Published in final edited form as:

Psychooncology. 2017 June ; 26(6): 822–828. doi:10.1002/pon.4095.

Physical Activity in Black Breast Cancer Survivors: Implications for Quality of Life and Mood at Baseline and 6-Month Follow-Up

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Abstract

Objective—The present study sought to examine the influence of physical activity on quality of life and negative mood in a sample of Black breast cancer survivors to determine if physical activity (dichotomized) predicted mean differences in negative mood and quality of life in this population.

Methods—Study participants include 114 women diagnosed with breast cancer (any stage of disease, any type of breast cancer) recruited to participate in an adaptive cognitive-behavioral stress management intervention. The mean body mass index (BMI) of the sample at baseline was 31.39 ($SD=7.17$).

Results—A multivariate analysis of covariance (MANCOVA) was conducted to determine if baseline physical activity predicted mean differences in negative mood and quality of life at baseline and at follow ups while controlling for relevant covariates. A one-way MANCOVA revealed a significant multivariate effect by physical activity group for the combined dependent variables at Time 2 (post 10 week intervention), $p=.039$. The second one-way MANCOVA revealed a significant multivariate effect at Time 3 (6 months after Time 2), $p=.034$. Specifically, Black breast cancer survivors who engaged in physical activity experienced significantly lower negative mood and higher social/family well-being at Time 2 and higher spiritual and functional well-being at Time 2 and Time 3.

Conclusions—Results show that baseline physical activity served protective functions for breast cancer survivors over time. Developing culturally relevant physical activity interventions specifically for Black breast cancer survivors may prove vital to improving quality of life and mood in this population.

Declaration of Conflicting Interests The authors declared no conflicts of interest with respect to the research, authorship, and publication of this article.

Background

Breast cancer is the most commonly diagnosed cancer among Black women and the second leading cause of cancer deaths among these women [1]. Despite having a lower breast cancer incidence rate, Black women have higher mortality than women from any other racial/ethnic group. Although the number of Black women surviving long-term with breast cancer is increasing, survivorship is often coupled with several physical and psychological concerns [2]. Factors that contribute to racial/ethnic disparities in breast cancer mortality and morbidity, such as advanced stage of diagnosis, comorbidities, reduced access to effective treatments, lower quality of care and poor health literacy and social support, are also likely to increase the risk of poor survivorship outcomes among Black women [3–6]. Black breast cancer survivors often report a number of these concerns at much higher rates than survivors from other racial/ethnic groups, including higher rates of poorer health outcomes and heightened cancer-specific symptoms [1, 7].

Additionally, an estimated 71% of breast cancer survivors in the United States are overweight or obese, with Black breast cancer survivors having the highest prevalence [1, 2]. Physical activity has been indicated as an intervention that may decrease weight and improve health outcomes following a breast cancer diagnosis [2, 3]. However, 67% of Black breast cancer survivors do not meet current guidelines for physical activity as outlined by the American Cancer Society (ACS) [2, 4]. Additionally, physical activity interventions among samples of predominately White breast cancer survivors have been associated with a number of psychological benefits including improved quality of life [6–8] and better mood [2].

Black breast cancer survivors often report lower levels of quality of life (QOL) than women from other racial/ethnic groups with a history of breast cancer and women without a history of cancer [2, 8]. QOL is often conceptualized as a multi-dimensional construct that incorporates physical, social, spiritual, functional, and emotional well-being [9]. QOL is defined from the patient's perspective and is based on their objective state and the congruence between their objective state and their expectations [10]. A recent meta-analysis indicated that physical activity contributes to multiple aspects of QOL and that the meaning of QOL and physical activity benefits is subjective and contextualized [11]. Disturbances in QOL among breast cancer survivors is an important indicator related to early treatment termination, tumor recurrence, and increased mortality [8]. Pinto (2013) found a dose-response relationship between physical activity and QOL among a sample of predominately White breast cancer survivors [11]. These researchers concluded that cancer survivors who engaged in greater amounts of physical activity for longer periods of time experienced the greatest improvements in QOL.

While QOL is focused on well-being in varying domains, negative mood encompasses an individual's emotional state and is based on feelings of sadness, terror and anger [12]. Mood has been linked to numerous significant health and psychosocial factors including health status, health behavior self-efficacy, physical symptoms and QOL [12, 13]. Some studies have found that regular physical activity improves negative mood associated with cancer and its treatment [14, 15]. For instance, positive mood has been associated with increased levels of physical activity among breast cancer survivors from Spain [16].

While it appears that physical activity may be important to both negative mood and QOL few existing studies have examined this relationship among Black breast cancer survivors and to our knowledge no studies have examined this relationship longitudinally [17]. It is plausible that cultural factors and varying experiences may influence the relationships between, physical activity, negative mood and QOL differentially among Black breast cancer survivors as compared to their White counterparts. Therefore, we (1) examined the baseline relationship between physical activity, QOL and negative mood in a sample of Black breast cancer survivors; (2) and then examined the influence of baseline physical activity on mood and QOL in this sample over time. There is a pressing need to examine these associations among Black breast cancer survivors who represent the population most affected by poorer health outcomes and lower survival rates [18].

Methods

Study participants include 114 women diagnosed with breast cancer (any stage of disease, any type of breast cancer) recruited to participate in an adaptive cognitive-behavioral stress management intervention (Project CARE). Participants were recruited through community-based breast cancer programs, local churches, community centers, health fairs, hospitals, private physicians, public service announcements and cultural events. This study was approved by the institutional review board of the University of Miami.

For inclusion in the study, all participants must have received at least one type of traditional medical treatment for breast cancer (i.e., surgery, chemotherapy or radiation therapy), completed treatment within 12 months of enrollment and no previous history of cancer. Furthermore, participants must have a self-reported life expectancy of 12 months or longer, have endorsed moderate stress or distress (a score of 4 or greater on a scale of 0 to 10), have no substance dependence within the past year, have had no inpatient psychiatric treatment for severe mental illness (e.g., psychosis) within the past year and have no active suicidality.

Participants who met the criteria for inclusion were assessed at a location of the participant's choice. Measures were given in interview format along with printed prompts for each of the response sets. Following the interviews, participants were paid for their participation. Following completion of the initial interviews, participants (overall $n = 114$ at baseline) were randomized into the 10-week group CBSM intervention ($n = 57$) or a time-matched group psychoeducational program ($n = 57$). The CBSM intervention included cognitive-behavioral skills and relaxation skills training. Neither the intervention nor control received information concerning physical activity. Both groups of women were given measures at baseline, immediately post intervention (Time 2) and then 6 months after Time 2 (Time 3). A comprehensive discussion of the methods involved in Project CARE is published elsewhere [19].

Measures

Demographics—Study demographics include age, education, marital/partner status, income, time since diagnosis, and stage of breast cancer. Cancer stage receipt of at least one traditional oncology treatment modality was verified by patient medical chart review.

Physical Activity—Physical activity was measured by summing the total minutes spent engaging in vigorous, moderate and light activity over the past 7 days. Physical activity was assessed using the Physical Activity Scale for the Elderly (PASE) [20]. The PASE is a self-report measure of occupational, household and leisure activities. [20].

Negative Mood—The Profile of Mood States-Short Version (POMS-SV) consists of 14 items that examine transient moods and enduring states of affect during the past week including the day of the assessment. The POMS is made up of six subscales including Anger Hostility, Confusion Bewilderment, Depression-Dejection, Fatigue-Inertia, Tension Anxiety and Vigor-Activity. Responses were rated on a 1–4 (ranging from not at all to extremely) Likert scale reflecting past week's feelings. Negative items were summed to obtain the negative mood scale [21]. Cronbach's alpha is .818 for the sample.

Quality of Life—The Functional Assessment of Cancer Therapy (FACT) consists of 33 items that examines general cancer related quality-of-life [22]. The FACT consists of six domains assessing functional well-being, spiritual well-being, physical well-being, emotional well-being, social/family well-being and additional concerns. Responses were rated on a 0–4 (not at all to very much) Likert scale reflecting how consistent statements are to participants in the past 7 days. The functional domain measures ability to work and perform other daily responsibilities [23]. The spiritual domain measures the spiritual and existential dimensions of experience. The physical domain includes concerns related to disease and general bodily concerns (e.g., pain, fatigue). The emotional domain assesses positive and negative affect. Lastly, the social/family domain measures social support from family and friends. Cronbach's alpha ranges from .870 to .887.

Baseline Results

Data Analysis

Multivariate analysis of covariance (MANCOVA) analysis was conducted to determine if baseline physical activity (dichotomized into no physical activity and any physical activity) produced mean differences in negative mood and quality of life (physical, social/family, emotional, functional and spiritual subscales) after adjusting for relevant covariates. Physical activity was dichotomized due to the preponderance of women who engaged in no physical activity over the past 7 days (around 60%). The variable was bi-modally distributed and did not meet criteria for common data normalization techniques. The covariates included in the baseline model were intervention condition, age, stage of breast cancer, time since diagnosis, income, and BMI. Intervention condition was included in the model to control for effects of the intervention on the variables of interest. Assumptions of linearity, normality and homogeneity of variance were examined for each continuous variable.

Results

All participants identified as Black (African American, African, Caribbean Black, Black Hispanic) and were between the ages of 27 and 77 ($M = 51.1$ years, $SD = 8.98$ years). The average education level was about 13 years (range = 9 to 20 years), and the average income was about \$33,000 (range = \$0 to \$300,000). The mean body mass index of the sample was

31.39 ($SD=7.17$), indicating the average participant can be classified as obese. The average number of months since diagnosis was 13.92 ($SD= 5.93$). For women in the physically active group, the mean number of minutes spent engaging in physical activity was 174.67 minutes (Table 1).

A one-way MANCOVA did not reveal a significant multivariate effect across physical activity groups for the combined dependent variables at Time 1, Pillai's trace = .084, $F(6, 99)= 1.512$, $p=.182$. The Box-M test for the homogeneity of variance-covariance matrices across design cells produced a significant result ($F[21, 31183.8] = 41.728$, $p=.01$). Thus, the relatively conservative Pillai's trace was used for the estimation of F -statistics in the analysis. When the univariate outcomes were examined, negative mood ($F(1, 99) = 5.13$, $p = .026$), functional well-being ($F(1, 99) = 6.83$, $p = .01$), and physical well-being ($F(1, 99) = 3.973$, $p = .049$) differed significantly across the two groups of physical activity status, after covariates were controlled for (Table 2).

Follow-Up Results

Data Analysis

Multivariate analysis of covariance (MANCOVA) analysis was conducted to determine if baseline physical activity (dichotomized into no physical activity and any physical activity) produced mean differences in negative mood and quality of life after adjusting for relevant covariates. The covariates included in the first model were intervention condition, age, stage of breast cancer, time since diagnosis, income, and BMI. Physical activity was assessed at Time 1. Whereas, negative mood and quality of life for these analyses were assessed at Time 2 (immediately post 10 week intervention) and Time 3 (6 months after Time 2).

Results

A one-way MANCOVA revealed a significant multivariate effect across physical activity groups for the combined dependent variables at Time 2, Pillai's trace = .129, $F(6, 94)= 2.325$, $p=.039$. The Box-M test for the homogeneity of variance-covariance matrices across design cells produced a significant result ($F[9,4583.923] = 2.841$, $p < .01$). Thus, the relatively conservative Pillai's trace was used for the estimation of F -statistics in the analysis. When the univariate outcomes were examined, negative mood ($F(1, 99) = 4.694$, $p = .033$), social/family well-being ($F(1, 99) = 5.542$, $p = .021$), functional well-being ($F(1, 99) = 5.851$, $p = .017$), and spiritual well-being ($F(1, 99) = 8.812$, $p = .004$) differed significantly across the two groups of physical activity status (Table 3). The magnitude of the mean between-group differences in negative mood and functional well-being suggest that these differences are clinically meaningful [24, 25]

A one-way MANCOVA also revealed a significant multivariate effect across physical activity groups for the combined dependent variables at Time 3, Pillai's trace = .135, $F(6, 92)= 2.392$, $p=.034$. The Box-M test for the homogeneity of variance-covariance matrices produced a significant result ($F[9,4583.923] = 2.841$, $p < .01$). Thus, the conservative Pillai's trace was used. Univariate outcomes show that functional well-being ($F(1, 97) = 6.344$, $p = .013$) and spiritual well-being ($F(1, 97) = 11.861$, $p = .001$) differ significantly across groups

at Time 3 (Table 4). The magnitude of the mean difference in functional well being between the two groups is considered clinically-meaningful [25]

Conclusions

Participating in regular physical activity is associated with health benefits for women who have been diagnosed with breast cancer, including fewer cancer-related symptoms, improved functioning and decreased body mass index (BMI) [2, 3]. In contrast, low engagement in physical activity has been related to an increased risk for mortality and poor health related quality of life among breast cancer survivors [26–29]. Although these associations have been explored in predominately White samples, little or no work has been done among Black breast cancer survivors. In an effort to address these relationships among Black breast survivors, our baseline analyses examined the relationship between physical activity, negative mood and QOL.

Although our results do not show a significant multivariate effect across physical activity groups at baseline, the univariate outcomes are compelling. First, negative mood was found to be significantly lower in breast cancer survivors who engaged in any level of physical activity. Secondly, functional well-being and physical well-being also differed significantly across the two groups of physical activity status. However, due to the cross-sectional nature of our baseline study, conclusions about causation are precluded.

Therefore, the follow-up analyses sought to build on these limitations and determine if physical activity predicted mean differences in negative mood and quality of life longitudinally, after controlling for relevant covariates. Our results indicate a significant multivariate effect for physical activity group for negative mood and quality of life while controlling for BMI, tumor stage, time since diagnosis, age and income. Specifically, Black breast cancer survivors who were in the physically active group reported significantly lower negative mood and higher social/family well-being at Time 2 and higher spiritual and functional well-being at both Time 2 and Time 3.

Previous research has acknowledged an association between mood and physical activity [30]. Physical activity has been found to stimulate the release of endorphins which function as mood elevators. For instance, Yang et al. (2010) found a home-based physical activity intervention to be significantly related to less mood disturbances among Taiwanese breast cancer survivors [31]. Additionally, Mutrie et al. (2012) reported that breast cancer survivors from the United Kingdom who participated in an exercise intervention experienced more positive moods 60 months after completion of the intervention [32]. Physical activity may improve mood by distracting survivors from stressors, providing opportunities for social interactions and improving self-confidence and body image [2]. Our results support this research by providing additional support for the connection between these two variables.

Among survivors who engaged in any level of physical activity, significantly higher social/family well-being at Time 2 was also found. The erosion of social support is a specific concern for Black women diagnosed with breast cancer [18, 32]. For instance, Soler-Vila, Kasl, & Jones (2003) found that lower perceived support at diagnosis predicted a higher

death risk over a 10 year period among breast cancer survivors [33]. As for the connection between physical activity and social/family well-being, Knopf (2014) reported a significant increase in social functioning among White breast cancer survivors who participated in an exercise intervention. Our results are in line with this preliminary research showing that baseline engagement in physical activity serves as a protective factor for later social/family well-being [6]. One explanation for the link between physical activity and social/family well-being has been the process by which engaging in physical activity strengthens and broadens support networks.

A higher functional well-being score was found for those women who engaged in any physical activity at both time points. Functional well-being is often overlooked in cancer research, but represents general functioning loss due to breast-cancer related factors [7]. Chhatre (2011) found that Black prostate cancer survivors reported impaired functional well-being [34]. Additionally, Braithwhite (2010) found that overweight or obese breast cancer survivors report greater functional limitations compared to their normal weight counterparts [35]. Therefore, it is plausible that impaired functional well-being would be a significant burden in a sample of Black women who suffer greatly from being overweight and obese. Importantly, our study provides evidence that despite dealing with increased weight, Black breast cancer survivors who engage in any level of physical activity can benefit from better functional well-being.

Additionally, women who were in the physically active group were found to have higher spiritual well-being at both time points. Spirituality has been regarded as one of the most vital coping strategies used by all cancer survivors [36]. Many cancer survivors convey positive spiritual changes and reliance on spirituality to derive meaning from their experiences [37]. Through spirituality survivors also report increased level of life satisfaction, reduced stress and an increased sense of meaning. Black women generally report greater interest in incorporating spirituality and religiousness than women of other racial/ethnic groups [38]. Our results are consistent with the benefits of Black women's reliance on religious coping. To our knowledge, there are no studies that acknowledge the benefits of physical activity on spiritual well-being.

Physical and emotional well-being were not found to differ among physical activity groups. Physical functioning has been an important domain in cancer literature with studies such as Paskett (2008) finding that Black breast cancer survivors report significantly lower scores on physical functioning compared to White breast cancer survivors [39]. Among the Black breast cancer survivors in our sample, the average BMI was 31.39, indicating weight was a particular challenge for these women. Interestingly, we did not find a difference in BMI between women who engaged in physical activity and women who did not. Therefore, it is plausible that since majority of individuals from both physical activity groups were overweight or obese, both groups dealt with issues related to weight such as lack of energy which was assessed by the physical well-being domain. Poorer health related quality of life has been found among obese individuals among a sample of Australian adults [40]. In addition, the study found that decreasing levels of both physical and emotional well-being were associated with higher BMI. Our results are consistent with this study, indicating

that BMI may be of central concern for physical and emotional well-being but not for the other domains.

Although our follow-up study provides support for the importance of physical activity, some limitations should be noted. The sample size of the two groups was relatively small and unbalanced which may have negatively affected statistical power to detect differences between the two groups. Physical activity was self-reported and only measured over the past 7 days. Use of accelerometers to monitor activity, assessing physical activity at multiple time points, the use of daily self-monitoring physical activity, and longer length of assessment should be used to confirm the results presented in future studies. Additionally, future research should assess different forms of physical activity as well as differences in intensity level. Adherence to physical activity recommendations in breast cancer survivors is challenged by both internal and external conditions and may be improved by supporting self-efficacy towards changing health behaviors [41]. For instance, findings from Hosubo (2014) identified treatment specificities as the greatest barrier to physical activity among a sample of breast cancer survivors. Specifically, fatigue and nausea associated with various forms of breast cancer treatment was explained for the lack of participation in physical activity. Future studies need to assess the impact of barriers on the feasibility of physical activity following breast cancer treatment specifically for Black survivors. Since Black women are more likely than White women to be diagnosed with breast cancer at a more advanced stage and earlier in life, role disruptions such as disruptions in child rearing serve as pertinent barriers for these women [42]. Although we controlled statistically for our intervention, it is plausible that factors related to the intervention group contributed to the changes in QOL and mood observed. However, given that there were no significant differences between the intervention groups in quality of life and or mood at Time 2 or Time 3 nor were there differences in regards to their level physical activity at Time 1, Time 2 or Time 3, we can conclude that the improvements seen may be related to physical activity level at baseline. Additionally, future studies should examine changes in physical activity in relation to outcomes, given that baseline physical activity was representative of physical activity level at Time 2 and Time 3 in this population. Despite the limitations, our novel study shows how significant finding the time to engage in any level physical activity can be for this population. Our results provide evidence that physical activity does in fact provide a protective factor for breast cancer survivors. Developing culturally relevant physical activity interventions specifically for Black breast cancer survivors may prove vital to improving QOL and mood in this population.

Acknowledgments

Funding This publication was made possible by Grant CA R01 131451 from the National Cancer Institute at the National Institutes of Health.

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Table 1**Demographics**

Age M (SD)	51.1 (8.9)	Time since diagnosis M (SD)	13.92 (5.93)
Education M (SD)	13.6 (2.3)	Stage % (N)	
Marital Status % (N)		0	8.8 (10)
Single, Never Married	25.4 (29)	I	22.8 (26)
Divorced	21.9 (25)	II	40.4 (46)
Separated	14 (16)	III	26.3 (30)
Widowed	7.9 (9)	IV	1.8 (2)
Married or Common Law	27.2 (31)	Treatments Received % (N)	
Annual Household Income % (N)		Mastectomy	98.2 (112)
<10,000	23.7 (27)	Chemotherapy	80.7 (92)
10,000–29,999	29.8 (34)	Radiation therapy	69.3 (79)
30,000–49,999	18.4 (21)	Hormone therapy	60.5 (69)
50,000–69,999	15.8 (18)	Physical Activity % (N)	
>70,000	11.4 (13)	Yes	40.2 (43)
BMI M(SD)	31.4 (7.2)	No	59.8 (64)

Table 2

MANCOVA Time 1

Variable	Physical Activity M (SD)	No Physical Activity M (SD)	F (group)	p
Negative Mood	3.9(6.8)	7.8(7.3)	5.1	.02
Physical Well-being	27.6(6.2)	23.8(7.2)	3.9	.04
Functional Well-being	27.4(4.9)	23.1(7.6)	6.8	.01
Spiritual Well-being	53.9(4.1)	50.6(8.1)	3.7	.05
Social/Family Well-being	29.6(5.3)	27.7(5.4)	2.8	.09
Emotional Well-being	25.7(3.5)	23.3(5.5)	3.1	.08

Table 3

MANCOVA Time 2

Variable	Physical Activity M (SD)	No Physical Activity M (SD)	F (group)	p
Negative Mood	3.8(5.2)	7.5(6.8)	4.7	.03
Physical Well-being	27.7(6.2)	24.9(6.6)	.235	.63
Functional Well-being	28.3(4.8)	23.3(7.8)	5.6	.02
Spiritual Well-being	56.3(4.1)	51.3(7.3)	8.8	.004
Social/Family Well-being	30.4(4.3)	27.4(6.3)	5.5	.02
Emotional Well-being	26.6(3.1)	24.3(4.6)	2.8	.09

Table 4

MANCOVA Time 3

Variable	Physical Activity M (SD)	No Physical Activity M (SD)	F (group)	p
Negative Mood	4.1(3.7)	6.5(5.9)	2.5	.15
Physical Well-being	28.2(5.5)	24.8(6.2)	2.2	.14
Functional Well-being	28.3(4.4)	23.5(6.9)	6.3	.01
Spiritual Well-being	56.5(4.4)	51.2(7.4)	11.9	.001
Social/Family Well-being	29.8(4.3)	27.6(5.9)	2.9	.09
Emotional Well-being	26.7(2.8)	24.8(4.6)	1.5	.22