Social and Clinical Determinants of Physical Activity in Prostate Cancer Survivors

Chanita Hughes Halbert, PhD[1,2], **Melanie S. Jefferson, PhD**[2], **Richard Drake, PhD**[2,3], **Michael Lilly, MD**[2,4], **Stephen J. Savage, MD**[2,5,6], **Georges J. Nahhas, PhD, MPH**[1,2], **Sarah Tucker Price, MD**[2,7], **Aundrea E. Loftley, MD**[4], **Alexandria Bauer, MA**[1]

[1]Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, SC

[2]Hollings Cancer Center, Medical University of South Carolina, Charleston, SC

[3]Department of Cellular and Molecular Pharmacology, Medical University of South Carolina, Charleston, SC

[4]Department of Medicine, Medical University of South Carolina, Charleston, SC

[5]Department of Urology, Medical University of South Carolina, Charleston, SC

[6]Ralph H. Johnson Veterans Affairs Medical Center, Charleston, SC

[7]Department of Family Medicine, Medical University of South Carolina, Charleston, SC

Abstract

Purpose: Physical activity is important for enhancing quality of life and cancer control among prostate cancer survivors. The purpose of this study was to examine characterize adherence to physical activity guidelines among African American and white prostate cancer survivors based on social and clinical determinants and psychosocial factors.

Methods: Observational study of meeting guidelines for moderate intensity physical activity in a retrospective cohort of African American and white prostate cancer survivors (n=89).

Results: Thirty-four percent of survivors met the recommended guidelines for moderate intensity physical activity. There were no racial differences in physical activity between African American and white prostate cancer survivors; however, the likelihood of meeting guidelines was associated significantly with stage of disease, self-rated health, and perceptions of stress. Survivors who had stage pT2c or higher disease had a significantly reduced likelihood of meeting recommended guidelines for physical activity (OR=0.27, 95% CI=0.08, 0.86, p=0.03). The likelihood of meeting guidelines was also reduced among survivors who rated their health as being the same or worse than before they were diagnosed with prostate cancer (OR=0.32, 95% CI=0.11, 0.96, p=0.04). As

CORRESPONDING AUTHOR: Chanita Hughes Halbert, PhD; Medical University of South Carolina, Department of Psychiatry and Behavioral Sciences, 68 President Street, Suite BE103, Charleston, SC 29425, Phone – (843) 876-2421, Fax – (843) 876-2340, hughesha@musc.edu.

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perceived stress increased, the likelihood of being physically active according to guidelines also decreased (OR=0.48, 95% CI=0.26, 0.89, p=0.02).

Conclusion: The results of this study underscore the need to develop, implement, and evaluate strategies to enhance physical activity among prostate cancer survivors, regardless of their racial background. Complementary and alternative strategies for physical activity may be one strategy for enhancing activity levels and managing stress among prostate cancer survivors.

Keywords

Prostate cancer; physical activity; social determinants; clinical factors

INTRODUCTION

Prostate cancer is one of the leading causes of cancer among men in the United States that disproportionately affects African American men in terms of risk and mortality [1]. Empirical data continue to show that men of African ancestry have the highest incidence of prostate cancer worldwide and the mortality rate from this disease is about twice as high among African American men compared to white men. In addition to being at increased risk for developing prostate cancer and dying from this disease, African American men also have an increased risk of experiencing poorer quality of life (QOL) after diagnosis than white men [2]. For example, Eton et al. found that after controlling for treatment type, comorbidities, and age, African American men reported significantly lower levels of physical functioning compared to white men [3].

Physical activity is essential for physical well-being and quality of life among men who have a personal history of prostate cancer [4]. Findings from a meta-analysis and systematic review demonstrate that physical activity has a beneficial effect on prostate-specific quality of life and also reduces treatment-related side effects (e.g., fatigue) and improves muscular strength [5]. Cancer patients in qualitative studies report similar types of benefits from physical activity; physical activity was viewed as an effective strategy for managing the adverse psychological, emotional, physical, and spiritual side effects of cancer treatment [6]. Other work has shown that vigorous physical activity can slow disease progression and reduce disease-specific and all-cause mortality among prostate cancer patients [7]; randomized trials are now being conducted to examine the effects of behavioral interventions on physical activity outcomes among prostate cancer survivors. Recent reports demonstrate that these approaches have some benefits among these men [8,9]. However, several important empirical questions remain about the reach and sustainability of these interventions because of the under-representation of African American men in behavioral studies overall and the short-term benefits observed in previous trials [10,11]. The challenges associated with recruiting men to participate in clinical research and the lack of minority participation in prostate cancer research [12,13] emphasizes the importance of examining physical activity interventions in diverse samples of prostate cancer survivors. To be effective, interventions also have to target the constructs that are most important to health behavior change as well as barriers and facilitators that are likely to influence physical activity. Findings from qualitative and quantitative studies show that lack of time, fatigue, and limited knowledge about recommended guidelines and strategies are barriers to physical

activity in prostate cancer patients [14]; however, social determinants may also be associated with physical activity among men who have a personal history of disease.

Social determinants are now recognized as having an important role in disease risk, clinical care, and health outcomes. While racial background is among the most important social determinants, previous studies show that other aspects of the social environment play a role in cancer-related outcomes among prostate cancer patients. For instance, perceived stress had a significant negative association with QOL in newly diagnosed prostate cancer patients in our previous research [12]. Further, stress management may be an intervention target in lifestyle and health behavior change survivorship programs for cancer patients [15]. To our knowledge, however, empirical data are not available on the association between physical activity and perceptions of stress among men who have a personal history of prostate cancer. The purpose of this study was to characterize physical activity among African American and white men who have a personal history of prostate cancer based on social determinants (e.g., racial background), clinical factors, and perceived stress. Based on racial differences in obesity that have been observed in prostate cancer survivors, we predicted that African American men would be less likely than white men to meet recommended guidelines for physical activity. We also hypothesized that men who have greater perceptions of stress would be less likely to meet the guidelines for physical activity.

MATERIALS AND METHODS

Study Population.

Participants were men who had a personal history of prostate cancer, were treated with radical prostatectomy, and had provided a tissue sample to the Biorepository and Tissue Analysis Shared (BTA) Resource at the Hollings Cancer Center (HCC). More than 90% of prostatectomy patients provide consent for their tissue sample to be stored in the BTA. Patients provided written informed consent and privacy authorization to donate tissue samples using approved procedures at the Medical University of South Carolina (MUSC). As part of providing informed consent, men agreed to be contacted about participating in future studies. The following clinical data were available for each sample: year of birth; date of diagnosis; prostate specific antigen (PSA) levels; pathologic stage (T1a; T1c; T2a; T2b; T2c; T3a; T3b); stage, and race (white, African American). Co-morbidities (e.g., diabetes, hypertension, cardiovascular disease) were also recorded in the patient's electronic health record and were abstracted for the present study. The BTA was queried to identify men who had an ICD-10-CM code of C61 and CPT codes of 55810 and 55866 and were registered in the biorepository since 2011; these men were invited to complete a Social Determinants Survey (SDS) that obtained self-report data on physical activity, perceived stress, self-rated health, and sociodemographic characteristics.

Procedures.

All study procedures were reviewed and approved by the Institutional Review Board at MUSC. First, information on social determinants (e.g., race, age) and prostate cancer variables (e.g., PSA, stage, date of diagnosis) were abstracted from the medical records of eligible patients who were identified from the BTA. Next, patients were contacted by mailed

invitation to complete the SDS. Patients could decline to participate in the SDS by returning a self-addressed response card or by contacting the program manager at MUSC by telephone or electronic mail. Those who did not decline the invitation were contacted by a research assistant at MUSC to complete the SDS. The SDS took approximately 30-minutes to complete by telephone. This study includes 89 men (28% of the 313 who were identified from the BTA) who completed the SDS.

Measures.

Race (African American, white) and age were abstracted from the patient's electronic medical record. Height, weight, and co-morbidities were also abstracted from the electronic medical record; these variables were used to calculate body mass index using the Centers for Disease Control and Prevention BMI calculator [16]. Patients were also categorized as having a personal history of hypertension (yes or no), diabetes (yes or no), heart problems (yes or no), stroke (yes or no), or high cholesterol (yes or no). Men who had at least one of these conditions were categorized as having a co-morbidity and those who did not have any of these diseases were categorized as not having a co-morbidity. Lastly, information on prostate cancer prognostic factors (e.g., date of diagnosis, PSA at diagnosis, stage) were abstracted from the electronic medical record. Stage was recoded into a dichotomous variable to reflect early versus later stage disease (T1/T2 versus T3).

The Perceived Stress Scale-Short Form (PSS) [17] was used to measure the extent to which men appraised the situations in their life as being stressful. The short-form of the PSS has been extensively validated and asked men how they have felt: (1) unable to control the important things in their life; (2) confident about their ability to handle personal problems; (3) felt that things were going their way; (4) felt that difficulties were piling up so high they could not overcome them since they were diagnosed with cancer (1=never, 2=almost never, 3=sometimes, 4=fairly often, 5=very often). Higher scores reflected greater perceived stress. We adapted an item from the Health Information National Trends Survey (HINTS) to measure self-rated health. Specifically, men were asked to indicate how they would rate their general health compared to before they were diagnosed with cancer (1=much better than one year ago, 2=somewhat better now than one year ago, 3=about the same, 4=somewhat worse than one year ago, 5=much worse than one year ago). Responses to this item were re-coded into a dichotomous variable (same/worse versus better/much better).

Items from the Health Information National Trends Survey (HINTS) were used to evaluate physical activity [18]. Specifically, men were asked how many days they do any physical activity or exercise of at least moderate intensity (e.g., brisk walking, bicycling at a regular pace) during a typical week. Those who reported being physically active at least one day per week were asked to indicate how long they typically perform these activities. The total number of minutes for moderate intensity physical activity per week was calculated by multiplying the number of days by the minutes reported. Men who reported no physical activity during a typical week and those who reported physical activity, but did not meet the physical activity guidelines (e.g., less than 150 minutes/week) were coded as not meeting guidelines [19]. Men who reported being physically active for 150 minutes/week or more were coded as having met the guidelines for physical activity. This method has been used to

determine adherence to recommended guidelines for physical activity in previous research [18].

Data Analysis.

First, descriptive statistics were generated to characterize the study sample in terms of race, age, prostate cancer variables, and co-morbidities. Frequencies were then generated to determine the proportion of men who met the recommended guidelines for physical activity. Next, Chi Square Tests of Association and T-tests were performed to examine the association between physical activity, social determinants, co-morbidity status, and self-rated health. Lastly, multivariate logistic regression analysis was used to identify factors having significant independent associations with meeting recommended guidelines for physical activity. Variables that had a bivariate association of $p<0.15$ with physical activity were included in the multivariate logistic regression analysis.

RESULTS

Table 1 shows descriptive information on the study sample and the bivariate analysis of physical activity based on social determinants and clinical variables. Overall, 85% of participants were white and 15% were African American. The majority of men were married (90%), had at least some college education (73%), and had an income that was greater than $50,000 (73%). Forty-one percent of men were employed and the mean (SD) age was 65.2 (6.0). With respect to clinical variables, 55% of men had at least one co-morbidity, and 74% had stage pT2c or higher disease. Seventy-one percent of men reported that their health was the same as or was worse than it was compared to the year before they were diagnosed with cancer. The mean (SD) for perceived stress was 7.7 (2.4).

Thirty-four percent of men met the recommended guidelines for moderate intensity physical activity and 66% did not meet this guideline. None of the social determinants (e.g., race, marital status) were associated significantly with meeting guidelines for physical activity. However, there were differences in meeting physical activity guidelines based on self-rated health. Men who rated their health as being better or much better than before they were diagnosed with prostate cancer were more likely to meet physical activity guidelines (54%) compared to those who reported that their health was the same as or worse than before they were diagnosed with prostate cancer (25%) (p=0.01). Men who were diagnosed with pT2b and lower stage disease were also more likely to meet physical activity guidelines compared to those who were diagnosed with higher stage disease (p=0.03). In addition, 41% of men who had a co-morbidity met the physical activity guidelines compared to 25% of men who did not have a co-morbidity (Chi Square=2.46, p=0.12). Lastly, there were significant differences in perceived stress between men who met guidelines for physical activity compared to those who did not meet this guideline. The mean (SD) level of perceived stress was lower [6.6 (2.2)] among men who met physical activity guidelines compared to those who did not meet guidelines [8.3 (2.3)] (p=0.002).

Table 2 shows the results of the multivariate logistic regression model of physical activity. Men who had stage pT2c or higher disease had a significantly reduced likelihood of meeting recommended guidelines for physical activity (OR=0.27, 95% CI=0.08, 0.86, p=0.03). Men

who rated their health as being the same or worse than before they were diagnosed with prostate cancer also had a reduced likelihood of meeting physical activity guidelines (OR=0.32, 95% CI=0.11, 0.96, p=0.04). Lastly, as perceived stress increased, the likelihood of being physically active according to guidelines decreased (OR=0.48, 95% CI=0.26, 0.89, p=0.02).

DISCUSSION

To our knowledge, this is the first empirical study to examine adherence to physical activity guidelines among prostate cancer survivors based on their social determinants, clinical characteristics, and psychological variables. But, some limitations should be noted. First, our sample size was modest and 28% of men who were identified from the BTA completed the SDS. Our enrollment rate is consistent with the challenges associated with recruiting cancer survivors to participate in cancer control research [20, 21]. Second, physical activity was measured by self-report in a retrospective cohort of prostate cancer survivors. However, our measure of physical activity has been validated in national and community samples of adults [19, 22]. We also did not have information on metastatic status and receipt of chemotherapy or radiation therapy among study participants; thus, additional research is needed to examine physical activity behaviors based on these variables among men who were treated with radical prostatectomy. Lastly, African American men made up 15% of our study sample. The challenges associated with recruiting African Americans to participate in cancer research have been documented [12]; the under-representation of African Americans in our study underscores the importance of using novel strategies to recruit and retain these men in survivorship research and supportive care studies. Despite these potential limitations, our study provides novel information about adherence to physical activity recommendations in a racially diverse sample of prostate cancer survivors.

Overall, a minority of men met the recommended guidelines for physical activity. The American Cancer Society recommends that cancer patients exercise for at least 150 minutes per week [23]; however, only 34% of prostate cancer survivors in the present study reported that they exercised for at least 150 minutes per week. Similar findings were reported by Ottenbacher et al. [24]; 44% of prostate cancer survivors in a HINTS cohort met recommended guidelines for physical activity. As in other reports [25], African American and white prostate cancer survivors in the present study did not differ in terms of adherence to physical activity guidelines. The low rates of physical activity observed in our study, together with the modest adherence rates observed among African American and white prostate cancer survivors in other reports [24], underscores the importance of developing, implementing, and evaluating strategies to enhance physical activity among these men regardless of their racial background.

Previous studies have shown that barriers to physical activity among cancer survivors include lack of knowledge about guidelines, limited skills in terms of performing different types of physical activity (e.g., aerobic, strength training), and lack of provider recommendation to perform these behaviors [10, 26]. Consistent with previous research with cancer survivors [27], we found that men who reported that their health was the same or worse than before they were diagnosed with prostate cancer were significantly less likely to

meet guidelines for physical activity. While there were no differences in adherence based on chronic disease status, men who had stage pT2c or higher disease were less likely than those with lower stage disease to meet physical activity guidelines. We also found that men who had greater perceptions of stress had a significantly lower likelihood of meeting recommended guidelines for physical activity. In our previous research with newly diagnosed prostate cancer patients [12], perceived stress was negatively associated with emotional and physical well-being and those who had greater perceived stress were likely to report adverse psychological reactions to being diagnosed with prostate cancer [12, 28]. Our findings suggest that perceived stress also has implications for health risk behaviors among prostate cancer survivors. These findings have important implications for the types of physical activity that could be recommended to prostate cancer survivors.

Cancer patients should engage in at least 150 minutes of moderate intensity physical activity and also perform strength training exercises [23]. Previous research has shown that vigorous physical activity can slow the progression of disease and reduce disease-specific and all-cause mortality among prostate cancer patients [7]. In other research with Australian men who had a personal history of prostate cancer, those randomized to a clinician-referred 12-week intervention that included supervised and unsupervised physical activity session reported significantly more vigorous physical activity compared to men in the control group [29]. Men in this intervention also had greater self-efficacy for being physically active and self-efficacy was important to meeting guidelines for vigorous physical activity among men in the intervention group [30]. However, only about 12% of men met guidelines for vigorous physical activity prior to this intervention [29]. Thus, prostate cancer survivors may not be likely to engage in vigorous physical activity without intervention because of treatment-related side effects (e.g., fatigue, incontinence) and other barriers [10, 26].

Our findings demonstrate that prostate cancer survivors may also be unable to perform moderate intensity physical activity according to recommended guidelines; thus, there may be a need to introduce additional strategies that are effective at improving functional mobility and stress management in order to increase the likelihood that men are able to meet recommended guidelines for physical activity. Yoga, for instance, is a mind-body approach for enhancing physical and emotional outcomes through postures and controlled breathing that is designed to enhance flexibility, improve muscular strength, and reduce stress [31–33]. Empirical data are now emerging on the beneficial effects of yoga among prostate cancer survivors. For instance, Ross Zahavich and colleagues found that a 7-week yoga program was feasible to implement and was associated with significant improvements in perceived stress, fatigue, and mood immediately after each yoga session [33]. Similarly, a mindfulness stress reduction program was associated with improved quality of life and beneficial changes in DHEAS, which is a hormonal indicator of HPA-axis functioning and stress symptoms, in breast and prostate cancer patients [34]. This program also resulted in improved physical activity, and among patients who had high cortisol levels before the intervention, there were significant decreases in these levels at each assessment point during the study [34]. These findings suggest that yoga-based interventions may be sensitive to the clinical needs and physical constraints of prostate cancer survivors while also addressing their psychosocial concerns. Additional research is needed to examine the feasibility and reach of theory-based yoga interventions in racially diverse samples of prostate cancer survivors. Future studies

should also evaluate the effects of yoga-based interventions on adherence to physical activity guidelines, physiological markers of stress responses and patient-reported perceived stress, and indicators of prostate cancer recurrence among men who have a personal history of disease.

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Table 1.

Sample Characteristics and Bivariate Analysis of Physical Activity

Variable	Level	n (%)	% Met Physical Activity Guidelines	Chi Square	p-value
Race	African American White	13 (15%) 76 (85%)	31% 34%	0.06	0.81
Marital status	Married Not married	80 (90%) 9 (10%)	34% 33%	0.0006	0.98
Education level	Some college High school	63 (73%) 23 (27%)	38% 26%	1.07	0.30
Employment status	Employed Not employed	32 (41%) 47 (34%)	38% 34%	0.10	0.75
Income level	> $50,000 < $50,000	55 (73%) 20 (27%)	33% 35%	0.03	0.85
Co-morbidity	Yes No	49 (55%) 40 (45%)	41% 25%	2.46	0.12
Self-rated health	Same/worse Better/much better	63 (71%) 26 (29%)	25% 54%	6.67	0.01
Time since diagnosis	5 years > 5 years	63 (71%) 26 (29%)	35% 31%	0.14	0.71
Stage	pT2c or higher pT2b or lower	65 (74%) 23 (26%)	28% 52%	4.53	0.03

*
n may not equal 89 because of missing data

Table 2.

Multivariate Logistic Regression Analysis of Meeting Guidelines for Physical Activity

Variable	Level	Odds Ratio	95% CI	p-value
Chronic disease	Yes No	1.34 Reference	0.46, 4.12	0.57
Self-rated health	Same/worse Better	0.32 Reference	0.11, 0.96	0.04
Stage	pT2c or higher pT2b or lower	0.27 Reference	0.08, 0.86	0.03
Perceived stress	***	0.48	0.26, 0.89	0.02

*** OR reflects one SD unit change