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ORIGINAL ARTICLE

The association between housing and food insecurity among medically underserved cancer patients

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Abstract

Purpose To assess the prevalence of socioeconomic needs and associations between housing characteristics and food insecurity among low-income cancer patients, among whom housing and food insecurity are particularly prevalent.

Methods Low-income cancer patients in active treatment ($N = 1618$) were enrolled in a comprehensive patient navigation program. Food insecurity was assessed using the 18-item US Department of Agriculture US Household Food Security Survey Module. Participants self-reported their need for assistance with housing issues/type of assistance needed, perception of overcrowding, satisfaction with living situation, and household density via a cross-sectional survey. Descriptive analyses, cross-tabulations and tests of proportions, and binary logistic regression were used in data analyses.

Results Seventy percent of patients were food insecure. Housing characteristics associated with food insecurity were homelessness or living in sheltered/supportive housing (83.3% food insecure), renting (71.9%), and homeownership (58.1%; $p < .001$); living situation satisfaction (not satisfied, 79.4%; somewhat satisfied, 25.6%; very satisfied, 66%; $p < .001$); need of housing assistance (79.2%; $p < .001$), and feeling crowded in their living unit (77.6%; $p < .05$). Associations of living unit type with food insecurity were significant in the binary logistic regression model (renters 1.68 OR, homeless/sheltered housing 2.80 OR vs homeowners).

Conclusion The vulnerability to food insecurity of patients in this low-income sample was underlined by the high rates found, and clear associations with housing characteristics of homelessness, housing assistance needs, and feeling overcrowded were identified. These results could help shape priorities around screening patients for nutrition and housing needs and developing interventions to address them.

Keywords Food insecurity · Housing · Household density · Overcrowding · Cancer · Social determinants of health

Background

Low-income, immigrant, and minority cancer patients, for whom a cancer diagnosis can be an extreme financial burden added to an already financially precarious situation [1], can be particularly affected by poor housing conditions and food insecurity [2]. Adequate housing and food are two fundamental human rights and are essential contributors to health [3–6]. Housing insecurity has no standard definition but can include affordability, safety, quality, and overcrowding issues, staying with relatives, and housing loss [7]. Food insecurity arises with inadequate and inconsistent access to enough food for an active healthy life [8]. Underserved New York City (NYC) cancer patients have a high number of characteristics associated with housing-related issues and food insecurity, including race/ethnicity, immigrant background, education level, and low income [9, 10].

Poor housing indicators are associated with negative physical and mental health outcomes and increased morbidity from infectious diseases, chronic illnesses, and injuries [3–6]. Overcrowding is negatively associated with mental health, coping with stress, social relationships, sleep, and psychological distress [11–13]. Housing insecurity is also a

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barrier to having a usual source of health care and is associated with postponing medical care, missing appointments, and higher hospitalization rates among low-income adults [14]. A qualitative study among NYC cancer patients/survivors identified housing needs as housing expenses (e.g., rent, mortgage, and utilities), housing loss, crowded/unstable housing, and housing conditions, accessibility, and safety [2].

Cancer patients who are food insecure are more likely to have poorer functional, social, and emotional well-being [14–17], are at higher risk for depression [18], and are more likely to have missed appointments and treatment delays and interruptions [18]. Food insecurity is associated with increased rates of diabetes, hypertension, hyperlipidemia, anemia, depression, stress, and anxiety [19–21]. Food insecure individuals are less likely to seek needed medical care and more likely to postpone medications and miss treatment appointments than food secure patients [18, 22].

Social determinants of health, the non-medical determinants of health outcomes that can include housing and food needs, are often interrelated [23]. In the biobehavioral theory of health, housing insecurity is an environmental and emotional contributor to food insecurity [24]. However, housing and food insecurity are rarely assessed in the cancer clinical encounter, and there is no literature on the association between housing characteristics and food insecurity among cancer patients. This study assessed the prevalence of socioeconomic needs and associations between housing characteristics and food insecurity among predominantly low-income, immigrant, and minority cancer patients enrolled in a comprehensive patient navigation program in NYC. The results could help shape priorities around screening patients for, and implementing interventions to address, cancer patients' social determinants of health-related outcomes.

Methods

Design and participants

This study focused on a nested cohort of cancer patients enrolled in the Integrated Cancer Care Access Network (ICCAN) [25] from 2012 through 2017, available to patients at eleven NYC cancer clinics located in safety net hospitals and academic medical centers. The primary aim of the ICCAN program is to address cancer disparities among NYC's low-income immigrant and minority communities by working to increase their access to care and essential needs. Patients were enrolled in the program at the beginning of or at another point during their cancer treatment and remained enrolled for the duration of their treatment and for up to a year afterwards. Patients were screened for housing issues and food insecurity at intake.

Cancer patients in active treatment were approached by bilingual access facilitators who administered an intake survey in English, Spanish, or Mandarin, according to patient preference. Access facilitators were trained in administering the intake questionnaire during a face-to-face interview and addressed any questions during the survey administration. A detailed description of the study methodology and intake survey has been previously published [25]. This study was approved by the Institutional Review Board of Memorial Sloan Kettering Cancer Center.

Measures

The routine ICCAN needs assessment questionnaire was administered to all participants at intake, collecting information on sociodemographic characteristics, medical history, cancer treatment history, and financial, housing, food, transportation, and other non-medical needs.

Participants self-reported their *need for assistance with housing issues*. Patients were asked "Do you feel that you need assistance with housing issues?" with a yes/no response format and an option to specify type of housing assistance needed. In addition, patients were asked "Do you have any of the following problems with your living unit?" and provided with a multiple-choice list, including no stove/oven, heat, water, hot water, electricity, or windows; flooding; and an "other" option.

To assess *perception of overcrowding and satisfaction with one's living situation*, participants were asked, "Do you feel that your living unit is too crowded?" with a yes/no response format and "Overall, how satisfied are you with your living situation?" with answer choices of not satisfied, somewhat satisfied, or very satisfied.

Household density was determined according to the US Department of Housing and Urban Development standard, which is based on the number of people per bedroom. Households with >2 people per bedroom were categorized as high density and households with ≤ 2 people per bedroom were categorized as low density [26].

Food insecurity was assessed using the US Department of Agriculture (USDA) US Household Food Security Survey Module [27]. This survey includes 18 items that assess household food security over the preceding 12 months [27]. Survey items address, for example, whether individuals ran out of food before being able to buy more, cut the size of or skipped meals, were hungry, did not eat for a whole day, and/or lost weight due to not having enough money for food.

Statistical analyses

Descriptive analyses were performed to examine sociodemographic and housing characteristics: means and standard deviations for continuous variables and percentages for

categorical variables. Food security categories were calculated based on the Food Security Survey Module (USDA) guidelines: raw score 0–2 = food secure, raw score > 2 = food insecure [26, 27].

Cross-tabulations and tests of proportions were used to investigate the differences in housing characteristics between food secure households and food insecure households. Significance (p) values were obtained using Pearson chi-squares for most variables, and the Fisher's exact test was used for small groups ($n < 5$). All tests were two sided and a p value of < .05 was considered statistically significant.

Covariates with a statistically reliable univariate association were entered into a binary logistic regression to examine to what extent food insecurity was associated with housing variables. The 10-event-per-covariate rule was considered to minimize model overfit [28]. We did not conduct any false-discovery-rate adjustments for multiple statistical comparisons [29]. The logistic regression examined the housing predictors of food insecurity. All missing values were excluded from analyses and all statistical analyses were conducted using SPSS version 24 [30].

Results

Participant characteristics ($N = 1618$) are shown in Table 1. Most were female (71.6%) and/or born outside the USA (78.0%) with a mean age of 57 (13 SDs). Almost half (47.6%) were non-Hispanic Black, and just over one-fifth (22.7%) were Hispanic. Two-thirds (66.3%) were single (separated, divorced, widowed, never married). Most (75.7%) were unemployed. The most frequent cancer diagnoses were breast cancer (43.6%), followed by prostate (9.2%) and lung (6.9%). Many (43.8%) had completed less than a high school education (< 12th grade), including 12.1% with up to a 5th grade education. Many (41.8%) participants reported speaking English less than "very well." A high proportion of participants (91.7%) had health care coverage, most of which was public: 32.6% had Medicaid for the treatment of an emergency medical condition, 46.3% Medicaid, 6.2% Medicare, 9.1% both Medicaid and Medicare, and 5.7% private insurance. Almost one-fourth (23.5%) had no household income, and 68.8% were food insecure.

Table 2 shows participants' housing characteristics and their self-reported assessments of their living conditions. Most (77.4%) participants lived in rental units, including 19.0% of the study population in public housing, and almost one-fifth were homeowners (18.7%). A few were in supportive housing (1.3%) or a shelter/homeless (0.3%). Over one-fifth (22.0%) lived in high-density households (> 2 individuals per bedroom), and 16.3% felt that their living unit was overcrowded. One hundred eight (7.1%) participants reported problems with their living unit, including having no heat (13.0%), hot water (13.0%), stove (12.0%), windows (5.6%), and/or electricity (4.6%), and some (5.6%) had experienced home flooding. Most participants were very (59.1%) or somewhat (30.6%) satisfied with their living situation, and 10.3% were not satisfied. Assistance was needed with housing (16.4%), transportation (59.1%), and acquiring nutrition information (90.0%).

Table 3 summarizes the relationships between housing and characteristics and satisfaction and food security status. Patients who were homeless or lived in a shelter/supportive housing were most likely to be food insecure (83.3%), followed by those who lived in a rental unit (71.9%), and those who lived in a private unit that they owned (58.1%; $p < .005$). Patients who were not satisfied with their living situation were more likely to be food insecure (79.4%) than those who were very satisfied (63.0%; $p < .000$). Patients who needed housing assistance were more likely to be food insecure (79.2%) than those who did not need assistance (66.0%; $p < .001$), and those who felt crowded in their living unit were more likely to be food insecure (77.6%) than those who did not feel crowded (66.9%; $p < .011$). Patients who needed nutritional information were more likely to be food insecure (71.4%) than food secure (22.4%; $p = .000$). There was no significant association of race/ethnicity with food security status ($p = .098$).

Housing factors that were significant in predicting food insecurity in the univariate analyses (living unit type, living situation satisfaction, need for assistance with housing, and feeling overcrowded) were further analyzed in a binary logistic regression to examine their relative influence on food insecurity (Table 4). Living unit type was significantly associated with food insecurity: patients who lived in a shelter/supportive housing or who were homeless were more likely to be food insecure (OR, 2.803; 95% CI, 0.584–13.445) than patients who owned their housing unit. Patients who lived in a rental unit were also more likely to be food insecure (OR, 1.680; 95% CI, 1.116–2.420) than patients who owned their housing unit.

Discussion

We found that low-income, immigrant, and minority cancer patients who were homeless or lived in sheltered/supportive housing, lived in a rental unit, were not satisfied with their living situation, reported a need for housing assistance, and/or reported feeling too crowded were more likely to be food insecure than others. Housing and food insecurity are particularly prevalent among low-income minority patients, putting them at greater risk of associated negative outcomes. However, this is the first study to examine associations between housing and food insecurity among cancer patients.

Table 1 Frequencies ($N = 1618$[a])

Characteristics	Categories	Total sample, no. (%)
Gender ($n = 1618$)	Female	1158 (71.6)
	Male	460 (28.4)
Age ($n = 1618$), mean (SD)		57 (13)
Race ($n = 1553$)	Non-Hispanic Black	727 (46.7)
	Hispanic/Latino	353 (22.7)
	Non-Hispanic White	119 (7.4)
	Some other race	354 (23.2)
Education level ($n = 1587$)	None	33 (2.1)
	Kindergarten–2nd grade	26 (1.6)
	3rd–5th grade	133 (8.4)
	6th–8th grade	252 (15.9)
	9th–11th grade	251 (15.8)
	12th grade/HS graduate	524 (33.0)
	Some college	161 (10.1)
	College graduate	170 (10.7)
	Post college/graduate school	37 (2.3)
Marital status ($n = 1608$)	Married	542 (33.7)
	Partnered	38 (2.4)
	Divorced	136 (8.5)
	Separated	132 (8.2)
	Widowed	155 (9.6)
	Single	605 (37.6)
Employment status ($n = 1565$)	Employed (full time)	31 (2.0)
	Employed (part time)	89 (5.7)
	Unemployed	1185 (75.7)
	Retired	256 (16.4)
	Student	4 (0.3)
Cancer diagnosis ($n = 1485$)	Breast	648 (43.6)
	Prostate	137 (9.2)
	Lung	103 (6.9)
	Colon	103 (6.9)
	Lymphoma	57 (3.8)
	Other cancer	437 (29.6)
Monthly household income ($n = 929$)	No income	218 (23.5)
	Low income ($1–$999)	294 (31.6)
	Middle income ($1000–$2300)	351 (37.8)
	High income (> $2300)	66 (7.1)
English proficiency ($n = 1610$)	Very well	938 (58.3)
	Well	191 (11.9)
	Not well	275 (17.1)
	Not at all	206 (12.8)
Language ($n = 1529$)	English	1012 (66.2)
	Spanish	429 (28.1)
	Other	88 (5.8)
Born in USA ($n = 1390$)	Yes	306 (22.0)
	No	1084 (78.0)
Health insurance status ($n = 1494$)	Uninsured	124 (8.3)
	Insured	1370 (91.7)

Table 1 (continued)

Characteristics	Categories	Total sample, no. (%)
Health insurance type ($n=1301$)	Emergency Medicaid	424 (32.6)
	Medicaid	602 (46.3)
	Medicare	81 (6.2)
	Medicaid & Medicare	119 (9.1)
	Private	75 (5.7)
Food security ($n=792$)	Food secure	247 (31.2)
	Food insecure	545 (68.8)

[a]Missing data excluded

Table 2 Housing quality and other needs ($N=1618$)

Housing characteristics	Categories	Total sample, no. (%)
Living unit type ($n=1614$)	Rental	1250 (77.4)
	Private	317 (18.7)
	Supportive housing	21 (1.3)
	Shelter/homeless	5 (0.3)
	Other	21 (1.3)
Housing density ($n=1360$)	Overcrowded (> 2 PPB)	299 (22.0)
	Not overcrowded	1061 (78.0)
Public housing ($n=1541$)	Yes	293 (19.0)
	No	1248 (81.0)
Problems with living situation ($n=1541$)	No	1403 (92.9)
	Yes	108 (7.1)
	No stove	13 (12.0)
	No heat	14 (13.0)
	No water	14 (13.0)
	Flooding	6 (5.6)
	No electricity	5 (4.6)
	No windows	6 (5.6)
Satisfaction with living situation ($n=1618$)	Not satisfied	166 (10.3)
	Somewhat satisfied	495 (30.6)
	Very satisfied	957 (59.1)
Self-reported need for assistance with housing issues ($n=1590$)	Yes	260 (16.4)
	No	1330 (83.6)
Feeling too crowded ($n=1611$)	Yes	262 (16.3)
	No	1349 (83.4)

Abbreviation: *PPB*, persons per bedroom

This study recruited largely from NYC public hospitals that serve a disproportionate share of the city's low-income and uninsured population, and 95% of the hospitals' patients are of racial/ethnic minority backgrounds [31]. These hospitals serve areas designated as medically underserved by the federal Health Resources and Services Administration and have two to three times as many uninsured patients as other NYC hospitals [31]. One study clinic was located in a Bronx community district in which the cancer mortality rate was 30% higher than for NYC overall, according to a 2018 report; 31% of residents lived in poverty, 16% were unemployed, and 60% of renters were rent burdened (vs. NYC averages of 20%, 9%, and 51%, respectively), meaning that they spent over 30% of household income on rent [32]. In the East Harlem district of another study clinic, the cancer mortality rate was 27% higher than for NYC overall; 23% of residents lived in poverty, 11% were unemployed, and 48% of renters were

Table 3 Housing/demographic characteristics and associations with food insecurity ($n=792$)

Housing characteristics	Categories	Food secure ($n=247$), no. (%)	Food insecure ($n=545$), no. (%)	p value
Race ($n=763$)	Non-Hispanic Black	128 (35.2)	236 (64.8)	.098
	Hispanic/Latino	30 (22.1)	106 (77.9)	
	Non-Hispanic White	13 (22.0)	46 (78.0)	
	Some other race	65 (33.5)	139 (66.5)	
Living unit type[a] ($n=792$)	Rental	169 (28.1)	432 (71.9)	**.005**
	Private	70 (41.9)	97 (58.1)	
	Shelter/supportive housing/homeless	2 (16.7)	10 (83.3)	
	Other	4 (44.4)	5 (55.6)	
Monthly household income ($n=450$)	No income	35 (28.0)	90 (72.0)	.087
	Low income	42 (29.0)	103 (71.0)	
	Middle income	47 (32.2)	99 (67.8)	
	High income	17 (50.0)	17 (50.0)	
Household density ($n=673$)	Overcrowded	47 (33.3)	94 (66.7)	.355
	Not overcrowded	156 (29.3)	376 (7.7)	
Public housing ($n=749$)	Yes	51 (33.8)	100 (66.2)	.495
	No	185 (3.9)	413 (69.1)	
Problems with living situation ($n=743$)	Yes	15 (23.4)	49 (76.6)	.162
	No	218 (32.1)	461 (67.9)	
Problems with living situation ($n=64$)	No stove[a]	2 (28.6)	5 (71.4)	.641
	No heat	6 (2.0)	24 (8.0)	.231
	No water[a]	3 (33.3)	6 (66.7)	.507
	Flooding[a]	1 (10.0)	0 (0.0)	.285
	No electricity[a]	0 (0.0)	2 (100.0)	.513
	No windows[a]	0 (0.0)	1 (100.0)	.717
Satisfaction with living situation ($n=792$)	Not satisfied	20 (2.6)	77 (79.4)	**.000**
	Somewhat satisfied	67 (25.6)	195 (74.4)	
	Very satisfied	160 (37.0)	273 (63.0)	
Self-reported need for housing assistance ($n=786$)	Yes	33 (2.8)	126 (79.2)	**.001**
	No	213 (34.0)	414 (66.0)	
Feeling too crowded ($n=789$)	Yes	34 (22.4)	118 (77.6)	**.011**
	No	211 (33.1)	426 (66.9)	

Table 4 Binary logistic regression on food insecurity ($n=771$)

Variables		Coefficient	Odds ratio	95% CI	p value
Living unit type	Private	ref	ref	ref	
	Rental	.519	1.68	(1.116–2.420)	**.005**
	Shelter/supportive housing/homeless	1.031	2.803	(.584–13.445)	**.015**
Satisfaction with living situation	Very satisfied	ref	ref	ref	
	Somewhat satisfied	.352	1.422	(.976–2.072)	.067
	Not satisfied	.471	1.601	(.855–2.999)	.142
Self-reported need for assistance with housing issues	Yes	ref	ref	ref	
	No	− .33	.719	(.446–1.158)	.175
Feeling too crowded	Yes	ref	ref	ref	
	No	− .143	.867	(.542–1.388)	.552

rent burdened (vs. 9%, 5%, and 40%, respectively, for the adjacent Upper West Side) [32]. Therefore, the characteristics of our patient population included high frequencies of characteristics associated with housing issues and food insecurity and that reflect long-standing structural inequities [9, 10]. Indeed, the food insecurity rate was 70%—five times the NYC average of 14.4% and six times the national average of 11.8% [33]. These structural issues exist in vulnerable communities throughout the USA, as recently illustrated by the vast racial/ethnic disparities in COVID-19 health outcomes nationally [34].

Other US studies have found associations between housing and food insecurity. One study in Los Angeles found that respondents who had experienced homelessness in the past 5 years were at high risk of food insecurity (OR, 5.6) [9]. In a Chicago study of marginally housed individuals, 75% were food insecure and 53% met severe food insecurity criteria [35]. A qualitative study among low-income Latino immigrants in rural US areas found that the families with the highest housing costs had "consistent" (long-term) food insecurity and that housing issues drained resources away from meeting food needs [36].

According to the biobehavioral theory of health, human behavior is shaped by a complex interplay of social and environmental exposures and biobehavioral responses [24]. At the environmental level, housing challenges, such as high housing costs, overcrowding, lack of kitchen access, and homelessness, create obstacles to the acquisition, storage, and preparation of healthful foods. Also, affordable healthful foods may not be readily available in low-income communities, where energy-dense nutritionally poor foods are often cheaper, heavily advertised, and more readily available than nutritious foods, and nutritional knowledge can be lacking [24]. Within this framework, income alone cannot fully address food insecurity and diet quality, and environmental factors, including housing, must also be addressed.

Living in a rental unit was associated with food insecurity and the overcrowding rate was at least 4 times the citywide average of 4.6% [37]. Racial/ethnic minorities in NYC are more likely than non-Hispanic Whites to live in rented and/or overcrowded housing and to be housing cost burdened [37]. Among low-income NYC renters, almost half (45.6%) are severely rent burdened, spending at least 50% of household income on gross rent [37]. Furthermore, immigrants without status are not eligible for government benefits related to housing, such as subsidized housing, housing vouchers, and public housing programs, so they may find it particularly hard to find assistance with housing costs [38].

Some of our participants were homeowners, and as household income is affected by cancer-related income and/or job loss, home maintenance, taxes, and mortgage payments may become difficult for low-income cancer patients to afford. In a qualitative study of cancer patients and survivors with housing needs, the participants who had been homeowners when they commenced treatment had lost their homes to foreclosure after falling behind on mortgage payments [2]. Potentially burdensome housing costs and home loss, and the stress they entail, could be contributing factors to food insecurity among renters and homeowners.

Socioeconomic hardships, such as poor housing conditions and food insecurity, could exacerbate low-income, immigrant, and minority cancer patients' already elevated risk of poor cancer health outcomes [39]. However, there is the potential to ameliorate this. Patient navigation programs, for example, can help address these hardships. In an assessment of ICCAN patients in urgent need of financial support, 86% reported that navigation services had helped them to attend medical appointments and 72% that services had decreased their care worries [25]. When possible, cancer clinics should have designated patient navigators, nutritionists, education and outreach coordinators, and social workers for comprehensive and timely case management assistance, and ideally, they should be bilingual in languages spoken in the local community. Printed information should also be available in languages spoken in the local community. Cancer clinics should establish partnerships, such as with community-based and legal service organizations, to enable sustainable access to additional resources. Patients should be screened regularly over their treatment course to monitor for the emergence or worsening of housing and food security issues as the financial strains of cancer treatment and survivorship often increase over time [40]. Successful patient navigation requires clear guidelines, definition, and rigorous testing of outcomes and processes [41]. National initiatives, such as the National Cancer Institute Patient Navigation Research Program, have been created to design and evaluate patient navigation programs for vulnerable populations [41]. Clear metrics should be established to assess successful outcomes of patient navigation targeted to vulnerable cancer populations who are food and housing insecure. Policy advocacy can then support implementation of evidence-based successful patient navigation programs on the local, state, and national levels.

Patient navigators and social workers who work with housing insecure cancer patients can help them to identify and apply for some existing resources. For example, the specific housing problems that participants who were renters reported in our study are NYC housing code violations [37, 42]. US cities and counties often have local housing codes that are designed to assure renters of minimal standards of housing; therefore, an option for addressing renters' issues is to refer patients to local low- or no-cost legal assistance organizations [43]. Additionally, some foundations provide grants that help cancer patients with housing-related costs, such as rent, which may be helpful for immigrants without status, who may not have ready access to other resources [44]. There are also government benefits and programs, including through the Department of Housing and Urban Development and the USDA in rural communities, that can help with housing-related costs and needs, if patients meet

eligibility requirements, which include immigration status [38].

In addition to screening for and recognizing housing and food insecurity during patient visits and referring patients to supportive services and resources, clinicians should consider advocating for policies and working closely with government and community organizations to facilitate change. Previous research has proposed a conceptual model informed by the social ecologic model to address food insecurity [45]. Based on this, we recommend that at the societal level, policy can be influenced by producing research evidence; at the community level, increased awareness of and screening for food insecurity are needed, and at the individual level, staff should be designated as financial navigators and trained and utilized to perform this role [45]. Additionally, health plans could be incentivized to provide integrated medical and social services to low-income and minority patients who screen positive for housing and food insecurity. At Hennepin Health (Minnesota), which offers comprehensive housing and social services navigation and intensive case management to low-income Medicaid patients, quality of life improved among patients with various medical conditions, and emergency department visits decreased by 9.1% within 2 years of program implementation [46, 47].

In New York State, the Delivery System Reform Incentive Payment Program has focused on creating partnerships between hospitals and community-based service providers to reduce avoidable hospitalizations among Medicaid patients [48]. The program includes social determinants of health screening in public hospitals, including for housing and food insecurity, and recognizes the importance of addressing social determinants of health to achieve their overall goal [48]. Health care organizations that bring together medical and social services in one location can play an important role in increasing overall patient health and well-being. A long-term investment among hospital systems, health plans, and public and government organizations could enhance clinical and social services, address substandard housing, housing insecurity, homelessness, and food insecurity and reduce these threats to patient survival and well-being.

Study limitations

This study had some limitations. The study sample was a convenience sample of medically underserved cancer patients served in the 11 cancer clinics in NYC that participate in the ICCAN program. As such, our findings are not generalizable to the overall cancer patient population. Future studies are needed to assess cancer patient socioeconomic needs in other settings, including rural and suburban settings, as well as in clinics with different patient demographics. In addition, various patients entered the ICCAN program during different points in their treatment, and the study intake was administered at the time of patient entry into the program. Future studies should assess changes in housing and food insecurity at the beginning and throughout the continuum of care and outcomes following case management interventions. Another limitation was missing intake data due to patient time constraints/not feeling well. The missing data were excluded from data analysis, which could impact data analysis and results.

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Data availability N/A

Code availability N/A

Declarations

Ethics statement This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Memorial Sloan Kettering Cancer Center's Institutional Review Board/Privacy Board and from each study site.

Consent to participate Written informed consent was obtained from all individual participants included in the study.

Conflict of interest To the best of our knowledge, no conflict of interest, financial or other, exists for any of the authors except for V. Blinder (Pfizer, Inc., consultant fee). This manuscript has not been previously published and is not under consideration in the same or substantially similar form in any other peer-reviewed media.

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