who used opioids in the last 30 days also reported using heroin in the last 30 days.

Table 4 presents conditional associations between covariates and opioid and heroin use. Females were at lower odds for opioid use (both infrequent and frequent use) and heroin use. While older students were not at risk for opioid use, they were in fact at increased odds for heroin use (AOR = 1.22, $p$ = .024). Compared to white students, black or Hispanic students were less likely to report nonmedical use of opioids, especially more frequent use, yet protective effects were less robust for heroin use. With regard to population density, students residing in large MSAs were at low odds for reporting frequent nonmedical opioid use (AOR = 0.73, $p$ = .005). Moderate and high levels of religiosity, and residing with two parents, was consistently protective against opioid use and heroin use. Parent education, however, had mixed results. Moderate education was a risk factor for ever-using opioids (AOR = 1.12, $p$ = .002), but not for frequent use. Higher parent education, however, was a protective factor against heroin use (AOR = 0.72, $p$ = .002). Higher weekly student income —especially from sources other than a job—was often a robust risk factor for opioid use, especially frequent use. Results were similar for heroin, but results were not as robust as they were for frequent opioid use.

Finally, focusing on the subsample of heroin users, we delineated correlates of *not* reporting lifetime nonmedical opioid use (as only 22.7% of heroin users did not report nonmedical opioid use). Controlling for all covariates, race/ethnicity was the only significant correlate of heroin use. Specifically, Blacks (AOR = 2.73, 95% CI: 1.26–5.95, $p$ = .011) and Hispanics (AOR = 3.05, 95% CI: 1.68–5.53, $p$ < .001) were at increased odds for reporting lifetime heroin use without ever using opioids.

## 4. DISCUSSION

For a substantial number of individuals, especially young, white males, nonmedical opioid use is an important correlate of use of a more dangerous substance—heroin (Mateu-Gelabert

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[1]Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:…
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et al., 2015; Peavy et all, 2012; Brands et al. 2005; Lankenau et al., 2012; Mars et al., 2014; Jones, 2013). Considering this alarming trend, it is essential to determine the risk factors for nonmedical use of opioids and heroin use. Although longitudinal data would most adequately delineate correlates of transition to heroin, our study is among the first to elucidate and compare correlates of use of nonmedical opioids and heroin among a sample of adolescents approaching adulthood. These findings add to a growing literature describing how nonmedical opioid use relates to heroin use in a large nationally representative sample.

We found that among students who did use opioids or heroin, "experimentation" (using only 1–2 times) was most common (for both drugs). However, the subset of students that had reported any nonmedical use of opioids was at increased odds for reporting lifetime heroin use. In fact, a dose-response was observed with students who reported more frequent opioid use being at greater odds of reporting lifetime heroin use. Frequent use (e.g., 40 times) was associated with an increase in odds of reporting heroin use by 8,700% with all else being equal. In addition those students who reported recent use (in the last 30 days) were also much more likely to report heroin use. While temporality could not be determined, this study does confirm that nonmedical use—especially more frequent and recent use—is a robust correlate for heroin use.

Females were less likely to report use of opioids or heroin than their male counterparts. This finding was not fully consistent with the literature, which provides somewhat conflicting information about gender and opioid use in young people. An analysis of data from the NSDUH found that for young individuals, age 12 to 25 years, patterns of use were different by sex, with nonmedical use of prescription-type pain medications more frequent by females than males (Cotto et al., 2010). In a sample of individuals seeking treatment, Cicero et al. (2014) found that while men were more likely to seek treatment for opioids and heroin decades ago; currently, men and women seek treatment at similar rates. However, our results were derived from a large nationally representative sample, and we examined associations using multivariable models that controlled for multiple demographic confounders.

Increased risk of heroin use was particularly distinct among white and male students, and these findings suggest that whites are at higher odds of using heroin than racial minorities. But, while black and Hispanic students are less likely to use heroin, they are more likely to use heroin without having used prescription opioids. Importantly, this seems to indicate a different pathway to heroin use by race/ethnicity. This is consistent with a study by Fischer et al. (2008) evaluating the differences between individuals who use heroin only or illicit prescription opioids only, which found that prescription opioid users were more likely to be white. Results from one study suggest it may be more difficult for black patients to obtain prescription opioids than white patients (Hausmann et al., 2013), and another study found that black and Hispanics are less likely to "doctor shop" compared to whites (Weiner et al., 2015). Peavy et al. (2012) also found that heroin injectors reporting opioid dependence prior to heroin were predominantly white, and national data shows that whites are more likely to receive treatment for opioids and heroin (SAMSHA 2014b). Recent research suggests that many individuals who begin using heroin today do so after using or becoming dependent on prescription opioids (Mateu-Gelabert et al., 2015; Cicero et al., 2014; Jones, 2013; Lankenau et al., 2012; Mars et all, 2014; Peavy et al., 2012); thus, blacks and Hispanics do appear to

be at lower risk for heroin initiation through the mechanism of prescription opioid dependence.

Thus, this study supports calls for efforts to prevent students from engaging in nonmedical use of prescription opioids in order to prevent possible future heroin use. Such efforts may not be as effective for many racial/ethnic minority students, as previous prescription opioid nonmedical use does not appear to be a determinant of their heroin use. Thus, although black and Hispanic students are still at low risk for heroin use, prevention efforts may need to consider race/ethnicity as they appear to be taking a different pathway to heroin use than their white counterparts. Our findings also suggest that students who live in large cities had lower risk of frequent opioid use than those who live in non-MSAs. These findings are consistent with Cicero et al. (2014), who suggest that heroin users (who have largely started on prescription opioids) are now more likely to reside in less-urban areas and these individuals were also more likely to use opioids concurrently with heroin.

We also found that higher student weekly income is a risk factor for opioid and heroin use among high school seniors. This finding corroborated an analysis of the National Health and Wellness Survey, which also found that higher income was associated with opioid abuse (Vietri et al., 2014). Furthermore, other studies have found that student disposable income is a risk factor for adolescent use of alcohol, tobacco, hookah, marijuana, ecstasy (MDMA, "Molly"), synthetic marijuana, "bath salts", and cocaine (Martin et al., 2009; Scragg et al., 2002; Zhang et al., 2008; Palamar, 2015; Palamar et al., 2015a, 2015b). This suggests that higher student income appears to be a common risk factor for various drugs, as income is often needed to pay for the drug. We have confirmed that this is no exception for opioids and heroin. However, we did find that higher student income (from sources other than a job) was more robustly associated with frequent nonmedical opioid use than heroin use. More research is needed, but this might suggest that those with higher incomes can in fact afford high-frequency opioid use, as prescription opioids tend to be more expensive than heroin. However, it should be noted that Cerdá et al. (2015) found that income was not associated with transition from opioids to heroin in a sample of youth who reported nonmedical use of opioids at a young age; however, this measure was of family income as opposed to student disposable income.

## 4.1 Limitations

High school dropouts were not surveyed and this could have affected the generalizability of our findings. As these data are cross-sectional, it is not possible to determine temporal order or causality so we cannot rule out that in some instances heroin use took place prior to use of other opioids. Multivariable analysis could not be utilized to examine more frequent (or recent) heroin use as an outcome as frequent and recent use was too rare. We used missing data indicators to fill samples with incomplete data. However we compared analyses with the case-complete samples and missing data indicators and found similar results. Although, it should be noted that 1.9% of students ($n = 1,288$) from the full dataset had to be excluded from analyses due to missing opioid and/or heroin data. Black and Hispanic students, and students with highest income from sources other than a job were more likely to have been excluded due to missing opioid and/or heroin data, and females, students residing with both

parents, and those with higher parent education were less likely to have been excluded due to missing opioid and/or heroin data (all $p$s < .01). Thus, it is possible that this systematic missingness may have biased results. MTF's definition of opioids ("narcotics other than heroin") contained a list of common opioids such as Oxycontin and Vicodin, but the list was not exhaustive, potentially leading to underreporting The list included opium, a nonprescription opiate, as well as methadone, which is commonly used to treat addiction, and we were unable to select such cases out as there was no specific opium or methadone question. However, we note that methadone is also often diverted and used for nonmedical purposes (Ompad et al., 2008). Finally, family income data were not available. This is important to consider with respect to our findings related to students' income.

### 4.2 Conclusions

Increases in heroin use in the last decade, particularly among younger demographics, may be related to opioid use and transition from opioid to heroin use, particularly among young, white, non-urban males. We found a dose-response indicating that greater frequency and more recent use of nonmedical opioids result in substantially greater odds of heroin use. Future interventions should be aimed at decreasing nonmedical opioid use among adolescents and young adults before initiation of heroin use, with special attention given to individuals who use opioids more frequently. Targeting this group may prevent future heroin initiation, and decrease the troubling trend in opiate-related deaths.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

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**HIGHLIGHTS**

12.4% of high school seniors reported lifetime nonmedical opioid use

As frequency of opioid use increased, so too did the odds for reporting heroin use

Over three-quarters (77.3%) of heroin users reporting lifetime nonmedical opioid use

Females were consistently at low odds for reporting use of opioids and heroin

Racial minority students were less likely to report opioid or heroin use

**Table 1**

Sample characteristics (Weighted *N* = 67,822).

| Variable | *Weighted N* | *%* |
|---|---|---|
| Sex | | |
| Male | 32,339 | 46.7 |
| Female | 33,311 | 49.1 |
| Missing | 2,172 | 3.2 |
| Age, years | | |
| < 18 Years | 28,840 | 42.5 |
| 18 Years | 38,675 | 57.0 |
| Missing | 189 | 0.5 |
| Race | | |
| White | 40,215 | 59.3 |
| Black | 7,598 | 11.2 |
| Hispanic | 10,228 | 15.1 |
| Missing | 9,781 | 14.4 |
| Population Density | | |
| Non-MSA | 13,939 | 20.6 |
| Small MSA | 33,620 | 49.6 |
| Large MSA | 20,262 | 29.9 |
| Religiosity | | |
| Low | 20,735 | 30.6 |
| Moderate | 14,538 | 21.4 |
| High | 15,992 | 23.6 |
| Missing | 16,557 | 24.4 |
| Parent Education | | |
| Low | 20,489 | 30.2 |
| Moderate | 18,741 | 27.6 |
| High | 25,644 | 37.8 |
| Missing | 2,947 | 4.3 |
| Family Composition | | |
| 0–1 Parents | 22,254 | 32.8 |
| 2 Parents | 18,195 | 66.1 |
| Missing | 767 | 1.1 |
| Income from Job | | |
| $10 or less | 30,645 | 45.2 |
| $11–50 | 7,320 | 10.8 |
| $51 or more | 25,837 | 38.1 |
| Missing | 4,019 | 5.9 |
| Income from Other Source | | |

| Variable | *Weighted N* | *%* |
|---|---|---|
| $10 or less | 35,222 | 51.9 |
| $11–50 | 21,243 | 31.3 |
| $51 or more | 6,462 | 9.5 |
| Missing | 4,895 | 7.2 |

*Note.* MSA = metropolitan statistical area.

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**Table 2**

Frequency and Recency of Nonmedical Opioid and Heroin Use.

|  | Lifetime Nonmedical Opioid Use | | Lifetime Heroin Use | |
|---|---|---|---|---|
|  | *Weighted N* | *%* | *Weighted N* | *%* |
| Used 0 Times | 59,419 | 87.6 | 67,002 | 98.8 |
| Used 1–2 Times | 3,121 | 4.6 | 388 | 0.6 |
| Used 3–5 Times | 1,684 | 2.5 | 102 | 0.2 |
| Used 6–9 Times | 1,005 | 1.5 | 70 | 0.1 |
| Used 10–19 Times | 1,009 | 1.5 | 55 | 0.1 |
| Used 20–39 Times | 593 | 0.9 | 47 | 0.1 |
| Used 40+ Times | 993 | 1.5 | 157 | 0.2 |
| Lifetime Use, but Not 12-Month Use | 2,815 | 4.2 | 365 | 0.5 |
| 12-Month Use, but Not 30-Day Use | 3,292 | 4.9 | 216 | 0.3 |
| 30-Day Use | 2,296 | 3.4 | 240 | 0.4 |

**Table 3**

Lifetime Heroin Use According to Frequency and Recency of Lifetime Nonmedical Opioid Use.

| Lifetime Opioid Use | Raw Percentages Ever Used Heroin | Adjusted Model AOR | 95% CI |
|---|---|---|---|
| 0 Times | 0.3 | 1.00 | |
| 1–2 Times | 2.7 | 8.71 | (6.41, 11.82) |
| 3–5 Times | 4.6 | 14.74 | (10.78, 20.17) |
| 6–9 Times | 8.5 | 27.03 | (19.05, 38.37) |
| 10–19 Times | 8.4 | 27.31 | (19.80, 37.67) |
| 20–39 Times | 11.8 | 39.34 | (27.54, 56.18) |
| 40+ Times | 23.2 | 88.05 | (67.42, 115.00) |
| Ever Used | 7.5 | | |
| Lifetime Opioid Use | Ever Used Heroin | AOR | 95% CI |
| Never Used | 0.3 | 1.00 | |
| Lifetime Use, but not 12-Month Use | 5.5 | 17.12 | (13.07, 22.43) |
| 12-Month Use, but not 30-Day Use | 4.9 | 15.36 | (11.80, 20.01) |
| 30-Day Use | 13.8 | 44.01 | (35.01, 55.32) |

*Note.* AOR = adjusted odds ratio (controlling for sex, age, race, population density, religiosity, family structure, parent education, weekly income from job, and weekly income from other sources); CI = confidence interval. All AORs presented are $p < .0001$.

**Table 4**

Logistic Regression Models Delineating Sociodemographic Correlates of Lifetime Nonmedical Opioid and Heroin Use.

| | Lifetime Opioid Use (Used ≥1 Times) | | Frequent Lifetime Opioid Use (Used ≥40 Times) | | Lifetime Heroin Use (Used ≥1 Times) | |
|---|---|---|---|---|---|---|
| | AOR | 95% CI | AOR | 95% CI | AOR | 95% CI |
| Sex | | | | | | |
| Male | 1.00 | | 1.00 | | 1.00 | |
| Female | 0.79*** | (0.75, 0.84) | 0.59*** | (0.50, 0.69) | 0.57*** | (0.48, 0.68) |
| Age, years | | | | | | |
| <18 | 1.00 | | 1.00 | | 1.00 | |
| 18 | 1.02 | (0.96, 1.08) | 1.11 | (0.94, 1.30) | 1.22* | (1.03, 1.45) |
| Race | | | | | | |
| White | 1.00 | | 1.00 | | 1.00 | |
| Black | 0.35*** | (0.32, 0.41) | 0.26*** | (0.18, 0.39) | 0.52*** | (0.38, 0.73) |
| Hispanic | 0.54*** | (0.49, 0.60) | 0.38*** | (0.28, 0.54) | 0.71* | (0.54, 0.93) |
| Population Density | | | | | | |
| Non-MSA | 1.00 | | 1.00 | | 1.00 | |
| Small MSA | 1.04 | (0.97, 1.12) | 0.85 | (0.71, 1.01) | 1.20 | (0.97, 1.48) |
| Large MSA | 1.01 | (0.93, 1.09) | 0.73** | (0.59, 0.91) | 1.12 | (0.88, 1.43) |
| Religiosity | | | | | | |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Moderate | 0.74*** | (0.69, 0.80) | 0.60*** | (0.49, 0.74) | 0.74*** | (0.56, 0.91) |
| High | 0.43*** | (0.40, 0.47) | 0.33*** | (0.26, 0.43) | 0.45*** | (0.35, 0.59) |
| Family Structure | | | | | | |
| 0–1 Parents | 1.00 | | 1.00 | | 1.00 | |
| 2 Parents | 0.70*** | (0.66, 0.74) | 0.67*** | (0.57, 0.79) | 0.56*** | (0.47, 0.66) |
| Parent Education | | | | | | |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Moderate | 1.12** | (1.04, 1.21) | 1.11 | (0.92, 1.36) | 0.80 | (0.64, 0.99) |

| | Lifetime Opioid Use (Used ≥1 Times) | | Frequent Lifetime Opioid Use (Used ≥40 Times) | | Lifetime Heroin Use (Used ≥1 Times) | |
|---|---|---|---|---|---|---|
| | AOR | 95% CI | AOR | 95% CI | AOR | 95% CI |
| High | 0.94 | (0.87, 1.01) | 0.85 | (0.69, 1.04) | 0.72** | (0.59, 0.89) |
| Weekly Income from Job | | | | | | |
| $10 or Less | 1.00 | | 1.00 | | 1.00 | |
| $11–50 | 1.16** | (1.06, 1.28) | 0.77 | (0.57, 1.06) | 1.40* | (1.05, 1.86) |
| $51 or More | 1.53*** | (1.44, 1.63) | 1.78*** | (1.50, 2.16) | 1.65*** | (1.36, 2.01) |
| Weekly Income from Other Source | | | | | | |
| $10 or Less | 1.00 | | 1.00 | | 1.00 | |
| $11–50 | 1.48*** | (1.39, 1.57) | 1.80*** | (1.50, 2.16) | 1.27*** | (1.03, 1.56) |
| $51 or More | 1.85*** | (1.69, 2.03) | 3.27*** | (2.64, 4.04) | 2.66*** | (2.10, 3.38) |

*Note.* The models contain all covariates presented in the table. MSA = metropolitan statistical area, AOR = adjusted odds ratio, CI = confidence interval. All models included cohort indicators and missing data indicators.

*
$p < .025$,

**
$p < .01$,

***
$p < .001$