Title

Association of housing status and cancer diagnosis, care coordination and outcomes in a public hospital: a retrospective cohort study.

Journal

BMJ Open, 14(9)

Authors

Decker, Hannah
Colom, Sara
Evans, Jennifer
et al.

Publication Date

2024-09-12

DOI

10.1136/bmjopen-2024-088303

Peer reviewed

BMJ Open

Association of housing status and cancer diagnosis, care coordination and outcomes in a public hospital: a retrospective cohort study

Hannah Decker ,[1] Sara Colom,[2] Jennifer L Evans,[2] Dave Graham-Squire,[2] Kenneth Perez,[2] Margot Kushel,[2,3] Elizabeth Wick,[1] Maria C Raven,[2,4] Hemal K Kanzaria[2,4]

To cite: Decker H, Colom S, Evans JL, *et al*. Association of housing status and cancer diagnosis, care coordination and outcomes in a public hospital: a retrospective cohort study. *BMJ Open* 2024;**14**:e088303. doi:10.1136/bmjopen-2024-088303

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2024-088303).

Received 02 May 2024
Accepted 18 July 2024

[1]Department of Surgery, UCSF, San Francisco, California, USA
[2]Benioff Homelessness and Housing Initiative, Zuckerberg San Francisco General Hospital and Trauma Center, San Francisco, California, USA
[3]Department of Internal Medicine, UCSF, San Francisco, California, USA
[4]Department of Emergency Medicine, University of California San Francisco, San Francisco, California, USA

Correspondence to
Dr Elizabeth Wick;
Elizabeth.Wick@ucsf.edu

ABSTRACT

Objectives Cancer is a leading cause of death in unhoused adults. We sought to examine the association between housing status, stage at diagnosis and all-cause survival following cancer diagnosis at a public hospital.

Design Retrospective cohort study examining new cancer diagnoses between 1 July 2011 and 30 June 2021.

Setting A public hospital in San Francisco.

Exposure Housing status (housed, formerly unhoused, unhoused) was ascertained via a county-wide integrated dataset that tracks both observed and reported homelessness.

Methods We reported univariate analyses to investigate differences in demographic and clinical characteristics by housing group. We then constructed Kaplan-Meier curves stratified by housing group to examine unadjusted all-cause mortality. Finally, we used multivariable Cox proportional hazards models to compare the hazard rate of mortality for each housing status group, adjusting for demographic and clinical factors.

Results Our cohort included 5123 patients with new cancer diagnoses, with 4062 (79%) in housed patients, 623 (12%) in formerly unhoused patients and 438 (9%) in unhoused patients. Unhoused and formerly unhoused patients were more commonly diagnosed with stage 4 disease (28% and 27% of the time, respectively, vs 22% of housed patients). After adjusting for demographic and clinical characteristics, unhoused patients with stage 0–3 disease had a 50% increased hazard of death (adjusted HR (aHR) 1.5, 95% CI 1.1 to 1.9; p<0.004) as did formerly unhoused patients (aHR 1.5, 95% CI 1.2 to 1.9; p=0.001) compared with housed individuals 3 months after diagnosis.

Conclusions Unhoused and formerly unhoused patients diagnosed with non-metastatic cancer had substantially increased hazards of death compared with housed patients cared for in a public hospital setting. Current or former lack of housing could contribute to poor outcomes following cancer diagnoses via multiple mechanisms.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study uses a county-wide integrated dataset to determine housing status, which reduces misclassification of the exposure.
⇒ This dataset allows identification of formerly unhoused patients.
⇒ This is a single-centre study which limits generalisability to other settings.
⇒ Our outcome measure is all-cause mortality, not disease-specific mortality.
⇒ Given the observational nature of the study, there may be unmeasured confounding factors.

INTRODUCTION

Housing is essential for health, with unhoused people having worse health status when compared with the general population.[1] The drivers of these disparities are multifactorial and include poor access to primary and preventive care,[2 3] higher incidence of injuries,[4] higher rates of comorbid mental health and substance use disorders,[5] experiences of bias, stigma and structural racism within the healthcare system,[6] and financial and logistical barriers to care.[7]

Cancer is a leading cause of death in older unhoused adults.[8] Understanding the best way to provide unhoused patients with the full spectrum of high-quality cancer care—prevention, screening, disease-directed therapy and surveillance/survivorship—is critical as this population continues to age.[5 9 10] Research on cancer in unhoused patients has focused on screening with limited work examining cancer outcomes.[11] Two studies in the USA examined cancer survival in the unhoused population: a 2015 study in Boston, which compared mortality rates of 316 homeless individuals with cancer to standardised mortality estimates,[12] and a 2023 national study of over 5000 unhoused patients examining all-cause survival in breast, lung and colorectal cancers in veterans cared for in the Veteran Health Affairs (VA) setting.[13] While both studies found poorer survival outcomes

for unhoused patients with cancer, the disparity was attenuated in the VA, possibly because of reduced financial and insurance barriers and increased support for unhoused patients.[14]

Cancer care for patients experiencing homelessness in public hospitals, which provide care for high proportions of patients experiencing homelessness, has not been explicitly evaluated.[15] Public hospitals may have more developed programs and policies in place to care for socially marginalised patients as well as different financial and material constraints when compared with other settings. Further, while 40% of single adults experience homelessness in unsheltered settings,[16] there have not been studies in populations where a large proportion experience unsheltered homelessness. We sought to examine the association between housing status, stage at diagnosis and all-cause survival following cancer diagnosis at a public hospital. We hypothesised that unhoused patients would be diagnosed with later stages of cancer and have poorer all-cause survival.

METHODS

Overall design

We conducted a retrospective cohort study examining all new cancer diagnoses at Zuckerberg San Francisco General Hospital (ZSFG), a public hospital in San Francisco City and County that serves a diverse and underresourced population; less than 5% of patients served have commercial insurance with the remainder being publicly insured or uninsured.[17 18] This study used identifiable data for data linkage. We used Strengthening the Reporting of Observational Studies in Epidemiology guidelines to report our findings.[19]

Study population

We identified all patients with a new cancer diagnosis from 1 July 2011 to 30 June 2021 (fiscal year 2011–2012 through fiscal year 2020–2021) using the ZSFG Cancer Registry. We merged this cohort with the Coordinated Care Management System (CCMS). More information on the data systems and linkages is available in the online supplemental methods. CCMS is an integrated data system implemented by the San Francisco Department of Public Health (DPH) that links physical, behavioural and social health records.[20] A record is created in CCMS for any patient who a healthcare or social service worker determines to be unhoused, who used county behavioural health, housing or jail health services, or who used urgent or emergent medical services across physical, behavioural and substance use domains. Based on these criteria, we were able to link 75% of individuals in the Cancer Registry to individuals with CCMS records.

Exposure

Our exposure was housing status at time of diagnosis, which we categorised as housed, formerly unhoused or unhoused. We defined patients as unhoused if they were identified in CCMS as unhoused in the same fiscal year as their cancer was diagnosed. Housing status identifiers came from any DPH or county system and included both observed (e.g., shelter use, housing navigation services, case management services, medical respite stays) and reported homelessness (e.g., during a physical or behavioural health clinical encounter). We characterised patients as formerly unhoused if they had a homeless identifier in CCMS during any fiscal year prior to cancer diagnosis, but not in the same year of diagnosis. We classified all other patients (including those who could not be linked to CCMS) as housed.

Outcome

Our primary outcome was all-cause mortality, which we obtained from the Cancer Registry which is required to search and match individual patient data with the state vital record files.[21] Our secondary outcomes were stage at diagnosis, inpatient admission for definitive treatment or diagnosis,[22] presentation at a multidisciplinary tumour board and evidence of care fragmentation. We classified patients who were diagnosed and received all treatment at ZSFG as having no care fragmentation. All others had evidence of care fragmentation either via diagnosis or partial treatment at other hospitals. We obtained these data from the ZSFG Cancer Registry. We additionally assessed what proportion of patients would have been classified as unhoused had we relied on Cancer Registry documentation alone.

Covariates

We extracted age at diagnosis, sex, race, ethnicity, marital status, smoking status, alcohol use, cancer site, stage at diagnosis, year of diagnosis and date of death or last contact from the ZSFG Cancer Registry. We included information on race and ethnicity as a proxy for differential experiences of the healthcare system.[23] We calculated the Elixhauser score using comorbidity information from CCMS.[24]

Statistical approach

We first performed univariate analyses to investigate differences in demographic and clinical characteristics by housing group. We then constructed Kaplan-Meier curves stratified by housing group to show unadjusted all-cause mortality, defining survival time as the interval between diagnosis date and death. We censored patients at the last contact date. Finally, we constructed multivariable Cox proportional hazards models to compare the hazard rate of mortality for each housing status group. We stratified the model into stage 0–3 and stage 4 disease because of evidence of non-proportionality in the survival curves due to this variable. We also stratified the model into two time periods: the first 100 days after diagnosis and beyond 100 days after diagnosis, given evidence of non-proportionality in the survival curves prior to 100 days and a hypothesis that outcomes in different housing groups would become more evident beyond the initial diagnosis

and treatment interval. We then adjusted the models for age at diagnosis, sex, cancer site, race, ethnicity, marital status, smoking, alcohol use, Elixhauser score (which includes mental health comorbidities such as depression, psychosis and substance use disorders) and year of diagnosis. We used the Elixhauser score as a marker of total comorbidity burden rather than adjusting for each individual component. We additionally adjusted the stage 0–3 model for individual stage. We conducted data analysis in Stata (V.16 and V.18) from June 2023 to March 2024.

Patient and public involvement

Patients and the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

Population characteristics

We identified 5123 total new cancer diagnoses, with 4062 (79%) in housed patients, 623 (12%) in formerly unhoused patients and 438 (9%) in unhoused patients. Follow-up time after diagnosis ranged from 0 to 11.3 years with a mean of 3.6 years. The cohort was 54% male (n=2086), 49% white (n=2511), 32% Asian or Pacific Islander (n=1615) and 18% black (n=921). The most common cancer sites were lung (13%, n=675), breast (11%, n=576), colorectal (9%, n=453) and liver/biliary tract (9%, n=439). 30% (n=130) of our unhoused cohort was classified as unhoused by the Cancer Registry alone, with the remainder identified only through CCMS documentation.

Univariate analysis

Compared with housed patients, unhoused and formerly unhoused patients were more commonly male, Black and single (table 1). Unhoused and formerly unhoused patients had higher rates of current or prior smoking and alcohol use compared with housed patients.

Lung cancer was the most common cancer site in all housing status groups, though made up a higher proportion of diagnoses in unhoused and formerly unhoused patients when compared with housed counterparts (17% and 17%, compared with 12%). Liver and biliary tract cancers as well as cancers of the kidneys, ureters and bladder also comprised a greater share in unhoused and formerly unhoused patients.

Stage at diagnosis

Unhoused and formerly unhoused patients were more commonly diagnosed with stage 4 disease (28% and 27% of the time, respectively, vs 22% of housed patients). Common cancer sites with the largest difference in proportion of stage 4 disease between the unhoused and housed groups were in colorectal cancer (64% of unhoused patients (n=19) vs 26% of housed patients (n=100)) and breast cancer (34% (n=9) of unhoused patients vs 7% (n=36) of housed patients).

Care pathways

The proportion of patients who were admitted to the hospital for definitive cancer treatment or diagnosis was similar between housing status groups (56% of unhoused patients, 54% of formerly unhoused patients, 54% of housed patients) (table 2). A minority of patients were discussed at multidisciplinary tumour boards in all housing status groups (24% of unhoused, 30% of formerly unhoused and 22% of housed). Formerly unhoused patients less commonly had fragmented care than the other groups (30% vs 35% of unhoused and 36% of housed).

Kaplan-Meier curves

Housed patients had significantly better all-cause survival when compared with unhoused and formerly unhoused patients (figure 1). This relationship persisted when stratifying the curves into stage 0–3 and stage 4 disease.

Cox proportional hazards model

After adjustment, unhoused patients with stage 0–3 disease had a 50% increased hazard of death (adjusted HR (aHR) 1.5, 95% CI 1.1 to 1.9; p<0.004) as did formerly unhoused patients (aHR 1.5, 95% CI 1.2 to 1.9; p=0.001) compared with housed individuals 3 months after diagnosis (table 3). Unhoused patients with stage 4 disease had a 50% increased hazard of death (aHR 1.5, 95% CI 1.1 to 2.1; p=0.014) compared with housed patients. Formerly unhoused patients with stage 4 disease did not have a statistically significantly different hazard of death when compared with housed patients.

DISCUSSION

In this study of over 5000 patients with new cancer diagnoses at a San Francisco public hospital, unhoused and formerly unhoused patients diagnosed with non-metastatic cancer had substantially increased hazards of death 3 months after diagnosis compared with housed patients cared for in the same setting. ZSFG cares for a diverse and under-resourced group of patients, with 84% of patients identifying as non-white, less than 5% of patients having any private insurance and many having limited English proficiency.[17] However, even in this setting, in which healthcare teams commonly provide care to underserved patients, unhoused and formerly unhoused patients had substantially worse all-cause survival after cancer diagnosis.

Lack of housing could contribute to worse outcomes following cancer diagnoses via multiple potential mechanisms. Prior research has highlighted that unhoused patients face multiple challenges to accessing scheduled outpatient care,[25] including inconsistent access to phones and other forms of communication,[26] vulnerability to external forces,[27] transportation challenges, experiences of bias and stigma in healthcare[28] and more. All of these factors may play a role in cancer care, which is complex, multidisciplinary and longitudinal.[29] Clinicians and

Table 1 Demographic and clinical characteristics, stratified by housing status

	Housed n=4062	Formerly unhoused n=623	Unhoused n=438	P value
Age at diagnosis, median (IQR)	61 (52, 68)	60 (55, 66)	58 (51, 64)	<0.001
Sex				<0.001
Male	49.8 (2024)	71.6 (446)	76.7 (336)	
Female	49.9 (2026)	27.1 (169)	22.4 (98)	
Race				<0.001
White	49.0 (1992)	47.5 (296)	50.9 (223)	
Black	11.2 (453)	45.6 (284)	42.0 (184)	
Asian or Pacific Islander	38.3 (1555)	5.5 (34)	5.9 (26)	
Other	1.5 (62)	1.4 (9)	1.1 (5)	
Marital status				<0.001
Married or domestic partner	34.7 (1408)	7.5 (47)	5.5 (24)	
Single, separated, divorced, widowed	56.6 (2301)	82.5 (514)	81.5 (357)	
Elixhauser score, median (IQR)	9 (0, 19)	15 (4, 24)	9 (0, 21)	<0.001
Smoking status				<0.001
None	68.5 (2783)	40.1 (250)	43.2 (189)	
Current use	15.7 (639)	45.3 (282)	46.3 (203)	
Previous use	14.1 (573)	13.6 (85)	8.7 (38)	
Alcohol use				<0.001
None	76.6 (3112)	59.9 (373)	64.6 (283)	
Current use	12.0 (488)	23.3 (145)	20.5 (90)	
Previous use	5.4 (220)	10.6 (66)	8.9 (39)	
Site				<0.001
Lung	12.1 (493)	17.2 (107)	17.1 (75)	
Breast	12.8 (520)	4.8 (30)	5.9 (26)	
Colorectal	9.3 (379)	7.4 (46)	6.4 (28)	
Liver and biliary tract	7.2 (292)	14.4 (90)	13.0 (57)	
Kidneys, ureter, bladder and other urinary tract	6.9 (279)	8.5 (53)	9.6 (42)	
Female reproductive tract	7.7 (311)	3.7 (23)	3.0 (13)	
Prostate	5.4 (219)	7.1 (44)	8.2 (36)	
Head and neck	4.9 (198)	10.3 (64)	6.4 (28)	
Nervous system, including brain	5.0 (205)	3.4 (21)	3.2 (14)	
Blood or bone marrow	4.2 (171)	3.5 (22)	4.6 (20)	
Lymph nodes	3.2 (129)	3.0 (19)	3.7 (16)	
Skin	3.1 (125)	1.9 (12)	4.3 (19)	
Thyroid	3.2 (130)	0.3 (2)	2.5 (11)	
Stomach	3.0 (120)	1.9 (12)	2.1 (9)	
Pancreas	2.4 (98)	3.0 (19)	0.5 (2)	
Other	9.7 (393)	9.5 (59)	9.6 (42)	
Stage at diagnosis				<0.001
Stage 0–3	78.0 (3168)	73.4 (457)	71.7 (314)	
Stage 4	22.0 (894)	26.6 (166)	28.3 (124)	

Numbers may not sum to 100% due to missing data.

Table 2 Cancer care coordination, stratified by housing status

	Housed n=4062	Formerly unhoused n=623	Unhoused n=438	P value
Admitted for cancer treatment				0.81
No	45.7 (1858)	46.5 (290)	44.3 (194)	
Yes	54.2 (2200)	53.5 (333)	55.7 (244)	
Presented at multidisciplinary tumour board				<0.001
No	78.5 (3187)	70.0 (436)	76.5 (335)	
Yes	21.5 (875)	30.0 (187)	23.5 (103)	
Evidence of care fragmentation	52 (26, 84)	52.5 (20.5, 87.5)	49 (14, 81)	0.25
No	63.6 (2583)	69.6 (434)	64.6 (283)	0.015
Yes	36.4 (1478)	30.4 (190)	35.4 (155)	

unhoused patients may also be hesitant to pursue complex treatment regimens due to competing health priorities;[30] prior research has reported lower rates of high-intensity care for acute cardiovascular conditions in unhoused adults.[31] These factors may contribute to reduced initiation and completion of guideline-concordant care which may lead to disparate outcomes. In the present study, we were unable to examine treatment courses for each combination of cancer site and stage given our sample size. While there were no large differences in the proportion of patients admitted for definitive cancer treatment, discussed at multidisciplinary tumour boards or who had evidence of care fragmentation based on housing status, the question of cancer care delivery in unhoused patients warrants future study.[11]

Of note, our findings here are more pronounced than what was observed in lung, colorectal and breast cancer outcomes in unhoused patients at the VA,[13] which has universal coverage for its beneficiaries and has a multipronged, coordinated approach to preventing and reducing homelessness among veterans.[32] The VA is a unique, integrated system of care with dedicated investment for addressing health needs of homeless veterans and ending homelessness. A prior study has highlighted that 20% of unhoused veterans diagnosed with cancer gained housing in the year after diagnosis and that gaining housing was associated with improved cancer outcomes.[33] Without this type of structure and resources, it may be difficult for public hospital systems to conduct the intensive outreach and longitudinal care coordination needed to improve cancer outcomes in unhoused patients. However, there may be strategies from the VA that can be adopted to reduce inequities in cancer outcomes.

Formerly unhoused and unhoused patients were more commonly diagnosed with metastatic disease than housed patients. This finding was pronounced in cancers that can be screened for, such as colorectal cancer and breast cancer. Prior research has demonstrated lower rates of cancer screening in unhoused patients than in their housed counterparts.[34–37] Screening for colon cancer specifically may pose challenges in unhoused patients, who have poorer access to water, sanitation and hygiene facilities, including private bathrooms for colon preparation or stool-based tests.[38] Presentation at later stages may also be related to poorer access to primary or preventive care for symptom evaluation.[3] Other work has highlighted

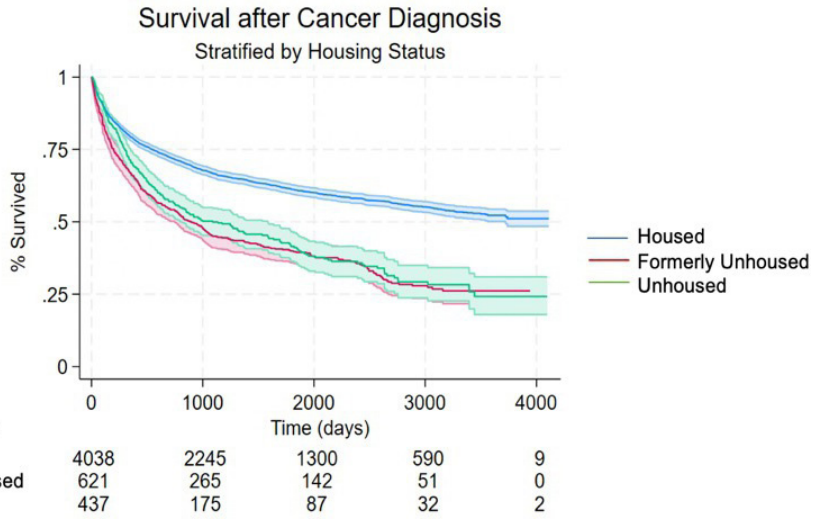

Figure 1 Kaplan-Meier survival estimates, stratified by housing group.

Table 3 Cox proportional hazards model for all-cause mortality 3 months after cancer diagnosis, stratified by stage and housing status

Housing category	Stage 0–3				Stage 4			
	>3 months				>3 months			
	Unadjusted (95% CI)	P value	Adjusted* (95% CI)	P value	Unadjusted (95% CI)	P value	Adjusted* (95% CI)	P value
Housed	Reference	–	–	–	Reference	–	–	–
Formerly unhoused	2.3 (1.9 to 2.6)	**<0.001**	1.5 (1.2 to 1.9)	**0.001**	1.4 (1.1 to 1.7)	**0.003**	1.2 (0.9 to 1.6)	0.266
Unhoused	2.3 (1.9 to 2.7)	**<0.001**	1.5 (1.1 to 1.9)	**0.004**	1.6 (1.2 to 2.0)	**<0.001**	1.5 (1.1 to 2.1)	**0.014**

Bold numbers highlight statistical significance (p<0.05).
*Adjusted for age at diagnosis, stage of cancer, site of cancer, race, ethnicity, marital status, smoking, alcohol, Elixhauser score, sex and year of diagnosis.

that unhoused patients more commonly underwent emergent operations for cancer than housed patients, which suggests that patients may have delayed evaluation of cancer-related symptoms.[39] Even in unhoused patients who do access primary care, clinicians may opt to focus on other real or perceived higher priority needs.[30]

In our study, both unhoused and formerly unhoused patients had worse cancer-related outcomes when compared with housed counterparts. This may be related to poorly addressed risk factors for cancer during the period of homelessness, persisting experiences of bias and stigma in healthcare systems, among other factors. We could not assess the quality of housing with our data, which may be variable among the formerly unhoused group. Given the increased interest in health-related social needs screening in health systems—including new requirements from Centers for Medicare & Medicaid Services that hospitals screen patients for health-related social needs beginning in 2024[40]—it is important to note that both ongoing homelessness and a history of homelessness were associated with worse outcomes. Homelessness screening tools should consider assessing a history of homelessness as well, which may be associated with ongoing vulnerabilities that impact health and access to care. Poverty is also significantly associated with later stages of cancer diagnosis and poorer survival.[41] As poverty and homelessness are inextricably linked in settings with high housing prices, unhoused and formerly unhoused individuals experience the stressors of poverty that are likely compounded by lack of safe and secure housing as well as bias and stigma against people experiencing homelessness.

There are several policies that may be beneficial for unhoused patients with new cancer diagnoses. First, research has highlighted that veterans who gained housing after cancer diagnosis had improved outcomes compared with those who experienced continued homelessness.[33] Housing may improve cancer outcomes by reducing competing priorities and improving the ability to receive outpatient cancer care, health maintenance and surveillance. As insurers and health systems have increased interest in addressing upstream health-related social needs, including direct investments in housing, more research is essential to understand where resource allocation may be most impactful in improving health.[42] Second, states may modify their Medicaid programs via Section 1115 waivers, which have been used to expand Medicaid coverage, enhance care coordination and address upstream social determinants of health.[43] In California's program (California Advancing and Innovating Medi-Cal (CalAIM)), unhoused individuals with at least one complex medical problem, such as cancer, are eligible for enhanced case management, which includes a lead care manager to coordinate doctors, specialists, pharmacists, case managers, social services providers and others.[44] This program was initiated in July 2023 and may help unhoused patients with cancer given the complexity of care coordination after a new cancer diagnosis. Additionally, as part of CalAIM, there are community supports related to housing navigation and post-hospitalisation housing services. Several states have included medical respite in these Medicaid waivers,[43] which provides a place for unhoused patients to recuperate after hospital care and provide shelter, medical care and social services.[45] Medical respite use has been associated with fewer readmissions and shorter hospital lengths of stay in unhoused patients with complex medical problems, including cancer.[46] Further work should explore barriers to medical respite utilisation, which may include lack of inpatient provider knowledge of medical respite as an option, bed availability constraints or patient-level barriers, among others. Evaluation of these waivers is essential to assess if this type of support improves outcomes in unhoused patients with cancer.

This study has certain limitations. First, there is the risk of misclassification of our exposure (housing status), which would bias our results towards the null. We attempted to capture the unhoused and formerly unhoused populations more robustly by using a novel, city-wide data source that tracks both observed and reported homelessness. When compared with the Cancer Registry documentation alone, we were able to identify over three times the

number of unhoused individuals. Our outcome measure is all-cause mortality, not cancer-specific mortality. As unhoused individuals have increased rates of mortality from other causes (including poorly managed chronic health conditions, injury and substance use disorders),[47] it is possible that not all of the deaths we captured were related to cancer. Finally, this is a single center with a small sample size for each individual cancer, so results may not be generalisable to other settings.

CONCLUSION

Unhoused and formerly unhoused patients with cancer are more commonly diagnosed with metastatic disease and have up to 50% poorer survival after cancer diagnosis even when compared with other patients cared for in a public hospital setting. There are multiple mechanisms by which lack of housing could contribute to poorer outcomes in this group. There are policies that may be beneficial for unhoused patients with new cancer diagnoses that ought to be further explored.

X Hannah Decker @hdecker731

Acknowledgements The authors gratefully acknowledge Neda Ratanawongsa, MD, MPH, and Hillary Kunins, MD, MPH, MS, for their review of this work and partnership on behalf of the San Francisco Department of Public Health.

Contributors HD: conception and design of the work, analysis and interpretation of data, drafting the work. SC-B: acquisition, analysis and interpretation of data, critical review of work for important intellectual content. JLE and DG-S: interpretation of data, critical review of work for important intellectual content. KP: acquisition and interpretation of data, critical review of work for important intellectual content. MK, EW, MCR: conception and design of the work, interpretation of data, critical review of work for important intellectual content. HKK: conception and design of the work, acquisition and interpretation of data, critical review of work for important intellectual content, oversight and leadership. All authors gave final approval of the manuscript and agreed to be accountable for all aspects of the work. HD acts as the guarantor.

Funding This work was funded by a grant from the UCSF Benioff Homelessness and Housing Initiative.

Competing interests Outside of the published work, HD is a National Clinician Scholar with salary support from the VA and receives person fees from Moon Surgical. HKK's salary is supported by a grant from the Benioff Homelessness and Housing Initiative, University of California, San Francisco, California, and he works as an advisor for Amae Health. MK is on the Board of Housing California, National Homelessness Law Center and Steinberg Institute (K24 2K24AG046372 and BHHI).

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the UCSF Institutional Review Board (22-36473) with a waiver of informed consent due to minimal risk to participants.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. This dataset contains sensitive information including housing status, interaction with the criminal justice system, behavioural health system, and more, and cannot be publicly shared.

ORCID iD

Hannah Decker http://orcid.org/0000-0003-0850-4134

REFERENCES

1 Fazel S, Geddes JR, Kushel M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *The Lancet* 2014;384:1529–40.
2 Martin P, Liaw W, Bazemore A, *et al*. Adults with housing insecurity have worse access to primary and preventive care. *J Am Board Fam Med* 2019;32:521–30.
3 Jeleff M, Haider S, Schiffler T, *et al*. Cancer risk factors and access to cancer prevention services for people experiencing homelessness. *Lancet Public Health* 2024;9:e128–46.
4 Mackelprang JL, Graves JM, Rivara FP. Homeless in America: injuries treated in US emergency departments, 2007-2011. *Int J Inj Contr Saf Promot* 2014;21:289–97.
5 The California statewide study of people experiencing homelessness toward a new understanding, 2023.
6 Winfield A, Haamid A. Beyond homelessness: expounding on housing inequality and racism. *Ann Emerg Med* 2022;79:413–5.
7 Wood D, Valdez RB. Barriers to medical care for homeless families compared with housed poor families. *Am J Dis Child* 1991;145:1109–15.
8 Brown RT, Evans JL, Valle K, *et al*. Factors associated with mortality among homeless older adults in California: the HOPE hOME study. *JAMA Intern Med* 2022;182:1052–60.
9 Culhane DP, Metraux S, Byrne T, *et al*. Aging trends in homeless populations. *Contexts (Berkeley Calif)* 2013;12:66–8.
10 Brown RT, Hemati K, Riley ED, *et al*. Geriatric Conditions in a Population-Based Sample of Older Homeless Adults. *Gerontologist* 2017;57:757–66.
11 Asgary R. Cancer care and treatment during homelessness. *Lancet Oncol* 2024;25:e84–90.
12 Baggett TP, Chang Y, Porneala BC, *et al*. Disparities in cancer incidence, stage, and mortality at Boston health care for the homeless program. *Am J Prev Med* 2015;49:694–702.
13 Decker HC, Graham LA, Titan A, *et al*. Housing status, cancer care, and associated outcomes among US veterans. *JAMA Netw Open* 2023;6:e2349143.
14 Secretary Shinseki details plan to end homelessness for veterans, 2023. Available: https://www.va.gov/opa/pressrel/pressrelease.cfm?id=1807
15 Mcconville S, Kanzaria H, Hsia R, *et al*. n.d. How hospital discharge data can inform state homelessness policy.
16 The 2023 annual homelessness assessment report. 2023.
17 ZSFG fiscal year 2022-2023 annual report, 2023. Available: https://live-zsfgcare.pantheonsite.io/wp-content/uploads/2023/11/Health-Commission-Final-ZSFG-FY-Annual-Report-2022-2023.pdf
18 San Francisco general hospital fiscal year report 2011-2012. 2012.
19 von Elm E, Altman DG, Egger M, *et al*. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet* 2007;370:1453–7.
20 Kanzaria HK, Niedzwiecki M, Cawley CL, *et al*. Frequent emergency department users: focusing solely on medical utilization misses the whole person. *Health Aff (Millwood)* 2019;38:1866–75.
21 N.d. Death clearance manual minimum requirements and best practices for conducting death clearance.
22 NAACCR Data Dictionary. Version 24 - data item #605: inpatient status, Available: https://apps.naaccr.org/data-dictionary/data-dictionary/version=24/data-item-view/item-number=605/
23 Hewlett MM, Raven MC, Graham-Squire D, *et al*. Cluster analysis of the highest users of medical, behavioral health, and social services in San Francisco. *J Gen Intern Med* 2023;38:1143–51.
24 Menendez ME, Neuhaus V, van Dijk CN, *et al*. The Elixhauser comorbidity method outperforms the Charlson index in predicting

inpatient death after orthopaedic surgery. *Clin Orthop Relat Res* 2014;472:2878–86.
25 Thorndike AL, Yetman HE, Thorndike AN, *et al*. Unmet health needs and barriers to health care among people experiencing homelessness in San Francisco's Mission District: a qualitative study. *BMC Public Health* 2022;22:1071.
26 Raven MC, Kaplan LM, Rosenberg M, *et al*. Mobile phone, computer, and internet use among older homeless adults: results from the HOPE HOME cohort study. *JMIR Mhealth Uhealth* 2018;6:e10049.
27 Qi D, Abri K, Mukherjee MR, *et al*. Health impact of street sweeps from the perspective of healthcare providers. *J Gen Intern Med* 2022;37:3707–14.
28 Decker H, Raguram M, Kanzaria HK, *et al*. Provider perceptions of challenges and facilitators to surgical care in unhoused patients: a qualitative analysis, 2023.
29 Zapka J, Taplin SH, Ganz P, *et al*. Multilevel factors affecting quality: examples from the cancer care continuum. *J Natl Cancer Inst Monogr* 2012;2012:11:11–9:.
30 Decker H, Raguram M, Kanzaria HK, *et al*. Provider perceptions of challenges and facilitators to surgical care in unhoused patients: A qualitative analysis. *Surgery* 2024;175:1095–102.
31 Wadhera RK, Khatana SAM, Choi E, *et al*. Disparities in care and mortality among homeless adults hospitalized for cardiovascular conditions. *JAMA Intern Med* 2020;180:357–66.
32 Tsai J, Pietrzak RH, Szymkowiak D. The problem of veteran homelessness: an update for the new decade. *Am J Prev Med* 2021;60:774–80.
33 Decker HC, Graham LA, Titan A, *et al*. Housing status changes are associated with cancer outcomes among US veterans. *Health Aff (Millwood)* 2024;43:234–41.
34 Asgary R. Cancer screening in the homeless population. *Lancet Oncol* 2018;19:e344–50.
35 Long HL, Tulsky JP, Chambers DB, *et al*. Cancer screening in homeless women: attitudes and behaviors. *J Health Care Poor Underserved* 1998;9:276–92.
36 Chau S, Chin M, Chang J, *et al*. Cancer risk behaviors and screening rates among homeless adults in Los Angeles County. *Cancer Epidemiol Prev Biomarkers* 2002;11.
37 Asgary R, Garland V, Sckell B. Breast cancer screening among homeless women of New York City shelter-based clinics. *Womens Health Issues* 2014;24:529–34.
38 Avelar Portillo LJ, Kayser GL, Ko C, *et al*. Water, Sanitation, and Hygiene (WaSH) insecurity in unhoused communities of Los Angeles, California. *Int J Equity Health* 2023;22:108.
39 Decker HC, Kanzaria HK, Evans J, *et al*. Association of Housing Status With Types of Operations and Postoperative Health Care Utilization. *Ann Surg* 2023;278:883–9.
40 A Rule by the Centers for Medicare & Medicaid Services on. *Medicare program; Hospital inpatient prospective payment systems for acute care hospitals and the long-term care hospital prospective payment system and policy changes and fiscal year 2023 rates; quality programs and medicare promoting interoperability Pr*.2023. Available: https://www.federalregister.gov/documents/2022/08/10/2022-16472/medicare-program-hospital-inpatient-prospective-payment-systems-for-acute-care-hospitals-and-the
41 Papageorge MV, Woods AP, de Geus SWL, *et al*. The persistence of poverty and its impact on cancer diagnosis, treatment and survival. *Ann Surg* 2023;277:995–1001.
42 Horwitz LI, Chang C, Arcilla HN, *et al*. Quantifying health systems' investment in social determinants of health, by sector, 2017–19. *Health Aff (Millwood)* 2020;39:192–8.
43 Greene LJ, Carter B, Loehrer AP. Examining medicaid waivers-an opportunity to promote equity in cancer care. *JAMA Oncol* 2024;10:291–2.
44 Home. n.d. Available: https://www.dhcs.ca.gov/CalAIM/ECM/Pages/Home.aspx
45 Garcia C, Doran K, Kushel M. Homelessness and health: factors, evidence, innovations that work. *Health Aff (Millwood)* 2024;43:164–71.
46 Doran KM, Ragins KT, Gross CP, *et al*. Medical respite programs for homeless patients: a systematic review. *J Health Care Poor Underserved* 2013;24:499–524.
47 Fowle MZ, Routhier G. Mortal systemic exclusion yielded steep mortality-rate increases in people experiencing homelessness, 2011–20. *Health Aff (Millwood)* 2024;43:226–33.