

One-Year Mortality of Patients After Emergency Department Treatment for Nonfatal Opioid Overdose

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Study objective: Despite the increased availability of naloxone, death rates from opioid overdose continue to increase. The goal of this study is to determine the 1-year mortality of patients who were treated for a nonfatal opioid overdose in Massachusetts emergency departments (EDs).

Methods: This was a retrospective observational study of patients from 3 linked statewide Massachusetts data sets: a master demographics list, an acute care hospital case-mix database, and death records. Patients discharged from the ED with a final diagnosis of opioid overdose were included. The primary outcome measure was death from any cause within 1 year of overdose treatment.

Results: During the study period, 17,241 patients were treated for opioid overdose. Of the 11,557 patients who met study criteria, 635 (5.5%) died within 1 year, 130 (1.1%) died within 1 month, and 29 (0.25%) died within 2 days. Of the 635 deaths at 1 year, 130 (20.5%) occurred within 1 month and 29 (4.6%) occurred within 2 days.

Conclusion: The short-term and 1-year mortality of patients treated in the ED for nonfatal opioid overdose is high. The first month, and particularly the first 2 days after overdose, is the highest-risk period. Patients who survive opioid overdose should be considered high risk and receive interventions such as being offered buprenorphine, counseling, and referral to treatment before ED discharge. [Ann Emerg Med. 2019;■:1-5.]

0196-0644/\$-see front matter

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<https://doi.org/10.1016/j.annemergmed.2019.04.020>

INTRODUCTION

Background

The opioid overdose epidemic continues, with an estimated 49,000 deaths in the United States involving an opioid overdose in 2017.¹ The emergency department (ED) is at the front line of caring for patients who overdose, and the large number of patients treated in the ED who survive to be discharged does not receive significant attention. Data indicate that there were 92,000 ED visits for unintentional, nonfatal overdose in 2014 in the United States.² This number appears to be increasing: a recent report from 45 states indicated that there were 142,557 ED visits for suspected opioid-involved overdoses between July 2016 and September 2017, a staggering average increase of 5.6% per quarter.³

In Massachusetts, greater than 2,000 opioid-related deaths occurred in 2016, more than doubling from 2013.⁴ These deaths occurred despite the broad distribution and use of the opioid antagonist naloxone, as well as laws and regulations designed to increase the safety of opioid prescribing.⁵ Through Chapter 55 of the Acts of 2015, the Massachusetts state legislature permitted individual linkage

of data from several state agencies, including the Acute Care Hospital Case Mix file and the Registry of Vital Records and Statistics.^{6,7}

Importance

The care of opioid overdose patients in the ED has been largely unchanged during the past decades. Life-threatening instability or cardiorespiratory arrest is treated with standard advanced cardiac life support techniques. Naloxone is administered to patients who experience respiratory depression. Then, the patient who survives is typically observed in the ED for a time before being discharged, often with a list of community substance use disorder treatment resources. Despite this common practice, the near- and long-term risk of mortality after surviving an ED visit for opioid overdose is understudied.

Goals of This Investigation

We aimed to determine the 1-year mortality of patients who were treated in a Massachusetts ED for suspected opioid overdose and subsequently discharged, describing

Editor's Capsule Summary*What is already known on this topic*

Death rates for opioid overdose continue to increase in the United States. The mortality after an emergency department (ED) visit for nonfatal opioid overdose is unknown.

What question this study addressed

This study measured the 1-year mortality of patients who were treated for nonfatal opioid overdose in all Massachusetts EDs.

What this study adds to our knowledge

Of patients discharged from the ED alive after an opioid overdose, greater than 5% died within 1 year; a notable minority died within 2 days of discharge.

How this is relevant to clinical practice

An ED visit for opioid overdose offers a potential opportunity for intervention.

both 30-day and 1-year mortality. If mortality after initial survival of an opioid overdose is high, it would support the need for an alternative approach to the treatment of this disease.

MATERIALS AND METHODS**Study Design, Setting, and Data Collection and Processing**

As part of Massachusetts's legislatively mandated epidemiologic study of opioid-related morbidity and mortality, we conducted a population-based retrospective cohort study using a linked data set combining a master demographics list, an acute care hospital case-mix database, and state death records. Death data were provided by the Registry of Vital Records and Statistics, which reports information based on death certificates, including medical examiner determinations, if applicable. The setting was the entire state of Massachusetts. A conservative matching procedure was used that considered various combinations of name, date of birth, address, and social security number to link records. The databases were held by the Massachusetts Department of Public Health. We programmed statistical analysis at our institution with a dummy data set and sent code to the Massachusetts Department of Public Health, who ran the code and returned deidentified study results from actual data. Analysis was conducted with SAS Studio (version 3.5; SAS Institute, Inc., Cary, NC). This work was mandated by

Massachusetts law to use a deidentified data set and was deemed exempt from review by the Massachusetts Department of Public Health institutional review board. Complete information about the state's initiative, the core data sets, the linking procedure, and privacy protections are described in a state report.⁷

Selection of Participants

We included patients who were treated in the ED for opioid overdose according to diagnosis code between July 1, 2011, and September 30, 2015, but did not have an ED visit for opioid overdose in the 6-month period from January 1, 2011, to June 30, 2011. Patients were identified from the state's Center for Health Information Analysis Case Mix Data indicating an ED visit with *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* code of overdose caused by prescription opioid (965.00, 965.01, 965.02, or 965.09) or heroin (E850.0, E850.1, or E850.2). Death records were analyzed until September 30, 2016, to capture 1-year all-cause mortality. In addition to 1-year mortality, we also determined daily mortality for the first 30 days after ED discharge. The date ranges chosen were the maximum time available in the data set that afforded both a 6-month exclusion period (described below) and a 1-year extrapolation to determine mortality at that time. The sample size was determined by the available data.

Methods of Measurement

Index overdose date was defined as having a flagged date for an overdose and no previous record of overdose. Because we observed individuals only from January 1, 2011, onward, we cannot know whether an individual had an overdose before entry into the database, making our data left censored. Therefore, we used a 6-month exclusion period, helping to ensure that everyone in the study cohort had been overdose free for a minimum of 6 months, at least within Massachusetts. Although it is possible that individuals had overdoses after the index visit, only the index overdose date was used to count sequentially numbered periods after overdose. Death records containing date of death were merged with ED data, using unique patient identifiers. Deaths were categorized by using the *ICD-10* codes for mortality or using a literal search of written cause of death from the medical examiner's office for records that did not yet have a valid *ICD-10* code. The following codes were selected from the field for underlying cause of death to identify poisonings or overdoses: X40 to X49, X60 to X69, X85 to X90, Y10 to Y19, and Y35.2. All fields for multiple cause of death were then used to identify

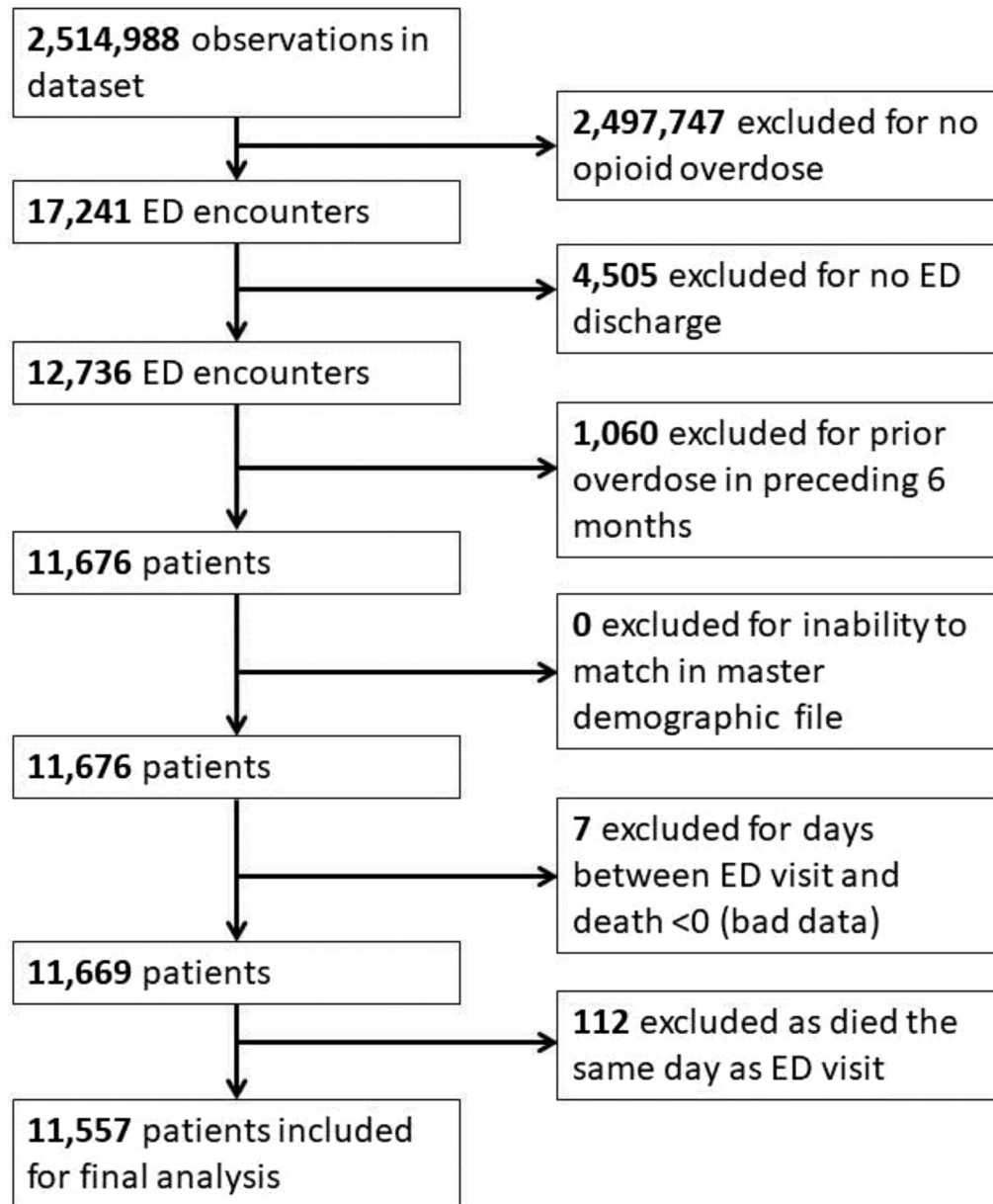


Figure 1. Flow diagram of included and excluded subjects.

an opioid-related death: T40.0, T40.1, T40.2, T40.3, T40.4, and T40.6. For individuals with an identified death record, number of days between index opioid overdose and death was computed. Demographic data on each individual were merged from the Acute Care Hospital Case Mix and master demographic files. Age was defined as the age of the patient in years as reported as of December 31, 2015, regardless of age at overdose.

Outcome Measures

Our primary outcome measure was 1-year mortality rate of patients after a first overdose. Mortality rate was

computed conditional on their being discharged from the ED.

Primary Data Analysis

The 1-year mortality rate was computed by calculating the percentages of individuals who survived the initial overdose and died within 1 year. Descriptive statistics (means, medians, and percentages) are reported for the demographic characteristics of cohorts, and 95% confidence intervals (CIs) are reported for the primary study outcomes.

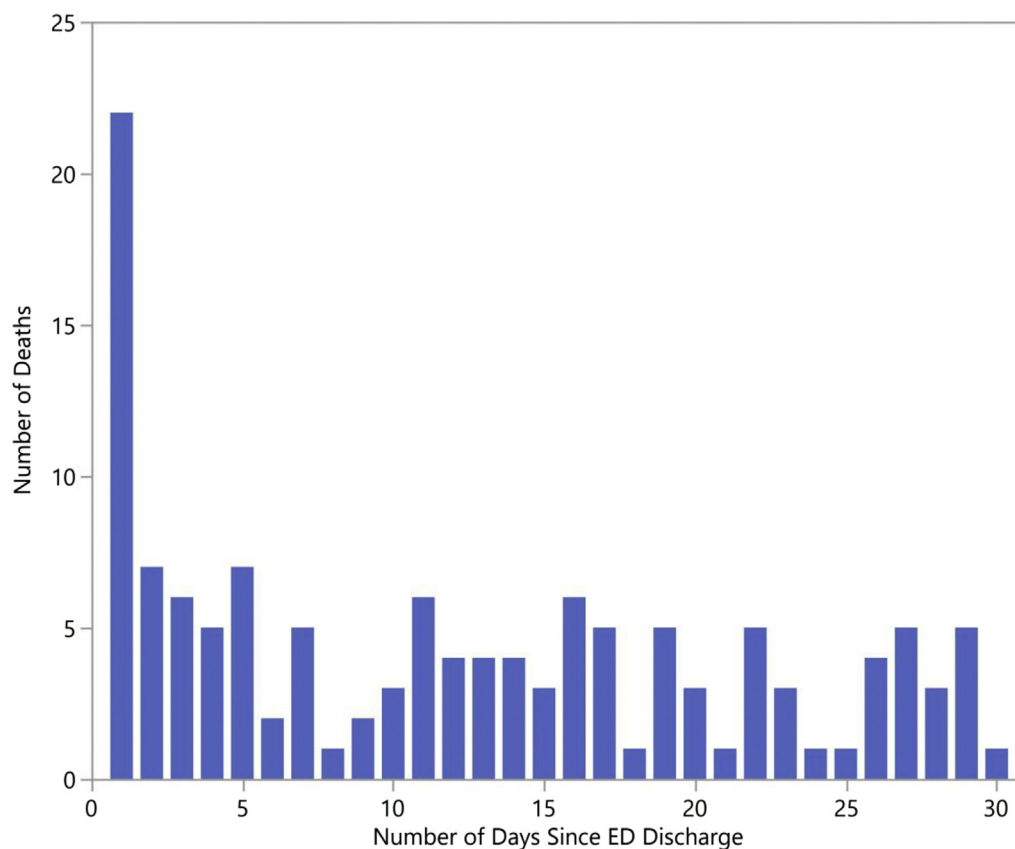


Figure 2. Number of deaths after ED treatment for nonfatal overdose by number of days after discharge in the first month, by day (n=130).

RESULTS

Between July 1, 2011, and September 30, 2015, there were a total of 17,241 patients treated for opioid overdose in Massachusetts EDs. Of these, 11,557 patients (67.0%) were discharged from the ED and met study inclusion criteria (Figure 1). Of the discharged patients, 635 (5.5%; 95% CI 5.08% to 5.92%) died within 1 year, 130 (1.1%; 95% CI 0.94% to 1.33%) died within 1 month, and 29 (0.25%; 95% CI 0.17% to 0.36%) died within 2 days. The median age of patients who died within 1 year was 39 years (interquartile range 31 to 53 years) and 451 (71.0%) were men. Race or ethnicity was recorded as white 557 (87.7%), black 21 (3.3%), and Hispanic 47 (7.4%). A total of 125 decedents (19.7%) were recorded to be homeless.

Of the 635 patients who died after discharge, death records indicated that 428 (67.4%) died of an opioid-related overdose. The manner of death was recorded as 121 natural causes (19.1%), 460 accidental (72.4%), 13 suicide (2.0%), and 41 (6.5%) other or pending investigation. The most common location of death was the hospital, 310 (48.8%), followed by in a residence, 146 (23.0%), and the remainder nursing home, other, or unknown.

Because the data included the date of discharge after overdose, it was possible to evaluate daily rates of death after ED treatment for overdose, and we did so for the first month after discharge. Of the patients who died, 130 (20.5%) died within the first month. The distribution of deaths for the first 30 days after ED discharge is demonstrated in Figure 2. A large number of patients who died in the first month after ED discharge (n=29; 22.4%) died within the first 2 days.

LIMITATIONS

The data in this study were provided by a single state and relied on details from large linked data sets that were not originally collected for research purposes. Hence, there may have been misclassification of the outcome variables either through lack of capture or error in linkage between the data sets. Also, if patients were treated for overdose or died in other states, the event would not be included in our analysis.

DISCUSSION

The short-term and 1-year mortality of opioid overdose patients who initially survive is high. For patients who were

treated in the ED for overdose, greater than 5% were dead within 1 year. These numbers are particularly tragic, given the relatively young age of those who died: the median age of decedents was only 39 years. The loss of life at this young age is responsible for an overall decreased life expectancy observed in the United States for the past 2 years,⁸ the first decrease in greater than 2 decades.

The location of death is also important: in approximately a quarter of cases, the place of death was a residence, possibly indicating patients who died before medical assistance arrived. This finding has implications in regard to bystander availability of naloxone, including the surgeon general's call for patients at risk for opioid overdose and community members who come into contact with those people to have naloxone available. It is possible that rapid access to naloxone in the community could have saved lives. Conversely, if an individual was using opioids alone, bystander naloxone would not have helped, and the actual lesson is to educate people not to use opioids alone.

A large number of patients discharged from the ED after an opioid overdose die in the first month. Approximately a fifth of patients who died did so in the first month after ED discharge, and approximately a fifth of those died in the first 2 days. These numbers highlight the importance of early, aggressive intervention for substance use disorder treatment. The initial health care contact in the ED is a critical period for intervention such as buprenorphine initiation,⁹ naloxone distribution, counseling, and referral to further treatment before ED discharge. These findings suggest that hospitals rapidly adopt medication for addiction treatment programs and other interventions for ED patients treated for opioid overdose.

Supervising editor: Richard C. Dart, MD, PhD. Specific detailed information about possible conflict of interest for individual editors is available at <https://www.annemergmed.com/editors>.

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Author contributions: All authors were responsible for the design of the study. OB and DB were responsible for analyzing the data. SGW wrote the article. All authors contributed to the interpretation of the results and provided intellectual contribution to the article and critically reviewed the article. All authors have read and approved the final article and take final responsibility for the decision to submit for publication in the present form. SGW takes responsibility for the paper as a whole.

All authors attest to meeting the four [ICMJE.org](http://www.icmje.org) authorship criteria: (1) Substantial contributions to the conception or design of the

work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding and support: By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). Dr. Weiner is supported by NIH grant 1-R01-DA044167. He completed an unrelated research project in 2016 funded by Kaleo Pharma, a company that produces a naloxone autoinjector, and is a former scientific advisory board member of Epidemic Solutions, LLC and General Emergency Medical Supplies Corp, both start-up companies aiming to increase availability of naloxone for bystanders.

Publication dates: Received for publication December 19, 2018. Revisions received March 2, 2019, and April 10, 2019. Accepted for publication April 18, 2019.

REFERENCES

1. National Center for Health Statistics. CDC Wonder. Number of deaths involving opioids. Revised January 2019. Available at: <https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates>. Accessed April 10, 2019.
2. Centers for Disease Control and Prevention. *Annual Surveillance Report of Drug-Related Risks and Outcomes—United States, 2017*. Atlanta, GA: US Dept of Health & Human Services, CDC; 2017. Available at: <https://www.cdc.gov/drugoverdose/pdf/pubs/2017-cdc-drug-surveillance-report.pdf>. Accessed April 10, 2019.
3. Vivolo-Kantor AM, Seth P, Gladden RM, et al. Vital signs: trends in emergency department visits for suspected opioid overdoses—United States, July 2016–September 2017. *MMWR Morb Mortal Wkly Rep*. 2018;67:279-285.
4. Massachusetts Department of Public Health. Data brief: opioid-related overdose deaths among Massachusetts residents. Available at: <https://www.mass.gov/files/documents/2018/11/16/Opioid-related-Overdose-Deaths-among-MA-Residents-November-2018.pdf>. Accessed April 10, 2019.
5. Commonwealth of Massachusetts. Massachusetts Chapter 52 of the Acts of 2016. An act relative to substance use, treatment, education and prevention. Available at: <https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter52>. Accessed April 10, 2019.
6. 190th General Court of the Commonwealth of Massachusetts. Chapter 55: an act requiring certain reports for opiate overdoses. Available at: <https://malegislature.gov/Laws/SessionLaws/Acts/2015/Chapter55>. Accessed April 10, 2019.
7. Commonwealth of Massachusetts. *An Assessment of Fatal and Nonfatal Opioid Overdoses in Massachusetts (2011-2015)*. 2017. Available at: <https://pilot.mass.gov/files/documents/2017/08/31/legislative-report-chapter-55-aug-2017.pdf>. Accessed April 10, 2019.
8. Kochanek KD, Murphy SL, Xu JQ, et al. *Mortality in the United States, 2016*. Hyattsville, MD: National Center for Health Statistics; 2017. NCHS Data Brief, no. 293. Available at: <https://www.cdc.gov/nchs/data/databriefs/db293.pdf>. Accessed April 10, 2019.
9. D'Onofrio G, O'Connor PG, Pantalon MV, et al. Emergency department-initiated buprenorphine/naloxone treatment for opioid dependence: a randomized clinical trial. *JAMA*. 2015;313:1636-1644.