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Mortality Among Homeless Older Adults: Findings from the HOPE HOME Prospective Cohort Study

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KEY POINTS

Question: What are the factors associated with mortality among adults aged 50 and older experiencing homelessness?

Findings: In this cohort study of 450 homeless adults aged 50 and older, 26% died over a median follow-up of 55 months, with a median age at death of 64.6 years. Factors associated with death included a first episode of homelessness in late-life and homelessness or institutionalization at any follow-up, compared to being housed.

Meaning: Factors associated with mortality among homeless older adults include late-life homelessness and ongoing homelessness, pointing to the urgent need for policy approaches to prevent and end homelessness among older Americans.

ABSTRACT

Importance: The population of homeless older adults is growing and experiences premature mortality. Little is known about factors associated with mortality among homeless older adults.

Objective: To identify the prevalence and factors associated with mortality in a cohort of homeless adults aged 50 and older.

Design: Prospective cohort study, the Health Outcomes in People Experiencing Homelessness in Older Middle agE (HOPE HOME) study. We recruited participants in two cohorts, from July 2013 to June 2014 and August 2017 to July 2018, and interviewed participants at 6-month intervals.

Setting: Oakland, California.

Participants: Four hundred and fifty adults aged 50 and older who were homeless at baseline, recruited via venue-based sampling.

Exposures: Baseline and time-varying characteristics including sociodemographic factors, social support, housing status, incarceration history, chronic medical conditions, substance use, and mental health problems.

Main Outcomes and Measures: Mortality through December 31, 2021, based on state and local vital records information from contacts and death certificates. We compared all-cause mortality rates to those in the general population from 2014-2019 using age-specific standardized mortality ratios with 95% confidence intervals.

Results: Median age at baseline was 58.1 years (IQR, 54.5-61.6), 24% were

women, and 80% were Black. Over a median follow-up of 55 months (IQR, 38-93 months), 26% of participants died. Median age at death was 64.6 years (IQR, 60.3-67.5 years). In multivariable analyses, characteristics associated with mortality included a first episode of homelessness at age 50 and older (adjusted hazard ratio [AHR], 1.62, 95% CI, 1.13-2.32); homelessness (AHR 1.82, 95% CI, 1.23-2.68) or institutionalization (AHR 6.36, 95% CI, 3.42-11.82) at any follow-up, compared to being housed; fair or poor self-rated health (AHR, 1.64, 95% CI, 1.13-2.40); and diabetes (AHR, 1.55, 95% CI, 1.06-2.26). Demographic characteristics, substance use problems, and mental health problems were not independently associated. All-cause standardized mortality was 3.5 times higher (95% CI, 2.5-4.4) compared to adults in Oakland. The most common causes of death were heart disease (14.5%), cancer (14.5%), and drug overdose (12.0%).

Conclusions and Relevance: Premature mortality is common among homeless older adults and associated factors include late-life homelessness and ongoing homelessness. There is an urgent need for policy approaches to prevent and end homelessness among older Americans.

INTRODUCTION

The median age of the homeless population is increasing. Over one-third of single homeless adults are aged 50 and older, compared to 11% in 1990.[1,2] Homeless people experience accelerated aging, including premature onset of chronic medical conditions, functional and cognitive impairments, and mortality.[3-7] A growing literature among other historically marginalized populations (e.g., persons with severe mental illness, racial/ethnic minorities) shows that adverse life course exposures (e.g., discrimination, adverse childhood experiences) are associated with premature aging and mortality.[8,9] People experiencing homelessness have these negative experiences, along with a high prevalence of comorbidities and behaviors associated with premature mortality.[4,10] Experiences while homeless (e.g., exposures, stress, limited healthcare access) may contribute directly to premature mortality.[4,11] Little is known about how life course and time-varying exposures and co-occurring conditions impact mortality risk among homeless older adults.

Few prior studies have examined factors associated with mortality in homeless persons; those that have are retrospective and rely on medical records.[12,13] These studies include only individuals who engage with care; they lack standardized assessments of life course or time-varying factors, including housing status. A recent cross-sectional study examined trends in mortality among homeless persons in San Francisco before vs. during the COVID-19 pandemic but did not examine factors associated with mortality.[14] Understanding how time-varying factors impact mortality risk in homeless

older adults is necessary to identify high-risk individuals, inform interventions to prevent premature mortality, and target resources.

In a prospective cohort study of adults aged 50 and older who were homeless at study entry, we examined the prevalence, associated factors, and causes of mortality. We also compared mortality rates to those of the general population.

METHODS

Design overview

We conducted a prospective cohort study of 450 homeless adults aged 50 and older recruited via venue-based sampling in Oakland, California (Health Outcomes in People Experiencing Homelessness in Older Middle agE [HOPE HOME]). We interviewed participants at baseline and every 6 months. The institutional review board of the University of California, San Francisco, approved the study. We followed the STROBE Reporting Guidelines for cohort studies.[15]

Sample and recruitment

We sampled homeless persons using a purposive venue-based approach to approximate the source population.[4,16] Sampling locations included low-cost meal programs and overnight shelters, a recycling center, and places where unsheltered people stayed. We set recruitment goals for each location based on estimates of the number of unique persons who visited a site or were unsheltered annually. We invited individuals who met a brief eligibility screen to participate in an enrollment interview.

Enrollment occurred in two phases: 350 participants enrolled from July 2013-June 2014 and 100 participants from August 2017-June 2018. Study staff conducted interviews at non-profit community-based organizations in Oakland. A Community Advisory Board guided all study protocols. Eligibility criteria included age 50 and older for the initial cohort and 53 and older for

the second; English-speaking; current homelessness based on the Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act, defined as lacking a regular nighttime residence (including staying in emergency shelter or a place not meant for human habitation) or staying temporarily in an institution, losing housing within 14 days, or fleeing interpersonal violence, all without another place to stay;[17] and ability to provide informed consent. We excluded non-English speakers because during the recruitment periods, few non-English speakers were homeless and aged 50 and older in Oakland. Participants provided written informed consent.

We conducted follow-up interviews every 6 months, for a maximum of 96 months for the first cohort and 48 months for the second. Participants remained in the study regardless of housing status. We interviewed participants at a community-based field site, or, if the participant preferred, where they were staying (e.g., encampment, home). To maximize follow-up, we collected detailed contact information at baseline and conducted monthly check-ins by telephone or in-person. Participants gave permission for us to contact emergency contacts if they missed two check-ins. Participants received $25 incentives for enrollment interviews, $20 for six-month follow-ups, and $5 for monthly check-ins.

Measures

Mortality

The primary outcome was mortality, assessed through December 31, 2021. To limit missed outcomes, we used multiple methods to assess mortality. We queried local vital statistics offices quarterly for participants who missed check-ins who we could not otherwise confirm were alive; we contacted local coroner's offices to review unidentified deaths using photos. We received annual California state death records and matched participants using names and birthdates. We queried emergency contacts and searched social media and on-line obituaries. We requested death records for suspected deaths. Vital records departments in some states require that a relative or legal surrogate request death certificates; for individuals who died in these states (n=3), we used date of death provided by emergency contacts or other sources. We used information from death certificates to classify causes of death using International Classification of Diseases, 10th Edition Revision underlying cause of death codes.[18] We defined drug overdoses as drug poisoning deaths that were unintentional or of undetermined intent.[5]

Other Measures

We assessed measures at baseline or each 6-month follow-up (time-varying).

Baseline Measures

We assessed sociodemographics, housing, substance use, mental

health problems, and incarceration. Sociodemographics included self-reported age, gender, race/ethnicity (Black, Latino, multiracial/other, white), marital/partner status, highest level of education, and usual occupation.[19] Participants reported their age when they first experienced adult homelessness, defined as experiencing homelessness for ≥1 night at age 18 or older.

We assessed alcohol and drug use during four life-course periods (<18 years, 18-25, 26-49, ≥50).[20,21] We defined a history of regular alcohol and drug use as drinking to get drunk ≥3 times weekly and using drugs (cocaine, amphetamines, or opioids) ≥3 times weekly.[20]

We adapted the lifetime mental health measures from the Addiction Severity Index[20] to ask if participants had experienced the following problems and at what age they first occurred: serious anxiety, depression, difficulty controlling violent behavior, or hallucinations unrelated to substance use; suicide attempt; or prescription of medication for psychiatric problems.[20] Participants reported if they had been hospitalized for mental health problems and whether they had served time in prison or jail.

Time-Varying Measures

Time-varying measures included housing, social support, health status, and incarceration. We assessed housing using a follow-back residential calendar, asking participants to report where they stayed each night during the prior six months.[22] For participants who missed an interview, we

determined housing status using information from contacts and other sources. We categorized housing based on the participant's location on the interview date, as homeless (HEARTH criteria); housed (e.g., apartment, transitional housing, medical facility); or staying in an institution (skilled nursing facility [SNF] or ≥3 months in jail/prison). Participants reported number of close confidants, defined as anyone in whom they could confide (0, 1-5, ≥6).[23]

We assessed self-rated health (fair or poor versus good, very good, or excellent). Participants reported if a healthcare provider had ever told them they had hypertension, cardiac disease, congestive heart failure, stroke or transient ischemic attack, diabetes, chronic lung disease, liver disease, kidney disease, HIV/AIDS, and cancer; we assessed new diagnoses at each follow-up.[24] We calculated body mass index using measured height and weight. Participants reported if they had difficulty performing activities of daily living (ADLs; bathing, dressing, eating, transferring, toileting)[25] and instrumental ADLs (taking transportation, managing medications, managing money, applying for benefits, setting up a job interview, finding a lawyer);[26] we defined impairment as reporting difficulty with ≥1 task. We administered the Modified Mini-Mental State Examination and defined cognitive impairment as a score <7th percentile (1.5 standard deviations below a reference cohort mean) or inability to complete the assessment.[27] Participants reported any falls in the prior 6 months. We administered the Short Physical Performance Battery and defined reduced performance as a

score ≤10 (range, 0-12).[28]

We assessed self-reported binge drinking, defined as drinking ≥6 alcoholic beverages on one occasion monthly or more often[29] and problematic drug use, defined as a WHO Alcohol, Smoking, and Substance Involvement Screening Test score ≥4 for cocaine, amphetamines, or opioids (range, 0-39).[30] We assessed smoking (current, former, never).[31]

We assessed mental health problems using the Addiction Severity Index.[20] Participants reported if they had a psychiatric hospitalization during the prior 6 months.

Statistical Analyses

We used descriptive statistics to analyze participant characteristics and causes of death. To examine associations of candidate factors with mortality, we used Cox regression models. Factors included variables associated with mortality in the general population and those prevalent in homeless populations that we hypothesized could be associated with mortality (Table 1). We obtained values of time-varying covariates from the visit at the beginning of each interval. We imputed time-varying measures for missed visits by carrying forward the last observation. For decedents, we carried forward measures to month of death. Of 4142 visits in the analysis, we carried forward data for 445 (10.7%). For surviving participants, we censored follow-up 12 months after the last interview to reduce potential misclassification and bias. We estimated our multivariable model using an

iterative process employing backward selection in which all variables with bivariate type III p-values <0.20 were entered and removed one at a time. The final parsimonious model included variables with a p-value <0.05 after adjustment. We verified that hazards were proportional for time-varying covariates by testing the interaction of visit time with each covariate and using episode splitting techniques. We analyzed Schoenfeld residuals to assess the proportionality assumption and evaluated goodness-of-fit using the likelihood ratio test.

For common causes of death, we examined whether each diagnosis had been previously reported. We compared death rate over 4-year follow-up among participants enrolled before February 28, 2016 to that in Oakland by calculating standardized mortality ratios (SMRs). We used 4-year follow-up to avoid calculating SMRs after onset of the pandemic. In sensitivity analyses, we examined deaths over 2-year and 3-year follow-up. For groups cross-defined by age group (45-54, 55-64, 65-74, 75-84) and sex, we calculated the 1-year mortality rate in Oakland. We defined this rate as number of observed deaths (obtained from California Department of Public Health annual mortality data for 2016-2020) divided by estimated population size (5-year American Community Survey for 2019).[32] We extrapolated this 1-year rate to the analytic window of interest and multiplied by the number of at-risk participants to obtain the expected number of deaths. We summed expected numbers across age groups, obtaining sex-specific expected death counts. Finally, we divided sex-specific observed death counts in HOPE HOME

by sex-specific expected death counts. We conducted analyses using SAS

version 9.4 (SAS Institute) and Stata version 17 (StataCorp).

RESULTS

Participant characteristics

Median age at baseline was 58.1 years (interquartile range [IQR], 54.5-61.6), 24% were women, and 80% were Black (Table 1). Median follow-up time through December 31, 2021 or date of death was 55 months for the overall cohort (IQR, 38-93); median follow-up times for the cohorts enrolled in 2013-2014 and 2017-2018 were 80 months (IQR, 47-95) and 45 months (IQR, 26-49), respectively.

Twenty-six percent of participants (n=117) died through December 31, 2021. One-hundred one deaths occurred among the 350 participants enrolled in 2013-2014 and 16 among the 100 enrolled in 2017-2018. Ninety-three deaths occurred among men and 24 among women. Forty-five deaths occurred after March 2020. Median age at death was 64.6 years (IQR, 60.3-67.5; Figure 1).

Association of participant characteristics with mortality

In multivariable analyses, increased risk of mortality was associated with first homelessness at age 50 and older (AHR, 1.62, 95% CI, 1.13-2.32) and homelessness (AHR 1.82, 95% CI, 1.23-2.68) or institutionalization (AHR 6.36, 95% CI, 3.42-11.82) at any follow-up, compared to being housed (Table 2). Similarly, fair or poor self-rated health (AHR, 1.64, 95% CI, 1.13-2.40) and diabetes (AHR, 1.55, 95% CI, 1.06-2.26) were associated with mortality.

Causes of death

We obtained death certificates for 104 of 117 decedents (88.9%). The most common causes of death were heart disease (14.5%), cancer (14.5%), and drug overdose (12.0%; Table 3). Chronic lower respiratory diseases comprised 9.4% and chronic liver disease 6.8%. Of participants with cancer as a primary cause of death, 41.2% had previously reported a diagnosis of cancer; the percentages for heart disease and liver disease were 29.4% and 37.5%. Of 46 participants who died after March 2020, three had SARS-COV-2 as a cause of death.

Standardized Mortality Ratios

Among participants enrolled in 2013-2014, the age-standardized SMR over 4-year follow-up was 3.5-fold higher than the general population (95% CI, 2.5-4.4; Table 4). Mortality rates for men were 3.1-fold higher (95% CI, 2.1-4.2); those for women were 5.2-fold higher (95% CI, 2.1-8.2). Sensitivity analyses using varying follow-up periods showed similar results (eTable).

DISCUSSION

In this population-based cohort study among homeless older adults, premature mortality was common, with an all-cause mortality rate 3.5-fold higher than the general population. The most common causes of death were heart disease, cancer, and drug overdose. Factors associated with mortality included late-life homelessness, ongoing homelessness or institutionalization, and self-rated fair or poor health.

Our findings confirm and extend prior work showing that homeless populations experience disparities in mortality. The average age of death among homeless adults is 42-52 years.[11] In a retrospective cohort study of adults who received care at a homeless healthcare organization, mortality rates in individuals ages 25-44 were 9-fold higher than the general population, while those in individuals ages 45-64 were 4.5-fold higher.[5,6] Other U.S.[6,33] and international studies show similar findings.[34] Despite differences in study design, we identified a similar mortality ratio.

Most prior studies include people who access homeless healthcare and use medical records to identify factors associated with mortality retrospectively.[12,13] These studies define homelessness at one point in time, without accounting for its dynamic nature. We found that many participants regained housing and that remaining homeless was associated with mortality. Staying in an institution was associated with increased risk, although this may reflect reverse causality: limited end-of-life options for persons experiencing homelessness may lead to reliance on SNFs to provide

end-of-life care. Self-reported fair or poor health was associated with mortality, suggesting that self-report provides valuable prognostic information. Diabetes was associated, consistent with prior research.[13]

Those with first homelessness at age 50 and older had elevated mortality risk compared to those with earlier homelessness. Several factors may explain this. First, people aged 50 and older with earlier homelessness have survived a period of homelessness. Newly-homeless individuals may not have access to resources, or resilience, from prior lived experiences of homelessness. Second, late-life homelessness may represent a "health shock" that leads to worse control of chronic conditions, precipitating health decline and premature mortality. Third, illness may be on the pathway to late-life homelessness. Individuals with late-life homelessness are more likely to have a crisis leading to homelessness; serious illness is a common precipitant.[21] In these cases, illness leads to job loss, eviction, and homelessness. Illness may then lead to death while homeless.

The most common causes of death were heart disease, cancer, and drug overdose, consistent with prior research.[5] Relatively few participants reported diagnoses of cancer, heart disease, and liver disease before dying from these conditions. This may reflect difficulties accessing healthcare while homeless, leading to delayed diagnosis and a short lag time between diagnosis and death. For heart disease, this discrepancy may reflect its overreporting as a cause of death.[35]

Although the pace of deaths accelerated during the pandemic, only

three participants died of SARS-COV-2. SARS-COV-2 spread rapidly in homeless shelters.[36] However, most participants experiencing homelessness during the pandemic stayed in unsheltered settings or non-congregate "shelter-in-place" hotels, where SARS-COV-2 spread was rare.[36] The higher mortality during the pandemic may reflect the impact of disruptions in health care, drug supply, and access to substance use treatment, plus cohort aging.

The high proportion of Black participants reflects the 3-4-fold elevated risk of homelessness among Black Americans, due to effects of structural racism in housing, employment, education, and criminal justice systems.[37] Homelessness may be one of many mediators between structural racism and elevated mortality risk among Black Americans.

Our findings underscore the need to recognize the elevated mortality risk in homeless older adults and deliver interventions to prevent and end homelessness. Older adults face the highest risk of severe rent burden in the U.S. and a high risk of homelessness.[38] Preventing homelessness for this population is key, given the increased mortality risk associated with late-life homelessness. For those with longstanding homelessness, studies support the use of permanent supportive housing (PSH). PSH is subsidized housing associated with voluntary supportive services and offered on a Housing First basis, without preconditions (e.g., sobriety, engagement in care).[39] PSH is highly effective at maintaining housing among those with chronic homelessness,[40] although efforts are needed to adapt PSH to meet older adults' needs.[4] For those with new-onset homelessness, housing subsidies

and navigation services can be deployed. While people remain homeless, risk can be mitigated through outreach and tailored medical care. The high risk of death from chronic disease highlights the need for end-of-life care tailored to the needs of homeless-experienced adults.[41]

Our study has several limitations. We may have underestimated out-of-state deaths. We were unable to obtain death certificates for thirteen individuals, including three who died in states requiring that a legal surrogate request certificates. Given the relatively small number of deaths, we may have lacked power to detect some factors associated with mortality. We sampled from a city with a larger-than-average Black population; 26% of the Oakland population is Black, compared to 12.4% nationally.[42] Nearly 80% of our cohort was Black, approximately 3 times that in Oakland. This over-representation is comparable to other large cities.[43] The interval between the last interview and month of death varied, which could result in misclassification and bias for time-varying variables. However, health status is unlikely to change over short time periods.[44] We categorized prolonged jail/prison stays as an institutional setting with SNF stays, which may not be comparable. However, prolonged incarcerations were rare (n=2) and results were similar when we classified these separately. We did not adjust SMRs for race, because homelessness is likely on the causal pathway for elevated mortality among Black Americans.

CONCLUSIONS

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We found that premature mortality was common among homeless older adults and that late-life homelessness and ongoing homelessness are key prognostic factors. These findings point to the urgent need for policy approaches to prevent and end homelessness among older Americans.

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FIGURE LEGENDS

Figure 1. Age at Time of Death Among 117 Homeless Adults Aged 50 and Older

The figure shows the number of participants who died in each 5-year age band from age 50 to 79.

Table 1. Baseline Characteristics of 450 Homeless Adults Aged 50 and Older

Characteristics	Participants, No. (%)		
	All (n=450)	Died (n=117)	Did not die (n=335)
Sociodemographics, No. (%) unless noted otherwise			
Age, median (IQR)	58.1 (54.5-61.6)	60.0 (55.5-63.8)	57.5 (54.1-61.0)
Man (Cis)	338 (75)	92 (79)	246 (74)
Woman (Cis)	107 (24)	24 (21)	83 (25)
Transgender	4 (1)	0 (0)	4 (1)
Black	359 (80)	91 (78)	268 (80)
Married/partnered	48 (14)	9 (11)	39 (15)
Less than high school education or GED	118 (27)	31 (27)	87 (26)
Usual occupation, unskilled laborer	330 (73)	87 (74)	243 (73)
Total years homeless before study entry, mean (SD)	6.8 (8.9)	6.1 (8.6)	7.1 (9.0)
First episode of homelessness at age 50 and older	201 (45)	62 (53)	139 (42)

Lifetime substance use and mental health problems, No. (%)			
Regular drinking, childhood (<18 years)	260 (59)	66 (58)	194 (59)
Regular drinking, adulthood (18-49 years)	188 (42)	52 (44)	136 (41)
Regular drug use, childhood (<18 years)	52 (12)	18 (15)	34 (10)
Regular drug use, adulthood (18-49 years)	262 (58)	69 (59)	193 (58)
Mental health problem, childhood (<18 years)	436 (98)	112 (97)	324 (98)
Mental health problem, young adulthood (18-25 years)	203 (45)	48 (41)	155 (47)
Psychiatric hospitalization, lifetime	91 (34)	23 (32)	68 (34)
Incarcerated in state or federal prison during lifetime	168 (37)	49 (42)	119 (36)
Incarcerated in jail during lifetime	299 (66)	85 (73)	214 (64)
Baseline values of measures collected every 6 months, No. (%)			
No. confidants			
0-5	416 (92)	109 (93)	307 (92)

≥6	34 (8)	8 (7)	26 (8)
Self-rated general health, fair or poor	292 (80)	80 (89)	212 (78)
Hypertension	259 (58)	74 (63)	185 (56)
Cardiac disease	16 (4)	6 (5)	10 (3)
Congestive heart failure	36 (8)	15 (13)	21 (6)
Stroke or transient ischemic attack	54 (12)	22 (19)	32 (10)
Diabetes	70 (16)	30 (26)	40 (12)
Chronic lung disease (asthma or COPD)	328 (73)	86 (74)	242 (73)
Liver disease	103 (23)	36 (31)	67 (20)
Kidney disease	21 (5)	7 (6)	14 (4)
HIV/AIDS	23 (5)	9 (8)	14 (4)
Cancer	32 (7)	11 (9)	21 (6)
Body mass index			
<18	11 (2)	4 (3)	7 (2)
18-24.99	200 (44)	48 (41)	152 (46)
25-29.99	130 (29)	34 (29)	96 (29)

>30	109 (24)	31 (26)	78 (23)
Impairment in activities of daily living	176 (39)	42 (36)	134 (40)
Impairment in instrumental activities of daily living	145 (32)	40 (34)	105 (32)
Cognitive impairment	82 (18)	24 (21)	58 (18)
Falls, past 6 months	146 (33)	42 (36)	104 (31)
Short physical performance battery score <10, %	209 (46)	63 (54)	146 (44)
Binge drinking, past 6 months	98 (22)	27 (23)	71 (21)
Drug use problem	177 (39)	48 (41)	129 (39)
Smoking status			
Current	91 (20)	19 (16)	72 (22)
Former	54 (12)	15 (13)	39 (12)
Never	305 (68)	83 (71)	222 (67)
Depression, past 6 months	180 (67)	40 (61)	140 (69)
Psychiatric hospitalization, past 6 months	19 (22)	5 (23)	14 (21)
Incarcerated in jail, past 6 months	56 (12)	15 (13)	41 (12)

SD, standard deviation; GED, general educational development; COPD, chronic obstructive pulmonary disease; HIV/AIDS, human immunodeficiency virus infection/acquired immune deficiency syndrome.

Percentages may not add to 100% due to rounding.

Table 2. Association of Participant Characteristics with Mortality Among 450 Homeless Adults Aged 50 and Older

Characteristics	Full Model, AHR[a] (95% CI)	Parsimonious Model, AHR[b] (95% CI)
Sociodemographics (baseline unless noted otherwise)		
Age (time-varying)	1.01 (0.98-1.05)	
Not married/partnered (time-varying)	1.49 (0.84-2.64)	
First episode of homelessness at age 50 or older	**1.49 (1.05-2.15)**	**1.62 (1.13-2.32)**
Lifetime substance use		
Regular drug use, childhood (<18 years)	1.49 (0.93-2.38)	
Time-varying characteristics		
Housing status		
Housed	Reference	
Homeless	1.76 (1.20-2.58)	**1.82 (1.23-2.68)**
Staying in skilled nursing facility or jail/prison >3 months	**6.12 (3.44-10.89)**	**6.36 (3.42-11.82)**
Incarcerated in jail	1.82 (1.07 – 3.10)	

Number of confidants		
≥6	Reference	
0-5	1.74 (0.87-3.46)	
Self-rated general health, fair or poor	**1.63 (1.13-2.36)**	**1.64 (1.13-2.40)**
Cardiac disease	1.55 (0.99-2.42)	
Congestive heart failure	1.43 (0.90-2.28)	
Stroke or transient ischemic attack	1.46 (0.96-2.23)	
Diabetes	1.59 (1.10-2.29)	**1.55 (1.06-2.26)**
Cancer	1.26 (0.74-2.16)	
Liver disease	1.73 (1.20-2.50)	
Cognitive impairment	**1.70 (1.11-2.60)**	
Falls, any	1.28 (0.88-1.86)	
Binge drinking	0.60 (0.32-1.13)	
Mental health problems	1.94 (0.76-4.98)	

AHR, adjusted hazard ratio; CI, confidence interval.
[a]Only variables with univariate p-value ≤0.20 were entered in the full model.
[b]Only variables significantly contributing to the fit of the model are retained in the adjusted parsimonious model.

Table 3. Causes of Death in a Cohort of 450 Homeless Adults Aged 50 and Older

Causes of death[a]	Deaths (N=117)
Heart disease, %	17 (14.5)
Cancer, %	17 (14.5)
Liver and intrahepatic bile ducts	4 (3.4)
Trachea, bronchus, and lung	3 (2.6)
Prostate	2 (1.7)
Colon, rectum, and anus	2 (1.7)
Bladder	1 (1.0)
Stomach	1 (1.0)
Non-Hodgkin's lymphoma	1 (1.0)
Multiple myeloma and myeloproliferative disorders	1 (1.0)
Corpus uteri and uterus	1 (1.0)
All other and unspecified malignant neoplasms (leiomyosarcoma)	1 (1.0)
Drug overdose, %	14 (12.0)

Polysubstance[b]	6 (5.1)
Cocaine	3 (2.6)
Amphetamines	3 (2.6)
Opioids	2 (1.7)
Chronic lower respiratory diseases, %	11 (9.4)
Chronic liver disease and cirrhosis, %	8 (6.8)
Cerebrovascular disease, %	7 (6.0)
Accidents, %	6 (5.1)
Pneumonia, %	5 (4.3)
Nephritis, nephrotic syndrome, and nephrosis, %	4 (3.4)
SARS-CoV-2, %	3 (2.6)
Diabetes, %	3 (2.6)
HIV, %	3 (2.6)
Homicide, %	2 (1.7)
Other digestive diseases, %	2 (1.7)
All other diseases (amyloidosis), %	1 (1.0)

Psychoactive substance use disorder, %	1 (1.0)
Missing, %	13 (11.1)

[a]Causes of death based on the International Classification of Diseases - 10th Revision underlying cause of death codes

[b]Of the 6 polysubstance deaths, one was attributed to alcohol and cocaine and one to cocaine and methamphetamine; the causes of the other 4 deaths were not further specified.

Table 4. Age-Standardized Mortality Ratios for All-Cause Deaths by Sex

Deaths by sex and age group	Observed deaths (no.)	Expected deaths (no.)	Standardized mortality ratio (95% CI)[a]
Males			
45-54 years	4	0.93	-
55-64 years	21	7.18	-
65-74 years	11	3.01	-
75-84 years	0	0.36	-
Total	36	11.47	3.1 (2.1-4.2)
Females			
45-54 years	1	0.13	-
55-64 years	5	1.37	-
65-74 years	5	0.51	-
75-84 years	0	0.12	-
Total	11	2.14	5.2 (2.1-8.2)

| Total males and females | 47 | 13.61 | 3.5 (2.5-4.4) |

[a]Deaths calculated based on participants enrolled prior to February 28, 2016 who died over 4-year follow-up.