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Neighborhood disadvantage, physical activity barriers, and physical activity among African American breast cancer survivors

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ABSTRACT

In view of evidence that African American cancer survivors experience the greatest challenges in maintaining adequate levels of physical activity, this cross-sectional study was designed to determine whether individual and residential environment characteristics are associated with physical activity in this population.

A total of 275 breast cancer survivors completed self-report items measuring sociodemographic variables, physical activity, and select barriers to physical activity in Spring of 2012. Neighborhood disadvantage variables were extracted from national databases. Regression models were computed to assess relationships.

Traditional correlates of smoking status and the presence of health complications were associated with physical activity. In addition, the relative number of renters versus homeowners in one's neighborhood was associated with lower levels of physical activity in the context of individual level barriers (i.e., interest and space), which were also associated with lower levels of physical activity.

Higher renter rates and individual barriers both contribute to lower levels of physical activity in African American breast cancer survivors. These data suggest that the potential for constant residential turnover (via rentership) and perceived barriers may increase physical inactivity even where facilities may be available.

Introduction

African American breast cancer survivors experience poorer disease-specific and overall survival when compared to cancer survivors of other racial and ethnic groups (American Cancer Society, 2014). In addition, they experience elevated risk for comorbid conditions such as cardiovascular disease following cancer treatment (Paxton et al., 2011, 2012,b; Tammemagi et al., 2005). Despite their risk, African American (AA) breast cancer survivors (BCS) remain underserved, and are especially vulnerable to conditions that threaten their ability to live independently. Engaging in health promotion and disease prevention activities, such as physical activity, may shield them from adverse outcomes following a cancer diagnosis.

Physical activity is associated with several benefits across the cancer continuum (Doyle et al., 2006; Schmitz et al., 2005; Speck et al., 2010), including reduced risk of breast cancer-related mortality (Holick et al., 2008; Holmes et al., 2005; McNeely et al., 2006), improvements in cardiorespiratory fitness, body mass index, body fat, upper and lower body strength, and health-related quality of life (Bertram et al., 2011; Schmitz et al., 2005; Speck et al., 2010). Despite the benefits of physical activity, most AA survivors do not meet current guidelines for physical activity (Irwin et al., 2004). Secondary analysis of the Women's Healthy Eating and Living (WHEL) Study showed that 40% of AA BCS reported meeting current physical activity guidelines (i.e., 150 min of moderate to vigorous intensity activity per week), compared to 60% of non-Hispanic White survivors (Paxton et al., 2012). In addition, our data from the Sisters Network (Paxton et al., 2013a,b, 2014) indicate that AA BCS spend a considerable portion of their day not engaged in physical activities.

The high prevalence rates of inactivity among AA BCS are likely due to the number and magnitude of physical activity barriers experienced (Oyekanmi and Paxton, 2014). Barriers to physical activity reported by healthy AA adults include time and personal constraints, a lack of social support, and a lack of access to fitness facilities (Komar-Samardzija et al., 2012; Nies et al., 1999; Williams et al., 2006). Among cancer survivors, barriers to physical activity are similar to those in healthy populations, but may also include cancer-related factors such as pain, fatigue, and neuropathy (Blaney et al., 2013; Courneya et al., 2008; Sander et al., 2012). In a recent study of AA BCS, barriers to physical activity included pain, a lack of social support, and safety concerns (Weathers et al., 2006). Our data indicated that lack of interest, self-discipline, and company (e.g., support) were the most commonly reported barriers, and they increased the odds of not meeting physical

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activity guidelines (Oyekanmi and Paxton, 2014). Consistent with models of health behavior change (Schwarzer, 2008), these studies highlight that there is an "intention-behavior gap" (Sheeran, 2002). In particular, barriers may emerge that lead to certain behavioral outcomes such as low levels of physical activity. This is evident because BCS are mostly knowledgeable about the importance of physical activity in their recovery process (McNeely et al., 2006). Thus, physical, social, and psychological barriers may pose a greater risk for this population.

Although studies have examined many of the psychosocial correlates of physical activity among AA BCS, limited research exists on the environmental effects of place on physical activity among this population. A number of studies have found that, in general, minority populations often reside in environments not conducive to being active (Kumanyika et al., 2008; Taylor et al., 2007). AA BCS will likely live in similar environments with contextual barriers that restrict activity levels. Elements of the built environment could be associated with individual levels of physical activity or could co-occur with psychosocial variables related to physical activity. As the socio-ecological models suggest (Sallis et al., 2006), people interact with their physical, social, and cultural surroundings, and as such, any interventions (such as increasing walkability or building recreational centers) are expected to influence behavior. However, these interventions are effective only if they operate on multiple levels. Walkability does not lead necessarily to more physical activity if individuals live in unsafe neighborhoods or experience barriers or cancer-related systems (e.g., pain and fatigue) (Mock et al., 1997). To our knowledge, limited data exist as to whether environmental variables play a role in the physical activity behaviors of AA BCS. Such data may help to shed light on why AA BCS have higher levels of inactivity when compared to survivors of other racial and ethnic groups.

The purpose of this study is to examine the relationship between psychosocial and environmental correlates of physical activity in a population of African American breast cancer survivors. Specifically, we focus on select barriers to physical activity that would increase the odds of not meeting physical activity guidelines. The aims of this study are to (a) determine whether the association between motivational, support, and facility barriers and physical activity exist in the context of elements of the built environment, and (b) determine whether the association between motivational, support, and facility and physical activity is moderated by elements of the built environment.

Methods

African American breast cancer survivors aged 18–70 years were identified through Sisters Network, Inc., the largest AA breast cancer survivorship organization in the United States. The Sisters Network Inc. is a national organization that contains 40 affiliate chapters in 19 states: California, Florida, Georgia, Illinois, Indiana, Louisiana, Maryland, Michigan, Mississippi, Nevada, New Jersey, New York, North Carolina, Ohio, South Carolina, Tennessee, Texas, Virginia, and Wisconsin. The women were recruited via solicitation emails about the survey and via anonymous survey links on social media sites and Sisters Network blog sites between April and July 2012. All surveys were completed using Survey Monkey, a web-based platform that allows investigators to create surveys, perform routine updates, and manage survey responses. Participants received a $10 gift card for participating in the study. Participants were eliminated from the final analyses if they were not breast cancer survivors, were not African American, or reported being diagnosed prior to their 18th birthday. A total of 473 AA BCS completed basic medical and demographic information and provided reasonable survey responses. However, 291 completed the entire survey (Paxton et al., 2014). This study focused exclusively on AA BCS who completed the entire survey. The project was approved by the Institutional Review Board at The University of Texas MD Anderson Cancer Center prior to data collection, and a consent form was included on the initial survey web page. The Institutional Review Board at the University of North Texas Health Science Center approved all procedures, including the development of the web-based survey and the use of a passive consent form, before the survey was administered.

Measures

Physical activity was assessed via a self-administered instrument designed for the Women's Health Initiative (Langer et al., 2003). The instrument consists of nine items that assess recreational walking and light, moderate, and vigorous physical activity using a frequency and duration item format. The instrument was highly correlated with accelerometer counts and had high sensitivity in a population of BCS (Johnson-Kozlow et al., 2007). Weekly metabolic equivalent (MET) minutes of physical activity was computed by multiplying a specific activity by a specific MET value (i.e., 3.3 for walking, 4.0 for moderate, and 8.0 for vigorous activity), which was then summed to indicate the total number of minutes of physical activity.

Individual, social, and environmental barriers to physical activity were measured with three items that were utilized from the original 15-item inventory (Hovell et al., 1989). These items were selected because they were highly associated with physical activity in a prior study (Oyekanmi and Paxton, 2014). Participants were asked to evaluate on a Likert-type response scale ranging from 1 (not at all) to 5 (very often) how often the following prevent them from getting regular physical activity: lack of interest (i.e., individual) in exercising, lack of company (i.e., social), and lack of facilities or space (i.e., environmental). Each barrier was reverse-coded and evaluated individually, rather than collapsed into a collective subscale. The internal consistency reliability for the overall measures was 0.92.

Sociodemographic and medical characteristics were self-reported by participants. These data included the following variables: their current age in years, the highest level of school completed or the highest degree received, their total household income in US dollars, their current marital status, the stage (I–IV) that the respondent was first diagnosed with breast cancer, whether the respondent was a former, current, or nonsmoker, and whether or not a doctor told the respondent that they currently have any of the following conditions: diabetes, high blood pressure, high cholesterol, arthritis, or osteoporosis.

Neighborhood characteristics are measured at the census tract level and are derived from the Federal Financial Institutions Examination Council (2015) geocoding and mapping system. The median household income of the census tract where the participant resides was compared to the median household income of the larger metropolitan statistical area (MSA). The median household income of the census tract where the respondent lived was multiplied by 100 and then divided by the MSA's median household income. This calculation standardizes the relative income differentials across all areas since all small-area incomes are relative to the larger-area incomes, and the value that is calculated is out of 100, which makes it a percentage. To clarify, if the median household income of a MSA is $98,765 and the median household income of a census tract within that MSA is $43,210, the resulting value would be 43.75. This variable suggests that higher values correspond to a more affluent census tract compared to the metropolitan area at large.

In addition, the percentages of residents in the census tract who were poor at survey administration, who rent, and those who were of racial/ethnic origin were also assessed. The four contextual variables capture socioeconomic processes that may be taking place in the environment where the participant resides.

Analytic strategy

Means and frequencies were used to characterize the study participants and the characteristics of the participants' locales. An unadjusted ordinary least squares regression model was used to evaluate the relationship between barriers to physical activity, individual attributes, and neighborhood characteristics on physical activity. Ordinary least

squares (OLS) regression coefficients and 95% confidence intervals were computed. OLS was appropriate for these data since no two respondents lived in the same census tract at survey administration. Because of this, hierarchical linear models (HLM) would be deemed inappropriate here. These data were analyzed using Stata 13.1 (StataCorp, 2013). All statistical tests were two-sided, and statistical significance was determined at a 0.05 alpha level. Multicollinearity was assessed using the variance inflation factor ("estat vif" command in Stata). The largest value VIF found was 4.93, suggesting that there is no concern for multicollinearity in this sample (DeMaris, 2004).

Results

The descriptive characteristics are reported in Table 1. The mean age of the survey participants was 54 years. Fifty-one percent of the women were college graduates. For income, over one-fifth (20%) made less than $35,000, similar to the proportion that had incomes greater than or equal to $100,000. Most participants reported being never smokers (68%), married (51%), and diagnosed with Stage II disease (45%). Similarly, a substantial proportion of the women reported comorbidities.

On average, respondents in the sample rate the lack of interest as a deterrent to being physically active a 2.8 on a scale of 1 to 5. Similarly, respondents in the sample rate the lack of company as a deterrent to being physically active a 2.3 on the same scale. Also, respondents in the sample rate the lack of facilities or space as a deterrent to being physically active as 2.0.

Neighborhood characteristics suggest that many of the survey respondents lived affluent areas. The mean ratio of median household income in the census tract compared to the median household income of the metropolitan statistical area (MSA) was 96 (out of 100). This statistic suggests that on average, the respondents were living in neighborhoods with a similar economic profile to the larger metropolitan area. Respondents in the sample live in neighborhoods where, on average, 64% of the residents are racial/ethnic minorities. In addition, 15% of residents in the respondents' neighborhoods are living below the Federal Poverty Level. Moreover, respondents in the sample tend to live in neighborhoods where 0.4% of the residents (on average) rent their place of residence.

Table 1 also includes the zero-order regression coefficients for physical activity as well as 95% confidence intervals. Each coefficient represents a suggested relationship to physical activity in MET-minutes/week units. Increasing lack of interest, lack of company, and lack of facilities or space is associated with a 369-point, 265-point, and 213-point decline in physical activity MET-minutes/week, respectively.

Two of the neighborhood characteristics are statistically associated with physical activity in this sample. First, a 1-point increase in the ratio between the median household income in the neighborhood and the median household income in the metropolitan area corresponds to a 4-point increase in physical activity MET-minutes/week. Second, when the percentage of households who rent increases by one, the physical activity MET-minutes/week decreased by 52-points.

Table 2 presents the regression estimates and 95% confidence intervals for physical activity. Model 2 isolates the motivational, support, and facility barriers. Lack of interest, company, and facilities/space is associated with a 300-point, 108.8-point, and 104.6-point decline, respectively in physical activity MET-minutes/week. Model 3 includes the motivational, support, and facility barriers and neighborhood characteristics to determine whether barriers were relevant correlates in the context of neighborhood characteristics. In the adjusted model, all variables remained statistically significant. That is, motivational, support, and facility barriers were negatively associated with physical activity. In addition, median household income, relative to the median household income of the metropolitan statistical area (MSA) is positively related to physical activity. As the median household income of the neighborhood increases relative to the median household income of the MSA, physical activity MET-minutes/week is increased. Furthermore, as the percentage of renters increase in the neighborhoods that the respondents represent, physical activity decreases by 24.5 points.

Model 4 is the full model that contains all variables. In addition to the lack of interest maintaining statistical significance, the lack of facilities/space remains significant after controlling for all variables. Lack of company failed to maintain significance in Model 4. Supplemental analyses

Table 1
Descriptive statistics of the AA breast cancer survivor sample.

Variable	Mean/%	SD	β (95% CI)[a]	
Individual characteristics				
Age (in years)	53.93	(9.84)	−13.26	(−24.79 , −1.72)
College graduate	51.37%	–	280.69	(15.23, 546.16)
Income category				
Less than $35,000	20.34%	–		Referent
$35,000–$49,999	13.98%	–	303.19	(−75.19, 681.57)
$50,000–$64,999	17.80%	–	230.37	(−89.03, 549.77)
$65,000–$79,999	13.14%	–	171.48	(−177.04, 520.01)
$80,000–$99,999	11.86%	–	491.00	(−15.49, 997.48)
$100,000 +	22.88%	–	593.67	(202.15, 985.19)
Married	50.78%	–	62.18	(−197.20, 321.57)
Stage of diagnosis				
Stage I	35.54%	–	150.05	(−132.68, 432.78)
Stage II	45.45%	–		Referent
Stage III	19.01%	–	254.45	(−148.68, 657.57)
Smoker status				
Never smoked	68.22%	–	698.01	(472.73, 923.29)
Currently smoke	3.10%	–		Referent
Former smoker	28.68%	–	670.23	(355.79, 984.66)
Number of comorbidities	1.30	(1.11)	−126.40	(−236.08, −16.71)
Activity motivation				
Lack of interest	2.80	(1.23)	−368.72	(−464.89, −272.56)
Lack of company	2.25	(1.21)	−265.07	(−369.65, −160.49)
Lack of facilities/space	2.03	(1.19)	−212.86	(−300.00, −125.72)
Neighborhood characteristics				
Median household income of census tract relative to MSA	95.94	(38.51)	4.45	(0.86, 8.04)
Percent poor	15.11	(11.81)	−0.51	(−10.74, 9.73)
Percent renters	0.38	(0.84)	−51.99	(−92.94, −11.04)
Percent minority	63.51	(26.60)	−3.05	(−7.74, 1.64)

[a] Coefficients come from zero-order regression model with that particular variable.

Table 2
Regression estimates and 95% confident intervals for physical activity, clustered by census tract (N = 275).

	Model 1	Model 2	Model 3	Model 4
Individual characteristics				
Age	−8.04 (−22.69, 6.60)			−5.24 (−20.06, 9.58)
College graduate	157.08 (−142.03, 456.20)			9.62 (−267.76, 287.01)
Income category				
Less than $35,000	Referent			Referent
$35,000–$49,999	150.27 (−238.35, 538.90)			98.32 (−355.38, 552.03)
$50,000–$64,999	127.87 (−228.26, 484.00)			117.73 (−262.19, 497.66)
$65,000–$79,999	91.52 (−268.79, 451.84)			−59.65 (−439.38, 320.07)
$80,000–$99,999	298.05 (−256.01, 852.11)			178.85 (−347.75, 705.45)
$100,000 +	472.51 (0.27, 945.29)			485.86 (5.70, 977.42)
Married	−117.08 (−433.56, 199.39)			−93.04 (−438.84, 252.76)
Stage of diagnosis				
Stage I	188.91 (−126.66, 504.48)			117.18 (−192.27, 426.64)
Stage II	Referent			Referent
Stage III	72.65 (−264.71, 410.00)			−56.82 (−402.67, 289.02)
Smoker status				
Never smoked	758.26 (350.85, 1165.66)			374.30 (−235.19, 983.80)
Currently smoke	Referent			Referent
Former smoker	691.91 (271.43, 1112.39)			293.04 (−368.76, 954.84)
Number of comorbidities	−58.35 (−193.73, −77.03)			−33.90 (−171.50, −103.69)
Activity motivation				
Lack of interest		−300.13 (−398.09, −202.17)	−292.02 (−386.90, −197.14)	−234.67 (−348.59, −120.75)
Lack of company		−108.83 (−207.59, −10.06)	−112.00 (−213.35, −10.65)	−86.38 (−204.54, 31.78)
Lack of facilities/space		−104.62 (−182.78, −26.46)	−79.58 (−158.39, −0.76)	−116.43 (−210.05, −22.81)
Neighborhood characteristics				
Median household income of census tract relative to MSA			5.55 (1.10, 12.19)	−0.13 (−5.72, 5.47)
Percent poor			9.42 (−7.17, 26.01)	5.99 (−9.66, 21.64)
Percent renters			−24.54 (−82.83, −33.75)	−43.36 (−121.24, −34.53)
Percent minority			−1.00 (−7.17, 5.17)	−3.37 (−10.21, 3.46)
Constant	247.47 (−609.00, 1103.95)	2095.27 (1698.53, 2492.02)	1420.95 (200.48, 2641.41)	1856.06 (279.79, 3432.34)
F statistic‡	2.35	20.99	10.72	4.07
R^2 statistic	0.09	0.25	0.28	0.33

‡ F statistics are significant across all models at the 0.001 alpha level.

suggest that the addition of income attenuated the effect of lack of company. Lastly, while the percentage of renters was still significant, the neighborhood measure of income was no longer significant in Model 4. Auxiliary analyses suggest that the addition of income at the individual level contributes to this variable no longer being statistically significant.

This research attempted to test the statistical interactions between the physical activity barriers and the neighborhood characteristics. However, none of the interactions was statistically significant, which suggests that each variable has a unique contribution to physical activity rather than an interactive contribution.

Discussion

In this study, we observed that barriers to physical activity and neighborhood characteristics appear to play a dual role in the physical activity behaviors of AA BCS in the context of sociodemographic characteristics. In particular, self-reported barriers of interest and access to facilities were associated with lower levels of physical activity. Similarly, the percentage of individuals renting in a neighborhood was associated with lower levels of physical activity. Overall, these data as well as others suggest that being motivated to be active may not be enough (Alexandris et al., 2002; Cerin et al., 2008; Holman et al., 1996). AA BCS may also need access to recreational facilities in a safe environment with limited transition to be physically active.

Three important findings emerged from this research. First, health-related characteristics were associated with physical activity in this population. Specifically, smoking status and number of comorbidities were associated with lower levels of physical activity. Prior research corroborates these findings, as a number of these studies have shown that comorbidities co-occur with poor lifestyle habits, including, including physical inactivity (Chinn et al., 1999). Prior studies have indicated that comorbidities and other adverse health risks may account for half of the mortality-related disparities that exist between non-Hispanic white and minority survivors (Tammemagi et al., 2005). Although comorbidities are universal challenges for all populations, it is alarming for this population. AA BCS experience “multiple hits” to the cardiovascular system as a result of the culmination of cancer treatment, co-occurring cardiovascular disease risk factors (i.e., hypertension), and poor lifestyle characteristics (L. W. Jones et al., 2007). The associations observed here are of relevance because they occur in the context of individual, social, and environmental-related barriers as well as neighborhood characteristics. In our prior work, the associations between comorbidities were only examined in bivariate models (Paxton et al., 2012). Thus, these data add to the relevance of comorbidities in the context of individual, social, and environmental risk factors.

Second, self-reported barriers are critical in understanding the physical activity levels of AA BCS. Here, lack of interest in exercising and lack of access to facilities and/or spaces to exercise were significantly related to physical activity levels. These results are consistent with the major tenets of the health behavior change model (Schwarzer, 2008) which suggests that people do not always behave in accordance with their intentions. Here, AA BCS are knowledgeable about the benefits of physical activity, but their lack of interest and facilities create unforeseen barriers that limit their physical activity engagement. Interventions designed to increase physical activity in this population should consider including strategies that increase general interest in exercise and education for women on activities that can be performed in their neighborhood or in surrounding communities. Approaches such as encouraging women to find activities that they enjoy and finding safe places to acquire steps such as walking in a shopping mall are recommended. The barriers to physical activity for this population intersect biology and psychology. The curative therapies associated with cancer treatment are associated with cancer-related fatigue, which could affect motivations to engage in physical activity (Lynch et al., 2011). In addition, any interventions geared towards increasing access to and

quality of the built environment, as well as ways to make spaces safer for exercise, would be especially beneficial for this population. While some research suggests that proximity to the built environment may not be beneficial to certain outcomes (Burdette and Whitaker, 2005), it is clear from these findings that it would help in motivating AA BCS to engage in recommended levels of physical activity.

Third, activity barriers to physical activity were important, even after adjusting for the sociodemographic context of the neighborhood. These findings suggest that both motivation and the structural and socioeconomic conditions of a neighborhood are essential in understanding what motivates individuals to exercise. Specifically, the presence of renters vis-à-vis homeowners was associated with low levels of physical activity. Neighborhoods where there are high numbers of renters may indicate that there is no residential stability or constant residential turnover, which has been shown to work against community building (Chaskin and Joseph, 2009). Having strong communities is important to health because it fosters social cohesion, and it can create empowered communities that can advocate local government and private enterprises to change the built environment to be health-centered (A. Jones et al., 2015). Recent work has shown the power of community political engagement in removing items detrimental to health in the built environment (Morello-Frosch et al., 2002; Pastor et al., 2002) and adding items in the built environment that facilitate a healthy lifestyle (González et al., 2007). These results are consistent with the socioecological model (Sallis et al., 2006) that suggests an interplay between intrapersonal characteristics, cultural values, physical environment, and policy. However, more research with AA BCS is necessary to make strong claims that the built environment itself differs based on the level of homeownership across neighborhoods.

The results from this study provide important and unique information about African American breast cancer survivors. There are, however, several limitations of this study that should be noted. Our study focused exclusively on AA BCS and adding a comparison group (e.g., non-Hispanic white survivors) may have helped to rule out the potential for confounding. The sample of AA BCS was relatively healthy and well educated, so the results may not be generalizable to other populations of AA BCS. Moreover, these data are cross-sectional and do not imply causal inference. Despite the limitations, there were a number of strengths associated with this study including being the first study among cancer survivors to examine barriers to physical activity in the context of contextual environmental factors (particularly for AA BCS), the use of robust statistical procedures to account for the correlations that may exist among variables, a modest sample size, and having an emphasis on a high-risk and underrepresented population of cancer survivors.

In summary, these data suggest that AA BCS may have both motivational and access barriers that are associated with lower levels of physical activity that occur in the context of the social structure of the neighborhoods. While the perception of barriers may be modifiable factors, the physical environment of one's neighborhood is less malleable. Future studies should consider evaluating the psychosocial elements of the build environment in various cancer survivor populations across various neighborhoods in the US to determine whether these factors influence patient-reported and behavioral outcomes among cancer survivors.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

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