Mortality Among Homeless Adults in Boston

Shifts in Causes of Death Over a 15-Year Period

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Background: Homeless persons experience excess mortality, but US-based studies on this topic are outdated or lack information about causes of death. To our knowledge, no studies have examined shifts in causes of death for this population over time.

Methods: We assessed all-cause and cause-specific mortality rates in a cohort of 28,033 adults 18 years or older who were seen at Boston Health Care for the Homeless Program from January 1, 2003, through December 31, 2008. Deaths were identified through probabilistic linkage to the Massachusetts death occurrence files. We compared mortality rates in this cohort with rates in the 2003-2008 Massachusetts population and a 1988-1993 cohort of homeless adults in Boston using standardized rate ratios with 95% confidence intervals.

Results: A total of 1302 deaths occurred during 90,450 person-years of observation. Drug overdose (n=219), cancer (n=206), and heart disease (n=203) were the major causes of death. Drug overdose accounted for one-third of deaths among adults younger than 45 years. Opioids were implicated in 81% of overdose deaths. Mortality rates were higher among whites than nonwhites. Compared with Massachusetts adults, mortality disparities were most pronounced among younger individuals, with rates about 9-fold higher in 25- to 44-year-olds and 4.5-fold higher in 45- to 64-year-olds. In comparison with 1988-1993 rates, reductions in deaths from human immunodeficiency virus (HIV) were offset by 3- and 2-fold increases in deaths owing to drug overdose and psychoactive substance use disorders, resulting in no significant difference in overall mortality.

Conclusions: The all-cause mortality rate among homeless adults in Boston remains high and unchanged since 1988 to 1993 despite a major interim expansion in clinical services. Drug overdose has replaced HIV as the emerging epidemic. Interventions to reduce mortality in this population should include behavioral health integration into primary medical care, public health initiatives to prevent and reverse drug overdose, and social policy measures to end homelessness.


A N ESTIMATED 2.3 TO 3.5 million Americans experience homelessness annually, and over 649,000 are homeless on a single night. Homeless individuals have a high prevalence of physical illness, psychiatric disease, and substance abuse, contributing to very high mortality rates in comparison with nonhomeless people.

Despite the persistence of homelessness in the United States, the past decade has yielded few studies on mortality among homeless Americans, and information on causes of death in this population is sparse. In the most recent study that examined causes of death in a US-based homeless population, Hwang et al analyzed data on 17,292 adults seen at Boston Health Care for the Homeless Program (BHCHP) in 1988 to 1993. This study documented the substantial toll of human immunodeficiency (HIV) infection, which was the leading cause of death among 25- to 44-year-olds and accounted for 18% of all deaths in the study cohort. Homicide was the principal cause of death for 18- to 24-year-olds, while heart disease and cancer were the leading causes among 45- to 64-year-olds.

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In view of interim advances in HIV treatment and expansion of federally funded Health Care for the Homeless clinical services, the mortality profile of homeless adults in the United States may have changed since 1988 to 1993; however, data to confirm this are lacking. A comprehen-
CAUSES OF DEATH

We based causes of death on the International Statistical Classification of Diseases, 10th Revision (ICD-10) underlying cause of death codes in the MDPH mortality file (eTable; http://www.jamainternalmed.com). The MDPH translates death certificate entries into ICD-10 cause of death codes using software developed by the National Center for Health Statistics (NCHS). 23 We defined “drug overdose” as drug poisoning deaths that were unintentional (codes X40-X44) or of undetermined intent (codes Y10-Y14). 24 We included undetermined intent drug poisonings in this definition because Massachusetts medical examiners made relatively frequent use of this category prior to a 2005 policy change at the Office of the Chief Medical Examiner requiring that most of these deaths be categorized as unintentional. 23,25 In addition, evidence suggests that poisonings of undetermined intent more closely resemble unintentional poisonings than suicidal poisonings. 26 For drug overdose deaths, we examined the multiple cause of death fields to ascertain which substances were implicated in each overdose. We classified deaths due to alcohol poisoning (codes X45, Y15) separately from drug overdose. Drug- and alcohol-related deaths could also be captured under the ICD-10 underlying cause of death codes for mental and behavioral disorders due to psychoactive substance use (codes F10-F19), which we analyzed collectively as “psychoactive substance use disorders.” These codes are generally intended for deaths related to a chronic pattern or sequel of substance abuse rather than acute poisoning. 27 Such deaths include those attributed to substance dependence (eg, chronic alcoholism), harmful substance use resulting in medical complications (eg, dilated cardiomyopathy, gastrointestinal hemorrhage, aspiration pneumonia), and substance withdrawal syndromes (eg, delirium tremens) (Robert N. Anderson, PhD, Chief, Mortality Statistics Branch, NCHS, written communication, June 22, 2012).

STATISTICAL ANALYSIS

We tabulated the leading causes of death overall and stratified by age and sex. We calculated mortality rates by dividing the number of deaths by the person-years of observation and expressed these rates as deaths per 100 000 person-years. Since the accuracy of the underlying cause of death may depend on whether a decedent underwent autopsy, we assessed the percentage of homeless decedents who underwent autopsy and used the χ² test to compare this with the percentage who underwent autopsy in the Massachusetts general population.

To compare our age- and sex-stratified findings with the 2003-2008 Massachusetts general population, we adjusted for race using direct standardization with weights chosen according to the racial breakdown in the general population. We then calculated overall and cause-specific mortality rate ratios by dividing the race-standardized mortality rates in the homeless cohort by the rates in the general population. We fitted 99% confidence intervals using conventional methods for standardized rate ratios. 28,29 We obtained mortality data for the 2003-2008 Massachusetts general population from the CDC Wide-ranging Online Data for Epidemiologic Research (WONDER) underlying cause of death compressed mortality files. 30

To compare our findings with the 1988-1993 BHCHP cohort, we directly standardized the overall and cause-specific mortality rates in the 2003-2008 cohort to match the age, sex, and race distribution of the 1988-1993 cohort. We limited this portion of the analysis to 18- to 64-year-olds to correspond to the age range analyzed in 1988 to 1993. From 1988 to 2008, BHCHP experienced substantial growth in the density and intensity of its clinical operations but did not change its core mission, geographical service area, target population, or eligibility requirements for pa-
A total of 28,033 adults were followed for a median of 3.3 years, yielding 90,450 person-years of observation. The mean age at cohort entry was 41 years (Table 1). In comparison with the 1988-1993 cohort, individuals 45 years or older comprised a greater proportion of observation time (45% vs 29%). Two-thirds of participants were male, and 42.5% were white.

### RESULTS

There were 1302 deaths during the study period, generating a crude mortality rate of 1439.5 deaths per 100,000 person-years. The mean age at death was 51 years (range, 19-93 years) (Table 1). Over 80% of decedents were male, and 60.2% were white. Most deaths occurred in a hospital. Overall, 38.0% of decedents in the study cohort underwent autopsy compared with 6.7% of decedents in the Massachusetts general population (P < .001).

#### MAJOR CAUSES OF DEATH

Drug overdose was the leading cause of death, accounting for 16.8% of all deaths in the cohort (Table 2). Opioids were implicated in 81% of overdose deaths; of these, heroin was identified in 13%, opioid analgesics in 31%, and other and unspecified narcotics in 60%. Cocaine contributed to 37% of overdose deaths, and 43% involved multiple substances. Alcohol was mentioned as a co-occurring substance in 32% of drug overdose deaths.

### Table 1. Characteristics of the Entire Study Cohort and the Decedents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Entire Cohort (n = 28,033)</th>
<th>Decedents (n = 1,302)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at index observation, mean (SD), y</td>
<td>41.0 (12.4)</td>
<td>51.2 (19.3-93.5)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male 18,612 (66.4)</td>
<td>Female 9,421 (33.6)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>White, non-Hispanic 11,912 (42.5)</td>
<td>Black, non-Hispanic 8,066 (28.8)</td>
</tr>
<tr>
<td>Race</td>
<td>White, non-Hispanic 784 (60.2)</td>
<td>Black, non-Hispanic 303 (23.1)</td>
</tr>
<tr>
<td>Place of death</td>
<td>Hospital 683 (52.5)</td>
<td>Residence 352 (27.0)</td>
</tr>
<tr>
<td>Autopsy performed</td>
<td>Yes 495 (38.0)</td>
<td>No 807 (62.0)</td>
</tr>
</tbody>
</table>

### Table 2. Causes of Death and Crude Mortality Rates

<table>
<thead>
<tr>
<th>Underlying Cause of Death</th>
<th>Deaths, No. (% of Total)</th>
<th>Crude Rate per 100,000 Person-years (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td>1302 (100)</td>
<td>1439.5 (1361.3-1517.7)</td>
</tr>
<tr>
<td>Drug overdose</td>
<td>219 (16.8)</td>
<td>242.1 (210.1-274.2)</td>
</tr>
<tr>
<td>Cancer</td>
<td>206 (15.8)</td>
<td>227.8 (196.6-258.9)</td>
</tr>
<tr>
<td>Trachea, bronchus, and lung</td>
<td>74 (5.7)</td>
<td>81.8 (63.2-100.0)</td>
</tr>
<tr>
<td>Liver and intrahepatic bile ducts</td>
<td>24 (1.8)</td>
<td>26.5 (19.5-39.7)</td>
</tr>
<tr>
<td>Colon, rectum, and anus</td>
<td>18 (1.4)</td>
<td>19.9 (10.7-29.1)</td>
</tr>
<tr>
<td>Esophagus</td>
<td>11 (0.8)</td>
<td>12.2 (5.0-19.3)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>8 (0.6)</td>
<td>8.8 (2.7-15.0)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>203 (15.6)</td>
<td>224.4 (193.6-255.3)</td>
</tr>
<tr>
<td>Psychoactive substance</td>
<td>99 (7.6)</td>
<td>109.5 (87.9-131.0)</td>
</tr>
<tr>
<td>use disorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use disorder</td>
<td>71 (5.5)</td>
<td>78.5 (60.2-96.8)</td>
</tr>
<tr>
<td>Other substance use disorders</td>
<td>28 (2.2)</td>
<td>31.0 (19.5-42.4)</td>
</tr>
<tr>
<td>Liver disease</td>
<td>89 (6.8)</td>
<td>98.4 (78.0-118.8)</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>58 (4.5)</td>
<td>64.1 (47.6-80.6)</td>
</tr>
<tr>
<td>and cirrhosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other liver diseases</td>
<td>31 (2.4)</td>
<td>34.3 (22.4-46.3)</td>
</tr>
<tr>
<td>HIV</td>
<td>76 (5.8)</td>
<td>84.0 (65.1-102.9)</td>
</tr>
<tr>
<td>Ill-defined conditions</td>
<td>41 (3.1)</td>
<td>45.3 (31.5-59.2)</td>
</tr>
<tr>
<td>Suicide</td>
<td>36 (2.8)</td>
<td>39.8 (26.8-52.8)</td>
</tr>
<tr>
<td>Transport accident</td>
<td>26 (2.0)</td>
<td>28.7 (17.7-39.8)</td>
</tr>
<tr>
<td>Pediatric injured</td>
<td>15 (1.2)</td>
<td>16.6 (8.2-25.0)</td>
</tr>
<tr>
<td>in transport accident</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>25 (1.9)</td>
<td>27.6 (16.8-38.5)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>24 (1.8)</td>
<td>26.5 (15.9-37.1)</td>
</tr>
<tr>
<td>Other accidents</td>
<td>23 (1.8)</td>
<td>25.4 (15.0-35.8)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>22 (1.7)</td>
<td>24.3 (14.2-34.5)</td>
</tr>
<tr>
<td>Homicide</td>
<td>21 (1.6)</td>
<td>23.2 (13.3-33.1)</td>
</tr>
<tr>
<td>Nephritis, nephrotic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>syndrome, and nephrosis</td>
<td>21 (1.6)</td>
<td>23.2 (13.3-33.1)</td>
</tr>
<tr>
<td>Events of undetermined intent</td>
<td>21 (1.6)</td>
<td>23.2 (13.3-33.1)</td>
</tr>
<tr>
<td>Chronic lower respiratory diseases</td>
<td>20 (1.5)</td>
<td>22.1 (12.4-31.8)</td>
</tr>
<tr>
<td>Viral hepatitis</td>
<td>18 (1.4)</td>
<td>19.9 (10.7-29.1)</td>
</tr>
<tr>
<td>Anoxic brain injury</td>
<td>12 (0.9)</td>
<td>13.3 (5.8-20.8)</td>
</tr>
<tr>
<td>Influenza and pneumonia</td>
<td>11 (0.8)</td>
<td>12.2 (5.0-19.3)</td>
</tr>
<tr>
<td>Metabolic disorders</td>
<td>8 (0.6)</td>
<td>8.8 (3.8-17.4)</td>
</tr>
<tr>
<td>Alcohol poisoning</td>
<td>6 (0.5)</td>
<td>6.6 (2.4-14.4)</td>
</tr>
<tr>
<td>All other causes</td>
<td>75 (5.8)</td>
<td>82.9 (64.2-101.7)</td>
</tr>
</tbody>
</table>

Abbreviation: HIV, human immunodeficiency virus.

*CAuses of death are based on the International Statistical Classification of Diseases, 10th Revision (ICD-10). See the eTable (http://www.jamacontentmed.com) for the ICD-10 codes used to define each cause of death.

To assess for racial differences in mortality, we compared the age-standardized all-cause mortality rates for white, black, and Hispanic adults, stratified by sex. We used SAS statistical software (version 9.3; SAS Institute Inc) and Microsoft Excel 2003 (Microsoft Corp) to conduct our analyses.

To gauge the potential impact of this clinical expansion, we distinguished between natural and external causes of death (eTable) because the former may be more responsive to traditional medical interventions. Since causes of death were classified according to ICD-9 codes in the 1988-1993 cohort and ICD-10 codes in the 2003-2008 cohort, we applied comparability ratios (CRs) (eTable) using methods outlined by the NCHS. We used SAS statistical software (version 9.3; SAS Institute Inc) and Microsoft Excel 2003 (Microsoft Corp) to conduct our analyses.

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RESULTS

A total of 28,033 adults were followed for a median of 3.3 years, yielding 90,450 person-years of observation. The mean age at cohort entry was 41 years (Table 1). In comparison with the 1988-1993 cohort, individuals 45 years or older comprised a greater proportion of observation time (45% vs 29%). Two-thirds of participants were male, and 42.5% were white.
Cancer and heart disease were also major causes of death, each accounting for about 16% of deaths (Table 2). Malignant neoplasms of the trachea, bronchus, and lung comprised over one-third of all cancer deaths. Psychoactive substance use disorders caused nearly 8% of all deaths, and 72% of these were attributable to alcohol.

MORTALITY RATE RATIOS BY AGE AND SEX

Drug overdose was the leading cause of death among 25- to 44-year-old homeless men and women, accounting for 35% of deaths at rates 16- to 24-fold higher than those in the Massachusetts general population (Table 3). All-cause mortality rates for men and women in this age group were 8.6- and 9.6-fold higher than in the general population, respectively.

Cancer and heart disease were the leading causes of death among 45- to 64-year-old homeless adults, and the mortality rates for these causes were about 2- and 3-fold higher than in the general population, respectively. All-cause mortality rates in this age group were 4.5- and 5.5-fold higher than in the general population. Among 65- to 84-year-olds, overall and cause-specific mortality rates generally were not significantly different than in comparably aged adults in Massachusetts.

COMPARISON WITH 1988-1993 COHORT

The age-, sex-, and race-standardized mortality rate among 18- to 64-year-old adults in the current study was not significantly different than in the 1988-1993 BHCHP cohort (Figure 1). However, there were significant differences with respect to specific causes of death. A 3-fold increase in drug overdose deaths and a 2-fold increase in suicide deaths contributed to an 83% higher rate of deaths due to external causes in comparison with the 1988-1993 cohort. Despite a 2-fold increase in deaths due to psychoactive substance use disorders, significant reductions in deaths due to HIV and cirrhosis contributed to a 15% overall decrease in natural causes of death.

RACIAL VARIATIONS IN MORTALITY

White men had a significantly higher age-standardized mortality rate than black men (rate ratio [RR], 1.94 [95% CI, 1.66-2.28]) and Hispanic men (RR, 1.80 [95% CI, 1.47-2.21]). The age-standardized mortality rate in white women was substantially higher than in Hispanic women (RR, 3.81 [95% CI, 2.19-6.61]) and marginally higher than in black women (RR, 1.31 [95% CI, 0.99-1.74]). Figure 2 juxtaposes these rates with those expected in the Massachusetts general population if it had the same age distribution as the homeless cohort.

COMMENT

Drug overdose was the leading cause of death in this cohort of currently and formerly homeless adults, occurring at substantially higher rates than in the Massachusetts general population. Despite comprising only 0.3% of the state’s adult population, the study cohort accounted for 5% of all drug overdose deaths among Massachusetts adults in 2003 to 2008. Opioids contributed to over 80% of these deaths. Cancer and heart disease were the leading causes of death.
among adults 45 years or older. In comparison with the general population, the greatest disparities in all-cause mortality occurred in the younger age groups.

There was no significant difference between the all-cause mortality rate in the 2003-2008 cohort compared with the 1988-1993 cohort. A 15% reduction in deaths owing to natural causes was offset by an 83% increase in deaths due to external causes. Although HIV-related deaths decreased considerably, we found a 3-fold increase in drug overdose deaths and 2-fold increases in deaths due to suicide and psychoactive substance use disorders.

Similar to findings in prior studies, we found significantly higher mortality rates among white homeless adults in comparison with other racial groups, which differs from the pattern in the general population. This may reflect underlying racial differences in the pathways to homelessness. Evidence suggests that African Americans are more likely to be homeless because of structural factors, such as discrimination and poverty, while homelessness among whites is more heavily linked to personal factors such as mental illness, trauma, family dysfunction, and substance abuse, placing these individuals at higher risk of death. This is supported by the finding that whites accounted for a particularly disproportionate percentage of deaths due to drug overdose (68%), substance use disorders (68%), and suicide (89%).

Our findings have implications for policymakers, public health professionals, and clinicians serving this population. The overall mortality pattern of homeless adults in this study demonstrates the substantial impact of substance abuse and mental illness, highlighting the need for integrated systems of care to address these complex issues. Interval increases in deaths due to drug overdose, psychoactive substance use disorders, and suicide suggest that chemical dependency counselors, psychiatrists, and other behavioral health specialists should be collocated with primary care practitioners serving this population. The dramatic rise in drug overdose deaths reflects a broader nationwide trend in drug poisoning mortality fueled largely by rising opioid-related deaths. Such deaths are fundamentally preventable. The bulk of opioid overdoses were due to nonheroin substances, including opioid analogs and other narcotics. Given the high prevalence of both chronic pain and addiction in homeless persons, health care organizations serving this population may wish to develop standardized pain management protocols to help ensure safe, effective, and appropriate opioid prescribing. Efforts to curb prescription drug diversion should remain a national policy priority. Public health initiatives aiming to prevent and reverse opioid overdoses through education and the distribution of intranasal naloxone may also help reduce these deaths. In addition to methadone maintenance programs, office-based buprenorphine treatment seems to be feasible in the setting of homelessness and may be an effective option for addressing opioid dependence in this population.

The impact of alcohol and tobacco use is also apparent. Alcohol was the principal substance implicated in 72% of deaths owing to psychoactive substance use disorders and was a co-occurring substance in one-third of drug overdose deaths. The preponderance of deaths due to heart disease and cancer, particularly neoplasms of the trachea, bronchus, and lung, suggests a pressing need to address the 73% prevalence of cigarette smoking among homeless adults.
address the social determinants of health through policy interventions that target the health issues of an aging homeless population. From 1988 to 2008, BHCHP substantially expanded the scope of its clinical services in greater Boston. While causality cannot be determined, this expansion may partially explain the interim reduction in natural causes of death that may be more amenable to medical interventions than external causes. However, the lack of change in all-cause mortality is consistent with the fact that multiple factors other than health care influence population health. Addressing the substantial mortality disparities in homeless populations will require not only clinical innovation and tailored health care services, but also creative public health programming combined with policy initiatives to address homelessness and other social determinants of health.

This study has certain limitations. We focused on adults who used Health Care for the Homeless clinical services in Boston. Our findings may not be generalizable to homeless individuals who avoid such services or to homeless adults in other cities. Our study included both currently and formerly homeless adults, which likely exerted a conservative bias on our findings since individuals who have exited homelessness may have lower mortality rates. Finally, the accuracy of death certificates in identifying cause of death has been debated. Death certificates have poor sensitivity but high specificity for identifying drug poisoning deaths, implying a low likelihood for "false-positive" drug overdose deaths in our study. Death certificates also seem to be relatively accurate in identifying cancer deaths, the second most common cause of death in this study. Furthermore, decedents in this study underwent autopsy at a 6-fold higher rate than decedents in the Massachusetts general population, providing some reassurance that the cause of death information is not less accurate, and may be more accurate, than for nonhomeless individuals.

In conclusion, drug overdose has replaced HIV as the emerging epidemic among homeless adults. While mortality rates due to certain causes have decreased in comparison with rates 15 years prior, we found substantial increases in addiction-related and mental health–related mortality rates among homeless adults, resulting in no overall change in mortality despite a major expansion in clinical services for this population. Findings suggest the need to integrate psychiatric and substance abuse services into primary medical care and to expand public health efforts to curb the growing problem of opioid-related deaths. The mortality disparity between homeless individuals and the general population, particularly among those who are youngest, underscores the need to address the social determinants of health through policy initiatives to eradicate homelessness.

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Author Contributions: Travis Baggett had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Baggett, Hwang, and O’Connell. Acquisition of data: Baggett, Hwang, and Stringfellow. Analysis and interpretation of data: Baggett, Hwang, O’Connell, Porneala, Orav, Singer, and Rigotti. Drafting of the manuscript: Baggett. Critical revision of the manuscript for important intellectual content: Baggett, Hwang, O’Connell, Porneala, Stringfellow, Orav, Singer, and Rigotti. Statistical analysis: Baggett, Hwang, Porneala, and Orav. Obtained funding: Baggett and O’Connell. Administrative, technical, and material support: Baggett, Hwang, O’Connell, Stringfellow, and Singer. Study supervision: Baggett, O’Connell, and Rigotti.

Conflict of Interest Disclosures: Drs Baggett and O’Connell are staff physicians at BHCHP, where they receive financial compensation for rendering patient care services. At the time of the study, Ms Stringfellow was employed by BHCHP as a research coordinator.

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Previous Presentations: A preliminary summary of a portion of the study findings was presented at the 34th Annual Meeting of the Society of General Internal Medicine; May 6, 2011; Phoenix, Arizona. An updated summary of the study findings was presented at the National Health Care for the Homeless Council Annual Conference and Policy Symposium; May 16, 2012; Kansas City, Missouri.

Online-Only Material: The eTable is available at http://www.jamainternalmed.com.

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REFERENCES

Helping America’s Homeless: Emergency Shelter or Affordable Housing? Wash-
2. US Department of Housing and Urban Development. Office of Community Plan-
ning and Development. 2010 Annual Homeless Assessment Report to Congress.
cessed February 29, 2012.
3. Burt MR. Urban Institute. Homelessness: Programs and the People They Serve:
Findings of the National Survey of Homeless Assistance Providers and Clients:
ment, Office of Policy Development and Research; 1999.
5. Wright JD. The health of homeless people: evidence from the national health care
for the homeless program. In: Brickner PW, Scharer LK, Conanan B, Savarese
M, Scanlan BC, eds. Under the Safety Net: The Health and Social Welfare of the
7. Hwang SW, Drav EJ, O’Connell JJ, Lebow JM, Brennan TA. Causes of death in
8. Barrow SM, Herman DB, Córdova P, Streunen EL. Mortality among homeless
10. Cheung AM, Hwang SW. Risk of death among homeless women: a cohort study
11. Hwang SW, Wilkins R, Tjepkema M, O’Campo PJ, Dunn JR. Mortality among
residents of shelters, rooming houses, and hotels in Canada: 11-year follow-up
12. Kasprow WJ, Rosenheck R. Mortality among homeless and nonhomeless men
14. Nielsen SF, Højthøj CR, Erlangsen A, Nordentoft M. Psychiatric disorders and
mortality among people in homeless shelters in Denmark: a nationwide register-
15. Morrison DS. Homelessness as an independent risk factor for mortality, results
17. Breiding MJ, Wiersema B. Variability of undetermined manner of death classi-
18. Donaldson AE, Larsen GY, Fullerton-Gleason L, Olson LM. Classifying undeter-
19. Anderson RN, Minnifo AM, Fingerhut LA, Warner M, Heinen MA. Deaths: inju-
pincott; 1998.
22. Centers for Disease Control and Prevention, National Center for Health Statistics.
Compressed Mortality File, 1999-2008. CDC WONDER Online Database, com-
23. Kochanek K, Smith B, Anderson RN. Deaths: Preliminary Data for 1999: Na-
tional Vital Statistics Reports. Vol. 49, No. 3. Hyattsville, MD: National Center
24. Anderson RN, Minnifo AM, Hoyert DL, Rosenberg HM. Comparability of cause of
49(2):1-32.
ICD-10 for Mortality, Part II: Applying Comparability Ratios. Atlanta, GA: Cen-
ters for Disease Control and Prevention, National Center for Health Statistics;
2000.
27. North CS, Smith EM. Comparison of white and nonwhite homeless men and women.
October 29-30, 1998; Arlington, VA.
29. Warner M, Chen L, Makuc D, Anderson RN, Minnino AM. Drug Poisoning Deaths in
the United States, 1980-2008. NCHS Data Brief, No. 81. Hyattsville, MD: Na-
tional Center for Health Statistics; 2011.
30. Paulozzi LJ, Budnitz DS, Xi Y. Increasing deaths from opioid analgesics in the
31. 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;17(10):
997-1005.
32. Hwang SW, Wilkins E, Chambers C, Estrabolio E, Berendes J, MacDonald A.
Chronic pain among homeless persons: characteristics, treatment, and barriers
to management. BMC Fam Pract 2011;12:73.
33. Centers for Disease Control and Prevention (CDC). Community-based opioid over-
dose prevention programs providing naloxone, United States, 2010. MMWR Morb
34. Patrick-Murray Administration Announces New Milestone in Fight Against Opiate
Overdose Deaths in Massachusetts. 1000th opioid overdose reversal due to inno-
35. Alford DP, LaBelle CT, Richardson JM, et al. Treating homeless opioid dependent
patients with buprenorphine in an office-based setting. J Gen Intern Med 2007;
36. Baggett TP, Rigotti NA. Cigarette smoking and advice to quit in a national sample
2010.10.023.1024.
37. Hahn JA, Kusel MB, Bangsberg DR, Riley E, Moss AR. Brief report: the aging of
the homeless population: fourteen-year trends in San Francisco. J Gen Intern Med
2006;21(7):775-778.
1099-1104.
39. Ravakhab K. Death certificates are not reliable: revivification of the autopsy. South
40. Moyer LA, Boyle CA, Pollock DA. Validity of death certificates for injury-related
41. Kircher T, Nelson J, Burdo H. The autopsy as a measure of accuracy of the death
The accuracy of cancer mortality statistics based on death certificates in the United