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RESEARCH BRIEF

U.S. National 90-Day Readmissions After Opioid Overdose Discharge

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Introduction: U.S. hospital discharges for opioid overdose increased substantially during the past two decades. This brief report describes 90-day readmissions among patients discharged from inpatient stays for opioid overdose.

Methods: In 2018, survey-weighted analysis of hospital stays in the 2016 Healthcare Cost and Utilization Project National Readmissions Database yielded the national estimated proportion of patients with opioid overdose stays that had all-cause readmissions within ≤90 days. A multivariable logistic regression model assessed index stay factors associated with readmission by type (opioid overdose or not). Number of readmissions per patient was assessed.

Results: More than 24% (n=14,351/58,850) of patients with non-fatal index stays for opioid overdose had at least one all-cause readmission ≤90 days of index stay discharge and 3% (n=1,658/58,850) of patients had at least one opioid overdose readmission. Less than 0.2% (n=104/58,850) of patients had more than one readmission for opioid overdose. Patient demographic characteristics (e.g., male, older age), comorbidities diagnosed during the index stay (e.g., drug use disorder, chronic pulmonary disease, psychoses), and other index stay factors (Medicare or Medicaid primary payer, discharge against medical advice) were significantly associated with both opioid overdose and non-opioid overdose readmissions. Nearly 30% of index stays for opioid overdose included heroin, which was significantly associated with opioid overdose readmissions.

Conclusions: A quarter of opioid overdose patients have ≤90 days all-cause readmissions, although opioid overdose readmission is uncommon. Effective strategies to reduce readmissions will address substance use disorder as well as comorbid physical and mental health conditions.

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INTRODUCTION

Hospital discharges in the U.S. for opioid overdose increased substantially during the past two decades.[1–4] Substance use disorder (SUD) is a risk factor for hospital readmission[5–11] but readmissions after opioid overdose have not been described using national data. The readmission rate following opioid overdose and risk factors for readmission constitute meaningful information for clinical and public health decision making on "tertiary prevention" in the context of the opioid overdose epidemic; that is, efforts that increase access to effective addiction treatment when SUD is diagnosed.[12] Intervention following overdose is critical; substance use–associated diseases are the most common cause of death among adults with Medicaid aged less than 65 years in the year following non-fatal opioid overdose.[13] This brief report describes 90-day readmissions among patients discharged from opioid overdose inpatient stays.

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METHODS

In 2018, authors analyzed the 2016 Healthcare Cost and Utilization Project National Readmissions Database (HCUP-NRD), which can be used for survey-weighted national estimates of same-year, same-state readmissions to community hospitals.[14] Opioid overdose stays were classified by ICD-10-CM and other administrative codes (Figure 1), including whether patients received inpatient drug detoxification or rehabilitation services (e.g., counseling or pharmacotherapy).[3,15,16] Comorbidities were classified by Elixhauser Comorbidity Software for ICD-10-CM.[17] Patient age, sex, primary payer, and discharge status were reported in the data source.

Index stays were patients' first admission with opioid (illicit or prescribed) overdose during January–September. Readmission was any inpatient stay during January–December ≤90 days of index stay discharge. Multivariable logistic regression models assessed whether index stay factors were associated with readmissions by type (opioid overdose and non-opioid overdose). The number of readmissions per patient by type was assessed. Authors used SAS, version 9.4. All results reflect index stay survey weighting.

RESULTS

During January–September 2016, an estimated 61,170 patients had index stays for opioid overdose (Table 1). Mean patient age was 47 years and 50% of patients were female. Patients had a high prevalence of diagnosed drug use disorder (45%) and other comorbidities (e.g., fluid and electrolyte disorders, hypertension, depression, chronic pulmonary disease); just 4% of patients had no comorbidities (Table 1). Nearly 28% of patients had heroin overdose and just 3% had documented inpatient substance detoxification or rehabilitation services. More than 63% of patients were routinely discharged, 16% were transferred, 9% were discharged to home health care, 8% were discharged against medical advice, 4% died in hospital, and <1% were discharged to an unknown destination. Medicare (34%) and Medicaid (30%) were the primary payer for a majority of index stays.

Twenty-four percent (n=14,351/58,850) of patients with non-fatal index stays (excludes n=2,320 fatalities) had at least one all-cause readmission ≤90 days (Table 1). Just 3% (n=1,658/58,850) of patients were readmitted for opioid overdose, whereas 23% (n=13,311/58,850) had non-opioid overdose readmissions (a patient could be in both categories). Three percent (n=1,554/58,850) of patients had one readmission for opioid overdose ≤90 days of index stay discharge and 0.2% (n=104/58,850) had two or more such readmissions (Figure 2). More than 15% (n=9,107/58,850) of patients had one readmission for non-opioid overdose conditions and 7% (n=4,204/58,850) had two or more such readmissions.

Females (compared with males) and obese patients (compared with non-obese patients) were significantly less likely to have an opioid overdose readmission, whereas older patient age was associated with both opioid and non-opioid overdose readmissions (Table 1). Patients with diagnosed drug use disorder, chronic pulmonary disease, psychoses, and other comorbidities (i.e., observed among <10% of patients) were more likely

Opioid overdose: Any type	Diagnosis code (primary or non-primary): • T40.0X1-4: Poisoning by opium • T40.1X1-4: Poisoning by heroin • T40.2X1-4: Poisoning by other opioids • T40.3X1-4: Poisoning by methadone • T40.4X1-4: Poisoning by other synthetic narcotics • T40.6X1-4: Poisoning by other and unspecified narcotics
Opioid overdose: Heroin	Diagnosis code (primary or non-primary): • T40.0X1-4: Poisoning by heroin
Detoxification or rehabilitation services	Procedure code: • HZ2: Detoxification services for substance abuse treatment • HZ3: Individual counseling for substance abuse treatment • HZ4: Group counseling for substance abuse treatment • HZ5: Individual psychotherapy for substance abuse treatment • HZ6: Family counseling for substance abuse treatment • HZ8: Medication management for substance abuse treatment[a] • HZ9: Pharmacotherapy for substance abuse treatment[a] Diagnostic Related Group code: • 895: Alcohol, drug abuse or dependence with rehabilitation therapy

Figure 1. Administrative codes used to classify opioid overdose index stays.
Source: www.icd10data.com. Accessed November 28, 2018.
[a]Nicotine, antabuse, and bupropion not included.

Table 1. Opioid Overdose Index Stay Factors Associated With Readmissions, Healthcare Cost and Utilization Project National Readmissions Database, 2016

		Readmissions ≤90 days among patients with non-fatal index stays[a] January–December 2016 (N=58,850)				
			Opioid overdose		Other (non-opioid overdose)	
Index stay measure	**Patients with index stay discharged January–September 2016, *n* (%)**	**All-cause, *n* (%)[b]**	***n* (%)[b]**	**AOR (95% CI)**	***n* (%)[b]**	**AOR (95% CI)**
Sample size	61,170 (100.0)	14,351 (24.4)	1,658 (2.8)	NA	13,311 (22.6)	NA
Age, years	46.8 (0.19)[c]	51.7 (0.24)[c]	48.5 (0.66)[c]	**1.01 (1.00, 1.01)**	52.1 (0.25)[c]	**1.01 (1.00, 1.01)**
Female	30,630 (50.1)	7,528 (25.4)	723 (2.4)	**0.79 (0.69, 0.92)**	7,088 (23.9)	0.98 (0.92, 1.05)
Comorbidities[d]						
Drug abuse	27,771 (45.4)	6,525 (24.5)	946 (3.5)	**1.47 (1.22, 1.77)**	5,926 (22.2)	**1.15 (1.08, 1.24)**
Fluid and electrolyte disorders	27,558 (45.1)	6,695 (25.9)	794 (3.1)	1.11 (0.93, 1.33)	6,183 (24.0)	**0.94 (0.88, 1.00)**
Hypertension	25,205 (41.2)	7,488 (30.7)	697 (2.9)	0.90 (0.74, 1.09)	7,093 (29.0)	**1.21 (1.11, 1.32)**
Depression	19,371 (31.7)	4,542 (23.9)	531 (2.8)	1.12 (0.94, 1.35)	4,205 (22.1)	0.94 (0.88, 1.02)
Chronic pulmonary disease	15,812 (25.8)	4,949 (32.2)	540 (3.5)	**1.32 (1.09, 1.59)**	4,659 (30.3)	**1.30 (1.21, 1.39)**
Other neurologic disorders	12,838 (21.0)	3,439 (27.8)	381 (3.1)	1.13 (0.93, 1.38)	3,216 (26.0)	**1.09 (1.01, 1.18)**
Alcohol abuse	9,997 (16.3)	2,387 (24.7)	296 (3.1)	1.03 (0.83, 1.28)	2,199 (22.8)	1.08 (0.99, 1.18)
Deficiency anemias	9,323 (15.2)	2,934 (32.8)	286 (3.2)	1.10 (0.89, 1.36)	2,776 (31.0)	**1.31 (1.20, 1.44)**
Psychoses	7,960 (13.0)	2,159 (27.9)	260 (3.4)	**1.25 (1.01, 1.53)**	2,018 (26.0)	**1.22 (1.11, 1.34)**
Obesity	7,750 (12.7)	2,073 (27.7)	161 (2.2)	**0.74 (0.57, 0.94)**	1,999 (26.7)	0.97 (0.89, 1.07)
Other comorbidities	27,766 (45.4)	8,582 (32.2)	855 (3.2)	**1.27 (1.06, 1.54)**	8,109 (30.5)	**1.61 (1.50, 1.73)**
None	2,690 (4.4)	293 (11.1)	45 (1.7)	1.07 (0.63, 1.82)	254 (9.7)	**0.77 (0.62, 0.95)**
Heroin overdose	17,110 (28.0)	3,160 (19.8)	617 (3.9)	**1.67 (1.37, 2.04)**	2,731 (17.1)	**0.88 (0.81, 0.96)**
Detoxification or rehabilitation services	1,812 (3.0)	448 (24.8)	51 (2.8)	0.89 (0.59, 1.35)	425 (23.5)	**1.26 (1.04, 1.52)**
Discharge status						
Routine	38,807 (63.4)	8,512 (21.9)	1,084 (2.8)	ref	7,804 (20.1)	ref
Transfers	10,014 (16.4)	2,718 (27.1)	222 (2.2)	**0.74 (0.59, 0.93)**	2,604 (26.0)	**1.12 (1.03, 1.22)**
Home health care	5,182 (8.5)	1,899 (36.6)	156 (3.0)	0.95 (0.71, 1.27)	1,811 (35.0)	**1.38 (1.25, 1.52)**
Against medical advice	4,771 (7.8)	1,206 (25.3)	190 (4.0)	**1.29 (1.02, 1.64)**	1,080 (22.6)	**1.30 (1.14, 1.48)**
Died in hospital	2,320 (3.8)	NA	NA	NA	NA	NA
Discharged alive, destination unknown	76 (0.1)	NR	NR	2.60 (0.93, 7.32)	NR	0.74 (0.35, 1.55)

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Table 1. Opioid Overdose Index Stay Factors Associated With Readmissions, Healthcare Cost and Utilization Project National Readmissions Database, 2016 (*continued*)

		Readmissions ≤90 days among patients with non-fatal index stays[a] January–December 2016 (N=58,850)				
			Opioid overdose		Other (non-opioid overdose)	
Index stay measure	**Patients with index stay discharged January–September 2016, *n* (%)**	**All-cause, *n* (%)[b]**	***n* (%)[b]**	**AOR (95% CI)**	***n* (%)[b]**	**AOR (95% CI)**
Primary payer						
Medicare	20,902 (34.2)	6,546 (32.3)	670 (3.3)	**1.77 (1.34, 2.35)**	6,169 (30.4)	**1.53 (1.37, 1.71)**
Medicaid	18,521 (30.3)	4,345 (24.6)	575 (3.3)	**1.54 (1.21, 1.96)**	3,995 (22.6)	**1.54 (1.40, 1.70)**
Private	12,572 (20.6)	1,996 (16.4)	216 (1.8)	ref	1,834 (15.1)	ref
Self-pay	6,470 (10.6)	947 (15.4)	145 (2.4)	1.10 (0.76, 1.59)	827 (13.4)	1.01 (0.87, 1.16)
Other[e]	1,907 (3.1)	365 (20.0)	NR	0.57 (0.32, 1.03)	355 (19.4)	1.19 (0.99, 1.42)
No charge	683 (1.1)	131 (19.7)	29 (4.3)	**1.91 (1.05, 3.50)**	114 (17.1)	1.30 (0.92, 1.83)
Unknown	115 (0.2)	NR	NR	0.71 (0.11, 4.54)	NR	1.03 (0.54, 1.96)

Note: 2016 Healthcare Cost and Utilization Project National Readmissions Database. All data reflect index stay survey weights. Logistic regression model included all factors reported in the table. Boldface indicates statistical significance ($p<0.05$).

[a]Survey-weighted estimates of the number of patients readmitted ≤90 days (i.e., either a patient was readmitted during that period or not). Each patient is counted only once in each readmission category: Any, opioid overdose, non-opioid overdose. Analysis details: Index stays defined using HCUP-NRD variable *DQTR*=1–3 for stays with qualifying opioid overdose diagnosis codes (Figure 1). Readmissions per patient (*NRD_VisitLink*) defined as all *NRD_DaysToEvent* ≤90 of the value of *NRD_DaysToEvent* plus length of stay (*LOS*) for the index stay.

[b]Data are % of patients with non-fatal index stay discharges (n=58,850; excluding patients that died during the index stay [n=2,320, reported in the table]) by measure (or, table row) that had readmissions ≤90 days.

[c]Data are mean (SE).

[d]Comorbidities affecting ≥10% of index stay patients reported.

[e]Includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs.

NA, not applicable; NR, not reported (when relative SE was >30% or the SE=0 the survey-weighted estimate was considered unreliable).

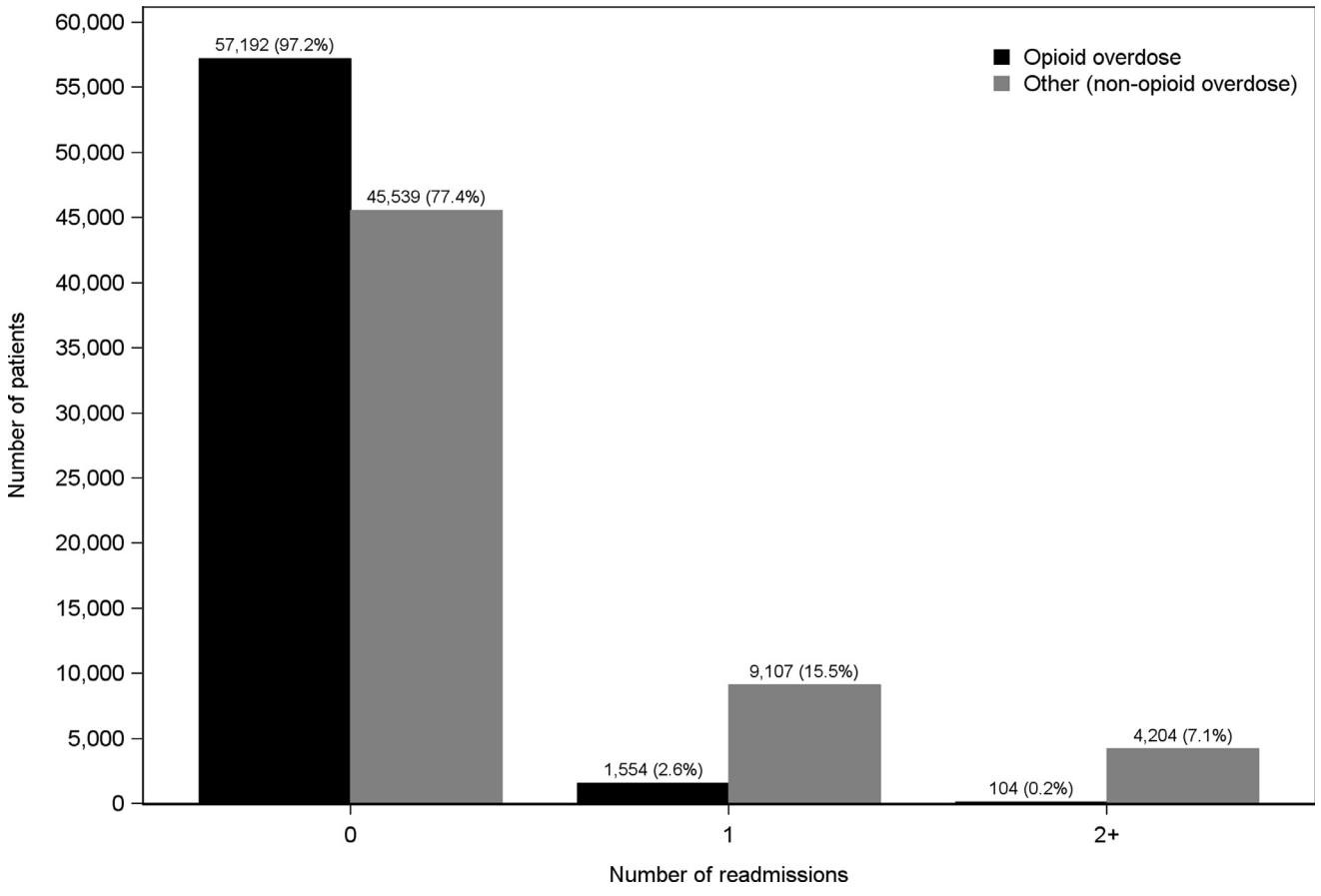

Figure 2. Readmissions ≤90 days following discharge from non-fatal opioid overdose index stays (N=58,850 patients).
Note: "0" refers to the number of patients with non-fatal index stays for opioid overdose who had zero readmissions ≤90 days of index stay discharge. Admissions by type — opioid overdose and other (non-opioid overdose) — each sum to 100% of analyzed patients.

to have both opioid and non-opioid overdose readmissions. Patients with hypertension, other neurologic disorders, and deficiency anemias were more likely and patients with fluid and electrolyte disorders or no diagnosed comorbidities were less likely to have non-opioid overdose readmissions.

Patients treated for heroin overdose (compared with other opioids) were more likely to have opioid overdose readmissions but less likely to have non-opioid overdose readmissions, whereas patients with inpatient substance detoxification or rehabilitation services were more likely to have only non-opioid overdose readmissions. Patients discharged against medical advice (compared with routine discharge) and those with Medicare or Medicaid as primary payer for the index stay (compared with private payer) were more likely to have both readmission types. Patients not charged for index stays were more likely to be readmitted for opioid overdose and patients discharged to home health care were more likely to have non-opioid overdose readmissions. Patients transferred after the index stay were less likely to have opioid overdose readmission but more likely to have non-opioid overdose readmission.

DISCUSSION

Twenty-four percent of patients discharged after 2016 hospital admissions for opioid overdose had 90 or less days all-cause readmissions, but just 3% were readmitted for another opioid overdose. A 90-day follow-up period aimed to provide a longer-term perspective than common readmissions assessment periods of 7 or 30 days. For some context, nationally 14% of inpatient stays have 30 or less days all-cause readmissions and the index stay principal diagnosis with the highest 30-day readmissions rate is schizophrenia and other psychotic disorders (23 readmissions per 100 index stays).[18]

Consistent with previous research demonstrating differences between heroin and non-heroin overdose inpatients,[1] heroin overdose patients were more likely to be readmitted for opioid overdose; however, just 3.9% of heroin overdose patients had such readmissions (Table 1).

This study supports previous research indicating that opioid use disorder is a risk factor for readmissions[7,11] and that many patients admitted for drug and alcohol overdose have serious comorbid health conditions.[19–21] High prevalence of comorbidities among opioid overdose inpatients highlights the need for a coordinated, careful, "warm handoff" transfer of patients to outpatient SUD treatment services, including effective communication between inpatient and outpatient clinicians.

Medication-assisted treatment (MAT) and residential treatment within 14 days of discharge for SUD inpatients are associated with reduced risk of behavioral health readmissions.[22] Inpatient addiction consultation is associated with reduced alcohol and drug addiction severity and increased number of abstinence days immediately following discharge.[23] Ongoing outreach—including phone calls and counseling—has helped some SUD inpatients initiate treatment following discharge.[24,25] Previous research suggests inpatient-initiated MAT can help some opioid use disorder inpatients initiate treatment programs following discharge.[26] MAT integration in primary care settings aims to treat SUD before overdose.[27]

Despite urgent need, many opioid overdose inpatients do not receive timely follow-up treatment services and many continue to misuse opioids.[22,28–30] Current regulations provide strict oversight regarding use of buprenorphine and methadone for opioid MAT.[31] In addition to regulatory considerations, workforce capacity (e.g., limited waivered clinicians), geographic disparities, reimbursement (payer) policy, and stigma toward addiction inhibit MAT.[32–34]

Limitations

This study did not address overdoses in non-inpatient settings (e.g., emergency departments), length of index stay, non-opioid overdoses, potential drug misclassification on the discharge record, non-hospital mortality, nor related outpatient services. Index stays were patients' first 2016 opioid overdose admission, but not necessarily first ever such admission. This analysis did not control for patient race/ethnicity (not reported in HCUP-NRD). Readmissions in other U.S. states and calendar years are not observable through HCUP-NRD; however, these circumstances likely have a modest impact on readmission rates.[14] This study period comprises hospitals' first full year of ICD-10-CM diagnosis coding, which may be more sensitive to identify opioid-related hospital stays.[15]

CONCLUSIONS

A quarter of opioid overdose patients have 90 or less days all-cause readmissions, although opioid overdose readmission is uncommon. Effective strategies to reduce readmissions following opioid overdose likely require greater coordination of general medical, substance use, and mental health care.[27]

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2018.12.003.

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