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Increases in Methamphetamine Use among Heroin Treatment Admissions in the United States, 2008–2017

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Abstract

Background and Aims: Due to their small sample sizes, geographic specificity, and limited examination of sociodemographic characteristics, recent studies of methamphetamine use among people using heroin in the U.S. are limited in their ability to identify national and regional trends and to characterize populations at risk for using heroin and methamphetamine. This study aimed to examine trends and correlates of methamphetamine use among heroin treatment admissions in the U.S.

Design: Longitudinal analysis of data from the 2008 through 2017 Treatment Episode Data Set. Descriptive statistics, trend analyses, and multivariable logistic regression were used to examine characteristics associated with methamphetamine use among heroin treatment admissions.

Setting: United States

Participants: Treatment admissions of people 12 years whose primary substance of use is heroin.

Measurements: Primary measurement was heroin treatment admissions involving methamphetamine. Secondary measurements were demographics of sex, age, race/ethnicity, U.S. census region, living arrangement, and employment status.

Findings: The percentage of primary heroin treatment admissions reporting methamphetamine use increased each year from 2.1% in 2008 to 12.4% in 2017, a relative percentage increase of 490% and an annual percent change (APC) of 23.4% ($p < 0.001$). During the study period, increases were seen among males and females, and across all demographic and geographic groups examined. Among primary heroin treatment admissions reporting methamphetamine use in 2017,

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47.1% reported injecting, 46.0% reported smoking, 5.1% reporting snorting, and 1.8% reported oral/other as their usual route of methamphetamine use.

Conclusions: Methamphetamine use among heroin treatment admissions in the United States increased from 1 in 50 primary heroin treatment admissions in 2008 to 1 in 12 admissions in 2017.

INTRODUCTION

Rising rates of opioid-involved overdose deaths continue to affect many developed countries, including the United States, Canada, Australia, and countries in the European Union [1–5]. In the U.S., the overdose epidemic continues to evolve [1,6,7]; recent data indicate that overdose deaths involving psychostimulants such as methamphetamine have been increasing in the U.S., and often involve opioids [1]. Data from other developed countries also show recent increases in methamphetamine availability and harms associated with its use [5,8,9]. Similarly, law enforcement data and news reports indicate methamphetamine availability and use are increasing in the U.S. [10,11]. According to data from the Drug Enforcement Administration, methamphetamine reports in the National Forensic Laboratory Information System have increased 175% since 2009, and methamphetamine availability is increasing in areas that have not been major markets for the drug, particularly in the Northeast U.S. [10].

In the U.S., emerging research suggests that the increase in methamphetamine use is intertwined with the evolving opioid overdose epidemic [12–14]. Among people who inject drugs (PWID) engaging with syringe services programs in King County, Washington, combined heroin and methamphetamine injection in the past three months increased from 18% in 2009 to 31% in 2017 among men who have sex with men (MSM) and from 10% to 53% among non-MSM [12]. Among PWID in Denver, Colorado, 50% reported injecting heroin and methamphetamine in the past 12 months in 2015 [13]. Ellis et al., found that among people seeking treatment for opioid use disorder (OUD) from approximately 170 treatment facilities in the U.S., past-month use of methamphetamine increased from 18.8% in the second quarter of 2011 to 34.2% in the first quarter of 2017 [14].

The phenomenon of increasing methamphetamine use among people using opioids is of great concern. Methamphetamine use carries its own risks, including a range of physical and mental health consequences such as psychosis and other mental disorders, cognitive and neurologic deficits, cardiovascular and renal dysfunction, transmission of HIV, viral hepatitis, and sexually transmitted infections, and increased mortality [15–23]. Individuals who use both opioids and methamphetamine are more likely to be homeless, inject drugs daily or more than once a day, reuse or share syringes, and report a nonfatal overdose in the past year compared to people who inject either drug alone [12,13]. Thus, increasing use of methamphetamine among people using opioids stands to substantially complicate current efforts in the U.S. to address opioid misuse and overdose.

Although previous studies [12–14] provide important insights into the emerging issue of methamphetamine use among people using heroin in the U.S., due to their small sample sizes, geographic specificity, and limited examination of sociodemographic characteristics, they are limited in their ability to identify national and regional trends and to characterize populations at risk for using heroin and methamphetamine. To address this gap and to

inform prevention, treatment, and response efforts, we examined nationwide treatment admission data in the U.S. from 2008 to 2017.

METHODS

Data source

Treatment admissions data are from the 20,139,771 treatment admissions reported in the 2008–2017 Treatment Episode Data Set (TEDS) public use files [24]. TEDS, reported annually by the Substance Abuse and Mental Health Services Administration, provides information on substance use treatment admissions among people 12 years or older to state-licensed or certified substance use treatment centers that receive federal public funding in the U.S. TEDS represents a compilation of data collected through the individual data collection systems of the state agencies for substance use treatment [25].

Substance use measures

TEDS captures data on the primary, secondary, and tertiary substances of use at treatment admission, usual route of administration (injection, smoking, snorting, oral/other), age of first use for each reported substance, treatment referral source, and whether OUD medications were part of the treatment plan. This study focuses on the 3,547,977 admissions where the primary substance of use at treatment admission was heroin. Heroin treatment admissions that also involved methamphetamine use were those that listed heroin as primary substance and methamphetamine as secondary or tertiary substance.

Demographic measures

Demographic measures include: 1) sex; 2) age; 3) race/ethnicity; 4) U.S. census region; 5) living arrangement: independent living, 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); and 6) employment status: full-time (working ≥ 35 hours per week), part-time (working <35 hours per week), unemployed (looking for work in past 30 days or on layoff from job), or not in labor force).

Statistical Analyses

Annual number and percentage of heroin treatment admissions involving methamphetamine were estimated for each year, 2008–2017, overall and by sex, age group, race/ethnicity, and U.S. census region. The Joinpoint regression program (v 4.6.0.0, NCI, 2019) using a log-linear model assessed changes in trends by incorporating point estimates and their standard errors and testing a regression model using a Monte Carlo permutation method with no joinpoints (i.e., no changes in trends occurring during the assessed time period) against alternative models to determine whether and where more joinpoints (i.e., significant changes in trend) should be added [26]. Joinpoint calculates the annual percentage change (APC), a measure of the change in trend over the joinpoint time period. A p value of <0.05 was considered statistically significant.

Routes of methamphetamine use were calculated for primary heroin treatment admissions reporting use of methamphetamine. Results are presented as percentages of heroin treatment admissions reporting each route of methamphetamine use among primary heroin treatment admissions.

Bivariable and multivariable logistic regression examined characteristics associated with methamphetamine use among primary heroin admissions. In the multivariable model, variables included in the model were sex, age group, race/ethnicity, U.S. census region, employment status, living arrangement, treatment referral source, OUD medications planned, heroin injection, and age of first heroin use. The model also controlled for state-level clustering. Multicollinearity was assessed using variance inflation factors and was not identified in the final models. Data analyses were conducted with STATA version 15.0 (Stata Corp. College Station, TX).

RESULTS

Treatment admissions reporting any methamphetamine use increased from 186,711 in 2008 to 372,926 in 2017. Primary heroin treatment admissions increased from 283,347 in 2008 to 533,394 in 2017 (Appendix 1). The percentage of primary heroin treatment admissions reporting methamphetamine use increased each year from 2.1% in 2008 to 12.4% in 2017, a relative percentage increase of 490% and an annual percent change (APC) of 23.4% (Figure 1). Females had higher percentages of heroin treatment admissions involving methamphetamine (2.8% in 2008 to 15.1% in 2017; APC=21.7% compared to males (1.7% in 2008 to 10.8% in 2017; APC=24.3% (Appendix 1).

Methamphetamine involvement in heroin treatment admissions increased among all age and race/ethnicity groups and U.S. census regions between 2008 and 2017 (Appendix 1). In 2017, the highest percentage was among 12–17 year olds (27.8%), followed by 18–24 year olds (17.4%). Admissions aged 18–24 and 35–44 experienced the largest APCs during the study period. Among race/ethnicity groups, in 2017, the highest percentage was found among non-Hispanic American Indians/Alaska Natives (37.4%); non-Hispanic blacks had the lowest percentage (2.0%), but experienced the largest APC during the study period.

Among primary heroin treatment admissions reporting methamphetamine use in 2017, 47.1% reported injecting, 46.0% reported smoking, 5.1% reporting snorting, and 1.8% reported oral/other as their usual route of methamphetamine use.

In the adjusted multivariable logistic regression model (Table 1), characteristics associated with increased odds of reporting methamphetamine at treatment admission among heroin treatment admissions included: females compared to males (aOR, 1.44, 95% CI,1.31–1.59); age 25–34 years compared to those aged 35–44 years (aOR, 1.18, 95% CI,1.04–1.35); Non-Hispanic American Indian/Alaska Native compared to Non-Hispanic Whites (aOR, 2.73, 95% CI,1.08–6.89); admissions in the Midwest (aOR, 7.68, 95% CI,3.09–19.09), South (aOR 3.97, 95% CI,1.30–12.15), and West (aOR 47.36, 95% CI,27.61–81.23) compared to the Northeast; part-time employment (aOR, 1.15, 95% CI,1.02–1.29), unemployment (aOR, 1.63, 95% CI,1.44–1.85), and not in labor force (aOR, 1.59, 95% CI,1.34–1.88) compared to

full-time employment; dependent living (aOR, 1.31, 95% CI, 1.10–1.57) and homeless (aOR, 1.66, 95% CI, 1.45–1.89) compared to independent living; treatment referral by healthcare provider (aOR, 1.25, 95% CI, 1.04–1.49), other community referral (aOR, 1.33, 95% CI, 1.07–1.1.67), and criminal justice referral (aOR, 1.91, 95% CI, 1.60–2.28) compared to individual/self-referral; and reporting heroin injection compared to other route (aOR, 1.71, 95% CI, 1.47–1.98). Heroin treatment admissions reporting methamphetamine use had lower odds of having OUD medications as part of their treatment plan (aOR, 0.65, 95% CI, 0.50–0.84)

DISCUSSION

In the U.S., the percentage of primary heroin treatment admissions reporting methamphetamine use increased from 1 in 50 admissions in 2008 to 1 in 12 admissions in 2017. Increases were seen across all demographic and geographic groups examined. The trends seen in our study are consistent with emerging data from other countries that indicate methamphetamine availability, use, and harms are increasing internationally [5,8,9]. The U.N. 2018 World Drug Report notes that global seizures of methamphetamine continue to increase and that methamphetamine use continues to expand into new markets [5]. Of particular note, Australia and Canada, which are currently experiencing their own opioid crises, have also recently reported increases in methamphetamine availability and harms [8,9]. Our findings of increasing methamphetamine use among people using heroin may provide an early indicator of what other countries may soon experience. Taken together, these findings underscore the need for urgent, coordinated action to halt further expansion of methamphetamine availability and implement strategies to prevent methamphetamine-related harms.

The higher percentages and increased odds for methamphetamine use among heroin treatment admissions among females is consistent with prior research documenting higher prevalence of co-use among women [27] and an increased risk of death among women who use opioids and methamphetamine or cocaine [28]. Although the basis for this difference is not well-understood, prior research has found that females consume more methamphetamine and transition from recreational use to dependence more quickly than males, and this may be due to underlying gender differences in behavioral and subjective effects of methamphetamine [29,30]. In addition, having a history of sexual abuse or other types of violence is common among women reporting opioid and methamphetamine use [31], underscoring the importance of incorporating trauma-informed treatment and gender-specific approaches into prevention and treatment initiatives.

Primary heroin treatment admissions that were aged 12–17 and 18–24 had the highest prevalence of methamphetamine use and some of the highest annual percent increases during the study period. Not only do these findings highlight a need to focus intervention and treatment efforts aimed at reaching younger age groups, but together with the finding that early age of heroin initiation was associated with methamphetamine use at treatment admission, these findings underscore the importance of expanding policies, programs, and practices that can prevent initiation of these substances in the first place. Universal prevention interventions implemented among youth have demonstrated lasting protective

effects in reducing substance use, including use of opioids and methamphetamine [32]. Expansion of these programs more broadly is urgently needed.

Prior research has found that people who use both heroin and methamphetamine are at increased risk for overdose, are more likely to engage in risky injection behaviors, have higher medical and psychiatric comorbidity, and poorer treatment outcomes [12,13,33,34]. Thus, finding that treatment admissions with use of both substances were 35% less likely to have OUD medications as part of their treatment plan is especially concerning. Further, these individuals were more likely to be homeless, unemployed, and justice-involved. Together, these findings highlight the critical need to ensure that individuals are provided appropriately tailored evidence-based services. In particular, medications for OUD combined with contingency management and community reinforcement approach [35] may be an effective clinical strategy for this population. In addition, given the high prevalence of methamphetamine injection and the increased odds of reporting methamphetamine injection among treatment admissions reporting heroin injection, expansion of interventions aimed at reducing injection drug use-related harms such as implementation of comprehensive syringe services programs (needle and syringe exchange programs) are needed to mitigate additional spread of infectious diseases such as viral hepatitis and HIV and injection drug-use associated morbidity and mortality. Testing and treatment for HIV and viral hepatitis are indicated and, for those without HIV, consideration of pre-exposure prophylaxis (PREP) treatment as an HIV prevention intervention is suggested. These strategies should be employed in tandem with recovery support services such as housing and job supports that address underlying social needs.

The study is subject to limitations. TEDS comprises a significant proportion of all admissions to substance use treatment in the U.S.; however, it does not capture all admissions. TEDS includes admissions at facilities licensed or certified by state substance abuse agencies or administratively tracked for other reasons. The primary, secondary, and tertiary substances of use reported to TEDS are those substances that led to the treatment episode and not necessarily a complete enumeration of all drugs used at time of admission. Third, TEDS may include multiple treatment admissions for the same patient. Thus, TEDS data in this study represent admissions not patients.

Methamphetamine use among heroin treatment admissions increased significantly in the U.S. between 2008 and 2017. Given the increase in risk for negative health outcomes among people using both substances, comprehensive prevention, treatment, and harm reduction strategies that address the poly-substance nature of opioid use and are appropriately tailored to specific demographic groups and at-risk populations are needed.

Supplementary Material

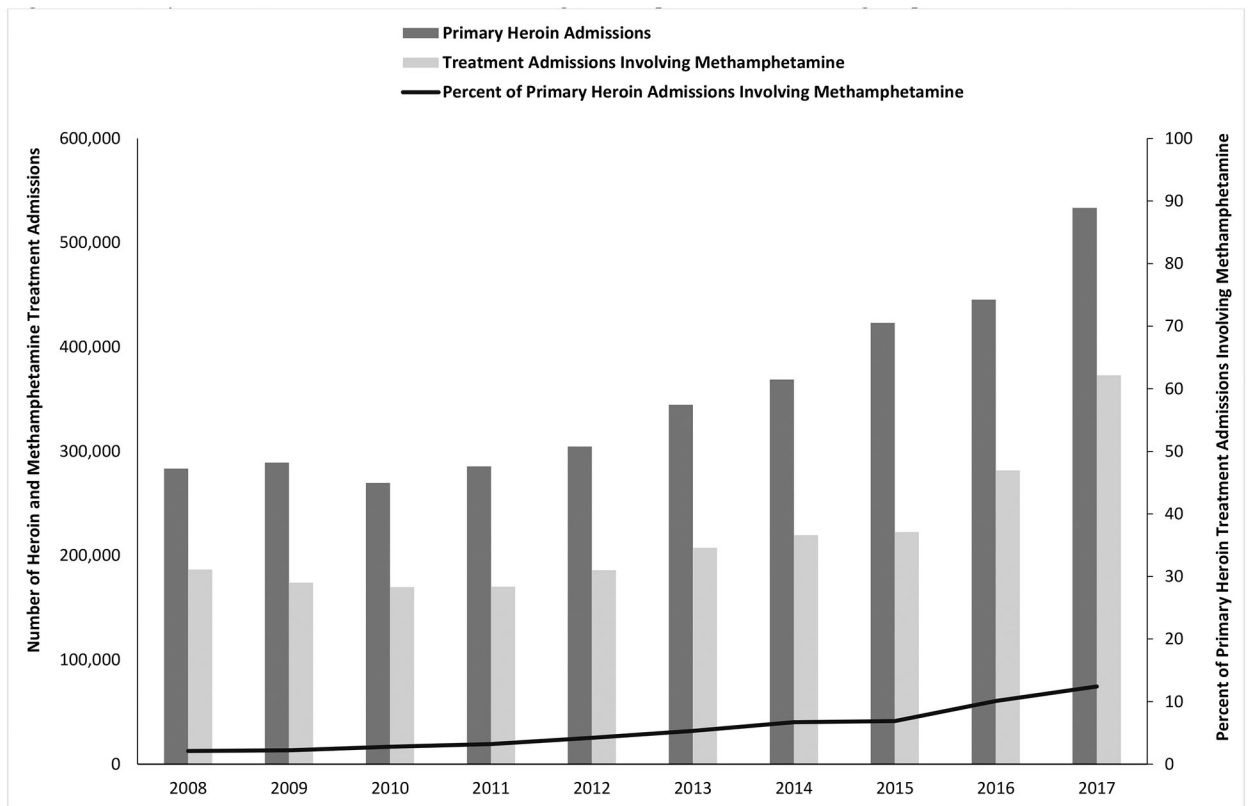
Refer to Web version on PubMed Central for supplementary material.

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Source: Data sources: 2008–2017 Treatment Episode Data Set. Heroin treatment admissions were defined as admissions where heroin was the primary substance of use. Heroin treatment admissions involving methamphetamine were those where heroin was the primary substance of use and methamphetamine was listed as the secondary or tertiary substance of use.

Figure 1. Primary Heroin Treatment Admissions Involving Methamphetamine Use Among People 12 Years or Older, U.S., 2008–2017

Source: Data sources: 2008–2017 Treatment Episode Data Set. Heroin treatment admissions were defined as admissions where heroin was the primary substance of use. Heroin treatment admissions involving methamphetamine were those where heroin was the primary substance of use and methamphetamine was listed as the secondary or tertiary substance of use.

Table 1.

Characteristics Associated with Methamphetamine Abuse among Heroin Treatment Admissions, Among People 12 Years or Older, U.S., 2017

	Treatment Admissions Unadjusted Odds Ratios (95% Confidence Interval)	Treatment Admissions Adjusted Odds Ratios (95% Confidence Interval)
Sex		
Female	1.47 (1.24–1.75)	1.44 (1.31–1.59)
Male	Ref	Ref
Age		
12–17	2.99 (1.47–6.07)	1.78 (0.91–3.47)
18–24	1.63 (1.21–2.20)	1.28 (0.95–1.72)
25–34	1.37 (1.18–1.60)	1.18 (1.04–1.35)
35–44	Ref	Ref
45–54	0.55 (0.35–0.85)	0.69 (0.57–0.84)
55 and older	0.36 (0.20–0.67)	0.39 (0.33–0.46)
Race/ethnicity		
Non-Hispanic White	Ref	Ref
Non-Hispanic Black	0.13 (0.07–0.23)	0.28 (0.22–0.36)
Non-Hispanic American Indian or Alaska Native	3.74 (1.78–7.82)	2.73 (1.08–6.89)
Non-Hispanic Other	0.84 (0.42–1.70)	0.61 (0.38–0.99)
Hispanic	1.03 (0.59–1.80)	0.74 (0.64–0.86)
U.S. Census Region		
Northeast	Ref	Ref
Midwest	8.01 (3.13–20.48)	7.68 (3.09–19.09)
South	2.79 (0.65–11.98)	3.97 (1.30–12.15)
West	44.07 (24.59–78.99)	47.36 (27.61–81.23)
Employment Status		
Full-time	Ref	Ref
Part-time	1.33 (1.07–1.65)	1.15 (1.02–1.29)
Unemployed	1.79 (1.34–2.39)	1.63 (1.44–1.85)
Not in labor force	1.36 (0.81–2.31)	1.59 (1.34–1.88)
Living Arrangement		
Independent	Ref	Ref
Dependent	2.40 (1.57–3.69)	1.31 (1.10–1.57)
Homeless	2.47 (1.68–3.64)	1.66 (1.45–1.89)
Treatment Referral Source		
Individual/Self-referral	Ref	Ref
Substance use provider	0.79 (0.44–1.43)	0.97 (0.72–1.32)
Healthcare provider	1.24 (0.68–2.28)	1.25 (1.04–1.49)
School/Educational	1.44 (0.80–2.59)	1.10 (0.62–1.95)

	Treatment Admissions Unadjusted Odds Ratios (95% Confidence Interval)	Treatment Admissions Adjusted Odds Ratios (95% Confidence Interval)
Employer/EAP	0.25 (0.07–0.82)	0.43 (0.13–1.38)
Other community referral	1.30 (0.76–2.22)	1.33 (1.07–1.67)
Criminal Justice referral	2.33 (1.57–3.46)	1.91 (1.60–2.28)
Medication for Opioid Use Disorder Treatment Planned		
No	Ref	Ref
Yes	0.56 (0.28–1.09)	0.65 (0.50–0.84)
Heroin Injection		
No	Ref	Ref
Yes	1.76 (1.31–2.36)	1.71 (1.47–1.98)
Age First Use of Heroin		
14 or less	Ref	Ref
15–17	0.83 (0.72–0.96)	0.88 (0.83–0.93)
18–20	0.82 (0.69–0.98)	0.87 (0.80–0.94)
21–24	0.79 (0.64–0.98)	0.87 (0.79–0.95)
25–29	0.81 (0.64–1.01)	0.97 (0.86–1.09)
30 or older	0.66 (0.52–0.83)	1.11 (0.94–1.32)

Bold text indicates statistically significant finding

In the multivariable model, variables included in the model were sex, age group, race/ethnicity, U.S. census region, employment status, living arrangement, treatment referral source, OUD medications planned, heroin injection, and age of first heroin use. The model also controlled for state-level clustering. Adjusted odds ratios represent the odds ratio for the specific variable controlling for all other variables in the model.

Data sources: 2017 Treatment Episode Data Set. Heroin treatment admissions were defined as those where heroin was listed as the primary substance of use. Heroin treatment admissions involving methamphetamine were those where heroin was listed as the primary substance of use and methamphetamine was listed as the secondary or tertiary substance of use.