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Receipt of Addiction Treatment After Opioid Overdose Among Medicaid-Enrolled Adolescents and Young Adults

Rachel H. Alinsky, MD, MPH,
Division of General Pediatrics and Adolescent Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland

Bonnie T. Zima, MD, MPH,
Semel Institute for Neuroscience and Human Behavior, UCLA (University of California, Los Angeles), Los Angeles

Jonathan Rodean, MPP,
Children's Hospital Association, Lenexa, Kansas

Pamela A. Matson, MPH, PhD,
Division of General Pediatrics and Adolescent Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland

MarcR. Larochelle, MD, MPH,
Grayken Center for Addiction, Boston Medical Center, Boston, Massachusetts

Section of General Internal Medicine, Department of Medicine, Boston University School of Medicine, Boston, Massachusetts

Hoover Adger Jr, MD, MPH, MBA,
Division of General Pediatrics and Adolescent Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland

Sarah M. Bagley, MD, MSc,
Grayken Center for Addiction, Boston Medical Center, Boston, Massachusetts

Section of General Internal Medicine, Department of Medicine, Boston University School of Medicine, Boston, Massachusetts

Department of Pediatrics, Boston Medicine Center, Boston, Massachusetts

Corresponding Author: Rachel H. Alinsky, MD, MPH, Division of General Pediatrics and Adolescent Medicine, Johns Hopkins School of Medicine, 200 N Wolfe St, Baltimore, MD 21287, (ralinsk1@jhmi.edu).

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Drafting of the manuscript: Alinsky.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Rodean.
Administrative, technical, or material support: Zima, Adger, Hadland.
Supervision: Zima, Matson, Adger, Hadland.
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Division of General Pediatrics, Department of Pediatrics, Boston University School of Medicine, Boston, Massachusetts

Scott E. Hadland, MD, MPH, MS
Grayken Center for Addiction, Boston Medical Center, Boston, Massachusetts

Department of Pediatrics, Boston Medicine Center, Boston, Massachusetts

Division of General Pediatrics, Department of Pediatrics, Boston University School of Medicine, Boston, Massachusetts

Abstract

IMPORTANCE—Nonfatal opioid overdose may be a critical touch point when youths who have never received a diagnosis of opioid use disorder can be engaged in treatment. However, the extent to which youths (adolescents and young adults) receive timely evidence-based treatment following opioid overdose is unknown.

OBJECTIVE—To identify characteristics of youths who experience nonfatal overdose with heroin or other opioids and to assess the percentage of youths receiving timely evidence-based treatment.

DESIGN, SETTING, AND PARTICIPANTS—This retrospective cohort study used the 2009–2015 Truven-IBM Watson Health MarketScan Medicaid claims database from 16 deidentified states representing all US census regions. Data from 4 039 216 Medicaid-enrolled youths aged 13 to 22 years were included and were analyzed from April 20,2018, to March 21, 2019.

EXPOSURES—Nonfatal incident and recurrent opioid overdoses involving heroin or other opioids.

MAIN OUTCOMES AND MEASURES—Receipt of timely addiction treatment (defined as a claim for behavioral health services, for buprenorphine, methadone, or naltrexone prescription or administration, or for both behavioral health services and pharmacotherapy within 30 days of incident overdose). Sociodemographic and clinical characteristics associated with receipt of timely treatment as well as with incident and recurrent overdoses were also identified.

RESULTS—Among 3791 youths with nonfatal opioid overdose, 2234 (58.9%) were female, and 2491 (65.7%) were non-Hispanic white. The median age was 18 years (interquartile range, 16–20 years). The crude incident opioid overdose rate was 44.1 per 100 000 person-years. Of these 3791 youths, 1001 (26.4%) experienced a heroin overdose; the 2790 (73.6%) remaining youths experienced an overdose involving other opioids. The risk of recurrent overdose among youths with incident heroin involvement was significantly higher than that among youths with other opioid overdose (adjusted hazard ratio, 2.62; 95% CI, 2.14–3.22), and youths with incident heroin overdose experienced recurrent overdose at a crude rate of 20 700 per 100 000 person-years. Of 3606 youths with opioid-related overdose and continuous enrollment for at least 30 days after overdose, 2483 (68.9%) received no addiction treatment within 30 days after incident opioid overdose, whereas only 1056 youths (29.3%) received behavioral health services alone, and 67 youths (1.9%) received pharmacotherapy. Youths with heroin overdose were significantly less likely than youths with other opioid overdose to receive any treatment after their overdose (adjusted odds ratio, 0.64; 95% CI, 0.49–0.83).

CONCLUSIONS AND RELEVANCE—After opioid overdose, less than one-third of youths received timely addiction treatment, and only 1 in 54 youths received recommended evidence-based pharmacotherapy. Interventions are urgently needed to link youths to treatment after overdose, with priority placed on improving access to pharmacotherapy.

Rates of opioid use and opioid overdose in the United States have been rapidly rising, including among adolescents and young adults,[1–4] the age groups in which the majority of substance use begins.[5,6] Adolescents and young adults (youths) between the ages of 15 and 24 years comprised 4027 fatal opioid overdoses in 2016,[7] and the opioid overdose mortality rate for children and adolescents under age 20 has tripled in the last 2 decades.[4] Rates of nonfatal opioid overdose have similarly escalated, resulting in 7410 hospitalizations and 28 207 emergency department visits for youths aged 15 to 24 years during 2015.[8] Whether these overdoses involve heroin, prescription opioids, or synthetic opioids, such as fentanyl, varies by age and other sociodemographic characteristics and continues to evolve.[8–10] The high risk of recurrent overdose after nonfatal overdose among adults has been described[11–14] although the rate, characteristics, and type of opioid (ie, heroin or other opioids) associated with recurrent overdose among youths remain unknown.

Nonfatal opioid overdose has been identified as a potential touch point, when individuals who had not previously received a diagnosis of opioid use disorder (OUD) can be drawn into treatment.[15,16] Evidence-based guidelines recommend that youths with OUD receive treatment that includes pharmacotherapy.[17] Unfortunately, youths in treatment for OUD receive pharmacotherapy at only one-tenth the rate of adults.[18] Other data suggest that only 23% of Medicaid-enrolled youths receive pharmacotherapy within 3 months of OUD diagnosis,[19] and 27% of commercially insured youths received pharmacotherapy within 6 months of receiving an OUD diagnosis.[5] Although research regarding adult access to addiction treatment is growing and has shown that timely receipt of pharmacotherapy following overdose is critical in reducing subsequent mortality,[16] very little is known about health care use following opioid overdose in youths.

This study aimed to fill this knowledge gap to inform the development of secondary prevention strategies, practice guidelines, and quality measures for the delivery of youth-specific OUD treatment. Using a 16-state sample of Medicaid-enrolled youths, we sought to determine (1) the characteristics of youths who experience nonfatal opioid overdose, comparing youths with heroin vs other opioid overdose; and (2) the percentage and characteristics of youths who receive recommended treatment within 30 days following opioid overdose.

Methods

Study Design

This retrospective cohort study was conducted using the 2009–2015 Truven-IBM Watson Health MarketScan Medicaid Database, encompassing 16 deidentified states representing all US census regions. Youths aged 13 to 22 years with at least 6 months of continuous enrollment were included. All inpatient, outpatient, emergency department, behavioral health service, and retail prescription drug claims between January 1, 2009, and December

31, 2015, were included. The Boston University School of Medicine Institutional Review Board granted this study exemption from formal review because this study used exclusively retrospective deidentified administrative records; thus, informed patient consent was also waived because it was not possible.

Cohort Selection

The study sample of all youths with incident opioid overdose occurring between January 1,2009, and September 30,2015, was created by identifying youths who had received a primary or secondary diagnosis of opioid poisoning using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes E850.0, E850.1, E850.2, 965.00, 965.01,965.02, and 965.09 on emergency department and inpatient claims (eTable 1 in the Supplement).[1,16,20–23] On the basis of *ICD-9-CM* codes, youths were further stratified into those with an overdose involving heroin (alone or in combination with other opioids) and those with overdose involving any other opioid.

Youths remained under observation as long as their coverage was active and were censored from the cohort if they dis-enrolled from their coverage.[19] Those previously in the cohort were not allowed to reenter at a later date. If youths had more than 1 opioid overdose during the study, the first overdose was selected as the incident opioid overdose. Recurrent opioid overdose was defined as a subsequent diagnosis of opioid poisoning occurring any time after hospital discharge from incident overdose.

Study Variable Construction

All study covariates were chosen based on their shown association with OUD or recurrent opioid overdose.[5,16,19] Sociodemographic covariates included age, sex, and race/ethnicity. Clinical covariates (diagnosed during the 3 months preceding through 1 month following the incident overdose) included pregnancy, acute pain condition, chronic pain condition, depression, anxiety disorder, attention-deficit/hyperactivity disorder, OUD, alcohol use disorder, and other substance use disorders (eTable 1 in the Supplement).[19,24–27] To evaluate the overlap between overdose and intentional self-harm, claims including diagnosis codes for suicidality and self-harm occurring in the 3 months preceding through 1 month after overdose were examined. Additional clinical covariates (during the 3 months preceding overdose) included receipt of an opioid prescription or prior addiction treatment (behavioral health services, pharmacotherapy, or both). The location of care for the overdose (emergency department or inpatient setting) was added as a covariate. We additionally adjusted for calendar year because states entering or exiting the study sample did so on January 1 and December 31, respectively. Thus, adjusting for calendar year approximated adjustment for the mix of states in the sample in any given year although this approach was unable to fully adjust for within-state correlation.

Limiting the sample to youths with at least 30 days of enrollment after incident overdose, timely receipt of addiction treatment was defined as a claim for behavioral health services, pharmacotherapy (buprenorphine, naltrexone, or methadone), or both within 30 days of incident overdose.[28,29] Dispensing of buprenorphine and oral and injectable naltrexone were identified using National Drug Codes in pharmacy claims (eTable 2 in the Supplement).

[5,19,30] In-office injectable naltrexone administration was identified using the Healthcare Common Procedure Coding System (HCPCS) code J2315 (“naltrexone, depot form”), and methadone receipt was identified via the HCPCS code H0020 (“methadone administration and/or service”).[19,31,32] Behavioral health services were identified across the spectrum of settings using *Current Procedural Terminology* and HCPCS codes (eTable 3 in the Supplement).[33,34]

Statistical Analysis

The overdose rate was calculated per 100 000 person-years at risk.[3] The χ^2 test was used to compare sociodemographic and clinical characteristics between youths with overdose vs the overall sample of youths without overdose, and between those with heroin vs other opioid overdose.

Among youths with incident overdose, the crude recurrent overdose rate was calculated. Using time since incident overdose as the time scale, the Kaplan-Meier method and logrank test were used to compare the cumulative incidence rates of recurrent overdose among youths with overdose involving heroin vs those involving only other opioids. A multivariable Cox proportional hazards model (including all clinical and sociodemographic covariates, which were selected a priori) was used to calculate hazard ratios for recurrent overdose. Because the outcome of interest, recurrent overdose, maybe associated with loss to follow-up (ie, if an individual experienced a fatal overdose and thus was removed from the insurance database), inverse probability of censoring weights[35] was used to create an additional proportional hazards model using estimated weights that adjusted for emigrative selection bias.

Youths with incident opioid overdose were stratified into mutually exclusive categories of having received no timely addiction treatment, behavioral health services only, or pharmacotherapy (alone or in combination with behavioral health services) within 30 days of overdose. The χ^2 test was used to compare receipt of each treatment category according to sociodemographic and clinical characteristics. Multivariable logistic regression was performed (including all sociodemographic and clinical covariates, which were selected a priori) to provide adjusted odds ratios for receipt of treatment.

Analyses were conducted from April 20, 2018, to March 21, 2019 (with the most recent data available at the time of analyses), using SAS, version 9.4 (SAS Institute Inc). All statistical tests were 2 sided and considered statistically significant at $P < .05$.

Results

Characteristics Associated With Overdose

There were 4 039 216 youths aged 13 to 22 years with at least 6 months of continuous Medicaid enrollment. In total, 3791 youths (0.1%) experienced a nonfatal opioid overdose between January 1, 2009, and September 30, 2015, resulting in an incidence rate of 44.1per 100 000 person-years. Table 1 provides the characteristics of the sample population. The median age of youths who experienced overdose was 18 years (interquartile range, 16–20 years). Of these 3791 youths with overdose, 2234 (58.9%) were female, amongwhom470

(21.0%) were pregnant. Most youths, 2491 (65.7%), were non-Hispanic white. Of 3791 youths with overdose, 725 (19.1%) received a diagnosis of OUD. Characteristics associated with overdose were female sex, pregnancy, non-Hispanic white race/ethnicity, comorbid acute or chronic pain conditions, depression, self-harm, anxiety, attention-deficit/hyperactivity disorder, OUD, alcohol use disorder, and other substance use disorders.

Table 2 gives characteristics of the youths according to the opioid involved in their incident overdose. Of 3791 youths who experienced an overdose, 1001 overdoses (26.4%) involved heroin and the remainder (2790 [73.6%]) involved opioids other than heroin. Heroin overdoses were more common in the later calendar years (2014–2015) and were more often treated in the emergency department (803 [80.2%]) than inpatient setting (198 [19.8%]). Youths with heroin overdose were more likely than youths with other opioid overdose to be 18 years or older, to be non-Hispanic white race/ethnicity (768 [76.7%] vs 1723 [61.8%]), to have previously received addiction treatment, or to have received a diagnosis of OUD (497 [49.7%] vs 228 [8.2%]), alcohol use disorder (252 [25.2%] vs 461 [16.5%]), or other substance use disorders (704 [70.3%] vs 1040 [37.3%]) (all $P < .001$). Youths with opioid overdose were more likely than those with heroin overdose to have pain conditions, depression (1889 [67.7%] vs 440 [44.0%]), self-harm (1137 [40.8%] vs 176 [17.6%]), anxiety (1425 [51.1%] vs 387 [38.7%]), attention-deficit/hyperactivity disorder (619 [22.2%] vs 152 [15.2%]), or previously received an opioid prescription (733 [26.3%] vs 116 [11.6%]) (all $P < .001$).

The sample was then limited to 3606 youths with continuous enrollment for at least 30 days after overdose. Youths with heroin overdose had a more than 7-fold higher unadjusted recurrent overdose crude rate (heroin, 20 770 per 100 000 person-years vs other opioids, 2855 per 100 000 person-years; $P < .001$), which is 471 times as a high as the general sample overdose rate of 44 per 100 000 person-years. The Figure shows survival time free from recurrent overdose by type of opioid involved in incident overdose (log-rank test, $P < .001$). Among youths experiencing incident heroin overdose, the cumulative incidence rates of recurrent overdose were 4.1% by 30 days, 6.2% by 60 days, and 8.1% by 90 days. Among youths experiencing incident overdose involving other opioids, the cumulative incidence rates of recurrent overdose were 1.2% by 30 days, 1.8% by 60 days, and 2.0% by 90 days.

Table 3 gives the characteristics associated with recurrent overdose. Youths with incident heroin overdose had 2.62 (95% CI, 2.14–3.22) times greater risk of recurrent overdose than youths with incident overdose involving other opioids, controlling for all other covariates. Male sex (adjusted hazard ratio [AHA], 1.44; 95% CI, 1.22–1.70), self-harm (AHA, 1.26; 95% CI, 1.05–1.51), diagnosis of OUD (AHA, 1.65; 95% CI, 1.36–2.01) or other substance use disorders (AHA, 1.86; 95% CI, 1.54–2.24), and treatment in the emergency department (AHA, 1.24; 95% CI, 1.03–1.48) were also associated with elevated risk of recurrent overdose. Conversely, prior receipt of behavioral health services was associated with lower risk of recurrent overdose (AHA, 0.65; 95% CI, 0.54–0.79).

Timely Addiction Treatment

Table 4 provides the characteristics associated with receipt of treatment in 3606 youths with continuous enrollment for at least 30 days after overdose. Of these, 2483 youths (68.9%) received no addiction treatment within 30 days after incident opioid overdose, 1056 (29.3%) received only behavioral health services, and 67 (1.9%) received pharmacotherapy (alone or in combination with behavioral health services). Lower unadjusted rates of treatment with pharmacotherapy were found for younger adolescents (13–15 years of age, 0.5%; 16–17 years of age, 0.8%; 18–20 years of age, 1.8%; 21–22 years of age, 4.2%) and for racial/ethnic minorities (Hispanic, 0%; non-Hispanic black, 0.2%; non-Hispanic white, 2.3%).

In the adjusted multivariable model, younger youths were more likely than older youths to receive any timely addiction treatment, driven by higher rates of behavioral health services. Youths with anxiety, depression, or self-harm were more likely to receive behavioral health services but not pharmacotherapy. Youths who had received a diagnosis of OUD were 9.03 (95% CI, 3.95–20.7) times more likely to receive pharmacotherapy and 1.74 (95% CI, 1.34–2.25) times more likely to receive behavioral health services than youths who had not received a diagnosis of OUD. Youths with heroin overdose or with emergency department encounters were less likely to receive behavioral health services than youths with other opioid overdose or inpatient admission, but were no more or less likely to receive pharmacotherapy. Youths with heroin overdose were significantly less likely than youths with other opioid overdose to receive any treatment after their overdose (adjusted odds ratio, 0.64; 95% CI, 0.49–0.83). Youths who were engaged in treatment prior to overdose were more likely to continue the same treatment after overdose than individuals not previously in treatment although no more or less likely to receive another modality of treatment after overdose.

Discussion

In this study of more than 4 million Medicaid-enrolled youths aged 13 to 22 years, nonfatal opioid overdose occurred in 3791 youths at a rate of 44.1 per 100 000 person-years. Approximately one-quarter of overdoses involved heroin. Youths with incident heroin overdose had 2.6 times higher risk of recurrent overdose than youths with incident overdose involving only other opioids. By 3 months, 8.1% of youths with incident heroin overdose and 2.0% of youths with incident other opioid overdose experienced recurrent overdose. Only 1 in 54 youths with overdose received timely treatment with pharmacotherapy, and less than one-third received behavioral health services, leaving more than two-thirds of youths who experienced overdose with no addiction treatment.

This study contributed several key findings. First, it complements the high risk of opioid overdose among adolescents described in the Centers for Disease Control and Prevention Annual Surveillance Report.[8] In that report, 15- to 19-year-olds experienced opioid poisoning hospitalizations and emergency department visits in 2015 at a rate of 9.1 and 26.5 per 100 000 person years, respectively. Youths aged 20 to 24 years experienced higher rates: 24.2 hospitalizations and 99.7 emergency department visits per 100 000 person years. However, that report[8] did not delineate between incident vs recurrent overdose, whereas the

present study showed a rate of subsequent opioid overdose among youths with heroin overdose 471 times as high as the general sample of Medicaid-enrolled youth.

Second, this study characterizes factors associated with opioid overdose in Medicaid-enrolled youth, and identifies crucial differences between youths who experience heroin vs other opioid overdose. Youths with heroin overdose tended to be older and have other co-occurring substance use disorders, whereas youths with other opioid overdose tended to be younger and have a high burden of mood disorders. These other opioids were likely to be largely prescription opioids given the time frame of the study because synthetic opioids, such as fentanyl, were only beginning to increase in prevalence toward the end of the study period, in2014.[9,36,37] Given that only 26.3% of youths with other opioid overdose in the present study had been prescribed an opioid, it is likely that youths acquired prescription opioids from friends, family members, and other sources.[38] Owing to recent contamination of the heroin supply with fentanyl, heroin use carries a high risk of overdose.[37,39,40] Even still, prescription opioid overdose continues to remain problematic among youth, accounting for approximately one-third of fatal opioid overdoses among 15- to 19-year-olds in 2016.[4] This highlights the importance of early recognition and treatment of opioid use and OUD.

Third, the present study showed a large unmet need for addiction treatment of youths following overdose. The poor follow-up of Medicaid-enrolled youths observed in this study is greater than that described for other mental health conditions.[41–43] Youths are less likely to receive recommended treatment after overdose than adults. A 2016 study using commercial claims found that 16.7% of adults received pharmacotherapy within 30 days of opioid overdose and 43.3% received behavioral health services.[28] To date, only 2 studies that included adolescents have been published regarding treatment trajectories after nonfatal opioid overdose. One study did not delineate outcomes for adolescents[32]; the other study examined a cohort of 195 Massachusetts youths, 8% of whom received pharmacotherapy within a year of overdose.[44] Because timely receipt of pharmacotherapy for adults is associated with decreased mortality, addressing the treatment gap for youths is imperative.[16] Future research should evaluate the population-level effects of timely addiction treatment in reducing recurrent overdose among youths and the effectiveness of programs designed to link youths to care after overdose.

There are numerous reasons for the large treatment gap observed in the present study. Foremost is a lack of pediatric clinician familiarity in treating opioid overdose and OUD. Less than 10% of youths with nonheroin opioid overdose were diagnosed as having OUD, and even among youths with heroin overdose, less than half received a diagnosis of OUD. For youths who are identified as having OUD and needing treatment, data suggest that clinicians struggle to connect youths to effective treatment amid a dearth of addiction treatment facilities that accept youths and, even more rarely, that offer pharmacotherapy.[19,45,46] In general, Medicaid has generous coverage of pharmacotherapy for OUD, with little heterogeneity between states regarding buprenorphine coverage.[47] However, many addiction treatment facilities do not accept Medicaid, and hurdles such as prior authorizations, lifetime limits, and requirements for concurrent behavioral health services may further limit access to pharmacotherapy.[47,48] Policy changes should be aimed at making it more feasible for clinicians to treat youths with opioid overdose according to evidenced-based guidelines

through payer reforms and clinician education and by increasing the number of youth-serving clinicians and facilities that prescribe pharmacotherapy for OUD. Emergency department programs that help place individuals with overdose immediately into care (including pharmacotherapy) are effective[49] and have begun to be mandated through policy.[50] Policymakers, public health officials, and clinicians should ensure that the needs of youths are specifically addressed in these programs. Researchers might also acknowledge the limitations of using OUD diagnoses in claims data, which likely represent a vast underreporting of the true OUD incidence.

Limitations

There were several limitations to this study. First, because this study used claims data, the data reflected only the extent to which opioid overdoses and clinical covariates were accurately coded. Because there is no *ICD-9-CM* code for synthetic opioid overdose and because drug testing for fentanyl was uncommon during the study period, it is likely that some overdoses classified as being attributable to heroin were actually attributable to fentanyl in the last 2 years of the study period, as the prevalence of fentanyl exposure among youths has risen since late 2014.[4,9,36,37] Second, some overdoses may have occurred before the study period or prior to youths' enrollment in Medicaid. Third, because the data were deidentified with respect to state, adjustment for within-state correlation was not possible although adjustment for calendar year approximated adjustment for the mix of states in the sample in any given year. Fourth, there were small sample sizes of youths from racial/ethnic minorities; thus, the study was not powered to make statistical inferences about the roles of race and ethnicity in access to treatment. Fifth, Medicaid-enrolled youths may have accessed addiction treatment in a private setting, which would not be captured in the present data. However, this might be expected to be rare because most youths received Medicaid eligibility based on low-income status.

Conclusions

In this large study of Medicaid-enrolled youths with opioid overdose, youths experienced incident and recurrent opioid overdose at high rates, and incident heroin overdose was associated with recurrent overdose. After incident overdose, less than one-third of youths received any timely addiction treatment, and only 1 in 54 youths received recommended evidence-based pharmacotherapy. Interventions are urgently needed to link youths to treatment after overdose, with priority placed on improving access to recommended pharmacotherapy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

Question

What are the characteristics of youths (adolescents and young adults) who experience nonfatal opioid overdose with heroin or other opioid, and do these youths receive timely evidence-based treatment?

Findings

In this cohort study of 4 039 216 Medicaid-enrolled youths 13 to 22 years of age, among 3606 individuals who experienced opioid-related overdose and had continuous enrollment for at least 30 days after overdose, less than one-third received timely addiction treatment after overdose, and only 1 in 54 youths received pharmacotherapy with buprenorphine, naltrexone, or methadone.

Meaning

Interventions are needed to link youths to treatment after overdose, with priority placed on improving access to evidence-based pharmacotherapy.

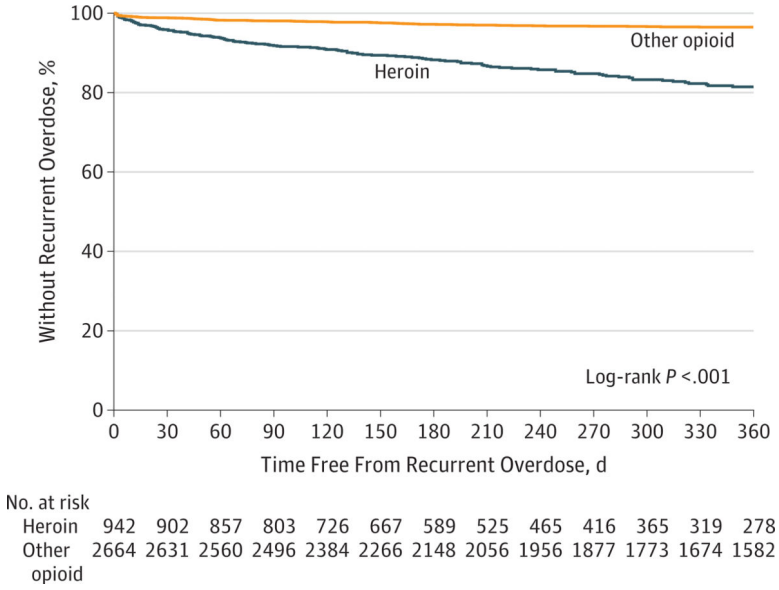

Figure.

Kaplan-Meier Survival Curve of Time Free From Recurrent Overdose in 3606 Youths After Incident Overdose, by Type of Opioid Involved in Incident Overdose

Table 1.

Baseline Characteristics of Overall Sample of 4 039 216 Youths Aged 13 to 22 Years Stratified by Opioid Overdose, January 1, 2009, to September 30, 2015

Characteristic	No. (%) of Youths by Column		
	Without Opioid Overdose (n = 4 035 425)	With Opioid Overdose (n = 3791)	*P* Value
Age at overdose, y			
13–15	NA	596 (15.7)	NA
16–17	NA	880 (23.2)	
18–20	NA	1542 (40.7)	
21–22	NA	773 (20.4)	
Sex			
Male	1 937 963 (48.0)	1557 (41.1)	<.001
Female	2 097 462 (52.0)	2234(58.9)	
Pregnant[a,b]	425 949 (10.6)	470(12.4)	<.001
Race/ethnicity			
White non-Hispanic	1 898 286 (47.0)	2491 (65.7)	<.001
Black non-Hispanic	1 352 276 (33.5)	680 (17.9)	
Hispanic	255 525 (6.3)	144(3.8)	
Other	529 338 (13.1)	476 (12.6)	
Pain condition[a]			
Acute	1 622 752 (40.2)	2242 (59.1)	<.001
Chronic	1479 933 (36.7)	2070 (54.6)	<.001
Depression[a]	515318(12.8)	2329 (61.4)	<.001
Self-harm/suicidal ideation[a]	87310 (2.2)	1313 (34.6)	<.001
Anxiety disorder[a]	418 322 (10.4)	1812 (47.8)	<.001
Attention-deficit/hyperactivity disorder[a]	510871 (12.7)	771 (20.3)	<.001
Use disorder[a]			
Opioid	14481 (0.4)	725 (19.1)	<.001

Characteristic	No. (%) of Youths by Column		
	Without Opioid Overdose (n = 4 035 425)	With Opioid Overdose (n = 3791)	*P* Value
Alcohol	50917 (1.3)	713 (18.8)	<.001
Other substance	138 717 (3.4)	1744 (46.0)	<.001
Prior pharmacotherapy[c]	NA	85(2.2)	NA
Prior behavioral health services[c]	NA	792 (20.9)	NA
Prior opioid prescription[c]	NA	849 (22.4)	NA
Year of overdose			
2009	NA	305 (8.0)	NA
2010	NA	355 (9.4)	
2011	NA	325 (8.6)	
2012	NA	493 (13.0)	
2013	NA	475 (12.5)	
2014	NA	1010(26.6)	
2015	NA	828 (21.8)	

Abbreviation: NA, not applicable.

[a]During the 3 months prior and up to 1 month after receiving an opioid overdose diagnosis.

[b]Percentage of all individuals in the sample.

[c]During the 3 months prior to receiving an opioid overdose diagnosis.

Table 2.

Baseline Characteristics of 3791 Youths Aged 13 to 22 Years With Opioid Overdose by Type of Opioid Overdose, January 1, 2009, to September 30,2015

Characteristic	Overdose, No. (%)		*P* Value
	Heroin (n = 1001)	Other Opioid (n = 2790)	
Age of overdose, y			
13–15	14(1.4)	582 (20.9)	<.001
16–17	73(7.3)	807 (28.9)	
18–20	481 (48.1)	1061 (38.0)	
21–22	433 (43.3)	340 (12.2)	
Sex			
Male	462 (46.2)	1095 (39.2)	<.001
Female	539 (53.8)	1695 (60.8)	
Pregnant[a,b]	137(13.7)	333 (11.9)	.15
Race/ethnicity			
White non-Hispanic	768 (76.7)	1723 (61.8)	<.001
Black non-Hispanic	44 (4.4)	636 (22.8)	
Hispanic	25(2.5)	119(4.3)	
Other	164(16.4)	312 (11.2)	
Pain condition[a]			
Acute	468(46.8)	1774(63.6)	<.001
Chronic[a]	444 (44.4)	1626 (58.3)	<.001
Depression[a]	440 (44.0)	1889 (67.7)	<.001
Self-harm/suicidal ideation[a]	176(17.6)	1137 (40.8)	<.001
Anxiety disorder[a]	387 (38.7)	1425 (51.1)	<.001
Attention-deficit/hyperactivity disorder[a]	152 (15.2)	619(22.2)	<.001
Use disorder[a]			
Opioid	497(49.7)	228 (8.2)	<.001

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Characteristic	Overdose, No. (%)		*P* Value
	Heroin (n = 1001)	Other Opioid (n = 2790)	
Alcohol	252 (25.2)	461 (16.5)	<.001
Other substance	704(70.3)	1040 (37.3)	<.001
Prior pharmacotherapy[c]	61 (6.1)	24(0.9)	<.001
Prior behavioral health services[c]	254(25.4)	538 (19.3)	<.001
Prior opioid prescription[c]	116(11.6)	733 (26.3)	<.001
Overdose encounter location			<.001
Emergency department	803 (80.2)	1549 (55.5)	
Inpatient	198(19.8)	1241 (44.5)	
Year of overdose			
2009	27(2.7)	278 (10.0)	
2010	26(2.6)	329 (11.8)	
2011	55(5.5)	270 (9.7)	
2012	68(6.8)	425 (15.2)	<.001
2013	61 (6.1)	414(14.8)	
2014	398 (39.8)	612 (21.9)	
2015	366 (36.6)	462 (16.6)	

[a] During the 3 months prior and up to 1 month after receiving opioid overdose diagnosis.

[b] Percentage of all individuals in the sample.

[c] During the 3 months prior to receiving opioid overdose diagnosis.

Table 3.

Multivariable Cox Proportional Hazards Model Showing Sociodemographic and Clinical Characteristics Associated With Recurrent Overdose Among 3606 Youths With Incident Opioid Overdose

	Hazard Ratio (95% CI)[a]	
Characteristic	**Adjusted**	**Adjusted Using Inverse Probability of Censoring Weights**
Age ≥21 y	1.13(0.80–1.61)	1.17 (0.92–1.50)
Male sex	1.33 (0.99–1.77)	1.44(1.22–1.70)
White non-Hispanic	0.96 (0.71–1.29)	0.93 (0.78–1.11)
Pregnant[b,c]	0.91 (0.57–1.46)	1.02 (0.76–1.36)
Depression, anxiety, ADHD[b]	0.92 (0.67–1.28)	0.95 (0.78–1.15)
Self-harm/suicidal ideation[b]	1.40(1.01–1.94)	1.26 (1.05–1.51)
Opioid use disorder[b]	1.72 (1.24–2.38)	1.65 (1.36–2.01)
Alcohol or other substance use disorder[b]	1.60 (1.16–2.22)	1.86 (1.54–2.24)
Acute or chronic pain condition[b]	1.17 (0.86–1.58)	1.15 (0.97–1.37)
Prior pharmacotherapy[d]	0.98(0.49–1.97)	1.07 (0.69–1.64)
Prior behavioral health services[d]	0.55 (0.07–4.23)	0.65 (0.54–0.79)
Type of incident opioid overdose		
Heroin	2.85 (2.00–4.06)	2.62 (2.14–3.22)
Other opioid	1 [Reference]	1 [Reference]
Overdose encounter location		
Emergency department	1.31(0.95–1.81)	1.24(1.03–1.48)
Inpatient	1 [Reference]	1 [Reference]

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.

[a] Adjusted values control for all covariates listed in the table in addition to year as an indicator variable.

[b] During the 3 months prior and up to 1 month after receiving incident opioid overdose diagnosis.

[c] Percentage of all individuals in the sample.

[d] During the 3 months prior to receiving incident opioid overdose diagnosis.

Table 4.

Sociodemographic and Clinical Characteristics of 3606 Youths With Opioid Overdose by Receipt of Timely Addiction Treatment Within 30 Days of Overdose, January 1, 2009, to September 30, 2015

Characteristic	No. (%) of Youths by Row			Adjusted Odds Ratio (95% CI)[a]		
	No Treatment[b]	Behavioral Health Service Only[b]	Pharmacotherapy[b,c]	Any Treatment[d]	Behavioral Health Service Only	Pharmacotherapy
Overall	2483 (68.9)	1056 (29.3)	67(1.9)			
Age at overdose, y						
13–15	360 (61.9)	219(37.6)	3(0.5)	1.82 (1.33–2.51)	1.81 (1.31–2.49)	1.31 (0.32–5.41)
16–17	531 (62.5)	311 (36.6)	7(0.8)	1.74(1.31–2.32)	1.72 (1.29–2.30)	1.12 (0.41–3.12)
18–20	1090 (74.6)	345 (23.6)	27(1.8)	0.94 (0.74–1.2)	0.93 (0.73–1.19)	0.90 (0.48–1.67)
21–22	502 (70.4)	181 (25.4)	30(4.2)	[1 Reference]	[1 Reference]	[1 Reference]
Sex						
Male	1055 (71.1)	402 (27.1)	27(1.8)	[1 Reference]	[1 Reference]	[1 Reference]
Female	1428 (67.3)	654(30.8)	40(1.9)	1.00 (0.83–1.21)	1.01 (0.84–1.22)	1.06 (0.57–1.96)
Pregnant[e,f]	312 (72.6)	107 (24.9)	11(2.6)	0.92 (0.70–1.23)	0.93 (0.70–1.24)	1.06 (0.46–2.46)
Race/ethnicity						
White non-Hispanic	1591 (67.1)	726 (30.6)	54(2.3)	1 [Reference]	1 [Reference]	1 [Reference]
Black non-Hispanic	459 (70.5)	191 (29.3)	1(0.2)	1.02 (0.81–1.27)	1.04 (0.83–1.30)	0.15 (0.02–1.20)
Hispanic	96(71.6)	38 (28.4)	0	1.05 (0.67–1.65)	1.08 (0.69–1.70)	NA
Other	337 (74.9)	101 (22.4)	12(2.7)	0.80 (0.61–1.04)	0.77 (0.59–1.00)	1.32 (0.65–2.69)
Pain condition[e]						
Acute	1412 (66.0)	686 (32.1)	40(1.9)	0.98(0.81–1.19)	0.99 (0.81–1.20)	1.31 (0.69–2.50)
Chronic	1308 (66.0)	634(32.0)	40 (2.0)	0.97 (0.80–1.18)	0.96 (0.79–1.17)	0.98 (0.51–1.88)
Depression[e]	1314(59.1)	862 (38.8)	47 (2.1)	2.33 (1.87–2.89)	2.30 (1.85–2.86)	1.92 (0.96–3.84)
Self-harm/suicidal ideation[e]	721 (56.9)	526 (41.5)	21(1.7)	1.27 (1.05–1.52)	1.21 (1.01–1.47)	1.35 (0.70–2.60)
Anxiety disorder[e]	1016 (58.9)	671 (38.9)	38(2.2)	1.18 (0.98–1.43)	1.22 (1.01–1.47)	0.83 (0.44–1.59)
Attention-deficit/ hyperactivity disorder[e]	430 (57.8)	301 (40.5)	13(1.7)	1.10 (0.90–1.36)	1.08 (0.88–1.33)	0.74(0.35–1.55)

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Characteristic	No. (%) of Youths by Row			Adjusted Odds Ratio (95% CI)[a]		
	No Treatment[b]	Behavioral Health Service Only[b]	Pharmacotherapy[b,c]	Any Treatment[d]	Behavioral Health Service Only	Pharmacotherapy
Use disorder[e]						
Opioid	390 (57.3)	237 (34.8)	54(7.9)	1.97 (1.53–2.54)	1.74 (1.34–2.25)	9.03 (3.95–20.7)
Alcohol	420 (61.9)	234(34.5)	24(3.5)	0.98 (0.79–1.22)	0.97 (0.78–1.21)	1.49 (0.82–2.70)
Other substance	1046 (63.5)	552 (33.5)	49 (3.0)	1.27 (1.06–1.54)	1.27 (1.05–1.54)	0.94(0.48–1.85)
Prior pharmacotherapy[g]	31 (40.3)	20 (26.0)	26 (33.8)	2.56(1.47–4.47)	0.76 (0.43–1.35)	14.2 (7.29–27.8)
Prior behavioral health services[g]	264(34.2)	481 (62.4)	26(3.4)	4.73 (3.89–5.75)	5.20 (4.27–6.34)	0.87 (0.47–1.61)
Prior opioid prescription[g]	574(71.4)	218(27.1)	12(1.5)	0.85 (0.68–1.05)	0.85 (0.69–1.06)	1.27 (0.61–2.65)
Type of opioid overdose						
Heroin	677 (71.9)	220 (23.4)	45 (4.8)	0.66 (0.51–0.85)	0.64 (0.49–0.83)	1.3 (0.63–2.68)
Other opioid	1806 (67.8)	836 (31.4)	22 (0.8)	1 [Reference]	1 [Reference]	1 [Reference]
Overdose encounter location						
Emergency department	1668 (74.7)	516(23.1)	49 (2.2)	0.64 (0.54–0.76)	0.62 (0.52–0.74)	1.22 (0.64–2.31)
Inpatient	815 (59.4)	540 (39.3)	18(1.3)	1 [Reference]	1 [Reference]	1 [Reference]

[a]Odds of receipt of each type of treatment of youths with certain characteristics compared with the reference group, or with condition vs youths without condition, adjusted for all other covariates listed in the table in addition to year as an indicator variable.

[b]$P < .001$ determined by χ^2 test for all except sex ($P = .049$), pregnancy ($P = .06$), prior pharmacotherapy ($P = .01$), and prior opioid prescription ($P = .02$).

[c]Included buprenorphine, methadone, or naltrexone.

[d]Included medication, behavioral health services, or both.

[e]During 3 months prior and up to 1 month after receiving opioid overdose diagnosis.

[f]Percentage of all individuals in the sample.

[g]During 3 months prior to receiving opioid overdose diagnosis.