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Sources of misused prescription opioids and their association with prescription opioid use disorder in the United States: Sex and age differences

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Abstract

Background—Prescription opioid (PO) misuse and prescription opioid use disorder (POUD) are a national crisis in the United States. To inform strategies for reducing the PO epidemic, research is needed on the sources of misused POs and their association with POUD.

Methods—Past-year PO misusers aged ≥ 12 (N=6033) from the 2015–2016 National Surveys on Drug Use and Health were analyzed. The most recent source of misused POs was assessed. Logistic regression analyses were used to determine the association between the sources of misused POs and past-year POUD. All analyses were stratified by age groups for each sex.

Results—Overall, the most common sources of misused POs were obtaining from friends/relatives for free (40.27%) and physicians (36.59%). Males had a higher prevalence of buying POs from friends/relatives or drug dealers/strangers than females. Significant age differences also emerged. Buying POs from drug dealers/strangers (vs. obtaining POs free from friends/relatives) was strong predictor of past-year POUD in both sexes. In the sex- and age-stratified analyses, significant associations of past-year POUD with (1) buying from drug dealers/strangers emerged among males aged 18+ and females aged 26+; (2) buying from friends/relatives emerged among males aged 12+ and females aged 18–25; (3) obtaining from physicians emerged among males aged 18+ and females aged 26+.

Conclusions—Our findings indicate different risk profiles for POUD across sex and age groups with different diversion sources. Prevention and treatment programs for POUD should be tailored to consider sex and developmental age differences in sources of opioids.

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Keywords

diversion; prescription opioid use disorder; prescription opioid misuse; sex differences; age differences

1. Background

The United States is experiencing an opioid epidemic that threatens public health. Opioids are the most widely used prescription pain medication in the United States, reaching over 214 million total opioid prescriptions in 2016 (Centers for Disease Control and Prevention, 2017). Prescription opioid (PO) misuse has increased along with the widespread prescribing of opioids (Wisniewski, Purdy, & Blondell, 2008). PO misuse is defined as (1) use without a prescription; (2) use in greater amounts, more often, or longer than told by a doctor to take a drug; or (3) use in any other way not directed by a doctor (Center for Behavioral Health Statistics and Quality [CBHSQ], 2017a). PO misuse is a serious public health problem because PO misuse may progress to prescription opioid use disorder (POUD; PO abuse or dependence) (Boyd, Teter, West, Morales, & McCabe, 2009). PO abuse is defined when individuals met the DSM-IV criteria for opioid abuse but did not meet the criteria for opioid dependence in the past 12 months; PO dependence is defined when individuals met the DSM-IV criteria for opioid dependence in the past 12 months (American Psychiatric Association [APA], 1994). A previous study has found that among lifetime PO misusers, 23.8% and 7.2% progressed to DSM-IV defined PO abuse and dependence during their lifetime, respectively (McCabe, West, Morales, Cranford, & Boyd, 2007). According to the results from the 2016 National Survey on Drug Use and Health (NSDUH), past-year prevalence of PO misuse and POUD among the general US population (aged ≥ 12) was 4.3% and 0.7%, respectively (CBHSQ, 2017b). Economic costs related to PO overdose, abuse and dependence were substantial, totaling over $78.5 billion in 2013 (Florence, Zhou, Luo, & Xu, 2016). Moreover, self-escalation of dose was among the most common types of PO misuse, which may contribute to increased risk of overdose death (Beaudoin, Straube, Lopez, Mello, & Baird, 2014; Gomes, Mamdani, Dhalla, Paterson, & Juurlink, 2011). PO-related overdose deaths remained stable at high rates (5.2 per 100,000) during 2016 and 2017 (Scholl, Seth, Kariisa, Wilson, & Baldwin, 2018).

These alarming figures clearly demonstrate that the opioid crisis is an urgent public health concern in the United States. To inform intervention strategies to combat the PO epidemic, it is very important to understand how people obtain POs they misuse. Diversion refers to “the unlawful channeling of regulated pharmaceuticals from legal sources to illicit marketplace” (Inciardi, Surratt, Kurtz, & Burke, 2006). Previous studies have suggested different mechanisms of prescription drug diversion, such as “doctor shopping” (visiting multiple doctors), liberal prescribing from pain management doctors, theft, “sponsoring” (selling extra pills to others for economic reasons), feigned symptoms/documentation, and the Internet (Cicero et al., 2011; Inciardi, Surratt, Cicero, Kurtz, et al., 2009). Some studies have examined sex or age differences in patterns of diversion. In a study of US adolescents, females reported theft and obtaining free from friends/relatives more frequently as their source than males, while males reported purchase and obtaining from physicians more

frequently than females (Schepis & Krishnan-Sarin, 2009). Mowbray & Quinn (2015) found that friends/relatives or drug dealers were found to be primary sources of POs for misuse among younger individuals, whereas physicians were identified to be primary source among older adults in the United States.

Furthermore, sex and age are important factors influencing PO misuse and/or the development of POUD. Females are more likely than males to misuse prescription drugs, particularly POs (Green, Grimes Serrano, Licari, Budman & Butler, 2009; Grella, 2008; Simoni-Wastila, Ritter & Strickler, 2004). Females are more likely than males to experience violence, psychological distress and mental health problems, and this may explain the increased risk of PO misuse among females (Hemsing, Greaves, Poole, & Schmidt, 2016; Jamison, Butler, Budman, Edwards, & Wasan, 2010). Moreover, female PO users progress to POUD at a much faster rate than male users (Back, Lawson, et al, 2011; Lewis B, Hoffman LA, & Nixon, 2014). Among opioid-dependent individuals, females had greater craving for opioids than males (Back, Payne, et al., 2011). The risk of PO misuse and/or POUD also varies by age (Becker, Sullivan, et al, 2008; Becker, Fiellin, et al, 2008; Martins, Keyes, Storr, Zhu, & Grucza, 2010; Miech, Bohnert, Heard, & Boardman, 2013). PO misuse starts in adolescence, peaks at ages 18–21 years and then declines, while the prevalence of POUD tends to increase at ages 18–34 (Hu, Griesler, Wall & Kandel, 2017). Yet, PO misuse, abuse, and PO-related deaths among older adults are increasing at an alarming rate (West, Severtson, Green, & Dart, 2015). Furthermore, Jones (2017) found that from 2003 to 2014, PO misuse decreased significantly among young people aged 18–25, whereas POUD increased significantly among adults aged 26+; PO misuse and POUD decreased significantly among adolescents aged 12–17. During 2005 and 2011, significant increases in PO-related emergency department visits were observed among adults aged 18+, except adolescents aged 12–17 (Crane, 2015). In the sex- and age-specific analysis, female adolescents and young women were more likely than male adolescents and young men to become dependent on POs (Cotto et al., 2010). Considering such differences, sex- and age-specific research is needed to better identify subgroups of PO misusers who are particularly vulnerable to POUD and diversion for targeted intervention.

Some studies have examined how different diversion sources are related to opioid addiction. For example, a prior study has found that buying POs from drug dealers/strangers was positively associated with PO abuse and dependence, while obtaining POs free from friends/relatives was negatively associated with PO abuse and dependence (Ford & Lacerenza, 2011). It also appeared that compared to low-risk opioid users (PO misuse 1–29 days/year), high-risk opioid users (PO misuse ≥200 days/year) were more likely to report obtaining POs from physicians or buying them from friends/relatives or drug dealers/strangers, but less likely to report obtaining POs from friends/relative for free (Jones, Paulozzi, & Mack, 2014). A recent study focusing on older adults in the United States has found that obtaining POs from purchase, physicians, or multiple sources was related to increased odds of POUD symptoms (Schepis, McCabe, & Teter, 2018). However, very few studies have considered sex and age differences together when examining the relationship between the sources of misused POs and POUD.

Accordingly, this study sought to (1) describe the most recent source of misused POs and (2) examine the association between the sources of misused POs and past-year POUD. To investigate the sex- and age-related differences in the relationship between the sources of misused POs and POUD, we stratified all analyses by age groups for each sex. A better understanding of the sex- and age-specific relationship between the sources of misused POs and past-year POUD could better inform the design of targeted, more effective prevention and treatment programs for POUD to address different intervention needs across sex and age groups.

2. Methods

2.1. Data

Data were obtained from the 2015–2016 NSDUH public-use files. Sponsored by the Substance Abuse and Mental Health Services Administration, the NSDUH is an annual cross-sectional survey that provides nationally representative estimates of alcohol, tobacco, and other drug use and mental health among the US population (aged ≥ 12). People without a fixed household address (e.g., homeless not living in shelter), military active-duty personnel, and institutional residents (e.g., jails and hospitals) were considered ineligible for the NSDUH. In the NSDUH, data were collected using computer-assisted interviewing for less sensitive questions (e.g., demographics) and audio computer-assisted self-interviewing for other sensitive questions (CBHSQ, 2017a). The NSDUH employed a multistage area probability sampling process. In this study, a sample of 6,033 past-year PO misusers (aged ≥ 12) from the 2015–2016 NSDUH publicly available datasets was analyzed.

2.2. Study variables

2.2.1. Sociodemographic—Sociodemographic variables included sex (male and female), age (12–17, 18–25, 26–34, and 35+), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic other), annual family income (≤$49,999, $50,000-$74,999, and ≥$75,000), population density (segment in a CBSA with ≥ 1 million, segment in a CBSA with < 1 million, and segment not in a CBSA), health insurance (none, private, and public), self-rated overall health (excellent, very good, good, and fair/poor), and past-year major depressive episode (MDE) (yes or no). These sociodemographic variables that were found to be related to PO misuse and POUD were included in the analysis as covariates (Bali, Raisch, Moffett, & Khan, 2013; Becker, Sullivan, et al, 2008; Becker, Fiellin, et al, 2008; Edlund, Steffick, Hudson, Harris, & Sullivan, 2007). Survey year was also included as a categorical covariate in the analysis.

2.2.2. Past-year substance use and use disorders—The NSDUH measured recency of PO misuse. Respondents who reported PO misuse within the past 30 days or more than 30 days ago but within the past 12 months were defined as past-year PO misusers. To assess PO misuse, respondents were shown the names and pictures of the pain relievers (e.g., Vicodin and Hydrocodone). Respondents were also asked not to include “over-the-counter” pain relievers such as aspirin, Tylenol, Advil, or Aleve. Past-year initiation of PO misuse was defined as misusing POs for the first time in the past 12 months prior to the

interview. Frequency of PO misuse in the past month was classified into the following five categories: no past-month use, 1–2 days, 3–5 days, 6–19 days, and 20–30 days.

Past-year substance use disorder was measured based on DSM-IV criteria (APA, 1994). The NSDUH included a set of questions for assessing four abuse criteria (serious problem at home, work, or school; physical danger; substance-related legal problems; and problem with family and friends) and seven dependence criteria (tolerance; withdrawal; intention; lack of control; time; reduction in other activities; and continuance) during the past year. Individuals were considered as having a substance specific use disorder if they met DSM-IV criteria for abuse or dependence on a specific substance (alcohol, marijuana, cocaine, hallucinogens, inhalants, stimulants, methamphetamines, POs, tranquilizers, simulants, and sedatives) during the past 12 months.

Based on previous studies that indicated relationship between substance use disorders and POUD (Schepis & Hakes, 2017; Edlund et al., 2010), the following variables were included in the analysis: past-year initiation of PO misuse, past-month frequency of PO misuse, past-year alcohol use disorder, past-year heroin use disorder, and past-year any drug use disorder other than opioid (POs or heroin) use disorder.

2.2.3. Most recent source of prescription opioids for misuse—Respondents who reported PO misuse in the past 12 months were asked about how they obtained POs the last time they misused. The NSDUH provided eight mutually exclusive response categories: got from one doctor; got from more than one doctor; stole from doctor office, clinic, hospital or pharmacy; got from friend or relative for free; bought from friend or relative; took from friend or relative without asking; bought from drug dealer or other stranger; got some other way. Responses from those with no past-year PO misuse or unknown responses were considered missing. In this study, we categorized the eight mutually exclusive response categories into the following six categories: 1) got from ≥ one doctor, 2) got from friend or relative for free, 3) bought from friend or relative, 4) took from friend or relative without asking, 5) bought from drug dealer or other stranger, and 6) other (stole from doctor office, clinic, hospital or pharmacy or got some other way).

2.3. Statistical analysis

To take into account sex and age differences, all analyses were stratified by age groups (12–17, 18–25, 26–34, and 35+) for each sex. First, we examined sociodemographic characteristics of PO misusers (aged ≥ 12). We then analyzed distribution of the sources of POs for last misuse. To determine the association between the most recent source of misused POs and past-year POUD, we conducted logistic regression analysis. Logistic regression model was adjusted for the following covariates; race/ethnicity, family income, population density, health insurance, self-rated overall health, past-year MDE, past-year initiation of PO misuse, past-month frequency of PO misuse, past-year alcohol use disorder, past-year heroin use disorder, past-year any drug use disorder other than opioid (POs or heroin) use disorder, and survey year. “Obtaining POs from friends/relatives for free” was chosen as the reference category due to the large sample size of this response category. The adjusted logistic regression analyses were conducted separately for males and females by age groups. Due to

the sample size consideration, we combined those aged 26–34 and those aged 35+ into one group when conducting adjusted logistic regression analyses in order to deal with issues regarding wide confidence intervals. Due to the NSDUH's complex survey design, all analyses were weighted using the NSDUH's sampling weights, taking into account the clustering and strata effects. All analyses were conducted using SAS 9.4 (SAS institutes, Cary, NC). Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) are reported to help interpret the results. All results are weighted estimates, except for sample size (unweighted).

3. Results

3.1. Sociodemographic characteristics (Table 1)

Table 1 displays sociodemographic characteristics of past-year PO misusers (N=6,033). Overall, more than half of respondents were male (55.03%), non-Hispanic White (66.40%), lower-income people (≤$49,999; 55.05%), and those living in large metropolitan areas (54.35%). Nearly 17% of PO misusers indicated POUD during the past year, and 22.13%, 3.85%, and 17.76% of PO misusers indicated alcohol use disorder, heroin use disorder, and any drug use disorder other than opioid use disorder (POs or heroin) during the past 12 months, respectively.

3.2. Most recent source of prescription opioids for misuse: by sex and age (Table 2)

Overall, "obtaining POs from friends/relatives for free" (40.27%) and "obtaining POs from physicians" (36.59%) were the two major sources of POs for last misuse. Among past-year PO misusers, 9.21% indicated "buying POs from friends/relatives." "Taking POs from friends/relatives without asking" (3.47%), "buying POs from drug dealers/strangers" (5.51%), and "other" (4.95%) accounted for relatively small proportions of the sources. Males were more likely than females to report purchase from friends/relatives (males, 11.18%; females, 6.80%) or drug dealers/strangers (males, 7.38%; females, 3.23%). Significant age differences also emerged. In both sexes, those aged 35+ were more likely than adolescents aged 12–17 to report physicians as their source (45.18% vs. 21.93% for males; 49.38% vs. 27.04% for females). In males, adolescents aged 12–17 were more likely than those aged 35+ to report "buying POs from drug dealers/strangers" (9.71% vs. 4.15%), "taking POs from friends/relatives without asking" (9.41% vs. 1.72%), and "other" (11.69% vs. 4.89%). In females, adolescents aged 12–17 were less likely than those aged 26–34 to report "obtaining POs from friends/relatives for free" (39.48% vs. 50.81%), but more likely to report "taking POs from friends/relatives without asking" (8.04% vs. 2.12%). "Buying POs from friends/relatives" was more common among female adolescents than female adults aged 35+ (8.46% vs. 4.09%).

3.3. Adjusted odds ratios of past-year prescription opioid use disorder by the sources of prescription opioids for misuse (Table 3)

Table 3 shows the results of separate logistic regression models in males and females. Among the sources of misused POs (reference= obtaining POs free from friends/relatives), buying POs from drug dealers/strangers was the most strongly associated with past-year POUD. When combining all age groups, those reporting physicians and drug dealers/

strangers as their source showed increased odds of past-year POUD in both sexes, compared with those obtaining POs free from friends/relatives. Buying POs from friends/relatives was associated with increased odds of past-year POUD among males but not females overall. In the sex- and age-stratified analyses (reference= obtaining POs free from friends/relatives), buying POs from drug dealers/strangers was associated with increased odds of past-year POUD among males aged 18+ and females aged 26+. Obtaining POs from physicians was associated with increased odds of past-year POUD among males aged 18+ and females aged 26+. Buying POs from friends/relatives was associated with increased odds of past-year POUD among males aged 12+ and females aged 18–25.

4. Discussion

Consistent with previous studies (Lipari & Hughes, 2017; Han et al., 2017), obtaining POs free from friends/relatives was the most common source of POs for last misuse (40.27% overall; males, 38.29%; females, 42.69%). The large volume of PO sharing via friends/relatives may be explained by the "sharing culture" that is related to the perception that opioids are safe because they are prescribed by physicians (Binswanger & Glanz, 2015; Daniulaityte, Falck, & Carlson, 2012). Prevalence of obtaining POs free from friends/relatives was similar across age groups in males, but not in females. Obtaining POs free from friends/relatives was striking among females aged 26–34 (50.81%). This may reflect in part the high rates of opioid prescribing in young and middle-aged females (Zhong, et al., 2013). Given the "sharing culture" (Binswanger & Glanz, 2015; Daniulaityte, Falck, & Carlson, 2012), it is likely that females aged 26–34 could easily get opioids from their friends or relatives who share their unused opioids with others. While getting opioids free from friends/relatives was prevalent among female aged 26–34, only 2.12% reported stealing from friends/relatives. These findings make sense given that people would be unwilling to take risks to steal opioids if they could obtain opioids free from friends/relatives.

Physicians were the second most common source of POs for last misuse, which accounted for 37% of the sources overall (males, 34.10%; females, 39.62%). This finding is in line with prior data that opioids were more frequently involved in multiple provider episodes than other controlled substances (Wilsey et al., 2010). Obtaining POs from physicians was particularly prevalent among older adults aged 35+ than adolescents in both sexes, which is consistent with previous studies (Mowbray & Quinn, 2015; Schepis et al., 2018). This is not surprising given that older adults who complain of pain could readily get POs (Inciardi, Surratt, Cicero, & Beard, 2009).

Other minor sources included bought from friends/relatives (9.21%) or drug dealers/strangers (5.51%), and theft from friends/relatives (3.47%). Interestingly, compared to older adults, male adolescents tended to purchase the drugs from drug dealers/strangers (9.71% vs. 4.15%), but female adolescents tended to purchase the drugs from friends/relatives (8.46% vs. 4.09%). Perhaps, female adolescents may be reluctant to obtain opioids from strangers if they could buy them from friends. Female adolescents were more likely than male adolescents to divert their drugs to someone they knew, such as female friends (Boyd, McCabe, Cranford & Young, 2007). Taking opioids from friends/relatives without asking was more prevalent among adolescents than adults for both sexes. This observation is in line

with prior findings, which show that adolescents can easily access to opioids from a medicine cabinet in the home (Ross-Durow, McCabe & Boyd, 2013).

Our overall results suggest sex- and age differences in the risk of POUD due to different sources of opioids. Of note, drug dealer/stranger source was the strongest predictor of POUD, which was observed among males aged 18+ and females aged 26+. This is probably because euphoria is a primary motive for misusing POs among those who purchase the drugs from drug dealers/strangers (Davis & Johnson, 2008). Given the strong association between drug dealer/stranger source and POUD risk, it is important to restrict the way drug dealers can acquire the drugs they sell. Drug dealers may utilize various healthcare sources, such as visiting multiple pain clinics, using a connection with healthcare workers who have consistent access to medication, and sponsoring all or part of costs (e.g., cost for a doctor visit) for those who cannot afford it, to acquire POs (Rigg, Kurtz, & Surratt, 2012). Thus, healthcare practices are important settings for implementing the surveillance and management strategies to prevent or reduce opioid diversion.

Physician source was the second strongest predictor of POUD, which was observed among males aged 18+ and females aged 26+. Doctor shoppers tend to seek strong opioids (Cepeda, Fife, Chow, Mastrogiovanni, & Henderson, 2013), which may increase the risk of POUD. To reduce POUD risk associated with physician source, physicians should be aware that patients, especially older people, could attempt to deceive their doctor to get a prescription drug for misuse (Bouland, Fine, Withers, & Jarvis, 2015; Stogner, Sanders, & Miller, 2014). Thus, it is important identify training or incentive strategies to encourage physicians to adhere to CDC guidelines for prescribing opioids; (1) checking patients' history of potential substance misuse by using state prescription drug monitoring program (PDMP), (2) conducting drug testing as a part of treatment program, and (3) providing evidence-based treatment for patients with POUD (Dowell, Haegerich, & Chou, 2016). Previous studies have found that use of state PDMP was effective in reducing doctor shopping, overprescribing, and fraudulent prescribing (Pradel et al., 2009; Surratt et al., 2014). However, one study pointed out that physicians' utilization of PDMP is not high (53% of 420 physicians) (Rutkow, Turner, Lucas, Hwang, & Alexander, 2015). It would be necessary to implement educational training, such as continuing medical education for physicians and health professionals, to improve PDMP utilization, opioid-related knowledge and practice behaviors (Finnell, Twillman, Breslan, Schultz, & Miller, 2017; Lofwall, Wunsch, Nuzzo, & Walsh, 2011).

Those who reported purchase opioids from friends/relatives also had increased odds of POUD among males aged 12+ and females aged 18–25. Friends/relatives were the major source of PO misuse, comprising 52.95% of all diversion sources (for free; 40.27%, purchase; 9.21%, theft; 3.47%). Previous study have found that more than two-thirds of patients reported improper storage of POs after surgery (Bicket, Long, Pronovost, Alexander, & Wu, 2017). A pilot study of outpatients with chronic pain also found that females were more likely than males to hoard unused mediations (Back et al., 2009). To restrict sharing, selling, and stealing POs from friends/relatives, therefore, it would be essential to educate patients with opioid prescriptions about the importance of safe disposal of POs as well as the dangers of PO diversion. Indeed, available data revealed that patient

educational interventions could be a useful way of improving knowledge about the safe use and disposal of POs, which may reduce POs available for diversion through friends/relatives (de la Cruz et al., 2017; McCauley, Back, & Brady, 2013).

This study has some limitations. First, the data on the sources of POs for misuse are limited to the most recent episode, which may not represent the most frequent or primary source. In a study of 640 lifetime PO misusers, about 25% indicated more than two sources (McCabe, Cranford, Boyd, & Teter, 2007). Future research examining the most frequent source and its association with POUD would provide more informative information. The assessment for diversion is also limited by the use of a single self-reported measure of diversion behavior. Nonetheless, the assessment of the most recent source might help to minimize memory errors due to recall bias, which can enhance the validity of research findings (Hassan, 2006). The focus on the recent use also reflects a pattern of recent or active use that is closely related to intervention needs. Second, the NSDUH is a cross-sectional survey. Due to the nature of study design, we could not establish a causal relationship. It is unclear whether those relying on a drug dealer source are at the elevated risk of POUD or vice versa. Future longitudinal studies are needed to examine developmental patterns of POUD across different types of sources of misused POs. It would also be interesting for future research to investigate whether there will be changes in the sources of misused POs before and after the development of POUD.

The results of this study have important policy implications. First, our findings underscore the importance of sex- and age-specific prevention and treatment programs tailored to different sources in clinical practice. Assessing sex, age, and primary sources of misused POs as a part of initial screening procedures would help physicians and allied health professionals to be aware of potentially high-risk groups of patients for POUD. In addition, prevention efforts for PO misuse and POUD in clinical practice should not interfere with treatment utilization of opioids for pain (Volkow & McLellan, 2011). Second, surveillance and management systems of opioid diversion in health care facilities should be more effectively enforced. Third, physicians need to be educated about how to utilize PDMPs to make optimal clinical decision before prescribing POs, while reducing diversion risks. Lastly, physicians and other health care professionals should provide mandatory education on safe storage and disposal of leftover opioids to their patients.

5. Conclusions

Our findings suggest different risk profiles for POUD across sex and age groups due to differences in diversion sources. Previous studies have highlighted the need to investigate the role of sex and age in determining POUD treatment outcomes (Bawor et al., 2015; Clausen, Waal, Thoresen, & Gossop, 2009). Research also needs to develop multifaceted interventions or prevention programs tailored to different risk profiles and psychosocial developmental needs for women, adolescents and older adults (e.g., screening/assessment, educational programs, use of PDMPs, brief intervention, referral to specialty, and opioid prescribing regulatory efforts). Additional research on source-related differences in possible pathways to POUD would be useful in informing the design of more effective PO misuse prevention strategies.

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References

American Psychiatric Association (1994). Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV) (4th ed). Washington, DC.

Back SE, Lawson KM, Singleton LM, & Brady KT (2011). Characteristics and correlates of men and women with prescription opioid dependence. Addictive behaviors, 36(8), 829–834. doi: 10.1016/j.addbeh.2011.03.013. [PubMed: 21514061]

Back SE, Payne RL, Wahlquist AH, Carter RE, Stroud Z, Haynes L, … Ling W (2011). Comparative profiles of men and women with opioid dependence: results from a national multisite effectiveness trial. The American journal of drug and alcohol abuse, 37(5), 313–323. doi: 10.3109/00952990.2011.596982. [PubMed: 21854273]

Back SE, Payne RA, Waldrop AE, Smith A, Reeves S, & Brady KT (2009). Prescription opioid aberrant behaviors: a pilot study of sex differences. The Clinical journal of pain, 25(6), 477–484. doi: 10.1097/AJP.0b013e31819c2c2f. [PubMed: 19542794]

Bali V, Raisch DW, Moffett ML, & Khan N (2013). Determinants of nonmedical use, abuse or dependence on prescription drugs, and use of substance abuse treatment. Research in social & administrative pharmacy, 9(3), 276–287. doi:10.1016/j.sapharm.2012.04.008. [PubMed: 22727534]

Bawor M, Dennis BB, Bhalerao A, Plater C, Worster A, Varenbut M, … Samaan Z (2015). Sex differences in outcomes of methadone maintenance treatment for opioid use disorder: a systematic review and meta-analysis. CMAJ Open, 3(3), E344–351. doi: 10.9778/cmajo.20140089.

Beaudoin FL, Straube S, Lopez J, Mello MJ, & Baird J (2014). Prescription opioid misuse among ED patients discharged with opioids. The American journal of emergency medicine, 32(6), 580–585. doi: 10.1016/j.ajem.2014.02.030. [PubMed: 24726759]

Becker WC, Sullivan LE, Tetrault JM, Desai RA, & Fiellin DA (2008). Non-medical use, abuse and dependence on prescription opioids among U.S. adults: psychiatric, medical and substance use correlates. Drug and alcohol dependence, 94(1–3), 38–47. doi:10.1016/j.drugalcdep.2007.09.018. [PubMed: 18063321]

Becker WC, Fiellin DA, Merrill JO, Schulman B, Finkelstein R, Olsen Y, … Busch SH (2008). Opioid use disorder in the United States: insurance status and treatment access. Drug and alcohol dependence, 94(1–3), 207–213. doi: 10.1016/j.drugalcdep.2007.11.018. [PubMed: 18222051]

Bicket MC, Long JJ, Pronovost PJ, Alexander GC, & Wu CL (2017). Prescription Opioid Analgesics Commonly Unused After Surgery: A Systematic Review. JAMA surgery, 152(11), 1066–1071. doi: 10.1001/jamasurg.2017.0831. [PubMed: 28768328]

Binswanger IA, & Glanz JM (2015). Pharmaceutical Opioids in the Home and Youth: Implications for Adult Medical Practice. Substance abuse, 36(2), 141–143. doi: 10.1080/08897077.2014.991058. [PubMed: 25671706]

Bouland DT, Fine E, Withers D, & Jarvis M (2015). Prescription Medication Obtainment Methods and Misuse. Journal of addiction medicine, 9(4), 281–285. doi: 10.1097/ADM.0000000000000130. [PubMed: 25961496]

Boyd CJ, Teter CJ, West BT, Morales M, & McCabe SE (2009). Non-medical use of prescription analgesics: a three-year national longitudinal study. Journal of addictive diseases, 28(3), 232–242. doi: 10.1080/10550880903028452. [PubMed: 20155592]

Boyd CJ, McCabe SE, Cranford JA, & Young A (2007). Prescription drug abuse and diversion among adolescents in a southeast Michigan school district. Archives of pediatrics & adolescent medicine, 161(3), 276–281. doi: 10.1001/archpedi.161.3.276. [PubMed: 17339509]

Center for Behavioral Health Statistics and Quality. (2017a). 2016 National Survey on Drug Use and Health: Methodological summary and definitions. Substance Abuse and Mental Health Services Administration, Rockville, MD.

Center for Behavioral Health Statistics and Quality. (2017b). 2016 National Survey on Drug Use and Health: Detailed Tables. Substance Abuse and Mental Health Services Administration, Rockville, MD.

Centers for Disease Control and Prevention. (2017). U.S. Prescribing Rate Maps. National Center for Injury Prevention and Control, Division of Unintentional Injury Prevention https://www.cdc.gov/drugoverdose/maps/rxrate-maps.html (Accessed 18 October 2017).

Cepeda MS, Fife D, Chow W, Mastrogiovanni G, & Henderson SC (2013). Opioid shopping behavior: how often, how soon, which drugs, and what payment method. Journal of clinical pharmacology, 53(1), 112–117. doi: 10.1177/0091270012436561. [PubMed: 23400751]

Cicero TJ, Kurtz SP, Surratt HL, Ibanez GE, Ellis MS, Levi-Minzi MA, … Inciardi JA (2011). Multiple Determinants of Specific Modes of Prescription Opioid Diversion. Journal of drug issues, 41(2), 283–304. doi:10.1177/002204261104100207. [PubMed: 22287798]

Clausen T, Waal H, Thoresen M, & Gossop M (2009). Mortality among opiate users: opioid maintenance therapy, age and causes of death. Addiction, 104(8), 1356–1362. doi: 10.1111/j.1360-0443.2009.02570.x. [PubMed: 19426288]

Cotto JH, Davis E, Dowling GJ, Elcano JC, Staton AB, & Weiss SR (2010). Gender effects on drug use, abuse, and dependence: a special analysis of results from the National Survey on Drug Use and Health. Gender medicine, 7(5), 402–413. doi: 10.1016/j.genm.2010.09.004. [PubMed: 21056867]

Crane EH (2015). The CBHSQ Report: Emergency Department Visits Involving Narcotic Pain Relievers. Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, Rockville, MD.

Daniulaityte R, Falck R, & Carlson RG (2012). "I'm not afraid of those ones just 'cause they've been prescribed": perceptions of risk among illicit users of pharmaceutical opioids. The International journal on drug policy, 23(5), 374–384. doi: 10.1016/j.drugpo.2012.01.012. [PubMed: 22417823]

Davis WR, & Johnson BD (2008). Prescription opioid use, misuse, and diversion among street drug users in New York City. Drug and alcohol dependence, 92(1–3), 267–276. doi: 10.1016/j.drugalcdep.2007.08.008. [PubMed: 17913395]

de la Cruz M, Reddy A, Balankari V, Epner M, Frisbee-Hume S, Wu J, … Bruera E (2017). The Impact of an Educational Program on Patient Practices for Safe Use, Storage, and Disposal of Opioids at a Comprehensive Cancer Center. The oncologist, 22(1), 115–121. doi: 10.1634/theoncologist.2016-0266. [PubMed: 27742907]

Dowell D, Haegerich TM, & Chou R (2016). CDC Guideline for Prescribing Opioids for Chronic Pain — United States, 2016. JAMA, 315(15), 1624–1645. doi: 10.1001/jama.2016.1464. [PubMed: 26977696]

Edlund MJ, Martin BC, Fan MY, Devries A, Braden JB, & Sullivan MD (2010). Risks for opioid abuse and dependence among recipients of chronic opioid therapy: results from the TROUP study. Drug and alcohol dependence, 112(1–2), 90–98. doi: 10.1016/j.drugalcdep.2010.05.017. [PubMed: 20634006]

Edlund MJ, Steffick D, Hudson T, Harris KM, & Sullivan M (2007). Risk factors for clinically recognized opioid abuse and dependence among veterans using opioids for chronic non-cancer pain. Pain, 129(3), 355–362. doi:10.1016/j.pain.2007.02.014. [PubMed: 17449178]

Finnell JT, Twillman RK, Breslan SA, Schultz J, & Miller L (2017). The Role of Continuing Medical Education in Increasing Enrollment in Prescription Drug Monitoring Programs. Clinical therapeutics, 39(9), 1896–1902.e2. doi: 10.1016/j.clinthera.2017.07.040. [PubMed: 28865800]

Florence CS, Zhou C, Luo F, & Xu L (2016). The Economic Burden of Prescription Opioid Overdose, Abuse, and Dependence in the United States, 2013. Medical care, 54(10), 901–906. doi: 10.1097/MLR.0000000000000625. [PubMed: 27623005]

Ford JA, & Lacerenza C (2011). The relationship between source of diversion and prescription drug misuse, abuse, and dependence. Substance use & misuse, 46(6), 819–827. doi: 10.3109/10826084.2010.538461 [PubMed: 21174499]

Gomes T, Mamdani MM, Dhalla IA, Paterson JM, & Juurlink DN (2011). Opioid dose and drug-related mortality in patients with nonmalignant pain. Archives of internal medicine, 171(7), 686–691. doi: 10.1001/archinternmed.2011.117. [PubMed: 21482846]

Green TC, Grimes Serrano JM, Licari A, Budman SH, & Butler SF (2009). Women who abuse prescription opioids: findings from the Addiction Severity Index-Multimedia Version Connect prescription opioid database. Drug and alcohol dependence, 103(1–2), 65–73. doi: 10.1016/j.drugalcdep.2009.03.014. [PubMed: 19409735]

Grella CE (2008). From generic to gender-responsive treatment: changes in social policies, treatment services, and outcomes of women in substance abuse treatment. Journal of psychoactive drugs, Suppl 5, 327–43. [PubMed: 19256044]

Han B, Compton WM, Blanco C, Crane E, Lee J, & Jones CM (2017). Prescription Opioid Use, Misuse, and Use Disorders in U.S. Adults: 2015 National Survey on Drug Use and Health. Annals of internal medicine, 167(5), 293–301. doi: 10.7326/M17-0865. [PubMed: 28761945]

Hassan E (2006). Recall bias can be a threat to retrospective and prospective research designs. The Internet Journal of Epidemiology, 3(2), 1–7. http://ispub.com/IJE.

Hemsing N, Greaves L, Poole N, & Schmidt R (2016). Misuse of Prescription Opioid Medication among Women: A Scoping Review. Pain research & management, 2016, 1754195. doi: 10.1155/2016/1754195. [PubMed: 27445597]

Hu MC, Griesler P, Wall M, & Kandel DB (2017). Age-related patterns in nonmedical prescription opioid use and disorder in the US population at ages 12–34 from 2002 to 2014. Drug and alcohol dependence, 177, 237–243. doi: 10.1016/j.drugalcdep.2017.03.024. [PubMed: 28622626]

Inciardi JA, Surratt HL, Cicero TJ, Kurtz SP, Martin SS, & Parrino MW (2009). The “black box” of prescription drug diversion. Journal of addictive diseases, 28(4), 332–347. doi: 10.1080/10550880903182986. [PubMed: 20155603]

Inciardi JA, Surratt HL, Cicero TJ, & Beard RA (2009). Prescription opioid abuse and diversion in an urban community: the results of an ultrarapid assessment. Pain medicine, 10(3), 537–548. doi: 10.1111/j.1526-4637.2009.00603.x. [PubMed: 19416440]

Inciardi JA, Surratt HL, Kurtz SP, & Burke JJ (2006). The diversion of prescription drugs by health care workers in Cincinnati, Ohio. Substance use & misuse, 41(2), 255–264. doi:10.1080/10826080500391829. [PubMed: 16393746]

Jamison RN, Butler SF, Budman SH, Edwards RR, & Wasan AD (2010). Gender differences in risk factors for aberrant prescription opioid use. The journal of pain, 11(4), 312–320. doi: 10.1016/j.jpain.2009.07.016. [PubMed: 19944648]

Jones CM (2017). The paradox of decreasing nonmedical opioid analgesic use and increasing abuse or dependence - An assessment of demographic and substance use trends, United States, 2003–2014. Addictive Behaviors, 65, 229–235. doi: 10.1016/j.addbeh.2016.08.027. [PubMed: 27561431]

Jones CM, Paulozzi LJ, & Mack KA (2014). Sources of prescription opioid pain relievers by frequency of past-year nonmedical use United States, 2008–2011. JAMA internal medicine, 174(5), 802–803. DOI:10.1001/jamainternmed.2013.12809. [PubMed: 24589763]

Lewis B, Hoffman LA, & Nixon SJ (2014). Sex differences in drug use among polysubstance users. Drug and alcohol dependence, 145, 127–133. doi: 10.1016/j.drugalcdep.2014.10.003. [PubMed: 25454410]

Lipari RN, & Hughes A (2017). How people obtain the prescription pain relievers they misuse. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD.

Lofwall MR, Wunsch MJ, Nuzzo PA, & Walsh SL (2011). Efficacy of continuing medical education to reduce the risk of buprenorphine diversion. Journal of substance abuse treatment, 41(3), 321–329. doi: 10.1016/j.jsat.2011.04.008. [PubMed: 21664789]

Martins SS, Keyes KM, Storr CL, Zhu H, & Grucza RA (2010). Birth-cohort trends in lifetime and past-year prescription opioid-use disorder resulting from nonmedical use: results from two

national surveys. Journal of studies on alcohol and drugs, 71(4), 480–487. doi: 10.15288/jsad.2010.71.480. [PubMed: 20553656]

McCauley JL, Back SE, & Brady KT (2013). Pilot of a brief, web-based educational intervention targeting safe storage and disposal of prescription opioids. Addictive behaviors, 38(6), 2230–2235. doi: 10.1016/j.addbeh.2013.01.019. [PubMed: 23501140]

McCabe SE, West BT, Morales M, Cranford JA, & Boyd CJ (2007). Does early onset of non-medical use of prescription drugs predict subsequent prescription drug abuse and dependence? Results from a national study. Addiction, 102(12), 1920–1930. doi: 10.1111/j.1360-0443.2007.02015.x [PubMed: 17916222]

McCabe SE, Cranford JA, Boyd CJ, & Teter CJ (2007). Motives, diversion and routes of administration associated with nonmedical use of prescription opioids. Addictive behaviors, 32(3), 562–575. doi: 10.1016/j.addbeh.2006.05.022. [PubMed: 16843611]

Miech R, Bohnert A, Heard K, & Boardman J (2013). Increasing use of nonmedical analgesics among younger cohorts in the United States: a birth cohort effect. The Journal of adolescent health, 52(1), 35–41. doi: 10.1016/j.jadohealth.2012.07.016. [PubMed: 23260832]

Mowbray O, & Quinn A (2015). Prescription pain reliever misuse prevalence, correlates, and origin of possession throughout the life course. Addictive Behaviors, 50, 22–27. doi: 10.1016/j.addbeh.2015.06.006. [PubMed: 26093503]

Pradel V, Frauger E, Thirion X, Ronfle E, Lapierre V, Masut A, … Micallef J (2009). Impact of a prescription monitoring program on doctor-shopping for high dosage buprenorphine. Pharmacoepidemiology and drug safety, 18(1), 36–43. doi: 10.1002/pds.1681. [PubMed: 19040199]

Ross-Durow PL, McCabe SE, & Boyd CJ (2013). Adolescents' access to their own prescription medications in the home. The Journal of adolescent health, 53(2), 260–264. doi: 10.1016/j.jadohealth.2013.02.012. Epub 2013 May 14. [PubMed: 23683499]

Rigg KK, Kurtz SP, & Surratt HL (2012). Patterns of prescription medication diversion among drug dealers. Drugs: education, prevention, and policy, 19(2), 144–155. doi:10.3109/09687637.2011.631197

Rutkow L, Turner L, Lucas E, Hwang C, & Alexander GC (2015). Most primary care physicians are aware of prescription drug monitoring programs, but many find the data difficult to access. Health affairs, 34(3), 484–492. doi: 10.1377/hlthaff.2014.1085. [PubMed: 25732500]

Schepis TS, & Hakes JK (2017). Age of initiation, psychopathology, and other substance use are associated with time to use disorder diagnosis in persons using opioids nonmedically. Substance abuse, 38(4), 407–413. doi: 10.1080/08897077.2017.1356791. [PubMed: 28723266]

Schepis TS, & Krishnan-Sarin S (2009). Sources of prescriptions for misuse by adolescents: differences in sex, ethnicity, and severity of misuse in a population-based study. Journal of the American Academy of Child and Adolescent Psychiatry, 48(8), 828–836. doi: 10.1097/CHI.0b013e3181a8130d. [PubMed: 19564803]

Schepis TS, McCabe SE, & Teter CJ (2018). Sources of opioid medication for misuse in older adults: results from a nationally representative survey. Pain, 159(8), 1543–1549. doi: 10.1097/j.pain.0000000000001241. [PubMed: 29624517]

Scholl L, Seth P, Kariisa M, Wilson N, & Baldwin G (2018). Drug and Opioid-Involved Overdose Deaths - United States, 2013–2017. Morbidity and mortality weekly report, 67(5152), 1419–1427. doi: 10.15585/mmwr.mm675152e1. [PubMed: 30605448]

Simoni-Wastila L, Ritter G, & Strickler G (2004). Gender and other factors associated with the nonmedical use of abusable prescription drugs. Substance use and misuse, 39(1), 1–23. [PubMed: 15002942]

Stogner JM, Sanders A, & Miller BL (2014). Deception for drugs: self-reported "doctor shopping" among young adults. Journal of the American Board of Family Medicine, 27(5), 583–593. doi: 10.3122/jabfm.2014.05.140107. [PubMed: 25201928]

Surratt HL, O'Grady C, Kurtz SP, Stivers Y, Cicero TJ, Dart RC, … Chen M (2014). Reductions in prescription opioid diversion following recent legislative interventions in Florida. Pharmacoepidemiology and drug safety, 23(3), 314–320. doi: 10.1002/pds.3553. [PubMed: 24677496]

Volkow ND & McLellan TA (2011). Curtailing diversion and abuse of opioid analgesics without jeopardizing pain treatment. JAMA, 305(13), 1346–1347. doi: 10.1001/jama.2011.369. [PubMed: 21467287]

West NA, Severtson SG, Green JL, & Dart RC (2015). Trends in abuse and misuse of prescription opioids among older adults. Drug and alcohol dependence, 149, 117–121. doi: 10.1016/j.drugalcdep.2015.01.027. [PubMed: 25678441]

Wisniewski AM, Purdy CH, & Blondell RD (2008). The epidemiologic association between opioid prescribing, non-medical use, and emergency department visits. Journal of addictive diseases, 27(1), 1–11. doi: 10.1300/J069v27n01_01.

Wilsey BL, Fishman SM, Gilson AM, Casamalhuapa C, Baxi H, Zhang H, … Li CS (2010). Profiling multiple provider prescribing of opioids, benzodiazepines, stimulants, and anorectics. Drug and alcohol dependence, 112(1–2), 99–106. doi: 10.1016/j.drugalcdep.2010.05.007. [PubMed: 20566252]

Zhong W, Maradit-Kremers H, St Sauver JL, Yawn BP, Ebbert JO, Roger VL, … Rocca WA (2013). Age and sex patterns of drug prescribing in a defined American population. Mayo Clinic proceedings, 88(7), 697–707. doi: 10.1016/j.mayocp.2013.04.021. [PubMed: 23790544]

Table 1.

Sociodemographic characteristics of past-year prescription opioid misusers, NSDUH 2015–2016

Variables	Column % (95% CI) N=6,033
Age, year	
12–17	7.77 (7.16–8.39)
18–25	22.40 (20.84–23.96)
26–34	23.40 (21.94–24.85)
35+	46.43 (44.36–48.49)
Sex	
Male	55.03 (53.33–56.73)
Female	44.97 (43.27–46.67)
Race/ethnicity	
Non-Hispanic White	66.40 (64.33–68.48)
Non-Hispanic Black	10.88 (9.59–12.17)
Hispanic	16.62 (15.02–18.22)
Non-Hispanic Others	6.10 (5.07–7.12)
Family Income	
≤$49,999	55.05 (53.10–57.00)
$50,000 – $74,999	14.98 (13.88–16.07)
≥$75,000	29.98 (27.92–32.03)
Population density	
Segment in a CBSA with ≥ 1 million	54.35 (52.54–56.16)
Segment in a CBSA with < 1 million	40.33 (38.51–42.15)
Segment not in a CBSA	5.32 (4.45–6.19)
Health Insurance	
None	15.59 (14.37–16.80)
Private	55.52 (53.72–57.33)
Public	28.89 (27.32–30.46)
Self-rated overall health	
Excellent	15.74 (14.45–17.03)
Very Good	33.95 (31.79–36.12)
Good	32.99 (31.08–34.89)
Fair/Poor	17.31 (15.46–19.15)
Missing % (n)	0.01% (1)
Past-year major depressive episode	
No	80.17 (78.55–81.79)
Yes	17.95 (16.36–19.55)
Missing % (n)	1.88% (120)
Past-month frequency of prescription opioid misuse	
no past month misuse	70.50 (68.65–72.36)
1–2 days	11.63 (10.18–13.09)
3–5 days	7.50 (6.64–8.36)

Variables	Column % (95% CI) N=6,033
6–19 days	6.75 (5.78–7.72)
20–30 days	3.62 (3.02–4.22)
Past-year initiation of prescription opioid misuse	
No	81.93 (80.56–83.29)
Yes	18.07 (16.71–19.44)
Past-year alcohol use disorder	
No	77.87 (76.48–79.25)
Yes	22.13 (20.75–23.52)
Past-year prescription opioid use disorder	
No	83.65 (82.33–84.96)
Yes	16.35 (15.04–17.67)
Past-year heroin use disorder	
No	96.15 (95.51–96.79)
Yes	3.85 (3.21–4.49)
Past-year any drug use disorder other than opioid (prescription opioids or heroin) use disorder [a]	
No	82.24 (80.90–83.58)
Yes	17.76 (16.42–19.10)
Survey year	
Year 2015	51.77 (49.89–53.66)
Year 2016	48.23 (46.34–50.11)

All results are weighted estimates, except for sample size (unweighted).

CI = Confidence Interval.

[a]Any drug use disorder other than opioid (prescription opioids or heroin) use disorder include any of following drug use disorder: marijuana, cocaine, hallucinogen, inhalant, methamphetamine, tranquilizer, stimulant, or sedative.

Table 2.

Most recent source of prescription opioids for misuse among past-year prescription opioid misusers: by sex and age, NSDUH, 2015–2016

Sex	Age, years	Most recent source of prescription opioids for misuse, Row % (95% CI)					
		From ≥ one doctor	From friends/relatives for free	Bought from friends/ relatives	Took from friends/ relatives without asking	Bought from drug dealers/strangers	Other[a]
Both sexes (n=5,699)	≥12 years	36.59 (34.53–38.64)	40.27 (38.44–42.11)	9.21 (8.06–10.35)	3.47 (2.81–4.14)	5.51 (4.78–6.24)	4.95 (4.08–5.82)
Males (n=2,918)	Overall	34.10 (31.31–36.89)	38.29 (35.70–40.88)	11.18 (9.60–12.76)	3.28 (2.48–4.08)	7.38 (6.12–8.63)	5.77 (4.40–7.14)
	12–17[†] (n=410)	21.93 (16.19–27.68)	37.11 (30.33–43.89)	10.14 (6.85–13.43)	9.41 (5.29–13.53)	9.71 (5.80–13.63)	11.69 (7.61–15.76)
	18–25 (n=1,107)	23.04 (19.80–26.28)	41.06 (37.48–44.63)	14.13 (11.26–17.00)	4.13 (2.63–5.63)	11.16 (8.73–13.60)	6.49 (4.71–8.27)
	26–34 (n=651)	27.20 (22.96–31.44)	40.73 (35.58–45.87)	13.84 (10.22–17.47)	3.80 (2.21–5.38)	9.17 (6.25–12.10)	5.26 (2.20–8.32)
	≥35 (n=750)	**45.18 (40.08–50.28)**	35.70 (30.91–40.50)	8.36 (5.56–11.16)	**1.72 (0.67–2.77)**	**4.15 (2.53–5.77)**	**4.89 (2.60–7.17)**
Females (n=2,781)	Overall	39.62 (36.67–42.57)	42.69 (39.96–45.41)	6.80 (5.57–8.03)	3.71 (2.68–4.75)	3.23 (2.45–4.02)	3.95 (2.94–4.96)
	12–17[†] (n=509)	27.04 (22.35–31.73)	39.48 (33.62–45.34)	8.46 (5.67–11.25)	8.04 (4.41–11.66)	5.27 (2.47–8.07)	11.72 (8.64–14.80)
	18–25 (n=1,006)	30.49 (26.71–34.28)	45.58 (41.60–49.55)	10.80 (8.22–13.38)	4.96 (3.23–6.69)	4.26 (2.79–5.74)	**3.90 (2.21–5.60)**
	26–34 (n=560)	31.78 (27.79–35.77)	**50.81 (45.85–55.78)**	8.18 (5.25–11.12)	**2.12 (0.82–3.41)**	5.24 (2.92–7.56)	**1.87 (0.53–3.20)**
	≥35 (n=706)	**49.38 (44.42–54.34)**	38.30 (33.86–42.73)	**4.09 (2.55–5.62)**	3.13 (1.46–4.80)	1.53 (0.48–2.58)	**3.58 (2.01–5.15)**

All results are weighted estimates, except for sample size (unweighted).

Bold: The estimate in a column differs from the estimate among those aged 12–17 ($p<0.05$).

[†]Reference group

[a]Other source includes stolen from doctor office/clinic/hospital/pharmacy and some other way.

Table 3.

Association between most recent source of prescription opioids for misuse and prescription opioid use disorder among past-year prescription opioid misusers, by sex and age

	Adjusted OR (95% CI)			
Males	Overall (n=2,882)	12–17 years (n=400) *	18–25 years (n=1,092)	26+ years (n=1,390)
Most recent source of prescription opioids for misuse:				
From ≥ one doctor	**3.78 (2.43–5.89)**	1.58 (0.18–13.91)	**3.33 (1.82–6.08)**	**4.30 (2.54–7.27)**
From friends/relatives for free †	1.00	1.00	1.00	1.00
Bought from friends/relatives	**2.17 (1.31–3.61)**	**8.14 (1.23–53.89)** ‡	**3.07 (1.10–8.54)**	**1.95 (1.03–3.70)**
Took from friends/relatives without asking	1.64 (0.76–3.52)	1.81 (0.38–8.75)	2.06 (0.69–6.10)	1.62 (0.42–6.19)
Bought from drug dealers/strangers	**6.22 (3.81–10.16)**	1.29 (0.35–4.71)	**4.37 (2.12–9.02)**	**8.77 (4.09–18.83)**
Other [a]	0.91 (0.42–1.99)	1.07 (0.11–10.70)	2.27 (0.91–5.65)	0.66 (0.21–2.08)
Females	Overall (n=2,735)	12–17 (n=496)	18–25 (n=987)	26+ (n=1,252)
Most recent source of prescription opioids for misuse:				
From ≥ one doctor	**1.89 (1.25–2.86)**	1.01 (0.40–2.53)	1.14 (0.66–1.97)	**2.44 (1.34–4.45)**
From friends/relatives for free †	1.00	1.00	1.00	1.00
Bought from friends/relatives	1.68 (0.97–2.89)	1.13 (0.43–2.94)	**2.35 (1.13–4.92)**	1.41 (0.48–4.22)
Took from friends/relatives without asking	1.88 (0.74–4.80)	1.60 (0.50–5.11)	1.37 (0.49–3.84)	2.49 (0.56–11.11)
Bought from drug dealers/strangers	**5.56 (2.81–11.02)**	0.78 (0.24–2.51)	2.06 (0.71–5.99)	**12.68 (3.95–40.67)** ‡
Other [a]	2.01 (0.99–4.08)	2.30 (0.87–6.06)	0.84 (0.23–3.10)	2.14 (0.67–6.77)

Note. Each logistic regression was adjusted for race/ethnicity, family income, population density, health insurance, self-rated overall health, past-year major depressive episode, frequency of prescription opioid misuse in the past month, past-year initiation of prescription opioid misuse, past-year alcohol use disorder, past-year heroin use disorder, past-year any drug use disorder other than opioid (prescription opioids or heroin) use disorder, and survey year.

All results are weighted estimates, except for sample size (unweighted).

OR= Odds Ratio; CI= Confidence Interval; Boldface: $p<0.05$.

† Reference group

‡ The results should be interpreted with caution due to a wide confidence interval.

[*] The results for those aged 12–17 years are limited by the sample size.

[a] Other source includes stolen from doctor office/clinic/hospital/pharmacy and some other way