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National Hospital Care Survey Demonstration Projects: Mortality Following Nonfatal Opioid Overdose Visits to the Emergency Department

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Abstract

Purpose—This report provides a descriptive analysis of a sample of adult patients who visited the emergency department (ED) for nonfatal opioid overdose (NOO), using restricted-use 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index and the 2016–2017 Drug-Involved Mortality data from the National Center for Health Statistics.

Methods—As identified from National Hospital Care Survey, patients eligible to be linked to the National Death Index who were aged 18–64; had complete demographic information on age, sex, and hospital region; and who visited the ED were included in the study. Numbers and percentages of patients visiting the ED for NOO are reported by demographic characteristics, and among those who died, by *International Classification of Diseases, 10th Revision* chapter and type of drug involved in the death. Results are unweighted considering that the 2016 National Hospital Care Survey is not nationally representative.

Results—Overall, 286,644 patients meeting the study's inclusion criteria visited the ED in 2016, where 8,339 visited for at least one NOO (2.9%). Among patients with an ED visit for NOO, 38.8% were women and 61.2% were men. In total, 485 patients with an ED visit for NOO died of a drug overdose and 399 died of other causes. Of these 399 patients, 23.1% died from diseases of the circulatory system, 14.0% from neoplasms, and 13.3% from external causes of morbidity and mortality. Among the 485 patients with an ED visit for NOO who died of a drug overdose and had specific drug terms listed on their death certificate records, the most frequent drugs were fentanyl (53.6%) and heroin (35.1%).

Keywords: health care • mortality • drug overdose • poisoning

Introduction

Given the rise of drug overdose deaths over the past couple of decades in the United States (1), the need to inform efforts to prevent drug overdose fatalities remains critical. Previous studies have shown that patients visiting for a nonfatal opioid overdose (NOO) have higher risks for both short-term (for example, 1 or 2 months) and 1-year mortality after discharge (2–11). However, broader population statistics (beyond state-level) on NOO from hospital encounters, mortality outcomes, and the specific drugs involved among those who died are limited.

The National Center for Health Statistics received support from the U.S. Department of Health and Human Services' Office of the Secretary Patient-Centered Outcomes Research Trust Fund (OS-PCORTF) to link several data sources related to drug overdose hospital visits and deaths (12). The first data source, the 2016 National Hospital Care Survey (NHCS), collected emergency department (ED), inpatient, and outpatient administrative claims or electronic health records data from participating hospitals. The second source, the 2016–2017 National Death Index (NDI), includes all deaths occurring in the United States and U.S. military overseas, and can be used to inform whether a person has died and, if so, the cause and manner of death. The third source, the 2016–2017 Drug-Involved Mortality (DIM) restricted-use data, was developed through a collaborative project between the National Center for Health Statistics and the U.S. Food and Drug Administration using National Vital Statistics System restricted-use mortality files. This source

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provides information on the specific drugs involved in the death based on information provided on the death certificate by the death certifier, which in the case of drug poisoning deaths is typically a medical examiner or coroner (13).

Following the linkage of these data sources (14), the National Center for Health Statistics developed an enhanced algorithm for identifying opioid overdose visits to the ED and other hospital settings as part of the OS-PCORTF project (15). This study sought to use this enhanced algorithm to provide a baseline understanding of the sample of patients visiting the ED for NOO, and to identify the specific drugs involved in the deaths of those who died 1 to 2 years after discharge. Few studies have examined the specific drugs involved in the death of ED patients who died of a drug overdose after their visit (2–6). Information on the specific drugs involved in the death may offer some insight into the behavioral patterns and the risk of mortality for NOO patients.

Although not nationally representative, these linked data can provide insight into hospital use and drug overdose deaths involving opioids. This report provides some baseline statistics on patients visiting the ED for NOO in 2016, with a particular focus on the number of drug overdose deaths and types of specific drugs involved in these deaths.

Methods

Data sources

The 2016 NHCS collected data from inpatient discharges and visits to the ED and outpatient departments, including hospital-based ambulatory surgical centers. As described elsewhere (12), the 2016 NHCS sampled 581 noninstitutional, nonfederal U.S. hospitals with six or more staffed beds, of which 158 hospitals provided ED data. Due to low response rates (27%), the 2016 NHCS is not nationally representative. The sampling frame was based on hospital size, type of hospital, and urban–rural designation using hospitals from a 2010 hospital database (12). Patient records from NHCS with sufficient personally identifiable information (78.3% of NHCS records) were linked to the 2016–2017 NDI, a centralized database of death certificate information, and included in this study (13). NHCS, NDI, and the 2016–2017 DIM data, a supplemental file containing information on the specific drugs involved in deaths, were directly linked using a unique ID consisting of the year of death, jurisdiction of death, and death certificate number (14).

Measures

This study focused on patients who visited the ED for NOO at any time in 2016. Records were limited to the last NOO ED visit, and for the remaining patients who did not visit the ED for NOO in 2016, on their last ED visit. The case definition for NOO was adapted from the syndrome definition of the Centers for Disease Control and Prevention's Drug Overdose Surveillance and Epidemiology (DOSE) System (16,17). ED visits for NOO were identified through a combination of *International Classification of Diseases, 10th revision, Clinical Modification* (ICD–10–CM) codes with titles that include "with intoxication" (opioid use [F11.92], opioid abuse [F11.12], opioid dependence [F11.22], poisonings by opium [T40.0], heroin [T40.1], other opioids [T40.2], methadone [T40.3], other synthetic narcotics [T40.4], or unspecified and other narcotics [T40.6]), as well as an algorithm using natural language processing techniques to search the clinical notes of electronic health records for indication of an overdose or poisoning; involvement of a drug; or diagnostic, procedure, medication, or laboratory testing codes consistent with opioid use, abuse, and dependence (17,18).

This study focuses on adults aged 18–64 for whom demographic characteristics such as sex, age group, and hospital region have been reported. Age was grouped as 18–24, 25–34, 35–44, 45–54, and 55–64. People aged 65 and over were considered a noncomparable population that may have greater rates of comorbidities, use of multiple medications (polypharmacy), and use of prescription opioids, and were not included in the analysis (19). Hospital region was based on location of the hospital and categorized by Census region: West, South, Midwest, and Northeast (20). West includes the Pacific and Mountain states (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming); South includes the south-central and southeastern parts of the country (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia); Midwest includes the north-central area of the country (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin); and Northeast includes the mid-Atlantic and New England areas (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) (19).

This report provides descriptive statistics for patients who died from a drug overdose by the end of 2017 and patients who did not die of a drug overdose by the end of 2017, as indicated by the 2016–2017 NDI. Consistent with other studies, drug overdose deaths were defined as deaths with an ICD–10 underlying cause-of-death code of X40–X44 (unintentional), X60–X64 (intentional self-harm/suicide), X85 (homicide), or Y10–Y14 (undetermined intent) (1,12,21).

Lastly, the specific drugs involved in drug overdose deaths were identified using the 2016–2017 DIM data. The DIM data were processed from the literal text information on death certificates using a published methodology (14). The DIM method determines the specific drugs involved in a death by identifying drug terms that were reported on the death certificate. These drug terms reflect prescription drugs, illicit drugs, precursors, misspellings, metabolites, and other variations (14). Similar to other studies reporting drugs based on DIM data (20), this study reports the most frequent referent drug groupings. These referent drug groupings (considered to

be meaningful broader drug categories) are made up of one or more "principal variants," which are made up of many search terms identified in death certificate literal text fields (14,20,21). For example, the referent drug grouping "fentanyl" in this report is a summation of its principal variants: prescription fentanyl, illicit forms of fentanyl, and misspellings of fentanyl, as well as metabolites, precursors, and analogs of fentanyl found in the DIM data (21).

Analysis

Numbers and percentages for sex, age group, and hospital region were calculated for patients visiting the ED for NOO (Table A). Numbers and percentages are provided for those who died of a drug overdose in 2016 or 2017, as well as those who died of another cause or did not die within that study period (Table B). Among those who died of a drug overdose, numbers and percentages by ICD–10 cause-of-death chapter are provided in Table C. Table D presents the number of specific drugs listed on the death records of patients who visited the ED for NOO and later died of a drug overdose.

Results

This study identified 286,644 patients aged 18–64 who met the inclusion criteria, and who visited an ED in 2016 (Table A). This included 164,009 women (57.2%) and 122,635 men (42.8%). By age group, 12.1% were aged 18–24, 23.2% were aged 25–34, 21.7% were aged 35–44, 22.7% were aged 45–54, and 20.4% were aged 55–64. By region, 30.1% of patients lived in the Northeast, 27.9% in the Midwest, 20.9% in the South, and 21.2% in the West.

Overall, 8,339 patients visited the ED for NOO in 2016. Of these patients, 38.8% were women and 61.2% were men. By age group, 15.3% were aged 18–24, 32.3% were aged 25–34, 19.8% were aged 35–44, 17.6% were aged 45–54, and 15.1% were aged 55–64. By region, 45.3% of patients lived in the Northeast, 30.1% in the Midwest, 15.9% in the South, and 8.7% in the West.

In total, 278,305 patients visited the ED for a visit other than NOO in 2016. Their distribution by sex, age group, and region were similar to the overall distributions. By region, 29.6% of patients lived in the Northeast, 27.8% in the Midwest, 21.0% in the South, and 21.6% in the West.

A total of 884 patients visited the ED for NOO in 2016 and died in either 2016 or 2017 (Table B). Of this number, 485 patients died of a drug overdose. Among these patients, 65.8% were men and 34.2% were women. By age group, the highest percentage was among patients aged 25–34 (35.3%), followed by those aged 35–44 (23.3%) and 45–54 (17.3%). Most deaths occurred in the Northeast (49.9%), followed by the Midwest (32.4%). Among the 884 patients, 399 who visited the ED for NOO died of other causes by the end of 2017. This group tended to be older (46.4% were adults aged 55–64). Among the 399 patients, 54.9% were men and 45.1% were women. Most of these deaths occurred in the Northeast (43.1%), followed by the South (25.8%).

Of the 399 patients who visited the ED and died of other causes in 2016 or 2017, 23.1% died from diseases of the circulatory system, 14.0% died from neoplasms, and 13.3% died from external causes of morbidity and mortality (Table C). Those who died of drug overdose correspond to the ICD–10 chapter for external causes of morbidity and mortality (100%).

Among the 485 patients who visited the ED for NOO and died of a drug overdose in 2016 or 2017, the most frequently mentioned opioids included fentanyl (53.6%) and heroin (35.1%) (Table D). Other drugs identified included cocaine (17.7%), methamphetamine (7.2%), alprazolam (6.8%), morphine

Table A. Patients visiting emergency department, by demographic characteristics and nonfatal opioid overdose status in 2016

Characteristic	Overall		Patients with emergency department visit for nonfatal opioid overdose		Patients with emergency department visit who did not visit for nonfatal opioid overdose	
	Number	Percent	Number	Percent	Number	Percent
Total	286,644	100.0	8,339	100.0	278,305	100.0
Sex						
Women	164,009	57.2	3,233	38.8	160,776	57.8
Men	122,635	42.8	5,106	61.2	117,529	42.2
Age group						
18–24	34,596	12.1	1,274	15.3	33,322	12.0
25–34	66,549	23.2	2,694	32.3	63,855	22.9
35–44	62,245	21.7	1,647	19.8	60,598	21.8
45–54	65,099	22.7	1,465	17.6	63,634	22.9
55–64	58,455	20.4	1,259	15.1	57,196	20.6
Census region						
Northeast	86,211	30.1	3,777	45.3	82,434	29.6
Midwest	79,835	27.9	2,514	30.1	77,321	27.8
South	59,853	20.9	1,322	15.9	58,531	21.0
West	60,745	21.2	726	8.7	60,019	21.6

NOTES: Results are unweighted and are not nationally representative. Percentages may not add to 100.0 because of rounding. Demographic information is based on the last emergency department visit for nonfatal opioid overdose.

SOURCES: National Center for Health Statistics, 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index and 2016–2017 Drug-Involved Mortality data.

Table B. Patients visiting emergency department in 2016 for nonfatal opioid overdose who died of a drug overdose or other causes by end of 2017

Characteristic	Overall		Patients with emergency department visit for nonfatal opioid overdose who died of a drug overdose		Patients with emergency department visit for nonfatal opioid overdose who died of other causes	
	Number	Percent	Number	Percent	Number	Percent
Total	884	100.0	485	100.0	399	100.0
Sex						
Women	346	39.1	166	34.2	180	45.1
Men	538	60.9	319	65.8	219	54.9
Age group						
18–24	79	8.9	62	12.8	17	4.3
25–34	208	23.5	171	35.3	37	9.3
35–44	166	18.8	113	23.3	53	13.3
45–54	191	21.6	84	17.3	107	26.8
55–64	240	27.1	55	11.3	185	46.4
Census region						
Northeast	414	46.8	242	49.9	172	43.1
Midwest	235	26.6	157	32.4	78	19.5
South	163	18.4	60	12.4	103	25.8
West	72	8.1	26	5.4	46	11.5

NOTES: Results are unweighted and are not nationally representative. Percentages may not add to 100.0 because of rounding. Demographic information is based on the last emergency department visit for nonfatal opioid overdose.

SOURCES: National Center for Health Statistics, 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index and 2016–2017 Drug-Involved Mortality data.

Table C. Patients visiting emergency department for nonfatal opioid overdose who died of any cause by end of 2017, by cause-of-death chapter

International Classification of Diseases, 10th Revision chapter	Patients with emergency department visit for nonfatal opioid overdose who died of other causes (number = 399)		Patients with emergency department visit for nonfatal opioid overdose who died of a drug overdose (number = 485)	
	Number	Percent	Number	Percent
External causes of morbidity and mortality	53	13.3	485	100.0
Diseases of the circulatory system	92	23.1	–	–
Neoplasms	56	14.0	–	–
Diseases of the respiratory system	46	11.5	–	–
Certain infectious and parasitic diseases	28	7.0	–	–
Endocrine, nutritional and metabolic diseases	23	5.8	–	–
Diseases of the digestive system	21	5.3	–	–
Diseases of the nervous system	21	5.3	–	–
Mental and behavioural disorders	20	5.0	–	–
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	18	4.5	–	–

– Quantity zero.

NOTES: Results are unweighted and are not nationally representative. Eight hundred eighty-four patients visiting the emergency department for nonfatal opioid overdose died of any cause in 2016 or 2017. Any *International Classification of Diseases, 10th Revision* chapter with deaths of 10 or more are reported.

SOURCES: National Center for Health Statistics, 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index.

(4.3%), oxycodone (4.1%), methadone (3.1%), and citalopram (2.9%).

Discussion

This study used data from a large sample of patients treated at U.S. hospitals to descriptively report drug overdose deaths among patients who had a previous visit to an ED for NOO. This analysis included 286,644 adult patients aged 18–64 who visited the ED in 2016, with 8,339 having at least one NOO (2.9%) and 278,305 visiting the ED for other reasons (97.1%). Among patients who died of a drug overdose, most were men. The most frequent drugs reported were fentanyl (53.6%), heroin (35.1%), and cocaine (17.7%). Many deaths involve more than one drug, so multiple drugs can be listed on death certificates (14,16,20). For the patients in this study who died of a drug overdose, other drugs found included oxycodone, morphine, methadone, methamphetamine, alprazolam, and citalopram.

The sampling frame of NHCS was designed to provide national estimates of health care use in the United States. However, due to low response rates in 2016 (less than 27% of the hospitals in the sample), the NHCS data cannot be used to make nationally representative estimates. Consequently, results are based only on data from hospitals that responded to NHCS and are not necessarily generalizable to other hospitals in the United States (13). However, these linked data allow for studies examining patient mortality up to 2 years after discharge, as well as for determining what specific drugs

Table D. Drug overdose deaths involving specific drugs among patients who visited emergency department for nonfatal opioid overdose

Drug involved in the death	Previous emergency department visit for nonfatal opioid overdose (number = 485)	
	Number	Percent
Fentanyl	260	53.6
Heroin	170	35.1
Cocaine	86	17.7
Methamphetamine	35	7.2
Alprazolam	33	6.8
Morphine	21	4.3
Oxycodone	20	4.1
Methadone	15	3.1
Citalopram	14	2.9

NOTES: Findings are unweighted and are not nationally representative. In total, 485 patients visited the emergency department for nonfatal opioid overdose and later died of a drug overdose and had at least one specific drug listed on their death certificate record. Specific drugs with fewer than 10 deaths were not reported. Drug categories are not mutually exclusive. A death may involve more than one drug (a death involving both hydrocodone and heroin would be counted in both categories, for example).

SOURCES: National Center for Health Statistics, 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index and 2016–2017 Drug-Involved Mortality data.

were involved in the deaths of patients who died. Completeness of individual records from the hospital data varied by participating hospitals in NHCS. All results presented in this report are based on the analyses using cases with complete data for sex, age group, and hospital region.

The causes of death, manner of death, and the specific drugs reported on death certificates for drug overdose deaths obtained through NDI and the DIM data are generally determined and reported by medical examiners and coroners. These death certifiers have varying levels of expertise, years of experience, and resources for drug testing. As a result, the reporting of specific drugs on death certificates can vary by death investigation system, resources, and reporting practices in the United States (22,23).

Conclusion

This analysis used data from a large sample of patients treated at U.S. hospitals linked to mortality data to show what drugs might be involved in the deaths of patients who visited the ED for NOO and later died of a drug overdose or other causes.

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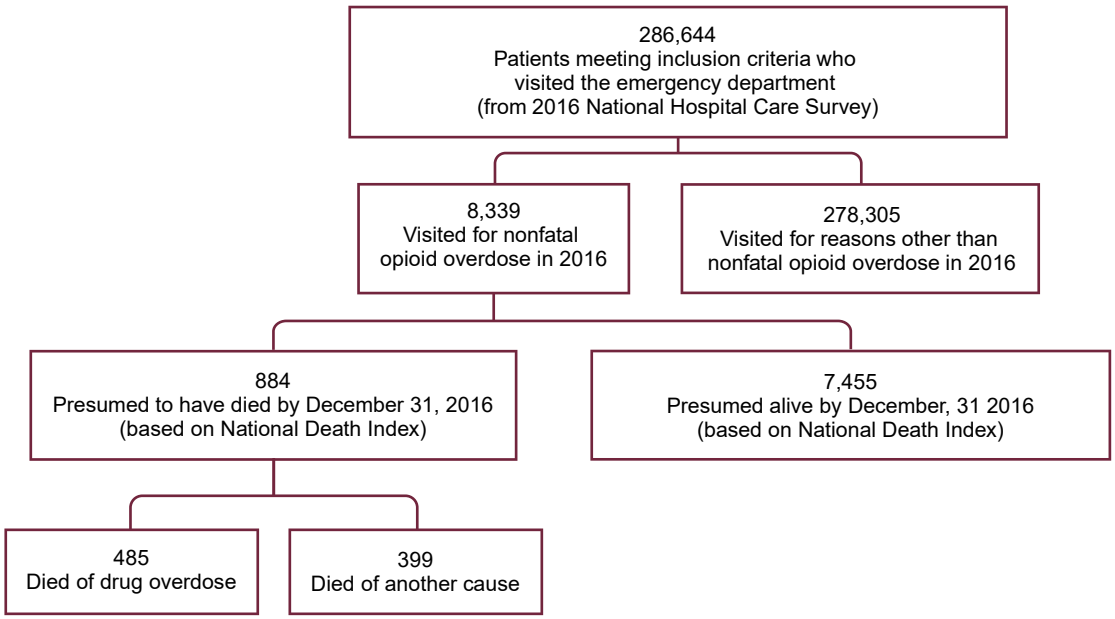
Appendix Figure

Figure. Flowchart of study population



NOTES: Inclusion criteria are based on a patient having sufficient personally identifiable information to be linked to the National Death Index (including complete demographic information on age and sex), and that the person did not die on the way to the hospital. Records were limited to the last nonfatal opioid overdose emergency department (ED) visit in 2016, and for the remaining patients, their last ED visit in 2016. ED visits for nonfatal opioid overdose were identified through a combination of *International Classification of Diseases, 10th Revision, Clinical Modification* (ICD–10–CM) codes with titles that include "with intoxication" (opioid use [F11.92], opioid abuse [F11.12], opioid dependence [F11.22], poisonings by opium [T40.0], heroin [T40.1], other opioids [T40.2], methadone [T40.3], other synthetic narcotics [T40.4], or unspecified and other narcotics [T40.6]), and an algorithm using natural language processing techniques to search the clinical notes of electronic health records for indication of an overdose or poisoning; involvement of a drug; or diagnostic, procedure, medication, or laboratory testing codes consistent with opioid use, abuse, and dependence. Drug overdose deaths are identified using ICD– 10 underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14.
SOURCES: National Center for Health Statistics, 2016 National Hospital Care Survey data linked to the 2016–2017 National Death Index and 2016–2017 Drug-Involved Mortality data.

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