



Published in final edited form as:

J Health Care Poor Underserved. 2016 ; 27(2): 846–859. doi:10.1353/hpu.2016.0075.

Characteristics of Homeless Adults Who Died of Drug Overdose: A Retrospective Record Review

Leah K. Bauer, MD,

Department of Psychiatry, Mid Coast Hospital, Brunswick, ME, Tufts University School of Medicine, Boston, MA

Jennifer K. Brody, MD, MPH,

Boston Health Care for the Homeless Program, Boston, MA Brigham and Women's Hospital, Boston, MA

Casey León, MPH, and

Boston Health Care for the Homeless Program, Boston, MA

Travis P. Baggett, MD, MPH

Division of General Internal Medicine, Massachusetts General Hospital, Boston, MA, Harvard Medical School, Boston, MA, Boston Health Care for the Homeless Program, Boston, MA

Leah K. Bauer: leahkbauer@gmail.com

Abstract

Drug overdose is a major cause of death among homeless people, but little is known about the characteristics of homeless overdose decedents. We conducted a retrospective record review of 219 adult patients of Boston Health Care for the Homeless Program (BHCHP) who died of drug overdose in 2003–2008. We assessed the substances implicated in overdose and the health and service use characteristics of decedents prior to death. Eighty-one percent of overdose deaths involved opioids and 40% involved multiple drugs. Problem substance use (85%), psychiatric illness (61%), and chronic pain (45%) were common, and 32% had documentation of all three. Half were well-connected to BHCHP, and 35% had a clinic visit within 90 days of death. The complex health histories and frequent health care contacts of homeless drug overdose decedents suggest that clinical facilities may be an important frontline venue for overdose education, naloxone distribution, and integrated substance use treatment programming.

Keywords

Homeless people; drug overdose; substance-related disorders; chronic pain; mental disorders

In the United States, drug overdoses have surpassed motor vehicle crashes as the leading cause of injury-related death.¹ Drug-related deaths are particularly common among homeless individuals.^{2,3} In a study of 28,033 adults seen at Boston Health Care for the Homeless Program (BHCHP) in 2003–2008, drug overdose caused one in three deaths

among those under the age of 45 years, a death rate 16 to 24 times higher than in the Massachusetts general population.² The age- and sex-adjusted rate of drug overdose death in this cohort was three times higher than in a BHCHP cohort from 15 years earlier² and mirrored a similar increase nationally during the same time period.⁴ Data on deaths among homeless people in New York City and San Francisco echoed the findings in Boston,^{5–7} suggesting that drug overdose may be an emerging problem among homeless people in U.S. cities.

In the general population, individuals who die of drug overdose tend to have histories of economic hardship, mental illness, and substance use disorders.^{8–10} Prior to death, many endure physical disabilities and receive prescription opioids for chronic pain.¹¹ Although homeless people experience a high burden of similar conditions,¹² no studies to our knowledge have examined the health characteristics of homeless people who die of drug overdose. Understanding the health characteristics of these decedents may offer insight into overdose prevention and other clinical interventions to address this at-risk population's upstream medical and psychosocial needs more effectively. Given the scope of this problem, such interventions could have a potentially important impact on public health.

Our objectives were 1) to describe the substances implicated in drug overdose deaths among homeless overdose decedents, 2) to assess the burden of problem substance use and medical and psychiatric illness among homeless overdose decedents, and 3) to examine the clinical use patterns of these individuals prior to death. To accomplish these aims, we reviewed the clinical and vital registry records of 219 BHCHP patients who died of drug overdose in 2003–2008.

Methods

Study subjects and setting

The current study focuses on 219 drug overdose decedents identified in a prior analysis of mortality among 28,033 adults 18 years and older who were seen at BHCHP between January 1, 2003 and December 31, 2008.² In that study, we used probabilistic methods to cross-link the BHCHP cohort with the Massachusetts Department of Public Health annual death occurrence files. We based causes of death on the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) underlying cause of death code in the Massachusetts mortality file. Drug overdose decedents were those with an underlying cause of death listed as unintentional (ICD-10 codes X40–X44) or undetermined intent (ICD-10 codes Y10–Y14) drug poisonings. We included undetermined intent drug poisonings because Massachusetts medical examiners made relatively frequent use of this category prior to a policy change in 2005 at the Office of the Chief Medical Examiner requiring that most of these deaths be categorized as unintentional.¹³ Additionally, poisonings of undetermined intent more closely resemble unintentional poisonings than suicidal poisonings.¹⁴

For each drug overdose death, we examined the multiple cause of death fields in the death occurrence file to ascertain which substances were implicated in the overdose. We classified these agents according to the convention used by the Massachusetts Department of Public

Health.¹³ We recorded whether alcohol intoxication or poisoning (ICD-10 codes X45, Y45, T51, or F10.0) was documented anywhere in the multiple cause of death fields for drug overdose decedents, but we did not include deaths where alcohol poisoning (ICD-10 codes X45 and Y15) was judged to be the underlying cause of death (N=6) because such deaths are clinically and epidemiologically distinct from drug overdose deaths and are generally considered separately.¹⁵⁻¹⁷

In keeping with convention,¹⁵⁻¹⁷ we also did not include patients whose underlying cause of death was coded as a mental or behavioral disorder due to psychoactive substance use (ICD-10 codes F10-F19), as these codes are generally intended for deaths related to a chronic pattern of substance abuse rather than acute poisoning.¹⁸ While individuals who die of drug overdose may have an underlying chronic substance use disorder, the mechanism of death is an acute poisoning event that presents a distinct opportunity for prevention efforts.

Although patients must be homeless to enroll in services at BHCHP, some individuals continue receiving care at BHCHP after they are no longer homeless. As a result, the overdose decedents examined in this study were homeless at some point but may not have been homeless at the time of death. Because all subjects were deceased at the time of record review, the Partners Human Research Committee judged this study to be not human subjects research.

Data collection procedures

Two investigators (LKB, JKB) conducted manual chart reviews of the BHCHP electronic health records of overdose decedents using a standardized approach and abstracted data into an electronic data collection form. These investigators reviewed a random selection of each other's charts to ensure consistent methodology. Discrepancies were resolved through team-based discussion and charts were re-reviewed as necessary. We supplemented manual chart review with automated data query procedures to abstract relevant ICD-9 and DSM-IV diagnostic codes applied during clinical encounters. Commonly used diagnostic codes for substance use, psychiatric, and chronic pain conditions were generated by physician investigators (LKB, JKB). These codes were then expanded by searching a comprehensive listing of ICD-9 codes for related terms, and then reviewed clinically by investigators (LKB, JKB) to streamline the list of codes for relevance and accuracy prior to automatic data query. Please contact the authors for a full list of diagnostic codes used. Electronic prescriptions written during clinical encounters were noted, as well as data on the frequency and type of clinical encounters at BHCHP.

Study variables

We collected data on demographic characteristics, substance use, psychiatric diagnoses, selected medical conditions, and characteristics of clinical encounters at BHCHP. Our selection of variables was guided by review of the literature relating to drug overdose mortality.

Demographic characteristics—We recorded age, sex, and race/ethnicity, since prior studies have suggested that young men^{19,20} and individuals who are White²¹ are overrepresented among overdose decedents.

Problem substance use—Having a substance use disorder is a known risk factor for misusing opioids and for drug overdose.^{21–23} However, establishing a formal diagnosis of substance use disorder by chart review poses several challenges because of clinician underdocumentation as well as complex diagnostic criteria. Instead, we established a framework for identifying “problem substance use” when any of the following criteria were met: 1) ICD-9 codes corresponding to substance use disorders, including codes for abuse and dependence of alcohol, opioids, cocaine, cannabis, amphetamines, hallucinogens, sedatives/hypnotics/anxiolytics, multiple substances, and other and unknown substances, were documented by an evaluating clinician; 2) free-text diagnoses of “substance use disorder,” “substance abuse,” or “substance dependence” were documented in the patient’s narrative problem list by an evaluating clinician; 3) a patient self-reported drug or alcohol abuse during a clinical encounter; 4) a clinician documented that a patient was intoxicated or impaired by a substance at the time of clinical evaluation, since this suggests use in larger amounts than intended and compromised social role obligations in the patient-clinician relationship; or 5) charted evidence of continued substance use despite persistent or recurrent social or interpersonal problems such as incarceration, unemployment, interpersonal difficulties, or persistent homelessness, as reflected in the social history and narrative body of clinical notes. Although these criteria do not establish a formal diagnosis of substance use disorder, they are generally concordant with the diagnostic criteria for substance abuse as set forth in the Diagnostic and Statistical Manual 4th Edition (DSM IV).²⁴

For individuals with evidence of problem substance use, we noted the specific substances used and classified these as heroin, non-heroin opioids, cocaine, alcohol, benzodiazepines, marijuana, and other or unknown substances. We made note of whether decedents had been involved in any form of substance abuse treatment at any point prior to death, including inpatient detoxification, residential or day treatment programs, peer support groups, or medication-assisted opioid dependence treatment with methadone or buprenorphine.

Psychiatric conditions—We recorded whether decedents had a lifetime history of depression, post-traumatic stress disorder (PTSD), other anxiety disorders, and attention deficit hyperactivity disorder (ADHD), since studies have suggested that these diagnoses may be associated with prescription opioid abuse²³ and fatal overdose.⁹ We also included bipolar disorder and psychotic disorders (schizophrenia and schizoaffective disorder) due to their tendency to be highly disabling conditions that are seen more frequently among homeless people.^{12,25} We determined the presence of these conditions based on either charted ICD-9 or DSM-IV codes consistent with the diagnoses of interest, or free-text entries indicating these diagnoses in the medical, psychiatric, or social history sections of the clinical record. We also recorded any history of suicidal ideation or past suicide attempts, since these are known risk factors for death in substance-dependent patients.²⁶

Medical conditions—Chronic pain is defined by the International Association for the Study of Pain as pain persisting beyond expected healing time, which is generally considered to be three months in the absence of other criteria.²⁷ We considered individuals to have a history of chronic pain if: 1) the medical record contained an ICD-9 code denoting either a pain diagnosis with a *chronic descriptor* (e.g., lower back pain) or a chronic medical diagnosis with pain as a predominant clinical feature (e.g., postherpetic neuralgia), 2) a specific pain complaint was clinically assessed more than once over a period of three months or longer, or 3) the clinical record indicated a past pain complaint that persisted for three months or longer. We considered HIV and hepatitis C diagnoses based on the presence of relevant ICD-9 codes, a charted diagnosis of these conditions, or laboratory results in the clinical record. We included these diagnoses because their acquisition is often related to substance use, and because people with these conditions who continue to use drugs may be at a uniquely high risk of death.^{23,28,29}

Clinical use characteristics—We noted whether decedents had an in-person encounter at BHCHP within 90 days of death. We considered this a timeframe in which it was likely feasible to identify issues that may have contributed to the subsequent overdose. We categorized these visits according to the type of service rendered: medical, mental health, case management, dental, or other.

We assessed the level of engagement and continuity of care using operational definitions developed at BHCHP and employed program-wide for the purpose of risk stratification and strategic planning. We defined high patient engagement as having three or more medical visits in the 12-month period prior to death. We defined high continuity of care as having a medical visit during three or more of the five years preceding death.

We determined whether decedents had ever been prescribed certain classes of high-risk medications and whether these prescriptions occurred within 90 days of death. High-risk classes of prescribed medications included those with abuse potential, those that cause sedation, and those that are toxic in overdose. Examples of such medications include any opioids or benzodiazepines; commonly-misused psychotropic medications such as quetiapine and gabapentin; psychotropic drugs that are toxic in overdose, including lithium and tricyclic antidepressants; and various other prescribed drugs with street value, such as clonidine and promethazine. We also made note of other psychotropic medications based on their potential for drug-drug interactions and toxidromes when used in combination with other substances.

Data analysis

To place the study sample into context, we began by comparing the characteristics of drug overdose decedents with individuals who died of other causes and with non-decedents in the broader cohort of all 28,033 patients seen at BHCHP in 2003–2008. We used t-tests and chi-square tests with a significance level of $p < .05$ for these comparisons. The remainder of our analyses focused solely on the 219 overdose decedents and was descriptive in nature. We used Microsoft Access (Microsoft Corporation, Redmond, WA) for data collection and management, Crystal Reports (Business Objects, San Jose, CA) for the automated

components of data abstraction, and SAS soft ware, version 9.3 (SAS Institute, Cary, NC), for data analysis.

Results

Of 1302 deaths in the original BHCHP study cohort of 28,033 adults, 219 deaths were due to drug overdose, 1,074 deaths were due to other causes, and nine deaths had no recorded underlying cause.

Demographics

On average, overdose decedents were 41 years old at the time of their index clinical encounter with BHCHP (Table 1). Sixty-eight percent were White, 16.9% were Black, and 10.1% were Hispanic. Few (4.6%) were military veterans. Almost half (46.8%) died at a residence and 40.4% died at a hospital. Nearly three-quarters of overdose decedents underwent autopsy.

In comparison to non-decedents, drug overdose decedents were more likely to be male (80.8% vs. 65.7%, $p < .001$) and differed significantly in their racial and ethnic composition ($p < .001$), with an overrepresentation of non-Hispanic Whites relative to other races. In comparison with individuals who died of other causes, overdose decedents were younger (41.3 vs. 50.4 yrs, $p < .001$), less likely to be veterans (4.6 vs. 14.3%, $p < .001$), and more likely to undergo an autopsy (72.2% vs. 30.7%, $p < .001$). The locations of death also differed significantly for these groups ($p < .001$).

Aim 1: Substances implicated in overdose deaths

Forty percent of overdoses involved multiple drugs, and 31% of overdose decedents were intoxicated with alcohol at the time of death (Table 2). Classes of drugs implicated in overdose deaths included opioids (N=177; 80.8% of total), cocaine (N=82; 37.4%), antidepressants (N=21; 9.6%), benzodiazepines (N=16; 7.3%), and antipsychotic agents (N=8; 3.7%). Antidepressants, benzodiazepines, and antipsychotic agents rarely caused overdose in isolation; the vast majority were accompanied by other drugs and/or alcohol. In contrast, 43% of opioid overdoses and 27% of cocaine overdoses involved no other drugs or alcohol.

Aim 2: Problem substance use, psychiatric illness, and medical conditions

Table 3 depicts the burden of substance use, psychiatric illness, and medical conditions among the 219 overdose decedents.

Problem substance use—Eighty-five percent of decedents had documented evidence of problem substance use (Table 3). Alcohol was the most common substance mentioned (63.5%), followed by opioids (53.9%), heroin (40.6%) and cocaine (40.2%). Almost one-quarter of decedents used injection drugs. Thirty individuals (13.7%) had a documented history of previous non-fatal overdose. Most patients (63.0%) had received some form of substance abuse treatment in their lifetime, but far fewer had, to our knowledge, ever been on methadone (19.6%) or buprenorphine (4.3%).

Psychiatric conditions—Over 60% of subjects had documented psychiatric illness, with depression being the most common diagnosis (38.8%), followed by anxiety disorders (30.6%), bipolar disorder (16.9%), and PTSD (11.4%) (Table 3). Nearly 40% of decedents had two or more documented psychiatric diagnoses.

Medical conditions—Forty-five percent of overdose decedents had documented evidence of a chronic pain history (Table 3). The prevalence of HIV was 5%, and the prevalence of hepatitis C was 23.7%.

Co-morbidity—The co-occurrence of substance use disorders, psychiatric conditions, and chronic pain was common (Table 3). Ninety-two percent (201/219) had at least one of these conditions, and 32% (71/219) had all three.

Aim 3: Clinical use characteristics

Forty-three percent of decedents had three or more BHCHP clinical encounters in the year preceding their death, and about half had a documented visit during at least three of the five years prior to their death. One-third of decedents (N=72) had at least one medical visit at BHCHP within 90 days of death. Thirteen of these decedents (5.9% of the cohort) had a mental health encounter during this timeframe. Forty-five decedents were prescribed a total of 268 medications within 90 days of their death, including 20 (9.1%) who received a prescription for opioids and 27 (12.3%) who received a prescription for other high-risk medications. Twenty individuals received a prescription medication from the same class that was implicated in their overdose, including 16 involving opioids. However, limitations in ICD-10 coding precluded determination of an exact match between particular medications.

Discussion

Homeless drug overdose decedents in this study had a complex array of health needs. Substance use disorders, mental health conditions, and chronic pain were each very common, and one-third of decedents had documented evidence of all three. Efforts to address and prevent drug overdose among homeless individuals will require clinical services capable of offering integrated care across these often segregated domains of illness. This should include coordinated pharmacologic and behavioral approaches to these problems, in addition to sustained surveillance of mortality and cause of death patterns in this population.⁷

As in studies in the general population,^{30,31} young White males were over-represented in this sample of drug overdose decedents. Opioids were the most commonly implicated substance in overdose deaths and the most frequently documented drug of abuse in the clinical records of overdose decedents. Although many overdose decedents had a history of drug treatment, fewer than half of decedents with documented opioid use had received pharmacologic treatment for opioid dependence. In particular, treatment with buprenorphine rarely occurred. This suggests a need to expand access to and use of medication-assisted treatment for opioid dependence, a strategy that is gaining wide support.^{32,33–35} Additionally, overdose education combined with community distribution of naloxone, an antidote for opioid poisoning, significantly reduces opioid overdose fatalities^{36,37,38} and

should be a component of overdose prevention efforts for homeless populations, particularly given the high number of deaths that occurred in a private residence.

At the same time, our study suggests that the substance use disorders of overdose decedents are not confined to opioids. This is consistent with other recent studies that show increasing overdose deaths with polysubstance involvement.^{39,40} In our study, a large percentage of overdose deaths involved multiple substances and about one-third involved alcohol intoxication. Our medical record review reinforced the polysubstance nature of drug and alcohol involvement, with nearly two-thirds of overdose decedents having a documented history of problem alcohol use. This is particularly salient as a recent study shows alcohol use disorder to be a risk factor for opioid overdose fatalities.⁴¹ Treatment programs to prevent overdose deaths in the homeless population should be capable of broadly addressing the co-occurring use of alcohol and multiple classes of drugs.

Despite the practical challenges in creating and sustaining a clinical relationship with homeless individuals, about one-half of overdose decedents had longitudinal involvement with BHCHP: over 40% had made three or more clinic visits in the year prior to their death, and more than one-third made an office visit within three months prior to death. However, despite the high prevalence of mental health conditions among decedents, only 6% received specialized mental health services with BHCHP in the three months leading up to death. Taken together, these findings suggest that clinical settings may be an important location for identifying those at highest risk of drug overdose and delivering interventions to help mitigate that risk. This could allow for a better understanding of barriers to services encountered by homeless individuals at risk for drug overdose and why some services are underutilized.

Limitations

We studied overdose decedents who were seen at a large Health Care for the Homeless program in Boston, so our findings may not be generalizable to other settings. Our clinical chart reviews were confined to records at BHCHP. Although BHCHP operates clinical services at over 70 sites in greater Boston and has maintained an integrated electronic health record for more than 15 years, this record may not capture clinical information derived from health services delivered outside BHCHP. As a result, our findings likely reflect a conservative estimate of the burden of health conditions and the pattern of health service use in this group of decedents. Finally, our study was descriptive in nature and did not include chart reviews of a control group of individuals who did not die of opioid overdose. Future studies should consider this approach in order to better clarify the risk factors for drug overdose death among homeless individuals.

Conclusions

Homeless drug overdose decedents in Boston have a complex set of medical and behavioral health conditions and frequently use multiple substances. Integrated, intensive, multidisciplinary services will be required to address the medical and psychiatric needs in homeless individuals at risk for drug overdose. Clinical facilities targeting homeless

populations may also be important frontline venues for overdose education, naloxone distribution, and integrated substance use treatment programs.

Acknowledgments

Research reported in this publication was supported by the National Institute on Drug Abuse of the National Institutes of Health under Award Number K23DA034008 to Dr. Baggett. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The funding agency had no role in the design, conduct, or reporting of this study.

References

1. Warner M, Chen LH, Makuc DM, et al. Drug poisoning deaths in the United States, 1980–2008. NCHS Data Brief. 2011 Dec;(81):1–8. PMID:22617462. [PubMed: 22617462]
2. Baggett TP, Hwang SW, O'Connell JJ, et al. Mortality among homeless adults in Boston: Shifts in causes of death over a 15-year period. JAMA Intern Med. 2013 Feb 11; 173(3):189–195. <http://dx.doi.org/10.1001/jamainternmed.2013.1604> PMID:23318302 PMCID:PMC3713619. [PubMed: 23318302]
3. Baggett TP, Chang Y, Singer DE, et al. Tobacco-, alcohol-, and drug-attributable deaths and their contribution to mortality disparities in a cohort of homeless adults in Boston. Am J Public Health. 2015 Jun; 105(6):1189–1197. Epub 2014 Dec 18. <http://dx.doi.org/10.2105/AJPH.2014.302248> PMID:25521869. [PubMed: 25521869]
4. Mack KA. Centers for Disease Control and Prevention. Drug-induced deaths—United States, 1999–2010. MMWR Surveill Summ. 2013 Nov 22; 62(Suppl 3):161–163. PMID:24264508.
5. Gambatese M, Madsen A, Marder D. Overdose fatality and surveillance as a method for understanding mortality trends in homeless populations. JAMA Intern Med. 2013 Jul 8; 173(13):1264–1265. <http://dx.doi.org/10.1001/jamainternmed.2013.6838> <http://dx.doi.org/10.1001/jamainternmed.2013.6849> PMID:23836271. [PubMed: 23836271]
6. Riley ED, Cohen J, Shumway M. Overdose fatality and surveillance as a method for understanding mortality trends in homeless populations. JAMA Intern Med. 2013 Jul 8; 173(13):1264. <http://dx.doi.org/10.1001/jamainternmed.2013.6849> <http://dx.doi.org/10.1001/jamainternmed.2013.6838> PMID:23836270 PMCID:PMC4220445. [PubMed: 23836270]
7. Gambatese M, Marder D, Begier E, et al. Programmatic impact of 5 years of mortality surveillance of New York City homeless populations. Am J Public Health. 2013 Dec; 103(Suppl 2):S193–S198. Epub 2013 Oct 22. <http://dx.doi.org/10.2105/AJPH.2012.301196> PMID:24148068 PMCID:PMC3969136. [PubMed: 24148068]
8. Marzuk PM, Tardiff K, Leon AC, et al. Poverty and fatal accidental drug overdoses of cocaine and opiates in New York City: An ecological study. Am J Drug Alcohol Abuse. 1997 May; 23(2):221–228. <http://dx.doi.org/10.3109/0095299709040943> PMID:9143635. [PubMed: 9143635]
9. Gossop M, Stewart D, Treacy S, et al. A prospective study of mortality among drug misusers during a 4-year period after seeking treatment. Addiction. 2002 Jan; 97(1):39–47. <http://dx.doi.org/10.1046/j.1360-0443.2002.00079.x> PMID:11895269. [PubMed: 11895269]
10. Bohnert AS, McCarthy JF, Ignacio RV, et al. Misclassification of suicide deaths: Examining the psychiatric history of overdose decedents. Inj Prev. 2013 Oct; 19(5):326–330. Epub 2013 Jan 15. <http://dx.doi.org/10.1136/injuryprev-2012-040631> PMID:23322257. [PubMed: 23322257]
11. Johnson EM, Lanier WA, Merrill RM, et al. Unintentional prescription opioid-related overdose deaths: Description of decedents by next of kin or best contact, Utah, 2008–2009. J Gen Intern Med. 2013 Apr; 28(4):522–529. Epub 2012 Oct 16. <http://dx.doi.org/10.1007/s11606-012-2225-z> PMID:23070654 PMCID:PMC3599020. [PubMed: 23070654]
12. Baggett TP, Jenkins DM. Homelessness and health: key themes from three decades of research. Fitzpatrick, KM., editor. Poverty and Health Praeger; 2013.
13. West, J.; Hood, M.; Caceres, I., et al. Massachusetts deaths, 2008. Boston, MA: Massachusetts Dept of Public Health, Division of Research and Epidemiology, Bureau of Health Information, Statistics, Research, and Evaluation; 2010.

14. Donaldson AE, Larsen GY, Fullerton-Gleason L, et al. Classifying undetermined poisoning deaths. *Inj Prev.* 2006 Oct; 12(5):338–343. <http://dx.doi.org/10.1136/ip.2005.011171> PMID:17018678 PMCid:PMC2563448. [PubMed: 17018678]
15. Paulozzi LJ, Kilbourne EM, Desai HA. Prescription drug monitoring programs and death rates from drug overdose. *Pain Med.* 2011 May; 12(5):747–754. Epub 2011 Feb 18. <http://dx.doi.org/10.1111/j.1526-4637.2011.01062.x> PMID:21332934. [PubMed: 21332934]
16. Paulozzi LJ, Xi Y. Recent changes in drug poisoning mortality in the United States by urban-rural status and by drug type. *Pharmacoepidemiol Drug Saf.* 2008 Oct; 17(10):997–1005. <http://dx.doi.org/10.1002/pds.1626> PMID:18512264. [PubMed: 18512264]
17. Hwang SW, Wilkins R, Tjepkema M, et al. Mortality among residents of shelters, rooming houses, and hotels in Canada: 11 year follow-up study. *BMJ.* 2009 Oct 26; 339:b4036. <http://dx.doi.org/10.1136/bmj.b4036> PMID:19858533 PMCid:PMC2767481. [PubMed: 19858533]
18. Anderson RN, Minino AM, Fingerhut LA, et al. Deaths: injuries, 2001. *Natl Vital Stat Rep.* 2004; 52:1–86. PMID:15222463. [PubMed: 15222463]
19. Darke S, Zador D. Fatal heroin ‘overdose’: a review. *Addiction.* 1996 Dec; 91(12):1765–1772. <http://dx.doi.org/10.1046/j.1360-0443.1996.911217652.x> <http://dx.doi.org/10.1111/j.1360-0443.1996.tb03800.x> PMID:8997759. [PubMed: 8997759]
20. Darke S, Ross J, Zador D, et al. Heroin-related deaths in new south wales, Australia, 1992–1996. *Drug Alcohol Depend.* 2000 Aug 1; 60(2):141–150. [http://dx.doi.org/10.1016/S0376-8716\(99\)00147-7](http://dx.doi.org/10.1016/S0376-8716(99)00147-7). [PubMed: 10940541]
21. Sherman SG, Cheng Y, Kral AH. Prevalence and correlates of opiate overdose among young injection drug users in a large U.S. city. *Drug Alcohol Depend.* 2007 May 11; 88(2–3):182–187. Epub 2006 Nov 15. <http://dx.doi.org/10.1016/j.drugalcdep.2006.10.006> PMID:17110058 PMCid:PMC1950747. [PubMed: 17110058]
22. Sullivan MD, Edlund MJ, Fan MY, et al. Risks for possible and probable opioid misuse among recipients of chronic opioid therapy in commercial and medicaid insurance plans: The TROUP Study. *Pain.* 2010 Aug; 150(2):332–339. Epub 2010 Jun 15. <http://dx.doi.org/10.1016/j.pain.2010.05.020> PMID:20554392 PMCid:PMC2897915. [PubMed: 20554392]
23. White AG, Birnbaum HG, Schiller M, et al. Analytic models to identify patients at risk for prescription opioid abuse. *Am J Manag Care.* 2009 Dec; 15(12):897–906. PMID:20001171. [PubMed: 20001171]
24. Association, AP. *Diagnostic and statistical manual of mental disorders.* 4th Ed., text revision. Washington, DC: Association AP; 2000.
25. Koegel P, Burnam MA, Farr RK. The prevalence of specific psychiatric disorders among homeless individuals in the inner city of Los Angeles. *Arch Gen Psychiatry.* 1988 Dec; 45(12):1085–1092. <http://dx.doi.org/10.1001/archpsyc.1988.01800360033005> PMID:2461690. [PubMed: 2461690]
26. Saitz R, Gaeta J, Cheng DM, et al. Risk of mortality during four years after substance detoxification in urban adults. *J Urban Health.* 2007 Mar; 84(2):272–282. <http://dx.doi.org/10.1007/s11524-006-9149-z> PMID:17221296 PMCid:PMC2231626. [PubMed: 17221296]
27. Classification of chronic pain. Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the international association for the study of pain, subcommittee on taxonomy. *Pain Suppl.* 1986; 3:S1–S226. [PubMed: 3461421]
28. Wright N, Oldham N, Jones L. Exploring the relationship between homelessness and risk factors for heroin-related death—a qualitative study. *Drug Alcohol Rev.* 2005 May; 24(3):245–251. <http://dx.doi.org/10.1080/09595230500170308> PMID:16096128. [PubMed: 16096128]
29. Walley AY, Cheng DM, Libman H, et al. Recent drug use, homelessness and increased short-term mortality in hiv-infected people with alcohol problems. *AIDS.* 2008 Jan 30; 22(3):415–420. <http://dx.doi.org/10.1097/QAD.0b013e3282f423f8> PMID:18195568 PMCid:PMC2247409. [PubMed: 18195568]
30. Hedegaard H, Chen LH, Warner M. Drug-poisoning deaths involving heroin: United states, 2000–2013. *NCHS Data Brief.* 2015 Mar.(190):1–8. PMID:25932890. [PubMed: 25932890]
31. Rudd RA, Paulozzi LJ, Bauer MJ, et al. Increases in heroin overdose deaths—28 states, 2010 to 2012. *MMWR Morb Mortal Wkly Rep.* 2014 Oct 3; 63(39):849–854. PMID:25275328. [PubMed: 25275328]

32. Volkow ND, Frieden TR, Hyde PS, et al. Medication-assisted therapies—tackling the opioid-overdose epidemic. *N Engl J Med*. 2014 May 29; 370(22):2063–2066. Epub 2014 Apr 23. <http://dx.doi.org/10.1056/NEJMp1402780> PMID:24758595. [PubMed: 24758595]
33. Marteau D, McDonald R, Patel K. The relative risk of fatal poisoning by methadone or buprenorphine within the wider population of England and Wales. *BMJ Open*. 2015 May 29.5(5):e007629. PMID:26024998 PMCid:PMC4452747.
34. Wikner BN, Ohman I, Selden T, et al. Opioid-related mortality and filled prescriptions for buprenorphine and methadone. *Drug Alcohol Rev*. 2014 Sep; 33(5):491–498. Epub 2014 Apr 16. <http://dx.doi.org/10.1111/dar.12143> PMID:24735085. [PubMed: 24735085]
35. Schwartz RP, Gryczynski J, O'Grady KE, et al. Opioid agonist treatments and heroin overdose deaths in Baltimore, Maryland, 1995–2009. *Am J Public Health*. 2013 May; 103(5):917–922. Epub 2013 Mar 14. <http://dx.doi.org/10.2105/AJPH.2012.301049> PMID:23488511 PMCid:PMC3670653. [PubMed: 23488511]
36. Walley AY, Xuan Z, Hackman HH, et al. Opioid overdose rates and implementation of overdose education and nasal naloxone distribution in Massachusetts: interrupted time series analysis. *BMJ*. 2013 Jan 30.346:f174. <http://dx.doi.org/10.1136/bmj.f174> PMID:23372174 PMCid:PMC4688551. [PubMed: 23372174]
37. Wheeler E, Jones TS, Gilbert MK, et al. Opioid overdose prevention programs providing naloxone to laypeople—United States, 2014. *MMWR Morb Mortal Wkly Rep*. 2015 Jun 19; 64(23):631–635. PMID:26086633. [PubMed: 26086633]
38. Strang J. Death matters: understanding heroin/opiate overdose risk and testing potential to prevent deaths. *Addiction*. 2015 Jul; 110(Suppl 2):27–35. <http://dx.doi.org/10.1111/add.12904> PMID: 26042565. [PubMed: 26042565]
39. Jones CM, McAninch JK. Emergency department visits and overdose deaths from combined use of opioids and benzodiazepines. *Am J Prev Med*. 2015 Oct; 49(4):493–501. Epub 2015 Jul 3. <http://dx.doi.org/10.1016/j.amepre.2015.03.040> PMID:26143953. [PubMed: 26143953]
40. Visconti AJ, Santos GM, Lemos NP, et al. Opioid Overdose Deaths in the City and County of San Francisco: Prevalence, Distribution, and Disparities. *J Urban Health*. 2015 Aug; 92(4):758–772. <http://dx.doi.org/10.1007/s11524-015-9967-y> PMID:26077643. [PubMed: 26077643]
41. Bogdanowicz KM, Stewart R, Broadbent M, et al. Double trouble: Psychiatric comorbidity and opioid addiction—all-cause and cause-specific mortality. *Drug Alcohol Depend*. 2015 Mar 1.148:85–92. Epub 2015 Jan 3. <http://dx.doi.org/10.1016/j.drugalcdep.2014.12.025> PMID: 25578253. [PubMed: 25578253]

Demographic characteristics of drug overdose decedents, non-overdose decedents, and non-decedents in the overall BHCHP cohort, 2003–2008

Table 1

Characteristic	Drug overdose decedents (N=219)	Non-overdose decedents (N=1074) ^a	P value ^b	Non-decedents (N=26,731)	P value ^c
Age at entry, mean (SD)	41.3 (8.6)	50.4 (11.3)	<0.001	40.6 (12.4)	0.25
Sex, male, N (%)	177 (80.8)	870 (81.0)	0.95	17,557 (65.7)	<0.001
Race/ethnicity, N (%)			0.07		<0.001
White, non-Hispanic	148 (67.6)	633 (58.9)		11,128 (41.6)	
Black, non-Hispanic	37 (16.9)	261 (24.3)		7,765 (29.1)	
Hispanic	22 (10.1)	106 (9.9)		5,170 (19.3)	
Other/unknown	12 (5.5)	74 (6.9)		2,668 (10.0)	
Veteran, N (%)	10 (4.6)	153 (14.3)	<0.001	—	—
Location of death, N (%)			<0.001		
Hospital	88 (40.4)	590 (54.9)		—	—
Residence	102 (46.8)	248 (23.1)		—	—
Nursing home	1 (0.5)	128 (11.9)		—	—
Other	27 (12.4)	108 (10.1)		—	—
Autopsy performed, N (%)	158 (72.2)	330 (30.7)	<0.001	—	—

^a 9 decedents had no underlying cause of death listed in the death occurrence file and were excluded from this comparison.

^b P value for test comparing overdose to non-overdose decedents.

^c P value for test comparing overdose decedents to non-decedents.

Table 2

Substances implicated in overdose deaths

Drug class implicated in overdose	Number of overdoses (% of total)	% involving other/multiple drug classes	% involving alcohol intoxication	% involving other/multiple drugs <i>or</i> alcohol
Any drug	219 (100.0)	39.7	30.6	54.3
Opioids	177 (80.8)	44.6	29.9	57.1
Cocaine	82 (37.4)	64.6	32.9	73.2
Antidepressants	21 (9.6)	90.5	52.4	95.2
Benzodiazepines	16 (7.3)	87.5	56.3	100.0
Antipsychotics/neuroleptics	8 (3.7)	87.5	37.5	87.5

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3

Clinical characteristics of drug overdose decedents (N=219)

	N	(%)
Substance use status		
Problem Substance Use	187	(85.4)
Alcohol	139	(63.5)
Any opioid	118	(53.9)
Heroin	89	(40.6)
Cocaine	88	(40.2)
Injection drug use	54	(24.7)
Marijuana	23	(10.5)
Benzodiazepines	21	(9.6)
Unspecified substance abuse	16	(7.3)
Other substance of abuse	12	(5.5)
History of drug overdose	30	(13.7)
History of substance abuse treatment	138	(63.0)
Outpatient treatment ^a	99	(45.2)
Inpatient treatment ^b	94	(42.9)
Methadone	27	(19.6)
Buprenorphine	6	(4.3)
Mental health status		
Any psychiatric condition	134	(61.2)
Depression	85	(38.8)
Anxiety disorder	67	(30.6)
Bipolar disorder	37	(16.9)
Post-traumatic stress disorder	25	(11.4)
Other or unspecified mental illness	10	(4.6)
Psychotic disorder	7	(3.2)
Attention deficit hyperactivity disorder	3	(1.4)
2 psychiatric diagnoses	86	(39.3)
History of suicidal ideation or suicide attempt	33	(15.1)
Medical status		
Chronic pain history	99	(45.2)
Human immunodeficiency virus	11	(5.0)
Hepatitis C virus	52	(23.7)
Co-morbidity		
Problem Substance Use (PSU) and Psychiatric Condition	127	(57.9)
PSU and Chronic Pain	90	(41.0)
Psychiatric Condition and Chronic Pain	75	(34.2)
PSU AND Psychiatric Condition AND Chronic Pain	71	(32.4)
PSU OR Psychiatric Condition OR Chronic Pain	201	(91.8)

^aDay treatment, AA/NA/other peer led support group, residential treatment, sober house

^bInpatient Treatment, Inpatient Detox

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript