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Racial/ethnic differences in trends in heroin use and heroin-related risk behaviors among nonmedical prescription opioid users*

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Abstract

Background—This study examines changing patterns of past-year heroin use and heroin-related risk behaviors among individuals with nonmedical use of prescription opioids (NMUPO) by racial/ethnic groups in the United States.

Methods—We used data from the National Survey on Drug Use and Health (NSDUH) from 2002–2005 and 2008–2011, resulting in a total sample of N=448,597.

Results—Past-year heroin use increased among individuals with NMUPO and increases varied by frequency of past year NMUPO and race/ethnicity. Those with NMUPO in the 2008–2011 period had almost twice the odds of heroin use as those with NMUPO in the 2002–2005 period (OR=1.89, 95%CI: 1.50, 2.39), with higher increases in Non-Hispanic (NH) Whites and Hispanics. In 2008–2011, the risk of past year heroin use, ever injecting heroin, past-year heroin abuse or dependence, and the perception of availability of heroin increased as the frequency of NMUPO increased across respondents of all race/ethnicities.

Conclusion—Individuals with NMUPO, particularly non-Hispanic Whites, are at high risk of heroin use and heroin-related risk behaviors. These results suggest that frequent nonmedical users of prescription opioids, regardless of race/ethnicity, should be the focus of novel public health efforts to prevent and mitigate the harms of heroin use.

Keywords

Heroin; Race/Ethnicity; Heroin-risk behaviors; Nonmedical Use of Prescription Opioids; National Survey on Drug Use and Health

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1. INTRODUCTION

Studies using national U.S. data have shown that individuals with previous nonmedical use of prescription opioids (NMUPO) are at greater risk of heroin use (Becker et al., 2008; Jones, 2013; SAMHSA, 2011). Risk increases as past year frequency of NMUPO increases (Jones, 2013). Increased rates of NMUPO across the U.S. have been linked to the increased prescribing of opioid pain relievers, such as OxyContin, since the 1990s (Manchikanti, 2007; Volkow et al., 2011). Rates of NMUPO only recently seemed to have reached a plateau (SAMHSA, 2012), probably due to the recent restrictions placed in the prescription opioids market as well as the introduction of new abuse-deterrent formulations of these drugs (Cicero et al., 2012, 2014). Links between NMUPO and prescription opioids abuse/dependence, NMUPO onset and transition to heroin and other illegal substances (Becker et al., 2008; Brands et al., 2004; Cleland et al., 2011; Compton and Volkow, 2006; Mars et al., 2013), and NMUPO-related and heroin-related fatal overdoses (Becker et al., 2008; Blanco et al., 2007; Cicero et al., 2005; Unick et al., 2013), have raised particular concerns in recent years. In addition, a particular public health concern is that the transition to heroin and further injecting heroin may increase the risk of bloodborne infections (Miller et al., 2004; Thorpe et al., 2002).

The transition from NMUPO to heroin use may be explained by individual motivations such as desire to get a more potent high, by heroin being easier to use, cheaper (given the low cost of heroin in the U.S. (Ciccarone et al., 2009) and more easily available compared to prescription opioids (Cicero et al., 2012, 2014). Moreover, the transition from NMUPO to heroin use might be different across race/ethnic groups (Becker et al., 2008; Blanco et al., 2007; Green et al., 2005; Keyes et al., 2013; Mars et al., 2013; Morrison et al., 2000). Minorities have been less likely to receive prescriptions for opioid medications compared to Non-Hispanic (NH) Whites (Morrison et al., 2000; Pletcher et al., 2008). NH Whites have been at greater risk of NMUPO onset and prescription opioids-related disorders compared to other ethnic groups (Green et al., 2005; Mars et al., 2013; Morrison et al., 2000). Also, although previous studies have shown that the prevalence of heroin use has been found to be greater among Hispanics and NH Whites compared to other race/ethnic groups (Bernstein et al., 2006a; Kopstein, 1998), recent data indicates that NH Whites are overrepresented among heroin/opioid-related fatal overdose cases (Mack, 2013; Paulozzi, 2012; Paulozzi et al., 2011; Rudd et al., 2014; Unick et al., 2013). Some evidence also shows that among teenagers, the strong association between early onset of NMUPO and heroin use does not vary by race/ethnic groups (Cerdá et al.). It is possible that small sample sizes, with low representation of NH Blacks and Hispanics, or aggregation of different racial/ethnic groups into one category as non-Whites, may limit the availability of information regarding race/ethnic differences in NMUPO and risk of heroin use. Having access to this knowledge could be helpful in the development of strategies targeting specific groups being at greatest risk of adverse outcomes.

Specifically, in this study we: 1) examine the change in the patterns of past-year NMUPO and heroin use between 2002–2005 and 2008–2011 across racial/ethnic groups; 2) examine the association between past year frequency of NMUPO with heroin use, heroin-related risk behaviors and exposure to heroin availability by race/ethnicity. Data came from the National

Survey on Drug Use and Health (NSDUH), a large nationally-representative household sample (approximately 67,500 persons are interviewed each year (SAMHSA, 2013), as it has good representation of various races/ethnicities in the US.

2. METHODS

2.1. Data

We used NSDUH data from 2002–2005 and 2008–2011, resulting in a total sample of N=448,597 participants (obtained from combining data from each of the 8 years used in analyses). The survey uses a multistage area probability sample for each of the 50 states and DC and oversamples younger age groups (aged 12–25) as well as African-Americans and Hispanics. Response rate for household screening and completed interviews ranged between 87–91% and 74–79%, respectively. Interviews were administered by computer-assisted personal interviewing (CAPI) and audio computer-assisted self-interviewing (ACASI) for illegal drug use and other sensitive behaviors (Morrall et al., 2003). Detailed survey methodology is available elsewhere (SAMHSA, 2009, 2011, 2013).

2.2. Measures

2.2.1. Outcome—The main outcome was self-reported heroin use in the past year. Participants were asked if they had used heroin within the last 12 months prior to the survey (yes/no).

2.2.2. Covariates

2.2.2.1 Main exposure variable: Our main exposure variable was self-reported past year NMUPO, by race/ethnicity. Nonmedical use refers to situations in which a subject used a substance that was not prescribed for him/her, or reporting that he/she took the drug only for the experience or feeling it caused (SAMHSA, 2009). Participants were classified as responding affirmatively to NMUPO if they endorsed using prescription opioids non-medically during the preceding 12 months. Frequency of past year NMUPO was coded as the number of days in which participants used prescription opioids nonmedically and categorized in 3 groups ('1–29', '20–99', and '100–365' days) as described previously (Jones, 2013).

2.2.2.2 Correlates of heroin use: DSM-IV abuse and dependence on heroin were included as covariates for the purpose of this study (combined as heroin use disorder). Information on either prescription opioids or heroin abuse and dependence was obtained from a set of structured questions based on dependence criteria for substance disorders from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (American Psychiatric Association, 2000).

Participants endorsing they had used heroin in the past, were also asked about the heroin route of administration (i.e., had ever used a needle and syringe to inject heroin). Heroin availability was also assessed. For analyses heroin availability was dichotomized as: 1) fairly/very easy, and 2) difficult to obtain, which included previous categories: probably impossible, very difficult, and fairly difficult.

2.2.2.3 Demographic covariates: Other demographics included the following: (1) age; gender; (2) race/ethnicity, categorized as [Non-Hispanic (NH) White, NH Black, Hispanic, and others (others included NH Native American/AK Native, NH Native Hawaiian/Other Pacific Islands, NH Asian, NH more than one race)]; (3) past-year family income; and (4) Metropolitan Statistical Area (MSA).

2.3. Statistical Analysis

Overall average annual rate of past year heroin use by frequency of past year NMUPO for the two periods (2002–2005 and 2008–2011) and average annual rate by racial/ethnic group were calculated and converted to annual rates per 1,000 population. Significant differences between the two periods in each of the NMUPO use frequency category were assessed using two-tailed *t*-test.

The association between heroin use and frequency of NMUPO use, in the entire sample and also by racial/ethnic group for 2008–2011, was estimated using weighted logistic regression models, adjusted for demographics, and using the category ‘1–29 days’ as reference. The association between the frequency of NMUPO use in 2002–2005 and in 2008–2011 by race/ethnicity and the other outcomes of interest were also assessed using similar models adjusted for demographics. Standard errors to obtained prevalence estimates of substance use in NSDUH were calculated using a Taylor series linearization approach (Chromy and Abeyasekera, 2005) to take into account the effects of complex survey design features of the NSDUH survey. Standard errors of non-linear statistics can only be expressed approximately using first order Taylor series approximations (Chromy and Abeyasekera, 2005). All analyses were carried out using STATA version 13 statistical software (STATA, 2013).

3. RESULTS

3.1. Heroin Use Rates (unadjusted)

Table 1 shows the average annual rates of past year heroin use for the two study periods by frequency of past year NMUPO and racial/ethnic group. The rate of heroin use among NH Whites, which was lower than that of NH Blacks and Hispanics in 2002–2004, increased by 75% in 2008–2011, which was the highest rate across racial/ethnic groups in this period (2.57 per 1,000). Among Blacks, significant increases in the rate of heroin use were only observed between those using any prescription opioids in the past year and those using prescription opioids 100–365 days in the past year. For Hispanics, increases were significant among those using prescription opioids any and 1–29 days in the past year. For all racial/ethnic groups other than NH Whites, there was no increase in the overall average annual rate of heroin use. This was also the case for those not using prescription opioids in the past year. In addition, the rate of ever injecting heroin and heroin abuse/dependence among past year heroin users did not significantly change between the two time periods for any race/ethnic groups (results shown in supplemental Table 1¹). However, in the overall population, the rate of heroin abuse/dependence significantly increased among NH Whites.

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3.2. Heroin Use Rates (adjusted odds ratio)

For NH Whites the odds ratios of past year heroin among NMUPO users between the two periods were similar as the ones observed for the entire population. Among Hispanics these results were statistically significant for individuals endorsing any NMUPO (OR=2.25, 95%CI: 1.05; 4.88) and those endorsing NMUPO 1–29 days in the past year (OR=8.12, 95%CI: 1.93; 34.12). For NH Blacks there were no significant differences, after adjusting for covariates, in the prevalence of past-year heroin use among those with NMUPO in both time-periods. Finally, in the group including all other racial/ethnic groups, differences were only significant for those endorsing any NMUPO.

3.3. Risk behaviors, prescription opioid abuse/dependence and heroin abuse/dependence (adjusted odds ratios)

In 2008–2011, among NH Whites, the risk of past year heroin use, ever injecting heroin or prescription opioids, past-year heroin abuse or dependence, and the perception of availability of heroin increased as the frequency of NMUPO increased (Table 2). Among NH Blacks, the risk for these outcomes was statistically significant only for those endorsing NMUPO 100–365 days in the past year, except for availability of heroin, which was not associated with frequency of NMUPO. Among Hispanics the risk of past year heroin use, and the perception of availability of heroin was significantly greater among those endorsing NMUPO 100–365 days in the past year compared to the risk of those in reference group. For the category including all other racial/ethnic groups, the risk of past year heroin use, ever injecting heroin, past year heroin abuse or dependence, and the availability of heroin was higher among those endorsing NMUPO 100–365 days in the past year compared to those in the reference group. In addition, frequent prescription opioids users of all race/ethnicities (those using prescription opioids at least 100 days in the past year) were at increased risk of past year prescription opioids abuse/dependence, with the exception of NH Blacks (Table 2). While among NH Whites, Hispanics and those of “Other” race/ethnicity that were using prescription opioids nonmedically than 100 or more days /year about half meet criteria for opioid abuse/dependence, among NH blacks who were using prescription opioids nonmedically 100 or more days/year around 1/5 (22%) meet criteria for opioid abuse/dependence. Because results were in the same direction, we do not show the associations described in Table 2 for those interviewed in the 2002–2005 period.

4. DISCUSSION

There were significant increases in heroin use among those endorsing past year NMUPO of all race/ethnicities between 2002–2005 and 2008–2011. In general, it has been observed that Hispanics and NH Whites report more use of drugs than NH Blacks (Golub and Johnson, 2005; McCabe et al., 2007), with Hispanics being more likely to use heroin than NH Whites or NH Blacks, and NH Blacks being more likely to use cocaine than non-Hispanic Whites and Hispanics (Bernstein et al., 2006b). This study sheds light on the racial/ethnic differences in trends of NMUPO and heroin use over time.

Interestingly, our findings indicate that a significant increase in the annual rate of heroin use from 2002–2005 to 2008–2011 (representing a 74.83% increment) was only observed

among NH Whites, and that contrary to what has been previously described, the rate of heroin use among NH Whites in 2008–2011 was greater than that observed among Hispanics (2.57 vs. 2.36, although not significantly different). This increment in heroin use among NH Whites was parallel to the increment in the proportion of NH Whites using prescription opioid >100 days in the past year, even when the proportion on overall NMUPO among NH Whites was stable over the two periods. Also, NH Whites using prescription opioids 100 or more days in the past year had the greatest prevalence of past year heroin use among overall prescription opioids users in the 2008–2011 (11.5%). In addition, it is interesting that trends data shows significant increases across time in heroin use among prescription opioids users of all race/ethnicities. It is possible that approaches restricting the prescription opioids market as well as the introduction of abuse-deterrent formulations may be less likely to reduce harm of opioid abuse compared to alternative approaches taking into account treatment options and demand-side reductions (Unick et al., 2013).

Individuals endorsing past year NMUPO who also use heroin are likely to be in a more advanced stage of their drug use trajectory. Furthermore, they are likely to use prescription opioids for purposes that are different from those not using heroin (i.e., as a substitute for heroin when heroin is unavailable, to augment an heroin induced “high”, to “treat” withdrawal symptoms, and to curb heroin use; Lankenau et al., 2012b). There is mounting evidence of the sale of prescription opioids for nonmedical purposes via the same illegal markets that sell other illegal drugs such as heroin (Fischer et al., 2010). In some markets, the same dealers sell both illegal and prescriptions drugs, and in other markets street dealers sell either type of drug but not both (Fischer et al., 2010). The association between NMUPO and the use of illegal drugs may be part of a pattern of gradually escalating drug use, and shared heroin and prescription opioids illegal street markets may facilitate this escalation, including the initiation of heroin use via injection and/or other routes of administration (Lankenau et al., 2012a; Young and Havens, 2012).

It is important to note that criteria for prescription opioid abuse/dependence was less likely to be endorsed by NH Blacks opioids with NMUPO >100 days /year, when compared to other race groups. It is possible that NH Blacks are more likely to endorse abuse/dependence criteria for other drugs if using these drugs in combination with prescription opioids and therefore attributing fewer criteria to their prescription opioid use. Also, it is also possible that different dose patterns or the quality of the opioids commonly used by NH Blacks who are frequent opioid users could explain the different findings observed in this group.

Frequent prescription opioids users who use heroin of all race/ethnicities, with the exception of Hispanics, are at increased risk of ever injecting heroin and of past year heroin abuse/dependence. Our findings are consistent with previous qualitative (Lankenau et al., 2012a; Mars et al., 2013) and quantitative (Cerdá et al., under review; Jones, 2013) studies showing an association between frequent NMUPO and injecting heroin and also with heroin use disorders (Blanco et al., 2007; Cicero et al., 2005). The retrospective past year measures used in this study do not allow us to recognize the temporality of these events, but show that heroin-related behaviors and disorders occur concurrently with frequent NMUPO. It is difficult to disentangle, with the current cross-sectional data, the factors driving these results among Hispanics, given the uncertainty about the temporality of these measures. It is

possible that Hispanics who were frequent opioids users (>100 days/year) and who were also likely to use heroin in previous years, are now only able to use prescription opioids 1–29 days/year in the past 12 months due to recent constraints in the prescription opioids market. Therefore, a high risk of ever injecting heroin among the reference group would translate into non-statistically significant results when compared to the risk of those using >100 days/year in the past 12 months. It is possible that Hispanics may be more affected by this market pressure, a phenomena that has been previously documented (Morrison et al., 2000; Pletcher et al., 2008).

Our findings also suggest that the rate of heroin abuse/dependence did not significantly increase among heroin users from the 2002–2005 period to the 2008–2011 one. However, when using the overall population in the denominator there was a significant increase in the annual rate of heroin abuse/dependence among NH Whites. This parallels the significant increase in NMUPO during the last decade (SAMHSA, 2012) and the growing number of heroin overdose deaths described for this race/ethnic group in recent years (Rudd et al., 2014). Overall, these results suggest a connection between NMUPO, heroin use and heroin-related adverse outcomes at the population level.

Limitations are noted. A major limitation of using NSDUH data is that estimates for years 2002–2010 were calculated using weights derived from the 2000 U.S. census data, and the 2011 weights were based on data from the 2010 census, thus affecting the comparability of estimates across years (SAMHSA, 2012). However, analyses on the impact of this change in the 2011 weights have shown that estimates of substance users within race groups are not substantially affected. Only estimates among groups of individuals reporting two or more race groups showed significant changes. These individuals are included in the “Other” group and the estimates in this group should be interpreted with caution (SAMHSA, 2012). As in most large-scale epidemiologic surveys, information is based on self-report, and there might be recall bias in reporting both drug use and other sensitive behaviors (Morril et al., 2003). In addition, respondents might under-report abuse and dependence symptoms. Also, data to distinguish whether these nonmedical prescription opioids users first started using these drugs when legitimately prescribed (e.g., pain relief) or when obtained illegally (i.e., to get high) were unavailable in the NSDUH. Individual factors not examined in this study such as intense pain or psychiatric disorders could be responsible for an increased NMUPO, as well as for the substance disorders and risky behaviors (Blanco et al., 2007; Lankenau et al., 2012b).

In conclusion, the risk of heroin-related behaviors increased as the frequency of NMUPO increased across prescription opioids users of all race/ethnicities. Results suggest that frequent nonmedical users of prescription opioids, regardless of race/ethnicity, should be the focus of public health efforts to prevent and mitigate the harms of heroin use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. APA; Washington, DC: 2000.
- Becker WC, Sullivan LE, Tetrault JM, Desai RA, Fiellin DA. Non-medical use, abuse and dependence on prescription opioids among US adults: psychiatric, medical and substance use correlates. *Drug Alcohol Depend.* 2008; 94:38–47.
- Bernstein E, Bernstein J, Tassiopoulos K, Valentine A, Heeren T, Levenson S, Hingson R. Racial and ethnic diversity among a heroin and cocaine using population: treatment system utilization. *J Addict Dis.* 2006a; 24:43–63. [PubMed: 16368656]
- Bernstein J, Bernstein E, Shepard DS, Valentine A, Heeren T, Winter M, Levenson S, Beaton-Blaakman A, Tassiopoulos K, Hingson R. Racial and ethnic differences in health and health care: lessons from an inner-city patient population actively using heroin and cocaine. *J Ethn Subst Abuse.* 2006b; 5:35–50. [PubMed: 16635973]
- Blanco C, Alderson D, Ogburn E, Grant BF, Nunes EV, Hatzenbuehler ML, Hasin DS. Changes in the prevalence of non-medical prescription drug use and drug use disorders in the United States: 1991–1992 and 2001–2002. *Drug Alcohol Depend.* 2007; 90:252–260. [PubMed: 17513069]
- Brands B, Blake J, Sproule B, Gourlay D, Busto U. Prescription opioid abuse in patients presenting for methadone maintenance treatment. *Drug Alcohol Depend.* 2004; 73:199–207. [PubMed: 14725960]
- Cerdá, M.; Santaella, J.; Marshall, B.; Kim, J.; Martins, S. Nonmedical prescription opioid use in childhood and early adolescence predicts transitions to heroin use in young adulthood: a national study. under reviewUnder review
- Chromy, J.; Abeyasekera, S. United Nations. Household Sample Surveys in Developing and Transition Countries Studies in Methods Department of Economic and Social Affairs Statistics Division. United Nations; New York: 2005. Statistical analysis of survey data.
- Ciccarone D, Unick GJ, Kraus A. Impact of South American heroin on the US heroin market 1993–2004. *Int J Drug Policy.* 2009; 20:392–401. [PubMed: 19201184]
- Cicero TJ, Ellis MS, Surratt HL. Effect of abuse-deterrent formulation of OxyContin. *N Engl J Med.* 2012; 367:187–189. [PubMed: 22784140]
- Cicero TJ, Ellis MS, Surratt HL, Kurtz SP. The changing face of heroin use in the United States: a retrospective analysis of the past 50 years. *JAMA Psychiatry.* 2014; 71:821–826. [PubMed: 24871348]
- Cicero TJ, Inciardi JA, Muñoz A. Trends in abuse of OxyContin® and other opioid analgesics in the United States: 2002–2004. *J Pain.* 2005; 6:662–672. [PubMed: 16202959]
- Cleland CM, Rosenblum A, Fong C, Maxwell C. Age differences in heroin and prescription opioid abuse among enrollees into opioid treatment programs. *Subst Abuse Treat Prev Policy.* 2011; 6:11. [PubMed: 21635762]
- Compton WM, Volkow ND. Abuse of prescription drugs and the risk of addiction. *Drug Alcohol Depend.* 2006; 83:S4–S7. [PubMed: 16563663]
- Fischer B, Bibby M, Bouchard M. The global diversion of pharmaceutical drugsnon-medical use and diversion of psychotropic prescription drugs in North America: a review of sourcing routes and control measures. *Addiction.* 2010; 105:2062–2070. [PubMed: 20840172]
- Golub A, Johnson BD. The new heroin users among Manhattan arrestees: variations by race/ethnicity and mode of consumption. *J Psychoact Drugs.* 2005; 37:51–61.
- Green CR, Ndao-Brumblay SK, West B, Washington T. Differences in prescription opioid analgesic availability: comparing minority and white pharmacies across Michigan. *J Pain.* 2005; 6:689–699. [PubMed: 16202962]
- Jones CM. Heroin use and heroin use risk behaviors among nonmedical users of prescription opioid pain relievers - United States, 2002–2004 and 2008–2010. *Drug Alcohol Depend.* 2013; 132:95–100. [PubMed: 23410617]
- Keyes KM, Cerda M, Brady JE, Havens JR, Galea S. Understanding the rural-urban differences in nonmedical prescription opioid use and abuse in the United States. *Am J Public Health.* 2013; 104:e52–59. [PubMed: 24328642]

- Kopstein, AN., editor. Drug Use Among Racial/Ethnic Minorities. DIANE Publishing Company; New York: 1998.
- Lankenau SE, Teti M, Silva K, Bloom JJ, Harocopos A, Treese M. Initiation into prescription opioid misuse amongst young injection drug users. *Int J Drug Policy*. 2012a; 23:37–44. [PubMed: 21689917]
- Lankenau SE, Teti M, Silva K, Bloom JJ, Harocopos A, Treese M. Patterns of prescription drug misuse among young injection drug users. *J Urban Health*. 2012b; 89:1004–1016. [PubMed: 22684424]
- Mack KA. Drug-Induced Deaths—United States, 1999–2010. *MMWR Surveill Summ*. 2013;161. [PubMed: 24264508]
- Manchikanti L. National drug control policy and prescription drug abuse: facts and fallacies. *Pain Physician*. 2007; 10:399–424. [PubMed: 17525776]
- Mars SG, Bourgois P, Karandinos G, Montero F, Ciccarone D. “Every ‘Never’ I Ever Said Came True”: transitions from opioid pills to heroin injecting. *Int J Drug Policy*. 2013; 25:257–266. [PubMed: 24238956]
- McCabe SE, Morales M, Cranford JA, Delva J, McPherson MD, Boyd CJ. Race/ethnicity and gender differences in drug use and abuse among college students. *J Ethn Subst Abuse*. 2007; 6:75–95. [PubMed: 18192205]
- Miller CL, Wood E, Spittal PM, Li K, Frankish JC, Braitstein P, Montaner JS, Schechter MT. The future face of coinfection: prevalence and incidence of HIV and hepatitis C virus coinfection among young injection drug users. *J Acquir Immune Defic Syndr*. 2004; 36:743–749. [PubMed: 15167294]
- Morrall AR, McCaffrey DF, Chien S. Measurement of adolescent drug use. *J Psychoact Drugs*. 2003; 35:301–309.
- Morrison RS, Wallenstein S, Natale DK, Senzel RS, Huang LL. “We don’t carry that”—failure of pharmacies in predominantly nonwhite neighborhoods to stock opioid analgesics. *N Engl J Med*. 2000; 342:1023–1026. [PubMed: 10749965]
- Paulozzi, L. Populations at Risk for Opioid Overdose. Center for Disease Control. US Food and Drug Administration; Washington, DC: 2012.
- Paulozzi LJ, CCD. Drug-induced deaths - United States, 2003–2007. *MMWR Surveill Summ*. 2011:60–61. [PubMed: 21430623]
- Pletcher MJ, Kertesz SG, Kohn MA, Gonzales R. Trends in opioid prescribing by race/ethnicity for patients seeking care in US emergency departments. *JAMA*. 2008; 299:70–78. [PubMed: 18167408]
- Rudd R, Paulozzi L, Bauer M, Burleson R, Carlson R, Dao D, Davis J, Dudek J, Eichler B, Fernandes J, Fondario A, Gabella B, Hume B, Huntamer T, Kariisa M, Largo T, Miles J, Newmyer A, Nitcheva D, Perez B, Proescholdbell S, Sabel J, Skiba J, Slavova S, Stone K, Tharp J, Wendling T, Wright D, Zehner A. Increases in heroin overdose deaths — 28 states, 2010 to 2012. *MMWR*. 2014; 63:849–854. [PubMed: 25275328]
- SAMHSA. NSDUH Series H-36, HHS Publication No. SMA 09–4434. Substance Abuse and Mental Health Services Administration, Office of Applied Studies; Rockville, MD: 2009. Results from the 2008 National Survey on Drug Use and Health: National Findings.
- SAMHSA. NSDUH Series H-41, HHS Publication No. SMA 11–4658. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2011. Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings.
- SAMHSA. NSDUH Series H-44, HHS Publication No. (SMA) 12–4713. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2012. Results from the 2011 National Survey on Drug Use and Health: Summary of National Findings.
- SAMHSA. NSDUH Series H-46, HHS Publication No. SMA 13–4795. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2013. Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings.
- STATA. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP; 2013. StataCorp.

- Thorpe LE, Ouellet LJ, Hershow R, Bailey SL, Williams IT, Williamson J, Monterroso ER, Garfein RS. Risk of hepatitis C virus infection among young adult injection drug users who share injection equipment. *Am J Epidemiol.* 2002; 155:645–653. [PubMed: 11914192]
- Unick GJ, Rosenblum D, Mars S, Ciccarone D. Intertwined epidemics: national demographic trends in hospitalizations for heroin- and opioid-related overdoses, 1993–2009. *PloS One.* 2013; 8:e54496. [PubMed: 23405084]
- Volkow ND, McLellan TA, Cotto JH, Karithanom M, Weiss SR. Characteristics of opioid prescriptions in 2009. *JAMA.* 2011; 305:1299–1301. [PubMed: 21467282]
- Young AM, Havens JR. Transition from first illicit drug use to first injection drug use among rural Appalachian drug users: a cross-sectional comparison and retrospective survival analysis. *Addiction.* 2012; 107:587–596. [PubMed: 21883604]

Highlights

- Odds of heroin use in nonmedical use of prescription opioids (NMUPO) users in 2008–2011 was twice the odds in the 2002–2005
- Increases in heroin use were more prominent among non-Hispanic (NH) Whites
- Injecting heroin and heroin abuse/dependence increased with frequency of prescription opioid (PO) use

Table 1

Average annual rate of past year heroin use and adjusted odds ratios for past year heroin use among people 12 years and older, by frequency of past year nonmedical use of prescription opioids (NMUPO), racial/ethnic group, and period.

Characteristics	Overall PY heroin use	No PY NMUPO	1–29 days PY NMUPO	aOR (95% CI)	30–99 days PY NMUPO	aOR (95% CI)	100–365 days PY NMUPO	aOR (95% CI)	Any PY NMUPO	aOR (95% CI)
Total sample										
2002–2005	1.59~	0.73	7.82^		26.42		59.27~		18.53~	
2008–2011	2.38	0.73	15.09	1.93 (1.19–3.12)	38.81	1.39 (0.90–2.13)	105.75	1.73 (1.22–2.44)	35.57	1.89 (1.50–2.39)
Race/Ethnic group										
NH White										
2002–2005	1.47~	0.41^	8.47^		34.41		72.42^		21.30~	
2008–2011	2.57	0.63	16.52	1.94 (1.15–3.28)	43.05	1.17 (0.73–1.88)	114.75	1.54 (1.01–2.35)	38.73	1.79 (1.36–2.35)
NH Black										
2002–2005	2.27	1.93	13.37		3.25		20.91^		11.65^	
2008–2011	2.15	0.92	6.69	0.24 (0.03–1.75)	38.3	12.05 (0.72–202.50)	108.76	4.56 (0.85–24.46)	34.28	2.41 (0.72–8.03)
Hispanics										
2002–2005	1.92	1.41	2.33^		15.44		40.48		11.56^	
2008–2011	2.36	1.26	16.63	8.12 (1.93–34.12)	22.38	1.69 (0.37–7.60)	70.59	1.10 (0.42–2.90)	26.04	2.25 (1.05–4.88)
Other										
2002–2005	0.86	0.67	2.42		5.86		18.71		6.06^	
2008–2011	1.01	0.29	4.64	2.18 (0.67–7.12)	34.71	6.57 (0.73–58.93)	52.54	2.74 (0.63–11.91)	19.31	3.37 (1.25–9.13)

Data are given as rates per 1000 population of each frequency of use category.

^ Difference between the 2008–2011 and 2002–2005 average annual rate are statistically significant at the $p < 0.05$ level.

~ Difference between the 2008–2011 and 2002–2005 average annual rate are statistically significant at the $p < 0.01$ level.

Odds ratios for total sample were adjusted by socio-demographics (sex, age, race/ethnic group, total family income, and county type)

Odds ratios for specific ethnic groups were adjusted by socio-demographics (sex, age, total family income, and county type)

Abbreviations: PY, past year; NMUPO, nonmedical use of prescription opioids; NH, Non-Hispanic; aOR, adjusted odds ratio; 95% CI, 95% confidence interval.

Table 2

Adjusted odds ratios for past-year heroin and prescription opioids risk behaviors and past year abuse or dependence on heroin/prescription opioids by frequency of past-year NMUPO among people 12 years and older, 2008–2011.

Characteristic	All racial/ Ethnic groups	NH White	NH Black	Hispanics	Other~
Past year heroin use					
1–29 days of PY NMUPO	Reference	Reference	Reference	Reference	Reference
30–99 days of PY NMUPO aOR (95% CI) *	2.63 (1.72–4.01)	2.61 (1.63–4.19)	4.78 (0.88–25.85)	1.33 (0.41–4.33)	9.13 (1.71–49.04)
100–365 days of PY NMUPO aOR (95% CI) *	7.65 (5.09–11.51)	7.62 (4.46–13.00)	14.77 (4.04–53.96)	4.65 (1.36–15.90)	12.60 (4.15–38.24)
Ever injected heroin					
1–29 days of PY NMUPO	Reference	Reference	Reference	Reference	Reference
30–99 days of PY NMUPO aOR (95% CI) *	1.80 (1.05–3.10)	1.93 (1.15–3.25)	1.99 (0.25–15.58)	0.85 (0.10–7.45)	1.94 (0.51–7.36)
100–365 days of PY NMUPO aOR (95% CI) *	5.48 (3.36–8.96)	5.78 (3.40–9.84)	12.24 (2.35–63.92)	2.38 (0.30–18.75)	10.60 (3.40–33.04)
Past year NMUPO abuse or dependence					
1–29 days of PY NMUPO	Reference	Reference	Reference	Reference	Reference
30–99 days of PY NMUPO aOR (95% CI) *	2.88 (2.32–3.59)	3.71 (2.30–4.58)	1.55 (0.77–3.10)	1.39 (0.70–2.77)	1.03 (0.43–2.46)
100–365 days of PY NMUPO aOR (95% CI) *	9.05 (7.47–10.96)	11.82 (9.68–14.43)	2.11 (0.84–2.48)	6.08 (3.28–11.27)	4.72 (2.08–10.72)
Past year heroin abuse or dependence					
1–29 days of PY NMUPO	Reference	Reference	Reference	Reference	Reference
30–99 days of PY NMUPO aOR (95% CI) *	3.16 (1.77–5.67)	3.07 (1.58–5.97)	4.96 (0.73–33.96)	1.48 (0.27–8.05)	6.16 (1.09–34.64)
100–365 days of PY NMUPO aOR (95% CI) *	9.24 (5.82–14.67)	10.16 (5.97–17.30)	10.16 (1.91–54.03)	4.20 (0.87–20.25)	13.39 (3.23–55.45)
Heroin fairly or very easy to obtain					
1–29 days of PY NMUPO	Reference	Reference	Reference	Reference	Reference
30–99 days of PY NMUPO aOR (95% CI) *	1.38 (1.15–1.66)	1.59 (1.30–1.93)	1.08 (0.70–1.65)	0.98 (0.61–1.59)	1.18 (0.61–2.29)
100–365 days of PY NMUPO aOR (95% CI) *	2.27 (1.90–2.71)	2.72 (2.20–3.35)	1.04 (1.55–3.14)	1.67 (1.03–2.72)	2.50 (1.29–4.84)

* Odds ratios for all the all racial/ethnic groups were adjusted for sex, age, race/ethnicity, total family income, and metropolitan statistical area; Odds ratios for specific racial/ethnic groups were adjusted for sex, age, total family income, and metropolitan statistical area

Abbreviations: PY NMUPO, past year nonmedical use of prescription opioids; NH, Non-Hispanic; aOR, adjusted odds ratio; 95% CI, 95% confidence interval.

~ Includes: NH Native American/AK Native, NH Native HI/Other Pac Islander, NH Asian, and NH more than one