Research Square

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Factors Associated with Deaths within Income Restricted and Supportive Housing in Denver, Colorado: A Retrospective Cohort Study

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Abstract

People with a history of homelessness remain at elevated mortality risk even after transitioning into housing. This retrospective cohort study examined factors associated with preventable death among adults who died while housed and receiving services between 2022 and 2024 in Denver, Colorado. The primary outcome was cause of death, categorized as preventable (suicide, homicide, or accident) or non-preventable (natural). We performed multivariable logistic regression to estimate associations between preventable death (dependent variable) and demographics, housing program, support service engagement, substance use disorder (SUD), and substance use treatment. We also performed a subgroup analysis of individuals with SUD. Among 255 individuals, the leading causes of death were overdose (28.6%), heart disease (13.4%), and infection (9.4%); 90 (35.3%) died from preventable causes. American Indian and Alaskan Native race (aOR 2.90, 95% CI: 1.09–7.69), other races including multiracial, Native Hawaiian, and Pacific Islander (aOR 4.25, 95% CI: 1.22–14.80), and lack of substance use treatment (aOR 3.14, 95% CI: 1.31–7.54) were associated with increased odds of preventable death. Among individuals with SUD (n = 159), Black/African American race (aOR 3.06, 95% CI: 1.05–8.85), use of crisis intervention and property management services (aOR 5.05, 95% CI: 1.35-19.00), and lack of substance use treatment (aOR 3.63, 95% CI: 1.36–9.71) were associated with preventable death. In conclusion, overdose was the leading cause of death and lack of substance use treatment was associated with increased risk of preventable death. Improving access to substance use treatment may reduce premature mortality among housed individuals with a history of homelessness.

INTRODUCTION

Homelessness in the United States (US) is a major public health problem, affecting more than 740,000 people in 2025.[1] Homelessness results in significant morbidity and mortality due to sustained poverty, suboptimal access to healthcare, poorly controlled chronic disease, and inadequately treated substance use disorders (SUDs) and psychiatric illness.[2–4] Housing, often paired with supportive services, has been shown to effectively end homelessness while improving access to outpatient medical care and reducing overall mortality.[4, 5] However, individuals who transition from homelessness into stable housing continue to have an increased risk for death compared to the general population.[6] While average life expectancy increases from around 42 to 53 years while homeless to 57 years once housed,[6–8] this estimate falls well below the general US population average life expectancy of 78 years.[7] Some of this excess mortality has been attributed to high rates of fatal drug overdose, which has been consistently identified as a leading cause of death among people experiencing homelessness and those who have transitioned into housing.[4, 5, 8–10] Other contributors include high rates of chronic disease, lack of social support, isolation, and lack of preventive care while experiencing homelessness.[6, 10]

Many organizations provide a range of low-barrier housing options for individuals transitioning out of homelessness, such as rental assistance, transitional housing, rapid rehousing, and permanent housing. Housing may be coupled with a variety of supportive services aimed at addressing an individual's needs, including, but not limited to, case management, community-based services (such as job search support

and skill development), and physical and mental health care.[11] Permanent supportive housing (PSH), which pairs permanent housing with embedded, wrap-around supportive services for chronically homelessness individuals, is widely considered the gold standard for individuals with complex needs. However, PSH is not available to all, and many individuals are housed within other affordable or transitional housing with or without embedded (on-site or off-site) supportive services.

Most previous studies examining mortality among housed populations have focused on singular housing types such as PSH or single room occupancy buildings.[4, 6, 9] Examining mortality in a variety of housing types with a range of supportive services, which is reflective of how many housing service providers operate, may inform the development of pragmatic interventions that fit within existing heterogenous housing and service delivery models. As such, we aimed to characterize causes of death and identify factors associated with preventable death in a population of individuals receiving a variety of housing and supportive services through a large integrated housing and health service provider in Denver, Colorado.

METHODS

Study Design and Setting

We performed a retrospective cohort study of formerly homeless individuals who died while housed and receiving services through Colorado Coalition for the Homeless (CCH). CCH is an integrated housing and healthcare provider in the Denver metropolitan area and provides a range of housing including PSH, affordable housing, and transitional housing (Fig. 1).[12] In addition to managing housing properties, CCH provides extensive supportive services and healthcare, including medical, dental, and vision care, behavioral healthcare, home nursing, medication assisted treatment for substance use disorder (SUD), and case management. Services are delivered at housing sites and through a federally qualified health center, satellite clinics, mobile units, and street medicine. All encounters for services are documented within the electronic health record (EHR). In 2024, CCH provided supportive services, housing, and healthcare to over 19,000 individuals.[12] For context, within the Denver metropolitan area, there were approximately 34,500 individuals experiencing homelessness in 2024.[13]This study was reviewed and approved by the Colorado Multiple Institutional Review Board (COMIRB) and is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[14]

Population

The study population was identified through retrospective chart review of formerly homeless adults (18 years or older) who died while housed (either through CCH or a third party) and receiving CCH operated services between January 1, 2022 and October 31, 2024. There was no upper limit on age and no other exclusion criteria. This time period was chosen to exclude individuals who received temporary housing or services that were only available during the Coronavirus Disease 2019 (COVID19) pandemic.

Outcomes

The primary outcome was cause of death, which was subsequently categorized as preventable (defined as suicide, homicide, or accident) or non-preventable (natural). Suicide, homicide, accident, and natural causes of death are the categories used by coroners and medical examiners in the US. We recognize that complications of alcohol use, heart disease, infection, and other natural causes of death could be classified as preventable diseases. However, for the purposes of this study, we chose to categorize only accidents, homicides and suicides as preventable because they are potentially preventable in the short term through direct housing and service staff and programmatic changes. Cause of death was also categorized by disease type including overdose, drowning, traumatic injury, heart disease, infection, complications of alcohol use, malignancy, pulmonary disease, hepatic failure, stroke, and “other” (including complications of diabetes mellitus, hemorrhage, renal disease, and gastrointestinal disease such as bowel perforation, bowel ischemia, and pancreatitis). All causes of death were abstracted from death certificate, autopsy report, or hospital death discharge summary. When using the hospital death discharge summary to determine cause of death, the cause of death was abstracted and interpreted from the medical record by the primary author (KJ), a board-certified emergency physician who was blinded to the exposures (except when exposures were included in the EHR discharge summary). Death certificates and autopsy reports were available if the patient had a primary care physician at CCH. Hospital discharge summaries were only used then death certificates or autopsy reports were unavailable.

Measurements

Data were extracted from CCH EHR (NextGen Healthcare Information Systems LLC, Atlanta, GA) and safety incident reporting software (SafetyZone, Clarity Group Inc., Chicago, IL). We collected information on age at death, sex defined at birth, race (American Indian or Alaskan Native, Black/African American, White/Caucasian, or other including Asian, Native Hawaiian, Pacific Islander, or multiracial), Hispanic ethnicity, payor (Medicaid, Medicare, commercial, or self-pay), veteran status, current nicotine use, diagnosed SUD, current treatment for SUD, location at time of death (home, hospice, hospital, street, or other including another’s home or shelter), programs enrolled at time of death, behavioral health, case management, and medical encounters during the year prior to death, engagement in hospice, contributors to death (human immunodeficiency virus [HIV], hepatitis C virus [HCV] infection, and alcohol use), and type of death documentation (hospital discharge summary, death certificate, or autopsy report). Diagnosed SUD was attributed if there were International Classification of Diseases (ICD-10) codes indicating SUD (e.g., F11.X—F19.X) in the individual’s EHR. Current treatment for substance use was attributed if the individual had medication prescriptions for substance use or behavioral health treatment for substance use as documented by ICD-10 (e.g., F11.20) and/or Current Procedural Terminology (CPT) codes. Programs were categorized as PSH, affordable housing, community services (e.g., employment services, outreach services, payee support), health services (e.g., medical, behavioral health, dental, vision care), and operations (e.g., property management, customer support, crisis

response [teams comprised of CCH staff trained in verbal deescalation and non-violent crisis intervention and contracted security who respond to clients in crisis]). Program enrollment is not mutually exclusive, and individuals can be enrolled in multiple programs simultaneously.

Health service and case management encounters were defined using the visit and clinician type and categorized into (1) medical care (including home nursing visits, psychiatry visits, primary care visits, and addiction medicine visits), and (2) behavioral health (including counseling, therapy, peer support) and case management encounters. Because service use is predicated on both availability of the service and voluntary engagement by the individual, we measured engagement with services by dividing the total number of encounters with billing codes (numerator; indicating that the individual successfully used the service and did not refuse or "no show") by the total number of scheduled encounters (denominator). The total number of scheduled encounters (availability) and percent of successful encounters (engagement) are reported both as continuous variables and as a compound categorical variable. The compound categorical variable divides these into: (1) no service available and no engagement, (2) low availability (equal to or below the median number of encounters by subtype) and low engagement (≤ 50% successful encounters), (3) low availability and high engagement (> 50% successful encounters), (4) high availability (above the median number of encounters by subtype) and low engagement, and (5) high availability and high engagement.

Data Management and Statistical Analyses

All analyses were performed using SAS Enterprise Guide 8.3 (SAS Institute, Inc., Cary, NC). Medians, interquartile ranges (IQR), and Wilcoxon rank sum tests were calculated for continuous variables. Frequency, proportions, and proportion differences with associated 95% confidence intervals (CIs) were calculated for categorical variables. Multivariable logistic regression was used to estimate the association between demographics, payor, program enrollment, SUD, substance use treatment, and service availability and engagement (independent variables) and preventable death (dependent variable). We also performed a subgroup analysis of individuals with SUD and by service type (medical and behavioral health and case management) The unit of analysis was the individual, and significance was defined as $P < 0.05$. Due to small numbers of missing data, we used complete case analysis. To protect individuals' privacy, counts of less than 5 and the next lowest value were suppressed. No *a priori* sample size calculation was performed.

RESULTS

Cohort Characteristics

A total of 255 deceased individuals were identified for inclusion, of which the majority were male (72.9%) and had SUD (62.3%), yet less than one-fifth (19.6%) were receiving SUD treatment. The median age at death was 59 years (IQR: 52, 66). Individual characteristics are shown in **Table 1**. The most common

cause of death was accidental overdose (n = 73/255, 28.6%), followed by natural death due to heart disease (n = 34/255, 13.4%), and infection (24/255, 9.4%) (**eTable 1**). In total, 90 (35.3%) died due to a preventable cause.

Individuals who died of preventable causes were significantly younger (median 54 years; IQR: 45, 62) than individuals who died of non-preventable causes (median 61 years; IQR: 54, 66; $P < 0.001$). Nearly all deaths classified as preventable (n = 85/90, 94.4%) had a death certificate or autopsy report. American Indian or Alaskan Native individuals were more likely to die of preventable causes (difference = 9.9%; 95% CI: 1.0%, 18.8%) while White/Caucasian individuals were less likely to die of preventable causes (difference = -23.0%; 95% CI: -35.5%, -10.5%). There was no significant difference in the proportion of non-preventable and preventable deaths in PSH (difference = 11%; 95% CI: -0.0, 22.0), but individuals in affordable housing were more likely to die of preventable causes (difference = 13.6%; 95% CI: 1.2, 26.0).

Service availability and engagement during the year prior to death are described in **Table 2.** On average, individuals had 34 (IQR: 10, 77) encounters for services and successfully engaged with 64% (IQR: 47%, 80%) of all visits. On average, individuals had more behavioral health and case management encounters (median 23; IQR: 4, 50) and higher engagement (median 75%; IQR: 45%-90%) and fewer medical care visits (median 6; IQR: 0, 21) and lower engagement (median 35%; IQR: 0, 55%) in the year prior to their death. However, individuals who died of preventable causes had similar numbers of visits and similar engagement compared with individuals who died of non-preventable causes.

Regression Analyses

The results of the multivariable regressions are presented in **Table 3** and **eTable 2**. Older age was associated with decreased odds of preventable death (aOR 0.91, 95% CI: 0.88, 0.94). Compared with White/Caucasian individuals, individuals of American Indian or Alaskan Native race (aOR 2.90, 95% CI: 1.09, 7.69) and other races (aOR 4.25, 95% CI: 1.22, 14.80) had higher odds of preventable death. Additionally, while SUD was not associated with higher odds of preventable death, individuals who did not receive treatment for SUD had 3.14 (95% CI: 1.31, 7.54) higher odds of preventable death compared with those who did receive treatment. Similar findings are described by service type in **eTable 2**.

Within the subgroup of individuals with SUD, there was a similar association between age and preventable death (aOR 0.93, 95% CI: 0.89, 0.97). In this subgroup, individuals of Black/African American race (aOR 3.06, 95% CI: 1.05, 8.85) and other races (aOR 5.46, 95% CI: 1.10, 27.09) had higher odds of preventable death compared with individuals of White or Caucasian race. Additionally, enrollment in operations services, including crisis management, property management, and customer support, was associated with increased odds of preventable death (aOR 5.05, 95% CI: 1.35, 19.00). Finally, lack of SUD treatment remained associated with preventable death (aOR 3.63, 95% CI: 1.36, 9.71).

DISCUSSION

In this study, we analyzed deaths among individuals housed across a variety of settings and receiving a range of supportive services over nearly three years to identify factors associated with preventable deaths. This analysis mirrors the realistic conditions in which many housing service providers operate in the US, accounting for a mix of programs, housing types, and services. In this cohort, overdose was the leading cause of death, followed at far lower rates by heart disease, and infection. Notably, lack of substance use treatment was associated with increased odds of preventable death.

These findings build on existing literature examining mortality rates in PSH and single occupancy room settings, which have also demonstrated overdose to be a leading cause of death.[4–6] In a study conducted in New York City, 8% of all overdose deaths during 2022 occurred in PSH or single room occupancies.[15] A similar study by Rowe and colleagues found that fatal overdoses were 20 times higher within single room occupancy housing than in residential housing.[9] A combination of individual factors (high population rates of substance use), environmental factors (solitary use promoted by housing environments), and systemic factors (access to naloxone, staff training, and harm reductions services) may account for this elevated mortality risk.[16, 17]

First, rates of SUD are high among those experiencing homelessness and persists after transitioning into housing environments.[18–20] Multiple studies have found that substance use remains relatively stable during the first year after moving to housing,[19–21] regardless of the housing type.[22] This is corroborated by our study which found that 62% of deceased individuals had a diagnosed SUD. Nevertheless, other studies demonstrate that when housing is coupled with intensive, substance-use informed supportive services, substance use can be successfully decreased long term.[19, 23, 24] Our study adds to the existing literature demonstrating that while housing is an important factor for decreasing overdose risk, low-barrier substance use treatment and harm reduction services remain critical as people work toward recovery.

Additionally, overdose risk increases as individuals transition from using substances in more congregate settings while homeless (i.e. in encampments or outside) to use in more solitary environments after housing.[25, 26] Using substances while alone is one of the greatest predictors of fatal overdose.[16] Housing allows residents privacy, but also provides an environment wherein residents may use drugs alone, physically and functionally separated from staff or other residents who could administer lifesaving naloxone.[17, 27] Additionally, and somewhat counterintuitively, some qualitative studies have found that people who use drugs perceive using alone as safer due to fear of stigma, potential housing loss, violence, and criminalization.[16, 28, 29] One potential solution is overdose monitoring hotlines, such as Safe Spot, wherein people using drugs can call in and dispatchers create safety plans with the individual should they stop responding.[30] Furthermore, cultural and community efforts to reduce stigma around SUD within housing are paramount.

Compounding this risk are systemic barriers including lack of access to harm reduction strategies (e.g. fentanyl tests strips, naloxone), substance use treatment, and staff and resident overdose response training. In a recent study by Doran et al., staff at PSH sites in NYC were accepting of harm reduction

strategies at housing sites but expressed uncertainty about the feasibility of implementing such strategies. They found wide variation in staff and tenant training on naloxone administration and overdose response.[27] In response to these findings, researchers built a practical toolkit for housing agencies to train staff and residents on overdose response, increase access to harm reduction, and support access to substance use treatment.[17]

In our study, lack of substance use treatment was consistently associated with increased odds of preventable death due to suicide, homicide, trauma, and overdose. This suggests that improving access to and engagement in substance use treatment may decrease preventable mortality in housed populations. Across multiple populations, MOUD has been shown to reduce mortality and overdose death.[31] Improving access to on-site substance use treatment, including MOUD, and low barrier office-based addiction treatment are key mechanisms for reducing preventable deaths in this vulnerable population.[31, 32]

Additionally, we found that there was an association between some racial and ethnic minority populations (specifically individuals who identified as American Indian or Alaskan Native and African American/Black) and preventable death. In a large study using data from the US Department of Housing and Urban Development, states with disproportionate homelessness among individuals of African American/Black and American Indian or Alaskan Native race also had disproportionate overdose mortality among those same racial groups.[33] This is further evidence that structural barriers and inequities in housing and medical care result in increased risk of preventable death and overdose among racial and ethnic minority populations.

Finally, in our study, there were high numbers of service encounters and similar levels of engagement across both groups of decedents. This is particularly notable for behavioral health and care management visits, where, on average, individuals had 23 encounters in the year prior to their death and successfully engaged with 75% of encounters. This suggests that staff were actively attempting to engage individuals with services, possibly due to identification of these individuals as high risk or particularly vulnerable. This is further supported by the finding that use of operation services, which notably includes crisis management teams that respond to clients in crisis, was associated with preventable mortality among those with SUD. We hypothesize that this increased engagement with operation services was because staff identified persons at increased risk of suicide, overdose or trauma. However, the number of encounters and engagement were notably lower for medical visits; in fact, 68 individuals (26.7%) had no medical encounters. This may be due to the fact that we only had access to medical records through CCH, thus if individuals sought medical care through other providers or healthcare systems, this was not accounted for in our data. Further investigation is warranted to determine if increased access to medical services has an impact on overdose mortality and substance use treatment in housing.

Our study has important limitations. First, we studied adults who died while housed and receiving supportive services from a single housing service provider in metropolitan Denver, potentially limiting the

generalizability of our findings. However, the range of housing situations and supportive services received by individuals in our study likely mirrors those delivered by other housing service providers in large U.S. cities. Second, death certificates and autopsy reports were not available for all individuals, and this varied by the type of death (preventable vs non-preventable), as patients who died of preventable death were far more likely to have an available autopsy report. As such, there is the possibility of misclassification bias in cases where hospital discharge summaries were used to determine cause of death and contributing factors to death, although we suspect that this bias is negligible. Third, we did not have access to the amount of time individuals had been housed prior to death, which based on prior literature, may have confounded preventable mortality. Lastly, we were only able to collect data on services within the CCH system, and we were unable to ascertain the quality of engagement with services. Further investigation into whether quality of engagement is associated with mortality should be pursued in the future.

In conclusion, overdose was the leading cause of death in this cohort. Lack of substance use treatment among individuals with SUD was associated with increased risk of preventable death. Improving access to substance use treatment may reduce premature death among housed individuals with a history of homelessness.

Declarations

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None

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Tables

Table I. Demographic characteristics of individuals who died of preventable and non-preventable causes while in housing between January 1, 2022 and October 31, 2024 (N = 255)

	Non-Preventable Deaths (N = 165)		Preventable Deaths (N = 90)			
	n	%	n	%	Diff	(95% CI)
Age						
18–35 years	0	(0.0)	10	(11.1)	11.1	(4.6, 17.6)
36–45 years	8	(4.9)	15	(16.7)	11.8	(3.5, 20.2)
46–55 years	40	(24.3)	26	(28.9)	4.6	(-6.8, 16.1)
56–65 years	65	(39.4)	27	(30.0)	-9.4	(-21.4, 2.7)
≥ 65 years	52	(31.5)	12	(13.3)	-18.2	(-28.2, -8.2)
Male sex	123	(74.6)	63	(70.0)	-4.5	(-16.1, 7.0)
Race						
American Indian or Alaskan Native	13	(7.9)	16	(17.8)	9.9	(1.0, 18.8)
Black or African American	32	(19.4)	19	(21.1)	1.7	(-8.7, 12.1)
White or Caucasian	104	(63.0)	36	(40.0)	-23.0	(-35.5, -10.5)
Other	10	(6.1)	13	(14.4)	8.4	(0.3, 16.5)
Missing	6	(3.6)	6	(6.7)	3.0	(-2.9, 8.9)
Hispanic Ethnicity	33	(20.0)	20	(22.2)	2.2	(-8.3, 12.8)
Payor						
Medicaid	74	(44.9)	48	(53.3)	8.5	(-4.3, 21.3)
Medicare	26	(15.8)	11	(12.2)	-3.5	(-12.3, 5.2)
Commercial	22	(13.3)	13	(14.4)	1.1	(-7.8, 10.0)

	Non-Preventable Deaths (N = 165)		Preventable Deaths (N = 90)			
Self-Pay	43	(26.1)	18	(20.0)	-6.1	(-16.7, 4.6)
Veteran	24	(14.5)	8	(8.9)	-5.6	(-13.5, 2.4)
Nicotine use	76	(46.1)	42	(46.7)	0.6	(-12.2, 13.4)
Substance use	97	(58.8)	62	(68.9)	10.1	(-2.1, 22.3)
Treated for substance use	37	(22.4)	13	(14.4)	-8.0	(-17.6, 1.7)
Death certificate or autopsy report	90	(54.5)	85	(94.4)	39.9	(30.9, 48.8)
Location at time of death						
Home	80	(48.5)	68	(75.6)	27.1	(15.4, 38.8)
Hospice	25	(15.2)	0	(0)	-15.2	(-20.6, -9.7)
Hospital	55	(33.3)	6	(6.7)	-26.7	(-35.5, -17.8)
Street	0	(0)	7	(7.8)	7.8	(2.2, 13.3)
Other	< 5	(S)	S	S	7.7	(1.6, 13.8)
Missing	< 5	(S)	< 5	(S)	-0.7	(-3.7, 2.3)
Contributors to death						
Alcohol use	61	(37.0)	32	(35.6)	-1.4	(-13.7, 10.9)
HIV or HCV	6	(3.6)	< 5	S	S	S
Program Type*						
Permanent Supportive Housing	112	(67.9)	71	(78.9)	11.0	(-0.0, 22.0)
Health Services	104	(63.0)	63	(70.0)	7.0	(-5.0, 19.0)

	Non-Preventable Deaths (N = 165)		Preventable Deaths (N = 90)			
Community Services	23	(13.9)	11	(12.2)	-1.7	(-10.3, 6.9)
Affordable Housing	49	(29.7)	39	(43.4)	13.6	(1.2, 26.0)
Operations Services	23	(13.9)	16	(17.8)	3.8	(-5.7, 13.3)
Service Availability and Engagement						
All encounters						
No availability and no success	16	(9.7)	9	(10.0)	0.3	(-7.4, 8.0)
Low availability and low success	17	(10.3)	13	(14.4)	4.1	(-4.5, 12.8)
Low availability and high success	65	(39.4)	25	(27.8)	-11.6	(-23.5, 0.3)
High availability and low success	14	(8.5)	5	(5.6)	-2.9	(-9.3, 3.4)
High availability and high success	53	(32.1)	38	(42.2)	10.1	(-2.3, 22.5)
Behavioral health and case management encounters						
No availability and no success	30	(18.2)	15	(16.7)	-1.5	(-11.2, 8.2)
Low availability and low success	10	(6.1)	S	S	S	S
Low availability and high success	57	(34.5)	28	(31.1)	-3.4	(-15.4, 8.6)
High availability and low success	9	(5.5)	< 5	S	S	S
High availability and high success	59	(35.8)	39	(43.3)	7.6	(-5.0, 20.2)
Medical encounters						
No availability and no success	48	(29.1)	20	(22.2)	-6.9	(-17.9, 4.2)
Low availability and low success	26	(15.8)	18	(20.0)	4.2	(-5.7, 14.2)
Low availability and high success	20	(12.1)	10	(11.1)	-1.0	(-9.2, 7.2)

	Non-Preventable Deaths (N = 165)		Preventable Deaths (N = 90)			
High availability and low success	46	(27.9)	24	(26.7)	-1.2	(-12.6, 10.2)
High availability and high success	25	(15.2)	18	(20.0)	4.8	(-5.1, 14.8)

Abbreviations: HIV, human immunodeficiency virus; HCV, hepatitis C virus; Diff, difference; CI, confidence interval; S, suppressed
*These are non-exclusive categories. Individuals could be enrolled in multiple programs.
Note: Given the small sample size, in order to protect confidentiality, values with n < 5 and the next lowest value are suppressed.

Table II. Total and successful encounters for services one year prior to death among individuals who died while in housing between January 1, 2022 and October 31, 2024 (N = 255)

	All deaths (N = 255)		Non-Preventable Deaths (N = 165)		Preventable Deaths (N = 90)		P
	Median	IQR	Median	IQR	Median	IQR	
All encounters							
Total, n	34	(10, 77)	33	(10, 71)	39	(13, 84)	0.18
Successful, n	24	(6, 43)	22	(6, 40)	29	(7, 56)	0.11
Successful, %	64	(47, 80)	63.5	(45, 79)	65	(49, 82)	0.62
Behavioral health and case management encounters							
Total, n	23	(4, 50)	20	(4, 44)	27	(5, 59)	0.18
Successful, n	18	(3, 37)	17	(2, 34)	24	(3, 43)	0.13
Successful, %	75	(45, 90)	75	(44, 91)	75	(50, 90)	0.77
Medical encounters							
Total, n	6	(0, 21)	6	(0, 22)	9	(1, 19)	0.44
Successful, n	3	(0, 10)	2	(0, 9)	4	(0, 10)	0.40
Successful, %	35	(0, 55)	33	(0, 53)	37	(0, 60)	0.24

Abbreviations: IQR, interquartile range

Table III. Multivariable logistic regression of factors associated with avoidable death (primary outcome) among individuals receiving housing services from January 1, 2022 through October 31, 2024 (N = 255)

	All Deaths (N = 255)		Patients with Substance Use Disorder (N = 159)	
Variable	aOR	(95% CI)	aOR	(95% CI)
Age	0.91	(0.88, 0.94)	0.93	(0.89, 0.97)
Female sex	0.83	(0.41, 1.67)	0.44	(0.16, 1.23)
Race				
American Indian or Alaskan Native	2.90	(1.09, 7.69)	3.61	(0.92, 14.12)
Black or African American	2.15	(0.98, 4.71)	3.06	(1.05, 8.85)
Other	4.25	(1.22, 14.80)	5.46	(1.10, 27.09)
White or Caucasian	Ref	-	Ref	-
Unknown	2.21	(0.49, 10.11)	0.12	(0.00, 4.98)
Hispanic ethnicity	0.54	(0.20, 1.42)	0.77	(0.23, 2.56)
Payor				
Medicaid	0.47	(0.18, 1.23)	0.57	(0.17, 1.95)
Medicare	0.81	(0.26, 2.50)	0.32	(0.07, 1.55)
Commercial	Ref	-	Ref	-
Self-pay	0.58	(0.19, 1.78)	0.75	(0.17, 3.32)
Program enrollment				
Permanent Supportive Housing	1.25	(0.47, 3.35)	3.09	(0.72, 13.29)
Affordable Housing	1.67	(0.84, 3.31)	1.80	(0.74, 4.38)
Community Services	1.32	(0.49, 3.54)	2.61	(0.67, 10.25)
Health Services Programs	0.98	(0.47, 2.04)	1.57	(0.61, 4.08)
Operations Services	1.84	(0.69, 4.88)	5.05	(1.35, 19.00)
Service availability and successful engagement				
No availability, no success	Ref	-	Ref	-
Low availability, low success	1.28	(0.32, 5.16)	3.84	(0.52, 28.40)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval

	All Deaths (N = 255)		Patients with Substance Use Disorder (N = 159)	
Low availability, high success	0.46	(0.14, 1.51)	0.47	(0.08, 2.80)
High availability, low success	0.59	(0.11, 3.07)	0.59	(0.06, 5.66)
High availability, high success	0.85	(0.24, 2.94)	1.30	(0.23, 7.44)
Substance use	1.65	(0.81, 3.34)	-	-
No substance use treatment	3.14	(1.31, 7.54)	3.63	(1.36, 9.71)
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval				

Figures

Fig 1. Housing subtypes and supportive services provided by Colorado Coalition for the Homeless in Denver, Colorado.

	PERMANENT SUPPORTIVE HOUSING (PSH) Affordable housing for people with disabilities or chronic conditions who need ongoing support services	AFFORDABLE HOUSING Income restricted housing (typically capped at <30% of monthly income)	TRANSITIONAL HOUSING Temporary housing (typically < 24 months) for individuals and families experiencing homelessness	SINGLE OCCUPANCY UNITS (SROs) Private room that includes minimal amenities and may share bathroom or kitchen
COMMUNITY SERVICES	Onsite	Onsite or offsite	Onsite or offsite	Onsite or offsite
MEDICAL SERVICES	Onsite or offsite	Onsite or offsite	Onsite or offsite	Onsite or offsite
BEHAVIORAL HEALTH SERVICES	Onsite	Onsite or offsite	Onsite or offsite*	Onsite or offsite
CASE MANAGEMENT	Onsite	Onsite or offsite	Onsite or offsite*	Onsite or offsite*
OPERATIONS	Onsite or offsite	Onsite or offsite	Onsite or offsite	Onsite or offsite

Community services includes employment services, outreach services, and payee support. Operations includes property management, customer support, and crisis response teams, which are comprised of CCH staff trained in verbal deescalation and non-violent crisis intervention and contracted security who respond to clients in crisis. Substance use treatment is included in both medical and behavioral health services.

*Case management is commonly onsite, particularly for transitional housing and SROs. Behavioral health services are commonly onsite for transitional housing

Figure 1

See image above for figure legend

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