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ORIGINAL PAPER

Enhancing the utilization of healthy living interventions among cancer survivors in historically underserved populations and communities

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Abstract

Purpose This study aimed to describe the clinical characteristics and wellness programming preferences of cancer survivors from Acres Homes, a historically Black neighborhood in Houston, Texas, with areas of persistent poverty. The goal of this study was to identify opportunities to increase cancer survivor utilization of healthy eating and active living interventions aligned to cancer center community outreach and engagement efforts.

Methods This multiple methods study included a retrospective review of electronic health record data ($n=413$) and qualitative interviews with cancer survivors ($n=31$) immediately preceding initiation of healthy eating, active living programming in Acres Homes.

Results This study found Acres Homes survivors have high rates of co-occurrent cardiometabolic disease including obesity (45.0%), diabetes (30.8%), and other related risk factors as well as treatment-related symptoms. Four major concepts emerged from interviews: (1) Factors that influence survivors' ability to eat well and exercise, (2) Current usage of community resources, (3) Interest in relevant programming, and (4) Specific programming preferences. Opportunities for current and future health promotion programming for cancer survivors were explored.

Conclusion Strategically tailoring community resources for cancer survivors can provide a more robust network of support to promote healthy eating and active living in this population. This work informed community implementation of evidence-based health interventions in Acres Homes and may support future projects aiming to enhance community-led cancer prevention efforts in historically underserved communities.

Keywords Community health · Physical activity · Nutrition · Chart review

Introduction

The number of cancer survivors (those currently or previously treated for cancer) in the United States is projected to reach 22.2 million by the year 2030 [1]. Improvements in cancer detection and treatment have improved survival rates and duration [2]. However, enduring late effects of treatment throughout survivorship [3] and increased risk for subsequent cancers [4], cardiometabolic disease [5, 6], type 2 diabetes [7, 8], and weight gain [9] impact the long-term health of many survivors. Poor diet, lack of physical activity, and excess body weight exacerbates many of these late treatment effects and increases subsequent disease risk [10, 11]. Physical activity has been shown to improve cancer survivors' physical functioning, fatigue, psychological distress, and quality of life [12]. Both physical activity and diet

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quality have been associated with reduced cancer mortality [12, 13]. However, the majority of survivors do not meet established physical activity or nutrition recommendations [14, 15]. Thus, promoting active living and healthy eating throughout survivorship is an urgent public health priority.

This issue is even more critical in historically underserved populations and communities. Concurrently, African American and Hispanic cancer survivors are less likely to meet activity recommendations than non-Hispanic white counterparts [16]. Racial/ethnic minorities and those with low income are disproportionately affected by cardiometabolic disease, including diabetes, heart disease and obesity [17–20] and may have less access to comprehensive care, including preventive and survivorship care [21, 22]. Co-occurrence of cancer and cardiometabolic disease, combined with a lack of long-term preventive care access, and general neighborhood deprivation portends worse outcomes for cancer survivors living in areas of concentrated and persistent poverty [23].

The role of Comprehensive Cancer Centers in supporting community-based cancer prevention efforts is rapidly evolving. In 2016, The National Cancer Institute issued guidance that community outreach and engagement (COE) efforts be integrated throughout comprehensive cancer center operations, with an emphasis on working with community stakeholders to identify and address needs of the center's catchment area. As part of this effort, several cancer centers have increased investment in community-based initiatives targeting modifiable risk factors for cancer, including nutrition and physical activity in high-need neighborhoods. A place-based approach to cancer prevention aims to create systems-level change through the implementation of evidence-based health promotion programs in partnership with community-based organizations that are locally positioned to sustain these efforts into the future. Cancer survivors from historically underserved populations and communities could potentially benefit from these initiatives through increased access to healthy living programs and infrastructure. However, it is unclear how to best support and engage cancer survivors in utilizing these resources.

The University of Texas MD Anderson Cancer Center's Be Well™ Acres Homes is one such place-based COE initiative supporting community-led health promotion efforts. Be Well Acres Homes is part of MD Anderson's Cancer Prevention and Control Platform led in collaboration with Harris Health System, Memorial Hermann Community Benefit Corporation, UTHealth School of Public Health, and more than 30 community organizations united with residents of Acres Homes. Harris Health System provides health care to uninsured and underinsured residents of Harris County and is the nation's 4th largest safety net healthcare system. It includes 2 acute/specialty care hospitals and 17 primary care clinics throughout Houston. Harris Health's Lyndon B. Johnson (LBJ) Hospital is a 215-bed acute care hospital in central Houston that provides oncology care through partnership with MD Anderson. In 2019 alone, the MD Anderson Oncology Program at LBJ Hospital served more than 4,000 unique patients. The majority of LBJ oncology patients are Hispanic (60%) or African American (24%), and most (62%) are uninsured [University of Texas MD Anderson internal document—MD Anderson Oncology Program at LBJ Hospital Year-end Review FY 2019]. Many LBJ oncology patients are referred from Harris Health primary care clinics including the Acres Home Health Center, located in the Acres Homes neighborhood of Northwest Houston. Acres Homes is an area of historical persistent poverty. It is a majority minority (94% African American or Hispanic) area with a high concentration of poverty (25%), high proportion of adults without health insurance (35.7%) [24] and high prevalence of obesity (43.2%) [25]. Be Well Acres Homes aims to mobilize the community to promote health and wellness and reduce modifiable risk factors for cancer in Acres Homes through collaborative community-led implementation of a Community Action Plan including 15 evidence-based interventions (EBIs) related to healthy eating and active living [26]. Implementation of programs initiated in September 2021. To inform the approach for Be Well Acres Homes, a rigorous community assessment was completed by the Cancer Prevention and Control Platform in partnership with the community. While the assessment informed many aspects of community program implementation, there was limited information on the specific needs of cancer survivors in Acres Homes particularly related to food insecurity, poor diet, physical inactivity, and related factors.

With the goal of informing future interventions for cancer survivors as a component of Be Well Acres Homes, we conducted a retrospective chart review to examine the clinical characteristics of cancer survivors treated at the LBJ Hospital Oncology Clinic. The focus of the EMR extraction was on variables potentially related to diet and physical inactivity including anthropometrics, symptom burden, and cardiometabolic disease. We also conducted interviews with survivors from the area to identify needs and preferences for wellness programming. We then contextualized our findings to explore how future implementation of EBIs deployed through Be Well Acres Homes could be adapted for cancer survivors. The purpose of this research was to identify the wellness programming needs and preferences of cancer survivors and better understand how to optimize usage of healthy eating and active living interventions aligned to cancer center COE efforts.

Methods

This multiple methods study included: (1) quantitative assessment of characteristics of the Acres Homes cancer survivor population using retrospective review of EHR data

among individuals treated for any type of cancer at the LBJ Hospital and (2) qualitative in-depth interviews among oncology patients treated at the LBJ Hospital Oncology Clinic. These methods were selected as EHR data revealed the characteristics of health issues among cancer survivors in Acres Homes, including factors related to diet and exercise. Qualitative in-depth interviews augmented those data with lived experiences about diet and physical activity in this population.

Electronic health record review

A chart review was conducted of current and historical cancer patients over 18 years old who received primary care at the Acres Homes Health Center and oncology care at the LBJ Hospital between 2019 and 2021. Variables extracted included: demographics, socioeconomic factors, primary care clinic site, disease characteristics, anthropometric characteristics, cardiometabolic variables, and Edmonton Symptom Assessment System (ESAS) scores across nine common symptoms. Descriptive statistics including frequencies, means, and standard deviations were calculated for each variable of interest at last contact. BMI was calculated using height and weight measures reported in the EHR. Cancer treatments were extracted from the EMR text and procedure/protocols were categorized as chemotherapy, surgery, radiation therapy, and/or immunotherapy. Laboratory values (cholesterol, triglycerides, HbA1c, etc.) were categorized into two or three categories (e.g., normal/high; normal/prediabetes/diabetes) based on guidance from the Centers for Disease Control (CDC) [27, 28].

Interview study

Qualitative in-depth interviews were undertaken with current and historical cancer patients treated at LBJ Hospital, herein referred to as "survivors". A convenience sample of survivors were recruited by the LBJ Cancer Resource Center staff between June—November 2021. LBJ staff contacted individuals with upcoming oncology appointments to describe the study and gage interest. Interested individuals were then contacted by project staff to complete interviews. Although survivors that listed home addresses with Acres Homes area zip codes were prioritized, this criterion was broadened to the greater Houston area to enhance recruitment. Demographic differences between participants based in Acres Homes, and those living outside the area were explored using chi-squared and independent sample t-tests as appropriate. Based on the existing literature examining cancer survivor health issues [29–32] and guidelines for phenomenological research [33–35], it was determined that 30 interviews would provide sufficient data to achieve theoretical saturation, the point at which no new concepts emerge.

Interviews were conducted by research staff trained in qualitative research using a semi-structured interview guide focused on examining: (1) perceptions of nutrition and physical activity issues (e.g.. "What does being physically fit mean to you?"); (2) barriers and facilitators of achieving health goals (e.g., "What do you think helps you get enough exercise?"); and (3) preferences for wellness programming (e.g., "What would make you more likely to participate in a healthy eating or exercise program?"). Interviews were approximately one hour in length and conducted over video conference software (Zoom) or phone. After completion, participants received a $20 gift card as compensation for their time. Interviews were voice recorded and professionally transcribed. Transcripts were examined in a continuous fashion throughout the data collection period using a hybrid deductive-inductive content coding approach [36]. Pre-determined, deductive codes were developed from the interview guide content, and inductive codes were identified through review of the text. The final codebook was then re-applied to the entire set of interviews by two independent coders. Each coded transcript was reviewed in a group setting and disparities in coding rectified through discussion and mediation with the first author (MR). Qualitative analysis was completed using Atlas.ti software and guided by our objective of understanding current practices as well as needs and preferences for wellness programming to generate actionable recommendations [37]. Key concepts related to this end-goal were generated from the resulting data. Illustrative quotes for these concepts were selected based on representativeness of broader sentiment in the data set and to highlight responses from a diversity of participants.

Bringing together findings from the interviews and EHR analysis, the research team developed a set of recommendations on how EBIs implemented through Be Well Acres Homes could be adapted to increase utilization by cancer survivors. The goal of this exercise was to identify potential opportunities for better linking cancer survivors in the area to appropriate programs and services.

This project was approved by MD Anderson's Quality Assessment Improvement Board as well as the Harris Health System Quality Improvement Program Office. Informed consent was obtained when appropriate.

Results

Electronic health record results

Patient demographics and clinical characteristics

A total of $n=5,142$ patient records were originally extracted. Of those that reported a primary care location ($n=4,310$), 9.58% ($n=413$) indicated primary care at the Acres Home

Health Center and were included in this analysis. Table 1 details the demographic and clinical characteristics for included patient records. Most patients were over 40 years old (90.8%) and either African American or Hispanic (87.9%). More than one third of the sample (36.6%) received indigent care, which at Harris Health requires income at or below 150% of the federal poverty line and ineligibility for public coverage. Patients had a diversity of cancer types and 22.5% had stage 4 disease.

Cardiometabolic risk factors and disease prevalence

Rates of comorbid cardiometabolic disease among Acres Homes cancer survivors were high (Fig. 1). Over three-quarters (76.9%) of survivors in the sample had overweight or obesity. Blood lipid profiles revealed high triglycerides, total cholesterol and LDL cholesterol, as well as low HDL cholesterol. Based on HbA1c levels, most patients were pre-diabetic or diabetic (67.2%).

Cancer-related symptoms (ESAS)

Symptoms reported by patients for whom scores on the Edmonton Symptom Assessment System (ESAS) items were available at last contact ($n=392$) are shown in Fig. 2. Symptoms related to pain, sleep, tiredness and wellbeing were particularly elevated in this population. Over a third (36.1%, 37.2%, and 36.7%) of patients reported moderate to severe (ESAS score ≥ 4) pain, sleep, and tiredness symptoms , respectively. Reduced wellbeing was reported as moderate or severe by 30.9%.

Interview findings

A total of 31 cancer survivors (including active and post treatment oncology patients) completed interviews for this study. Patient demographics were diverse, with the majority Black/African American (71%) and over 50 years old (94%). Most participants (68%) were female. All respondents were from the greater Houston area; the majority (58%) were from the Acres Homes neighborhood specifically and 81% listed home zip codes within 11 miles of the Acres Homes Health Center (Table 2). With regard to race/ethnicity, the demographics of the sample are in line with population characteristics of Acres Homes which is predominately (71%) African American [25]. We did not identify any significant differences between interview participants from the Acres Homes neighborhood ($n=18$) and those from outside Acres Homes (more than 5 miles from the Acres Homes Health Center ($n=14$) based on gender (X^2 (1, $N=31$) $=1.98$, $p=0.16$), cancer type (X^2 (5, $N=31$) $=10.68$, $p=0.06$), race/ethnicity(X^2 (1, $N=31$) $=1.21$, $p=0.55$), or age t(29) $=1.37$, $p=0.18$).

Table 1 Sociodemographic and clinical characteristics of patients included in EHR review ($n=413$)

	N (%)
Age at diagnosis	
18–39	38 (9.2)
40–54	136 (32.9)
55–64	168 (40.7)
65 +	71 (17.2)
Sex	
Male	140 (33.9)
Female	273 (66.1)
Race/Ethnicity	
Non-Hispanic White	27 (6.5)
Black/African American	144 (34.9)
Hispanic	219 (53)
Other	23 (5.6)
Insurance Coverage/Payer Type	
Indigent Care	151 (36.6)
Commercial Insurance	67 (16.2)
Medicaid	67 (16.2)
Medicare	83 (20.1)
Self-Pay	25 (6.)
Unknown	20 (4.9)
Cancer Site	
Breast	106 (25.7)
Digestive non-Colorectal	47 (11.4)
Colorectal	34 (8.2)
Lung	33 (8)
Cervical	11 (2.7)
Other Solid	143 (34.6)
Hematopoietic	9 (2.2)
AJCC Clinical Stage	
0	28 (6.8)
1	90 (21.8)
2	64 (15.5)
3	47 (11.4)
4	93 (22.5)
Unknown	91 (22)
Treatment Type in Record	
Chemotherapy	187 (45.3)
Surgery	216 (52.3)
Radiation Therapy	139 (33.7)
Immunotherapy	22 (5.3)

Four major concepts relevant to the study goal of understanding and enhancing utilization of community-based wellness programming emerged from this data set: (1) Factors that influence survivors' ability to eat well and exercise, (2) Current usage of community resources related to diet and exercise, (3) Interest in healthy eating and active living programming, and (4) Specific preferences for such programs.

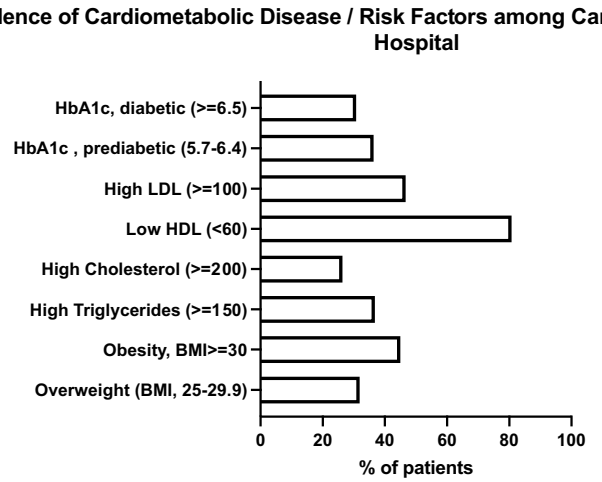

Fig. 1 Bar chart showing prevalence of cardiometabolic risk factors and disease among cancer survivors treated at LBJ hospital and based at the Acres Homes Health Center

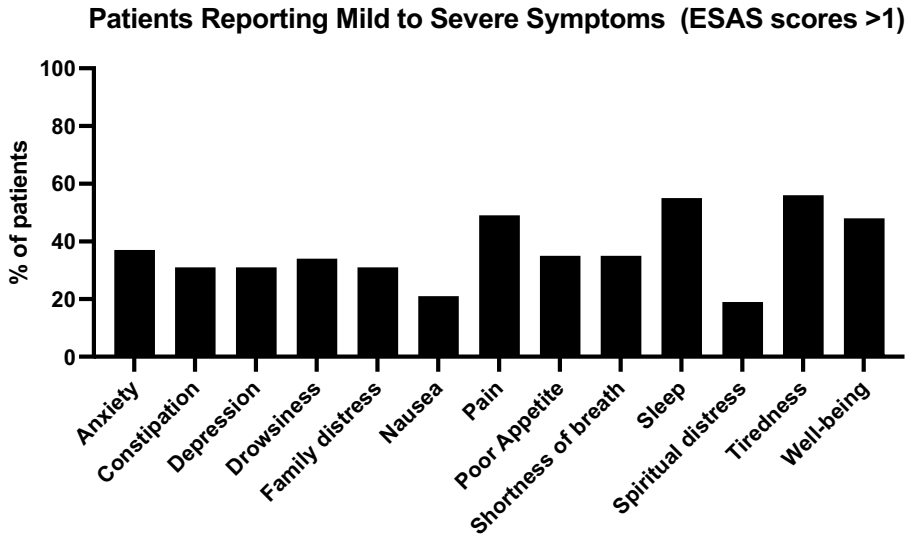

Fig. 2 Bar chart showing proportion of cancer survivors treated at LBJ hospital and based at the Acres Homes Health Center that report mild to severe symptoms based on the ESAS

Factors that influence survivors' ability to eat well and exercise

Several factors relating to knowledge, motivation and access were noted by participants as influencing diet and exercise behavior. Social support was indicated as a facilitator of both healthy eating and physical activity. In the context of eating, this manifested as friends and family cooking meals during and after treatment. More than half (52%) of participants noted that getting help with food preparation improved the quality of their diet. Regarding physical activity, respondents mentioned walking with friends to stay motivated.

> *That [*seeing others exercise*] motivates me because going for a walk by myself, I do not like that.*

Barriers to healthy eating and physical activity were often tied to cancer treatment. Most participants noted that cancer caused some change in diet and exercise habits. Side effects that particularly impacted health behaviors included reduced appetite and fatigue.

> I just don't feel like I have the energy [to exercise]. All the energy that I have I seem to consume by the things that I have to do, like household chores, laundry, that kinda thing.

Knowledge about nutrition and physical activity in the context of cancer was also noted as both a barrier and facilitator to healthy living. Participants noted the importance of balanced eating and key nutrients, and 65% reported that they felt they currently had healthy diets.

Table 2 Qualitative interview study participant demographics ($n=31$)

Treatment status	Active Treatment	35% (11)
	Post Active Treatment	65% (20)
Race	Black	71% (22)
	Hispanic	16% (5)
	White	13% (4)
Age	40–49	6% (2)
	50–59	43% (13)
	60–69	51% (16)
Gender	Male	32% (10)
	Female	68% (21)
Primary cancer site	Breast	26% (8)
	Colon	23% (7)
	Hematological	16% (5)
	Endometrial/Uterine	13% (4)
	Lung	10% (3)
	Other	13% (4)
Distance from Home Zip Code to Acres Homes Health Center	0—5 miles	58% (18)
	6—11 miles	23% (7)
	12 + miles	23% (7)

Conversely, 75% noted that they did not feel they got adequate exercise. Some expressed hesitancy to exercise given cancer-related health conditions.

> *For me, having lung cancer, I don't know what my limit is to push myself for this exercise.*

Current usage of community resources related to diet and exercise

Survivors indicated current usage of traditional grocery stores and local facilities, and some utilized hospital-based nutritionist and physical therapy services. Despite most respondents indicating they did not get enough exercise, 84% said exercise facilities were available and accessible including access to parks, gyms, pools, and home exercise equipment. Although the Acres Homes neighborhood is considered a food desert with an estimated 0.05 grocery stores per 1,000 residents [38], almost all participants noted availability of food stores and restaurants for adequate food sourcing. One third of participants specifically noted completing most of their grocery shopping at Kroger, a major US retailer, and some also mentioned utilizing online grocery shopping options. Farmers markets and food banks were not highly utilized by this population. Perceived affordability of healthy foods was mixed among respondents but reallocation of budgets away from food during cancer was noted.

> *I think a person has to make a choice—if I'm gonna eat that or pay my bills.*

Hospital-based services to support diet and exercise were also mentioned by several participants, but scheduling issues were common and most were only periodically seen by nutrition or physical therapy professionals.

> *My physical therapist says that he was givin' me some additional activities that might burn more calories while I was rehabbing. Then I've seen a nutrition—I had a virtual visit with a nutritionist a couple of times.*

Interest in healthy eating and active living programming

Interviews revealed that although few survivors reported participating in healthy eating or exercise program (23%), most would like to (84%).

> Oh, yes, for sure, because I wanna stay alive longer, and I know that's through eatin' healthier. Yeah, for the rest of my life I'd like to be on a program.
> *While I haven't [*participated in programming*], yes, I would. I would now. I guess, in a way, it'll teach you about good nutrition and exercise you can be doing*

Factors that would make participation in programs more appealing included provider recommendations, low cost, easy access, and perceived high quality of resources. Potential inconvenience, other responsibilities, and transportation issues were noted as potential barriers to participating in healthy eating or active living programs. Nine respondents specifically mentioned that they would not participate in a program if it were not convenient.

Preferences for healthy eating and active living programs

Figure 3a-c graphically illustrates program preferences among cancer survivors treated at LBJ. Patients expressed interest in exercise programs they could do at home or in a local gym, or park (Fig. 3a), although some expressed concern with the cost of gyms.

> Well, if I could afford it, at a gym would be nice, but I can't afford nothing at the gym. It would have to be at the park or behind my—or in backyard."

Participants were asked about their preferences for program participation throughout cancer care. More people said they were interested in participating in healthy eating and active living programs during or after treatment compared to before treatment. Logistically, the most popular format for programming was a combination of online and in-person learning, with LBJ and community locations being the most preferred in-person locations (Fig. 3b).

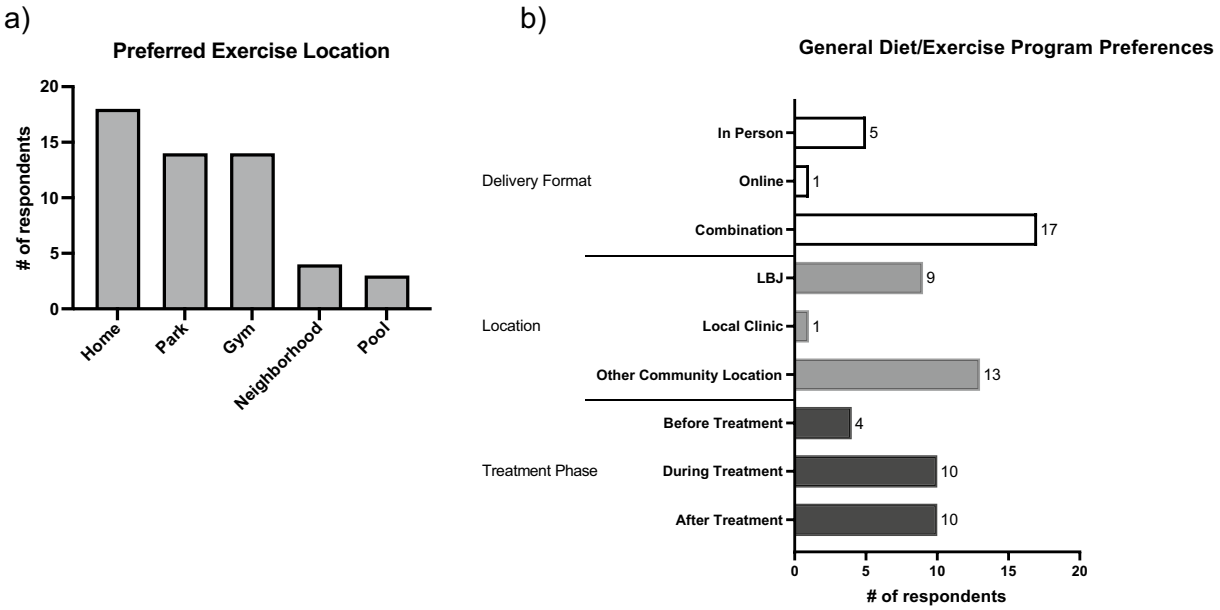

Fig. 3 **a** bar chart showing number of interview participants that indicated preferring home, park, gym, neighborhood, or pool locations for exercise programming, **b** bar chart showing number of interview participants that indicated preferences for healthy eating and active living programming logistics including delivery format, location and treatment phase

*I would like it [*programming*] to be at Acres Homes"* If it's in my neighborhood'cause I don't like dealing with traffic, 5:00 traffic, but I'm interested.

With regard to food programs specifically, most were interested in receiving food, but the preferred type of food varied and included raw ingredients, cooked dishes, and/or tailored meals that are specific to cancer prevention and survivorship.

Discussion

Acres Homes cancer survivors have high rates of cardiometabolic disease and symptom burden. Diabetes status, as measured by HbA1c, suggests rates in this population are more than double the national average (30.8% compared to 11.3%) [39]. Healthy eating and adequate physical activity may help ameliorate some of these issues and reduce subsequent cancer risk. Survivors indicated high interest in community-based wellness programming and detailed preferences for healthy eating and active living interventions. Survivors currently utilize community resources such as grocery stores, parks, and clinical services such as nutrition counseling and physical therapy.

There are opportunities to build off these current habits to increase utilization of EBIs currently available in the community and to implement new EBIs through Be Well Acres Homes, a central part of MD Anderson's place-based COE efforts. Table 3 depicts preferences and challenges experienced by cancer survivors, examples of existing EBIs delivered as a part of Be Well Acres Homes, and potential adaptations to enhance utilization by cancer survivors based on interview findings. Recommendations were developed by the authors and informed by interview findings.

Findings from this study informed the initial implementation of EBIs in the Acres Homes community and may help to support the future development and implementation of EBIs as a part of Be Well Acres Homes. Many interview participants noted parks and pools as part of their current physical activity utilization. Be Well Acres Homes invests in the improved infrastructure of local parks and schools to provide convenient, safe places for physical activity as part of its model. As several survivors mentioned a preference for programs that are convenient to the local area, food access initiatives may better support those with cancer by providing more flexibility through fruit and vegetable incentive programs. The addition of cooked foods may also better support those with cancer. Currently, Be Well Acres Homes offers a school-based program offering vouchers for healthy foods and this could be expanded to additional residents including cancer survivors.

Interest in community programs was high among survivors. Knowledge of what to eat and how to safely exercise were noted as a barriers to physical activity and healthy eating in the sample. To encourage participation among cancer populations in the Acres Homes area, specialized

Table 3 Cancer survivor preferences, example evidence-based interventions, and potential adaptations to inform future implementation of community-based cancer prevention efforts

Preferences and challenges experienced by survivors	Example interventions offered through Be Well Acres Homes	Potential adaptations to inform implementation and enhance utilization
Access to resources	Places for Physical Activity	Enhance infrastructure and offer fitness classes in local parks
		Ensure ADA compliant access for pools
		Develop a Safe Routes to Parks plan to increase safe access parks
Affordability of healthy foods	Fruit & Vegetable Incentive Programs	Expand food voucher program currently focused on school children to a wider audience inclusive of cancer survivors
Knowledge about safe physical activity	Individually Adapted Physical Activity Programs	Deliver adapted Exercise Rx type-program designed for cancer survivors
Side effects from treatment (e.g., loss of appetite, fatigue)	Multi-Component Obesity Prevention Interventions	Offer nutrition and cooking classes at convenient locations with recipes and approaches tailored for cancer patients
Knowledge about healthy eating in relation to cancer		Share videos and online content with tailored, culturally relevant recipes and content for cancer survivors
		Implement a communication campaign focused on being physically active, with tailored messages for cancer survivors
Provision of social support	Community-Based Social Support for Physical Activity	Offer walking clubs specifically for cancer survivors
Awareness of resources	Community Fitness Programs	Connect with local providers who can make recommendations and referrals directly for survivors

classes/resources could target those with a history of cancer to alleviate exercise concerns, build community among peers, and offer practical approaches to mitigating treatment side effects. Social support emerged as a key facilitator of healthy eating and exercise in the population, therefore, group classes and walking clubs may offer opportunities for building social networks. Interviewees also noted that healthy eating and active living programs would be more appealing if they were recommended by their healthcare provider. Creating links for patient referrals to community-based programs may be facilitated through building provider awareness, and further supported by the creation of a referral network to existing resources. Currently, Harris Health's Acres Home Health Center employs a dedicated Community Health Worker, supported by Be Well Acres Homes, who can help direct survivors to appropriate community resources.

Cancer centers nationwide have been tasked with integrating COE to support healthy living and cancer prevention in their catchment areas. As many cancer risk factors including smoking, obesity, and physical inactivity are concentrated in areas of poverty [40], hyper-local approaches may be needed to reduce cancer disparities in these regions. Strategically directing cancer survivors to community-led cancer prevention EBIs after acute cancer treatment closes the loop of cancer care. As comprehensive centers broaden their impact in cancer prevention, survivors have an opportunity to utilize prevention resources from a healthcare provider they know and trust as they reintegrate into community life. These efforts may help reduce burden on hospital resources by leveraging existing investments in place-based cancer prevention efforts as opposed to developing parallel programs for survivors, which may not be feasible for all centers. Health systems may not have the resources needed to provide specialized survivorship care and former patients may be hesitant to return to hospitals for wellness programming. The methods in the current study may help inform other researchers aiming to leverage existing community resources and place-based COE efforts for cancer survivors reintegrating into community life. Understanding key health issues for local patients through EHR review helps inform key health promotion targets. Adding qualitative methods to better identify optimal program structure can further support the adaptation of community programs, and build connections between survivors and local resources.

The findings from this study are in line with existing research in this area. Similar to our findings, survivors in other studies have noted interest in health promotion programs that are conveniently located in communities [41, 42]. Additionally, mixed methods and qualitative research with

cancer survivors has found high reliance on oncologists and nurses to offer wellness resources and referrals to programming, including community-based programs [41, 43, 44]. These findings highlight the importance of building multilevel partnerships to develop and deliver effective EBIs in community settings, and formal clinical workflows to connect cancer survivors with local resources. Given the high number of survivors based at Harris Health's Acres Home Health Center primary care clinic, there is a clear opportunity to align efforts with Be Well Acres Homes programs through direct referrals from local providers.

This study is strengthened by a relatively large and diverse qualitative sample ($n = 31$), and the integration of qualitative and quantitative data to explore the topic of community-based healthy eating and active living programming among cancer survivors. There are limitations to the current study. The study population focused on one region of a metropolitan area and may not be generalizable to other safety net populations. Additionally, the use of anonymized medical record data made it impossible to validate that those interviewed were also included in the EMR dataset. The inclusion of cancer survivors with diverse diagnoses, both on and off active cancer-directed therapies, and residing both in and around the Acres Homes area increased the heterogeneity of the population sampled and may influence survivor perception of physical activity and nutrition issues, as well as usage of community resources. Despite these limitations, this study offers a novel exploration of cancer survivor needs and preferences for community programming and illustrates potential opportunities to support the use of COE investments by survivors.

Conclusion

Cancer patients residing in Acres Homes often have complex medical situations in which cancer co-exists with other cardiometabolic diseases in resource-limited home settings. By offering more flexibility and tailoring community-based healthy eating and active living programs, cancer survivors may have more opportunity to participate. Strategically leveraging existing community resources for cancer survivors can provide a more feasible and robust network of support to promote healthy living in this high-risk population. This work can inform future projects aiming to enhance community-led cancer prevention efforts in historically underserved populations and communities.

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Author contributions KBE, RR, MR, MTW conceptualized the need for and approach to this study. KBE and MR were responsible for the study's conduct. RR, KO, and MTW were responsible for funding acquisition, resources supervision, and leadership of all aspects of participation by Be Well Communities. TH and DL supported participant recruitment. DL and JG supported EHR data extraction. HZ, XL, and JH conducted statistical analysis on the EHR data. DK, HM, RR, and KO assisted in the development of qualitative instruments and interpretation of qualitative analysis. HM and HG offered continuous input throughout the study design and implementation process. All authors supported the development of this manuscript.

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Data availability The data underlying this article will be shared on reasonable request to the corresponding author.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethical approval This study was approved by the University of Texas MD Anderson Cancer Center and Harris Health System Quality Improvement Review Board.

Consent to participate Participants in the interview study were read a consent statement prior to participation.

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