



Full length article

Increases in prescription opioid injection abuse among treatment admissions in the United States, 2004–2013



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ABSTRACT

Background: The 2015 HIV outbreak in Indiana associated with prescription opioid injection coupled with rising rates of hepatitis C, especially in areas with long-standing opioid abuse, have raised concerns about prescription opioid injection. However, research on this topic is limited. We assessed trends in treatment admissions reporting injection, smoking, and inhalation abuse of prescription opioids and examined characteristics associated with non-oral routes of prescription opioid abuse in the U.S.

Methods: Prescription opioid abuse treatment admissions in the 2004–2013 Treatment Episode Data Set were used to calculate counts and percentages of prescription opioid treatment admissions reporting oral, injection, or smoking/inhalation abuse overall, by sex, age, and race/ethnicity. Multivariable multinomial logistic regression was used to identify demographic and substance use characteristics associated with injection or smoking/inhalation abuse.

Results: From 2004–2013, oral abuse decreased from 73.1% to 58.9%; injection abuse increased from 11.7% to 18.1%; and smoking/inhalation abuse increased from 15.3% of admissions to 23.0%. Among treatment admissions, the following were associated with injection abuse: male sex, 18–54 year-olds, non-Hispanic whites, non-Hispanic other, homeless or dependent living, less than full-time work, living in the Midwest or South, ≥ 1 prior treatment episodes, younger age of first opioid use, and reporting use of cocaine/crack, marijuana, heroin, or methamphetamine.

Conclusions: The proportion of treatment admissions reporting prescription opioid injection and smoking/inhalation abuse increased significantly in the U.S. between 2004 and 2013. Expanding prevention efforts as well as access to medication-assisted treatment and risk reduction services for people who inject drugs is urgently needed.

1. Introduction

The United States is in the midst of an epidemic of opioid-related morbidity and mortality (Paulozzi et al., 2011; Rudd et al., 2016; U.S. Department of Health and Human Services (DHHS), 2013). Prior research has found that non-oral routes of abuse such as inhaling, snorting, smoking, and injecting are common among different groups misusing prescription opioids (Black et al., 2013; Davis and Johnson, 2008; Havens et al., 2007; McCabe et al., 2007, 2009; Surratt et al., 2011; Young et al., 2010). Non-oral routes of abuse provide faster drug delivery and onset compared to oral use, thereby intensifying the reinforcing, euphoric effects of opioids and increasing vulnerability to addiction (Compton and Volkow, 2006; Katz, 2008). In addition, non-oral routes, especially injecting, are associated with greater severity of

drug abuse and use disorder and increase the risk for overdose (Black et al., 2013; Katz, 2008; Surratt et al., 2011).

Research reflects that people who abuse opioids over time often move from less dangerous routes, such as oral abuse, to more dangerous routes, such as injection (Black et al., 2013). Multiple qualitative studies describe a trajectory from oral opioid abuse to inhalation or smoking and then injection of prescription opioids and in some cases concurrent or subsequent injection of heroin or other illicit opioids (Inciardi et al., 2009; Lankenau et al., 2012; Mars et al., 2014; Mateu-Gelabert et al., 2014; Peavy et al., 2012; Pollini et al., 2011). Injection may be the most dangerous route of abuse as it is associated with substantial health consequences, such as injection-related endocarditis, infectious disease transmission, increased risk for overdose, emergency department visits, and mortality (Black et al., 2013; Havens et al., 2007;

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Lankenau et al., 2015; Peters et al., 2016; Ronan and Herzig, 2016; Silva et al., 2013; Surratt et al., 2011; Young et al., 2010; Zibbell et al., 2014, 2015).

Importantly, the risk for certain negative health effects may be higher for prescription opioid injection compared to injection of other drugs. Studies have found that prescription opioid injection remains a risk factor for HCV even after accounting for injection of other drugs, including heroin. This increased risk is likely a result of factors such as the process of preparing the oral prescription opioid for injection (Lankenau et al., 2015; Zibbell et al., 2014). In addition, aspects of prescription opioid formulations, including other active and inactive ingredients such as talc can increase risk for injection-related skin complications and complications related to intranasal abuse (Katz et al., 2011; Lake and Kennedy, 2016; Roux et al., 2011; Roy et al., 2011; Vosler et al., 2014).

The recent outbreak of 181 HIV cases in Indiana associated with injection of the prescription opioid oxycodone coupled with several years of rising rates of HCV, especially in areas with long-standing problems of prescription opioid abuse, have refocused concerns on prescription opioid injection (Peters et al., 2016; Suryaprasad et al., 2014; Zibbell et al., 2015). Despite these pressing concerns, there is limited data on the population of people misusing prescription opioids via non-oral routes in the U.S. In particular, there is a paucity of data on trends related to drug routes of abuse and the characteristics of those engaging in non-oral routes of abuse. Characterizing these populations and how they have changed over time, as well as identifying risk factors associated with non-oral routes of abuse, in particular injection abuse, are fundamental steps to informing targeted policy, programmatic initiatives, and future research efforts.

2. Materials and methods

2.1. Data source

Data are from the 19,009,159 treatment admissions reported in the 2004 through 2013 Treatment Episode Data Set (TEDS) public use files (Substance Abuse and Mental Health and Services Administrations (Substance Abuse and Mental Health Services Administration, 2016). TEDS, reported annually by the Substance Abuse and Mental Health Services Administration, provides demographic and substance use characteristics of substance use treatment admissions among people 12 years and older to state-licensed or certified substance abuse treatment centers that receive federal public funding. TEDS represents a compilation of data collected through the individual data collection systems of the state agencies for substance use treatment. The data are publically available and primarily include substance use and demographic measures (Substance Abuse and Mental Health Services Administration, 2015).

2.2. Substance use measures

TEDS captures data on the primary, secondary, and tertiary substances of abuse and the usual route of abuse for each substance among treatment admissions. This study focused on the 1,260,151 treatment admissions where the primary substance of abuse was prescription opioids (non-prescription methadone and other opiates and synthetic opioids not including heroin). Usual route of abuse for prescription opioids was recoded into three groups: 1) oral; 2) injection; and 3) smoking or inhalation (1.0% of admissions reported other non-oral/non-injection route of abuse and are included in this group). Additional substance use measures included: 1) the number of previous substance use treatment episodes (i.e., distinct previous treatment admissions): 0, 1, 2, or 3 or more; 2) self-reported age of first abuse of prescription opioid analgesics: 14 years old or younger, 15–17, 18–20, 21–24, 25–29, 30–39, or 40 years or older; and 3) other substances abused in addition to the primary substance reported at

treatment admission: alcohol, cocaine or crack, marijuana, heroin, methamphetamine, and benzodiazepines.

2.3. Demographic measures

Demographic measures include: 1) sex: male or female; 2) age group: 12–17, 18–24, 25–34, 35–44, 45–54, or 55 and over; 3) race/ethnicity: non-Hispanic white, non-Hispanic black, non-Hispanic other, or Hispanic; 4) living arrangement: independent living (living alone or with others without supervision), dependent living (living in a supervised setting such as a residential institution, halfway house or group home, and children under age 18 living with parents, relatives, or guardians or in foster care), or homeless (no fixed address, includes shelters); 5) employment status: full-time (working 35 h or more each week), part-time (working less than 35 h per week), unemployed (looking for work during the past 30 days or on layoff from job), or not in labor force (not looking for work during past 30 days or a student, homemaker, disabled, retired, or inmate of an institution); and 6) U.S. census region: Northeast, Midwest, South, or West.

2.4. Data analysis

First, annual number and percentage of prescription opioid abuse treatment admissions reporting oral, injection, and smoking or inhalation as the usual route of abuse were calculated overall, by sex, age group, and race/ethnicity group for 2004 through 2013. Second, the percentage of prescription opioid analgesic treatment admissions reporting injection as the usual route of abuse was calculated by U.S. census region for each year for 2004 through 2013.

Joinpoint regression (v 4.2.0.2) was used to assess trends for each of the percentages calculated above. Joinpoint assesses changes in trends by incorporating point estimates and their standard errors and tests a regression model using a Monte Carlo permutation method with no joinpoints (i.e., changes in trends occurring during the assessed time period) against alternative models to determine whether and where more joinpoints should be added (Kim et al., 2000). For this analysis, the trend over the full study time period overall and for demographic groups were examined. A *p* value of < 0.05 was considered statistically significant.

Finally, a multivariable multinomial logistic regression was conducted to identify characteristics associated with injection or smoking or inhalation as the usual route of prescription opioid abuse compared to oral abuse. The demographic and substance use measures defined above were included in the model. Results are presented as adjusted relative risk ratios and associated 95% confidence intervals. Multicollinearity was assessed using variance inflation factors and was not identified in the final model. Data analyses were conducted with STATA version 14.0 (Stata Corp. College Station, TX).

3. Results

Treatment admissions for primary prescription opioid abuse increased from 58,125 in 2004–193,600 in 2011 and then declined to 153,870 in 2013. The number of treatment admissions reporting oral abuse as the usual route of opioid abuse increased from 42,489 in 2004–90,574 in 2013, a 113.2% increase; injection abuse increased 311.9% from 6774 admissions in 2004–27,903 in 2013; and smoking or inhalation abuse increased 299.4% from 8862 admissions in 2004–35,393 in 2013.

Fig. 1 presents the percentage of treatment admissions by usual route of abuse between 2004 and 2013. The percentage of admissions reporting injection abuse increased from 11.7% in 2004–18.1% in 2013—a 54.7% relative increase. For smoking or inhalation abuse, the percentage of primary prescription opioid abuse treatment admissions increased from 15.3% in 2004–23.0% in 2013—a 50.3% relative increase. In contrast to non-oral routes of abuse, the percentage of

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