

Built and Natural Environment Barriers and Facilitators to Physical Activity in Rural, Suburban, and Small Urban Neighborhoods

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PURPOSE: To explore built and natural environment barriers and facilitators to walking for exercise in cancer survivors.

PARTICIPANTS & SETTING: Cancer survivors (N = 7) living in rural, suburban, and small urban neighborhoods in central Virginia.

METHODOLOGIC APPROACH: The authors used a qualitative descriptive design with photovoice to explore the cancer survivors' experience with residential walkability.

FINDINGS: The following three themes were identified from the data: visual cues during walks provide recovery motivation and goal achievement; consistent activity is supported through access to a range of buildings and walking paths; and concerns about safety are compounded by cancer-related physical limitations.

IMPLICATIONS FOR NURSING: Clinicians should consider an evaluation of the built and natural environment to support walking in cancer survivors. These findings may be used in conjunction with known individual-level barriers to physical activity to develop guidance for oncology nurses to help survivors safely achieve physical activity goals.

KEYWORDS physical activity; cancer survivors; walking; exercise

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The U.S. cancer survivor population has grown substantially and is expected to reach 26.1 million by 2040 (Bluethmann, Mariotto, & Rowland, 2016). Researchers have found that ongoing physical activity (PA) is critical for cancer survivors during and after cancer treatment to regain and maintain health. PA has been demonstrated to prevent recurrent and second cancers, improve response to treatment, reduce fatigue, improve mood and quality of life, and lower risk of treatment side effects (Blanchard, Courneya, & Stein, 2008; Buffart, Galvão, Brug, Chinapaw, & Newton, 2014; Speck, Courneya, Mâsse, Duval, & Schmitz, 2010). The American Cancer Society (ACS) recommends that survivors avoid inactivity; this recommendation includes a minimum of 150 minutes of moderate aerobic activity each week and strength training at least two days per week (Rock et al., 2012). Despite this recommendation, fewer than one-fourth of cancer survivors meet the ACS guidelines (Weaver, Palmer, Lu, Case, & Geiger, 2013).

Reasons why cancer survivors struggle to get sufficient PA include the following: fatigue, impaired mobility, depressed mood, limited time to devote to exercise, and unclear provider recommendations (Arthur et al., 2016; Fisher et al., 2016; Lynch, Owen, Hawkes, & Aitken, 2010; Mizrahi et al., 2015; Sabatino et al., 2007). These barriers are not unique to those recovering from cancer, but they are exacerbated by it. Cancer treatment can leave survivors with years of lingering fatigue (Goedendorp et al., 2012), trigger depression and anxiety (Zainal, Nik-Jaafar, Baharudin, Sabki, & Ng, 2013), and lead to development of neuropathy, which can initiate or worsen existing mobility issues (Bonhof et al., 2018; Mols et al., 2015).

Survivors who have limited incomes or live in rural areas may lack access to exercise facilities because of prohibitive cost or travel time (Ottenbacher et al., 2011).

Oncology nurses may benefit from guidelines regarding how to assess, educate, and intervene with survivors who intend to exercise but fail to follow recommendations. Nurses caring for patients with cancer have an important role in the promotion of regular PA, and this role goes beyond simply educating patients about PA's benefits (Keogh et al., 2017); however, nurses often perceive themselves as insufficiently prepared to provide appropriate information (Keogh et al., 2017; O'Hanlon & Kennedy, 2014). Although barriers to PA are complex, most survivors are interested in increasing PA (Szymlek-Gay, Richards, & Egan, 2011). This interest suggests a need for structured guidance to assist nurses with assessing, counseling, and coaching survivors to achieve these important PA goals.

Background

For survivors who are unable to access recreational facilities because of symptoms or restrictions of cost and geography, walking in one's neighborhood may be the most accessible method of regular exercise. Still, neighborhood walking may present additional barriers to cancer survivors, many of whom are working to recover from fatigue resulting from cancer treatment (Servaes, Verhagen, & Bleijenberg, 2002). Variability in the built environment (aspects of the environment that are human-made) and variability in the natural environment (aspects of the environment that occur without human intervention) are known to affect walking in healthy populations (Björk et al., 2008; Frost et al., 2010; Lu, Sarkar, & Xiao, 2018; Michimi & Wimberly, 2012; Saelens & Handy, 2008). However, associations with PA may vary with the specific population examined. For example, sidewalks are associated with increased PA for rural and urban populations but have been associated with lower rates of PA in older adults, and heavier car traffic negatively influences PA in older adults and women with at least a moderate income (Frost et al., 2010; Osuji, Lovegreen, Elliott, & Brownson, 2006; Wilcox, Bopp, Oberrecht, Kammermann, & McElmurray, 2003). Although residents living farther than a 10-minute walk from a recreational facility or gym are more likely to be obese, actual use of indoor gyms is associated with PA in higher-income individuals (Frost et al., 2010). For urban residents, walking is correlated with living within 300 meters (about one-fifth of a mile) of spaces that

are perceived as serene, wild, lush, or spacious (Björk et al., 2008), or having access to abundant street-level greenery (Lu et al., 2018). Researchers assess neighborhood walkability variables in studies using instruments developed to evaluate the ability of environments to support residents' PA. The Neighborhood Environment Walkability Scale (NEWS) was developed to provide consistent, reliable, and valid built environmental measures associated with promotion or lack of active transportation by residents (Saelens, Sallis, Black, & Chen, 2003), and has been used to evaluate correlates of walking in hundreds of research studies. Since its development, multiple adaptations have been introduced, including a short form (NEWS-A), a version for youths (NEWS-Y), versions for other countries (Sallis, n.d.), and, most recently, the NEWS-A for seniors (NEWS-S) to evaluate walking in older adult populations (Starnes et al., 2014). NEWS and its adaptations have been used to determine which correlates of the built environment significantly affect walking in specific populations, including the following:

- The impact of access to transportation on walking in young adult populations (Shigematsu et al., 2009)
- The impact of access to recreation, walking, and cycling facilities and higher land use mix areas on active transportation of children and adolescents in three U.S. cities (Rosenberg et al., 2009)
- The impact of higher residential density, land use mix, street connectivity, walking infrastructure, lower levels of traffic load, and fewer cul-de-sacs and hilly streets on walking for Hong Kong urban residents (Cerin, Macfarlane, Ko, & Chan, 2007)

The impact of neighborhood environments on survivors' ability to walk for exercise is largely unexplored. Many cancer survivors cope with long-term side effects of treatment, including fatigue, chemotherapy-induced peripheral neuropathy, and dyspnea (Hershman et al., 2014; Servaes et al., 2002; Yang et al., 2012), and may benefit from a neighborhood environment that supports and promotes PA. However, it is unknown whether cancer survivors perceive barriers and facilitators to walking similar to those in healthy populations. As a first step toward understanding correlates of walking in cancer survivors, the purpose of this study was to explore built and natural environment barriers and facilitators to walking for exercise in cancer survivors.

Methods

Exploration of the built environment for walking may be viewed through a community lens. Therefore, the authors used a qualitative descriptive design

with photovoice to explore cancer survivors' experiences with walkability in their own neighborhoods (Sandelowski, 2000). Photovoice is a participatory process in which community members can "identify, represent, and enhance their community" (Wang, 1999, p. 185) through photographs supplemented with their personal narrative reflections (Heidelberger & Smith, 2016; Wang & Burris, 1994). Photography provides community members the opportunity to relay their precise reality and a launching point for a focused discussion of the phenomenon of interest (Hagedorn, 1994). The act of curating one's precise representation of reality empowers and allows individuals to visually relay personal meaning to researchers, policymakers, and community members (Wang & Burris, 1994). With respect to the built environment, providing visualization is a critical component of this representation because the strongest influences on whether people walk in public spaces are related to perceptions of safety and positive aesthetics of the walking environment (Koohsari, Karakiewicz, & Kaczynski, 2012).

Participants and Setting

The authors recruited survivors from an outpatient cancer center in Albemarle County and a community health fair in Charlottesville, both located in central Virginia. This area was chosen not only as a convenience sample but also because of the ability to recruit participants from small urban, suburban, and rural neighborhoods. The University of Virginia, which is the central geographic feature in the area, is located adjacent to Charlottesville, a small 10-square mile city located within the boundaries of Albemarle County. The population of these combined areas is less than 200,000 people. Residents of the area have access to numerous well-maintained and popular public hiking trails. Right outside Albemarle, the area transitions to rural farmland and wooded areas.

Participants were eligible if they had ever been diagnosed with cancer, were aged 18 years or older, and had access to a smartphone or digital camera to transmit photographs to the study team. Demographic characteristics, cancer stage, and type of cancer treatment were collected at the time of enrollment. Enrolled participants were instructed that they did not need to actually take a walk, but each time they attempted to walk for exercise during a two-month period, they were to take photographs of any barriers and facilitators experienced. At the end of the two months, participants' photographs were collected and each individual participated in a one-on-one semistructured interview

FIGURE 1. Interview Guide

- Tell me about a typical day for you.
- Tell me about what type of physical activity you typically engage in.
- Can you describe your neighborhood? (Probe: mostly residential or a mix of residences, businesses, schools, and parks; housing density; natural landscape)
- What do you see when you walk out the door of your house?
- What places can you walk to from your home?
- For each picture, tell me why you took this picture. (Probe: specifics of barriers and facilitators to walking)
- How were you feeling the day you took this picture?
- What recommendations did you receive from your providers regarding daily activity? What recommendations do you have for cancer providers who encourage their patients to engage in physical activity during and after treatment?

about their typical daily PA and the built environment around their home. Then, each photograph was used as a prompt to discuss barriers and facilitators encountered on the walks (see Figure 1).

Data Analysis

Interviews were audio recorded and transcribed verbatim. Interview transcripts were analyzed by the research team using a line-by-line approach. Inductive open coding was used, and tentative codes and themes were organized in Dedoose, version 8.0.42, a web application for managing, analyzing, and presenting qualitative and mixed-methods research data. To ensure rigor, two researchers (C.C. and P.B.D.) debriefed and conducted ongoing consensus of code and theme development and maintained reflexive field notes (Lincoln & Guba, 1985). The study was approved by the Sentara Martha Jefferson Hospital and the University of Virginia Social and Behavioral Sciences institutional review boards.

Findings

Twelve participants were enrolled. The authors were unable to contact 5 of the original 12, so photographs were collected and interviews conducted with the remaining 7. All seven participants were women, ranging in age from 55 to 68 years. All but one of the women were breast cancer survivors; one was a kidney cancer survivor. Six of the seven participants had stage 0–II cancer; one had stage IV cancer. Three of the seven participants were still in

treatment; the remainder were two months to six years post-treatment, and cancer treatments varied among participants (see Table 1). All participants were recruited in 2017; however, the authors were unable to recruit participants during the winter and summer months because of the potentially severe weather extremes during these seasons in Virginia, making walking more uncomfortable.

The following three built environment themes were identified from the data:

- Theme 1: Visual cues during walks provide recovery motivation and goal achievement.
- Theme 2: Consistent activity is supported through access to a range of buildings and walking paths.
- Theme 3: Concerns about safety are compounded by cancer-related physical limitations.

Theme 1

Five of the seven participants either had recently finished treatment or were still in treatment and were making strides to get out and exercise, despite the challenges related to recovering from cancer treatment. Several participants discussed how the beauty of the environment was a motivator and how the built environment provided visual cues that signaled to them that they had achieved their daily goal of exercise.

Several participants reflected on their fatigue during treatment, then went on to describe how walking presented a path back to health. A 67-year-old breast cancer survivor (S1) who was still in treatment

reported having been so fatigued during chemotherapy that she took a nap each day. She also reported the following:

I have some exercise DVDs, and I would use those for 10 to 15 minutes. I would occasionally go to . . . the gym and use some of their equipment. Mostly, I walked when I went there. I did a lot of walking. That's what I basically did.

Another 63-year-old breast cancer survivor (S2) who was four months post-treatment recalled how far she had come since being in treatment and how hard she had worked to regain her strength, sharing the following:

[A couple of months ago] I was really laid low . . . and one flight of stairs was pulling up my hamstring and stopping to catch your breath. That, to come from there to where I am now, is really encouraging . . . how hard it was to get out at all.

Four of the seven survivors photographed and discussed how beauty in the landscape was uplifting and described purposefully seeking out beauty in the built environment to motivate them to exercise. S2 described how the beauty of her neighborhood motivated her to walk:

One of the incentives to get out and walk is to see what all the neighbors have done with their

TABLE 1. Sample Characteristics

Characteristic	S1	S2	S3	S4	S5	S6	S7
Age (years)	67	63	57	53	55	59	68
Population density (population per square mile) ^a	520.46	70.75	520.46	128.64	136.63	80.78	520.46
Rural population (%) ^b	17	42	17	38	100	74	17
Cancer type	Breast	Breast	Breast	Breast	Breast	Kidney	Breast
Cancer stage	II	II	0	I	I	I	IV
Time since last treatment	Ongoing	4 months	4 years	Ongoing	2 months	6 years	Ongoing
Treatment type	Chemo, RT, surgery, HT	Chemo, RT, surgery, HT	RT, surgery	RT, surgery	Chemo, RT, surgery	Surgery	Chemo, RT, HT

^aPopulation density of the zip code of the residence

^bPercentage of the residential zip code population that does not live in a U.S. Census-defined urban area or urban cluster
Chemo—chemotherapy; HT—hormonal therapy; RT—radiation therapy; S—survivor

Note. All participants were Caucasian women.

flowers and their yards. . . . You get a little bit of the mountains in the distance, but I found that to be uplifting and encouraging too. . . . I knew that if I went for a walk, I was going to feel better when I came back both because of the physical activity and because of the nature and the beauty of the surroundings.

Others sought beauty beyond their own neighborhoods by traveling to downtown, a hiking trail, or the university. S1, who lives in the urban portion of the area, recalled traveling to the downtown area and walking near the public library: "There's a 10-block path that I take up there near [the] library. . . . It's really beautiful. It's an older residential neighborhood, which I like."

A 53-year-old breast cancer survivor (S4) living in a suburban neighborhood, which she described as pedestrian-friendly, chose instead to walk each day at the university because of the visual variety in the built landscape. She said,

It's such a stunningly beautiful campus. . . . [There's] a grassy quad and lots of sidewalks to pick from. And I know whichever direction I go in, I'll have some good opportunities for a really excellent walk. I love going around neighborhoods so I can look at all the houses and the architecture. . . . It keeps me more engaged that way. . . . I like having a lot more scenery . . . seeing people living where they do and the different styles of the architecture . . . and what they've done to their yards.

The built environment provided visual cues to goal achievement for those working to regain strength. S2 photographed and discussed several milestones while walking that encouraged her to keep going:

I knew that when I made it to the clubhouse, I was going to get to sit down in those rocking chairs in the shade and relax for a little while before making my way back home. . . . You have these things in your mind that, "Oh, OK. I can do this. . . . I have a spot to rest."

A 57-year-old breast cancer survivor who was four years post-treatment (S3) photographed milestones that helped motivate her to goal completion. She reported taking the bus home from work each day, using the walk from the bus stop to her home as daily exercise. She photographed the mailbox located at the end of her street. "When I saw that mailbox, [I] knew I was home," she said.

Theme 2

Several survivors who were motivated to walk regularly reported having access to a range of options for walking. Survivors discussed seeking out a variety of environments, flat areas to walk, or places to walk during bad weather. Availability of the range of locations was discussed frequently in interviews. S4, who was still in the midst of treatment, noted that varying the visual input during her daily walking routine helped her stay motivated: "Taking a lot of walks in the same neighborhood, it gets old. I mean, even though I love looking at the architecture and stuff." Although she lived in a neighborhood in a rural county, she worked at the nearby university, affording her the opportunity to seek out a variety of visual experiences and avoid boredom. Another survivor (S2), who reported walking in a residential setting, expressed appreciation for the seasonal variety of decor that her neighbors provided: "Different things are blooming in different months and seasons, and then people throw up decorations. . . . Everything's Halloween right now and cornstalks."

Survivors with close access to a variety of locations sought out alternative places to walk if their own neighborhood conditions were insufficient. One survivor's (S1) residential neighborhood was very hilly, so she sought out flatter areas to walk in the downtown area of the city. Living in the urban center of the area, she reported needing to drive only half a mile to access alternate locations.

Not all survivors had access to a variety of places to walk. A 55-year-old breast cancer survivor who was two months post-treatment (S5) noted that she avoided photographing her residential environment located in a subdivision: "I feel like I was taking pictures somewhat of the same thing . . . 'cause it's [either] the roadway and . . . the greenery areas or there's houses on both sides of the road." A 59-year-old kidney cancer survivor (S6) who lived on a 27-acre farm said it was not necessarily easy to walk on the farm: "You can walk around in the pasture fields and [it is] pretty flat in the front, but the back is more down and sloping."

Other survivors did not have access to an indoor exercise location, such as S5, who lived in a rural county and struggled with getting enough exercise, in part because of limited access to an indoor facility. She said,

[It's] like a half an hour drive [to the nearest gym]. It's not a big thing, but it can be because your time is limited. So you're not going to go on a day that

you work and then the days you're off, then you try to get things done. It's just excuses I guess. . . . So you could probably do it like one or two days out of a week to exercise, but it's mainly getting your priorities, what's your priority. Your health should come first, and everything else should work around it. Well, it's hard.

Several survivors commented on how to counsel other survivors on getting regular exercise within their own residential environment. Many articulated a need for cancer care providers to provide concrete strategies for daily exercise. According to S4,

Tell people that [exercise] doesn't have to be such a huge commitment . . . especially depending on energy level or what else is going on in their life, being able to carve out smaller chunks of time and putting them all together might be a successful way of doing it. And it doesn't have to always be at a gym or outside or something, but you can like, I had a picture of walking through the [university library] stacks, it might be just doing massive loops around your building or something.

Theme 3

Survivors' cancer treatment often resulted in weakness and fatigue that made safety of the walking path imperative. One survivor (S6) recalled her journey of regaining her strength as follows:

I've worked my way up to, I can walk pretty comfortably for 20 to 25 minutes without stopping. Of course, it's much shorter than it was before I was diagnosed, but it's a huge improvement from where I was just a few months ago.

Several survivors spoke of concerns with wildlife that truncated walking activity. Three survivors, all of whom lived in rural areas, specifically mentioned concerns with bears. S5 shared the following:

I live in a rural area . . . so I worry a little bit about walking sometimes because there have been bears sighted in the neighborhood. . . . A neighbor down the street has said that there's been a bear coming and getting in their trash, and my husband and son have seen a bear on the roadside, on the main road.

The presence of wildlife may limit options for those wishing to walk. S7, a 68-year-old breast cancer

survivor who was still in treatment, had abundant access to walking trails and paths near her home but avoided them. "[The walking trail is] a little bit difficult to get to, and there're snakes and ticks and stuff," she said.

Survivors also avoided walking alone and after dark. S4 lived in a rural county but reported that she often chose to walk on a popular hiking trail instead because it felt less isolated and she felt less likely to become a victim of a crime. She said,

We have lots of walking paths around here, but since I am usually by myself, safety is a concern, and I know I'll always be safe [from crime] on [the popular hiking trail], whereas I don't on others.

S2 reported avoiding trails and walking alone earlier in her recovery, because she did not feel strong enough to go alone and off the main pathway. She shared the following:

When I first started walking, I was sticking to the pavement. [A trail] has got roots, it's got leaves, it hides other things that you can trip on. . . . If you fall, you've got a distance to go to get back to the street. So, I did not do the trail until I was capable. And then when I did, I was using walking sticks. . . . My husband would go with me 'cause he likes to walk too, but now I've progressed enough to where I feel safe enough to do it on my own.

Four months following completion of treatment, she reported feeling strong enough to go by herself but still was not confident enough to walk after dark because of being isolated if she were to need help. She said,

I wouldn't do it late, you know? I'd do it when, if I were to run into trouble, somebody would come along and find me . . . just because of not being able to see well enough. . . . Late afternoon or twilight, most people are going home to get supper, and you feel a little more isolated.

Safety from car traffic was reported as being a concern in all regions of the area, but specific issues varied between rural and urban areas. In rural and suburban areas, lack of sidewalks was the major safety concern. These survivors discussed the need for sidewalks and crosswalks to feel safe when walking, even within a neighborhood development. When discussing an intersection she encountered frequently on a walk, S2 said, "[it] would be nice with a crosswalk

there. . . . When I wasn't quite as nimble as I am now, it was sometimes a little bit anxiety-producing to make it across there because cars could pop up."

Cars blocking the walking path or the road created a safety concern for urban walkers, because the blockage often forced them to walk in a moderately or highly trafficked road. If a road has no sidewalk, walkers are forced toward the middle of the street. According to S4,

[That] is such a typical thing [near the university] to have cars parked up, blocking sidewalks . . . trash cans blocking sidewalks. . . . That is the number one problem. . . . The parking situation is so horrible that people are just desperate, and they'll park wherever they can, and it usually blocks the sidewalk.

Discussion

Oncology nurses typically inquire about their patients' PA, but most are unsure how to provide guidance for appropriate, safe activity (Karvinen, McGourty, Parent, & Walker, 2012; Keogh et al., 2017). Barriers to PA are complex and involve not only individual (physical symptoms) and interpersonal (social support) obstacles, but also community-level (environmental) obstacles. Care providers tend to limit evaluation of barriers to physical symptoms related to pain, fatigue, and mobility restrictions (Cohen et al., 2016; El-Shami et al., 2015; Skolarus et al., 2014).

More precise information about barriers to PA for cancer survivors is needed to support a multilevel PA assessment tool. The results provide a greater understanding about what specific factors may influence walking for exercise in cancer survivors. The participants were influenced by visual and nonvisual aspects of the built environment. The visual landscape provided opportunities for motivation and goal setting, and were influenced by a participant's access to a variety of walking locations. Safety was identified by most participants as a barrier to walking on certain surfaces, in some locations, or at darker times of day. This finding was not surprising for a cohort of survivors still receiving or recovering from chemotherapy, radiation therapy, surgery, or a combination of treatments; however, because the sample was all women, this may reflect women's preference for not walking alone at night.

This research provides an entryway into identifying neighborhood-level factors critical to promotion of PA in cancer survivors. The next step is to evaluate

these findings with a quantitative assessment with multiple cancer survivor populations. A growing body of built environment research has focused on the significant associations between individuals' perceptions of their neighborhood environment and PA (Orstad, McDonough, Stapleton, Altincekic, & Troped, 2017); however, the impact of built environment perceptions has not been evaluated with cancer survivors, a group for whom walking is perhaps most critical because of its impact on mental and physical recovery and reduction of future cancer occurrence (Buffart et al., 2014; Speck et al., 2010).

Valid measures of survivors' perceptions of their neighborhood environments are necessary to support inferences about effects of the built environment on survivors' ability to meet PA recommendations. NEWS-S may be a good starting point for developing an instrument for evaluating the effects of the built environment on cancer survivors' walking behavior. The NEWS-S is a six-factor, 26-item survey developed from the short form of the original NEWS instrument, supplemented with items addressing perceptions of personal safety, walking infrastructure, and pedestrian safety. NEWS-S was tested with a sample from the Nurses' Health Study cohort, which was a predominantly Caucasian female sample ranging in age from 61 to 88 years (Starnes et al., 2014).

NEWS-S addresses many of the pedestrian safety issues and visual variety factors that were identified by the current cohort, includes some that were not mentioned by the current cohort, and omits other items and specificity of issues identified by the current participants, specifically relating to blocked sidewalks, access to paved paths, visual markers for goal setting, availability of places to stop and rest, and presence of wildlife. These items should be appended to the NEWS-S tool and evaluated for use in a cancer survivor population. This revised instrument could be used to determine which items affect walking in survivors working to recover from illness and regain strength and health.

A neighborhood environmental walking survey for cancer survivors can be used to evaluate the environmental conditions optimally supportive of cancer survivors' regular PA. Several hypotheses can be generated from these data and could be evaluated with the use of a cancer survivor-specific walking instrument. The following are examples of hypotheses that should be evaluated:

- Cancer survivors with access to safe walking environments (e.g., lack of wildlife, sidewalks that are

blocked, uneven pavement) walk more than those who do not experience these environmental factors.

- Cancer survivors with access to visually stimulating walking environments (e.g., cues that reinforce goal attainment, areas for rest, variety of locations) walk more than those without those stimulating cues.
- Some walkability factors (e.g., access to destinations, street connectivity) have less of an impact on cancer survivors' walking than they do on healthy populations.

Limitations

The authors recruited a convenience sample of cancer survivors (broadly defined as postdiagnosis) living in central Virginia to participate in a study of walking in cancer survivors. Likely because of self-selection bias, the authors interviewed only those who already were attempting to walk for exercise, not those who were sedentary because of pain, fatigue, mobility issues, or limited time and motivation. It is possible that the five individuals who enrolled but were unable to be contacted again were experiencing these barriers to exercise and did not want to continue participating. Although the authors recruited participants with any cancer diagnosis, those completing the study were all women, were of a similar age, and predominantly had a history of breast cancer, all of which are likely a reflection of the high proportion of individuals with breast cancer seen at the community hospital practice where most participants were recruited. The authors' intent was to recruit a broader population to reflect the heterogeneous sample encountered in many community practices and to generate broader knowledge translation. Although this sample limits clarity as to the applicability of these results to other survivors, the findings of this qualitative study were not intended for generalizability, but rather to guide hypothesis generation and instrument development, from which a rigorous quantitative study can be undertaken to explore correlates of PA in cancer survivors in which control variables can provide further precision.

An additional limitation stems from the difficulty the authors had recruiting participants during the summer and winter months. Central Virginia has four distinct seasons, with hot, humid summers, and cold, sometimes snowy and icy winters. The difficulty recruiting during the less comfortable times of year suggest what is already known about walking in the general population: that seasonality and adverse weather significantly affect PA (Tucker & Gilliland,

KNOWLEDGE TRANSLATION

- Cancer survivors have trouble with obtaining sufficient physical activity (PA); some of these difficulties are related to the built environment.
 - Survivors wishing to walk to achieve PA recommendations may benefit from access to a variety of places to walk, visually stimulating environments, and safety from traffic and wildlife.
 - Development of a neighborhood environment-walking tool specific to cancer survivors may assist care providers and researchers in improving survivors' access to PA.
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2007). However, even with the limited sample, the authors were able to identify themes suggesting that survivors with access to indoor spaces for exercise during poor weather may promote PA in this population.

Implications for Nursing

To optimally assist survivors with achievement of health goals, nurses may benefit from a multilevel PA assessment tool that includes an evaluation of how well the neighborhood environment can support regular PA. These data provide a step toward developing the community-level component of a multilevel PA assessment that will assist cancer survivors with overcoming all barriers that may prevent them from achieving PA goals. Once the assessment is developed, oncology nurses can evaluate a more complete range of barriers to health behaviors immediately following diagnosis and throughout treatment of cancer.

Conclusion

These findings suggest important distinctions in evaluating the built environment that may not be assessed by current neighborhood walkability tools. Adequate survivorship care must include not only instructions to increase PA, but also tools with which to measure and promote it. Current models of survivorship care focus on individual-level symptom management. Future care must incorporate an assessment of a survivor's environment to provide comprehensive guidance for health attainment. Development of a tool specific to the cancer survivor population—one that assesses the residential walking environment—will assist researchers, care providers, and community leaders to better understand the environments that best allow and encourage these individuals to regain health.

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REFERENCES

- Arthur, A.E., Delk, A., Demark-Wahnefried, W., Christein, J.D., Contreras, C., Posey, J.A., 3rd, . . . Rogers, L.Q. (2016). Pancreatic cancer survivors' preferences, barriers, and facilitators related to physical activity and diet interventions. *Journal of Cancer Survivorship*, 10, 981–989. <https://doi.org/10.1007/s11764-016-0544-5>
- Björk, J., Albin, M., Grahm, P., Jacobsson, H., Ardö, J., Wadbro, J., . . . Skärbäck, E. (2008). Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. *Journal of Epidemiology and Community Health*, 62(4), e2. <https://doi.org/10.1136/jech.2007.062414>
- Blanchard, C.M., Courneya, K.S., & Stein, K. (2008). Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: Results from the American Cancer Society's SCS-II. *Journal of Clinical Oncology*, 26, 2198–2204. <https://doi.org/10.1200/JCO.2007.14.6217>
- Bluthmann, S.M., Mariotto, A.B., & Rowland, J.H. (2016). Anticipating the “silver tsunami”: Prevalence trajectories and comorbidity burden among older cancer survivors in the United States. *Cancer Epidemiology, Biomarkers and Prevention*, 25, 1029–1036. <https://doi.org/10.1158/1055-9965.EPI-16-0133>
- Bonhof, C.S., Mols, F., Vos, M.C., Pijnenborg, J.M.A., Boll, D., Vreugdenhil, G., . . . van de Poll-Franse, L.V. (2018). Course of chemotherapy-induced peripheral neuropathy and its impact on health-related quality of life among ovarian cancer patients: A longitudinal study. *Gynecologic Oncology*, 149, 455–463. <https://doi.org/10.1016/j.ygyno.2018.03.052>
- Buffart, L.M., Galvão, D.A., Brug, J., Chinapaw, M.J., & Newton, R.U. (2014). Evidence-based physical activity guidelines for cancer survivors: Current guidelines, knowledge gaps and future research directions. *Cancer Treatment Reviews*, 40, 327–340. <https://doi.org/10.1016/j.ctrv.2013.06.007>
- Cerin, E., Macfarlane, D.J., Ko, H.-H., & Chan, K.-C. A. (2007). Measuring perceived neighbourhood walkability in Hong Kong. *Cities*, 24, 209–217. <https://doi.org/10.1016/j.cities.2006.12.002>
- Cohen, E.E., LaMonte, S.J., Erb, N.L., Beckman, K.L., Sadeghi, N., Hutcheson, K.A., . . . Pratt-Chapman, M.L. (2016). American Cancer Society head and neck cancer survivorship care guideline. *CA: A Cancer Journal for Clinicians*, 66, 204–239. <https://doi.org/10.3322/caac.21343>
- El-Shami, K., Oeffinger, K.C., Erb, N.L., Willis, A., Bretsch, J.K., Pratt-Chapman, M.L., . . . Cowens-Alvarado, R.L. (2015). American Cancer Society colorectal cancer survivorship care guidelines. *CA: A Cancer Journal for Clinicians*, 65, 427–455. <https://doi.org/10.3322/caac.21286>
- Fisher, A., Wardle, J., Beeken, R.J., Croker, H., Williams, K., & Grimmett, C. (2016). Perceived barriers and benefits to physical activity in colorectal cancer patients. *Supportive Care in Cancer*, 24, 903–910. <https://doi.org/10.1007/s00520-015-2860-0>
- Frost, S.S., Goins, R.T., Hunter, R.H., Hooker, S.P., Bryant, L.L., Kruger, J., & Pluto, D. (2010). Effects of the built environment on physical activity of adults living in rural settings. *American Journal of Health Promotion*, 24, 267–283. <https://doi.org/10.4278/ajhp.08040532>
- Goedendorp, M.M., Andrykowski, M.A., Donovan, K.A., Jim, H.S., Phillips, K.M., Small, B.J., . . . Jacobsen, P.B. (2012). Prolonged impact of chemotherapy on fatigue in breast cancer survivors: A longitudinal comparison with radiotherapy-treated breast cancer survivors and noncancer controls. *Cancer*, 118, 3833–3841. <https://doi.org/10.1002/cncr.26226>
- Hagedorn, M. (1994). Hermeneutic photography: An innovative esthetic technique for generating data in nursing research. *Advances in Nursing Science*, 17, 44–50. <https://doi.org/10.1097/00012272-199409000-00007>
- Heidelberger, L., & Smith, C. (2016). Low-income, urban children's perspectives on physical activity: A photovoice project. *Maternal and Child Health Journal*, 20, 1124–1132. <https://doi.org/10.1007/s10995-015-1898-4>
- Hershman, D.L., Lacchetti, C., Dworkin, R.H., Lavoie Smith, E.M., Bleeker, J., Cavaletti, G., . . . Loprinzi, C.L. (2014). Prevention and management of chemotherapy-induced peripheral neuropathy in survivors of adult cancers: American Society of Clinical Oncology clinical practice guideline. *Journal of Clinical Oncology*, 32, 1941–1967. <https://doi.org/10.1200/JCO.2013.54.0914>
- Karvinen, K.H., McGourty, S., Parent, T., & Walker, P.R. (2012). Physical activity promotion among oncology nurses. *Cancer Nursing*, 35, E41–E48. <https://doi.org/10.1097/NCC.0b013e31822d9081>
- Keogh, J.W., Pühringer, P., Olsen, A., Sargeant, S., Jones, L.M., & Climstein, M. (2017). Physical activity promotion, beliefs, and

- barriers among Australasian oncology nurses. *Oncology Nursing Forum*, 44, 235–245. <https://doi.org/10.1188/17.ONF.235-245>
- Koohsari, M.J., Karakiewicz, J.A., & Kaczynski, A.T. (2012). Public open space and walking: The role of proximity, perceptual qualities of the surrounding built environment, and street configuration. *Environment and Behavior*, 45, 706–736. <https://doi.org/10.1177/0013916512440876>
- Lincoln, Y.S., & Guba, E.G. (1985). Establishing trustworthiness. In *Naturalistic inquiry* (pp. 289–331). Newbury Park, CA: Sage.
- Lu, Y., Sarkar, C., & Xiao, Y. (2018). The effect of street-level greenery on walking behavior: Evidence from Hong Kong. *Social Science and Medicine*, 208, 41–49. <https://doi.org/10.1016/j.socscimed.2018.05.022>
- Lynch, B.M., Owen, N., Hawkes, A.L., & Aitken, J.F. (2010). Perceived barriers to physical activity for colorectal cancer survivors. *Supportive Care in Cancer*, 18, 729–734. <https://doi.org/10.1007/s00520-009-0705-4>
- Michimi, A., & Wimberly, M.C. (2012). Natural environments, obesity, and physical activity in nonmetropolitan areas of the United States. *Journal of Rural Health*, 28, 398–407. <https://doi.org/10.1111/j.1748-0361.2012.00413.x>
- Mizrahi, D., Naumann, F., Broderick, C., Samara, J., Ryan, M., & Friedlander, M. (2015). Quantifying physical activity and the associated barriers for women with ovarian cancer. *International Journal of Gynecological Cancer*, 25, 577–583. <https://doi.org/10.1097/IGC.0000000000000349>
- Mols, F., Beijers, A.J., Vreugdenhil, G., Verhulst, A., Schep, G., & Husson, O. (2015). Chemotherapy-induced peripheral neuropathy, physical activity and health-related quality of life among colorectal cancer survivors from the PROFILES registry. *Journal of Cancer Survivorship*, 9, 512–522. <https://doi.org/10.1007/s11764-015-0427-1>
- O'Hanlon, E., & Kennedy, N. (2014). Exercise in cancer care in Ireland: A survey of oncology nurses and physiotherapists. *European Journal of Cancer Care*, 23, 630–639. <https://doi.org/10.1111/ecc.12206>
- Orstad, S.L., McDonough, M.H., Stapleton, S., Altincekic, C., & Troped, P.J. (2017). A systematic review of agreement between perceived and objective neighborhood environment measures and associations with physical activity outcomes. *Environment and Behavior*, 49, 904–932. <https://doi.org/10.1177/0013916516670982>
- Osuji, T., Lovegreen, S., Elliott, M., & Brownson, R.C. (2006). Barriers to physical activity among women in the rural midwest. *Women and Health*, 44, 41–55. https://doi.org/10.1300/J013v44n01_03
- Ottensbacher, A.J., Day, R.S., Taylor, W.C., Sharma, S.V., Sloane, R., Snyder, D.C., . . . Demark-Wahnefried, W. (2011). Exercise among breast and prostate cancer survivors—What are their barriers? *Journal of Cancer Survivorship*, 5, 413–419. <https://doi.org/10.1007/s11764-011-0184-8>
- Rock, C.L., Doyle, C., Demark-Wahnefried, W., Meyerhardt, J., Courneya, K.S., Schwartz, A.L., . . . Gansler, T. (2012). Nutrition and physical activity guidelines for cancer survivors. CA: A *Cancer Journal for Clinicians*, 62, 242–274. <https://doi.org/10.3322/caac.21142>
- Rosenberg, D., Ding, D., Sallis, J.F., Kerr, J., Norman, G.J., Durant, N., . . . Saelens, B.E. (2009). Neighborhood Environment Walkability Scale for Youth (NEWS-Y): Reliability and relationship with physical activity. *Preventive Medicine*, 49, 213–218. <https://doi.org/10.1016/j.ypmed.2009.07.011>
- Sabatino, S.A., Coates, R.J., Uhler, R.J., Pollack, L.A., Alley, L.G., & Zauderer, L.J. (2007). Provider counseling about health behaviors among cancer survivors in the United States. *Journal of Clinical Oncology*, 25, 2100–2106. <https://doi.org/10.1200/JCO.2006.06.6340>
- Saelens, B.E., & Handy, S.L. (2008). Built environment correlates of walking: A review. *Medicine and Science in Sports and Exercise*, 40(Suppl.), S550–S566. <https://doi.org/10.1249/MSS.0b013e31817c67a4>
- Saelens, B.E., Sallis, J.F., Black, J.B., & Chen, D. (2003). Neighborhood-based differences in physical activity: An environment scale evaluation. *American Journal of Public Health*, 93, 1552–1558. <https://doi.org/10.2105/AJPH.93.9.1552>
- Sallis, J.F. (n.d.). Neighborhood Environment Walking Scale (NEWS). Retrieved from <http://www.midss.org/content/neighborhood-environment-walkability-survey-news-neighborhood-environment-walkability-survey>
- Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing and Health*, 23, 334–340.
- Servaes, P., Verhagen, C., & Bleijenberg, G. (2002). Fatigue in cancer patients during and after treatment: Prevalence, correlates and interventions. *European Journal of Cancer*, 38, 27–43. [https://doi.org/10.1016/S0959-8049\(01\)00332-X](https://doi.org/10.1016/S0959-8049(01)00332-X)
- Shigematsu, R., Sallis, J.F., Conway, T.L., Saelens, B.E., Frank, L.D., Cain, K.L., . . . King, A.C. (2009). Age differences in the relation of perceived neighborhood environment to walking. *Medicine and Science in Sports and Exercise*, 41, 314–321. <https://doi.org/10.1249/MSS.0b013e318185496c>
- Skolarus, T.A., Wolf, A.M., Erb, N.L., Brooks, D.D., Rivers, B.M., Underwood, W., 3rd, . . . Cowens-Alvarado, R.L. (2014). American Cancer Society prostate cancer survivorship care guidelines. CA: A *Cancer Journal for Clinicians*, 64, 225–249. <https://doi.org/10.3322/caac.21234>
- Speck, R.M., Courneya, K.S., Mâsse, L.C., Duval, S., & Schmitz, K.H. (2010). An update of controlled physical activity trials in cancer survivors: A systematic review and meta-analysis. *Journal of Cancer Survivorship*, 4, 87–100.
- Starnes, H.A., McDonough, M.H., Tamura, K., James, P., Laden, F., & Troped, P.J. (2014). Factorial validity of an abbreviated Neighborhood Environment Walkability Scale for seniors in the Nurses' Health Study. *International Journal of Behavioral Nutrition and Physical Activity*, 11, 126. <https://doi.org/10.1186/s12966-014-0126-8>

- Szymlek-Gay, E.A., Richards, R., & Egan, R. (2011). Physical activity among cancer survivors: A literature review. *New Zealand Medical Journal*, 124, 77–89.
- Tucker, P., & Gilliland, J. (2007). The effect of season and weather on physical activity: A systematic review. *Public Health*, 121, 909–922. <https://doi.org/10.1016/j.puhe.2007.04.009>
- Wang, C., & Burris, M.A. (1994). Empowerment through photo novella: Portraits of participation. *Health Education Quarterly*, 21, 171–186. <https://doi.org/10.1177/109019819402100204>
- Wang, C.C. (1999). Photovoice: A participatory action research strategy applied to women's health. *Journal of Women's Health*, 8, 185–192.
- Weaver, K.E., Palmer, N., Lu, L., Case, L.D., & Geiger, A.M. (2013). Rural–urban differences in health behaviors and implications for health status among US cancer survivors. *Cancer Causes and Control*, 24, 1481–1490. <https://doi.org/10.1007/s10552-013-0225-x>
- Wilcox, S., Bopp, M., Oberrecht, L., Kammermann, S.K., & McElmurray, C.T. (2003). Psychosocial and perceived environmental correlates of physical activity in rural and older African American and white women. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 58, P329–P337. <https://doi.org/10.1093/geronb/58.6.P329>
- Yang, P., Cheville, A.L., Wampfler, J.A., Garces, Y.I., Jatoi, A., Clark, M.M., . . . Sloan, J.A. (2012). Quality of life and symptom burden among long-term lung cancer survivors. *Journal of Thoracic Oncology*, 7, 64–70. <https://doi.org/10.1097/JTO.0b013e3182397b3e>
- Zainal, N.Z., Nik-Jaafar, N.R., Baharudin, A., Sabki, Z.A., & Ng, C.G. (2013). Prevalence of depression in breast cancer survivors: A systematic review of observational studies. *Asian Pacific Journal of Cancer Prevention*, 14, 2649–2656. <https://doi.org/10.7314/APJCP.2013.14.4.2649>