Physical Activity in Puerto Rican Breast Cancer Survivors

Maribel Tirado-Gómez, MD*; Daniel C. Hughes, PhD†; Velda González-Mercado, MSN*;
Rose A. Treviño-Whitaker, MPH†; Karen Basen-Engquist, PhD‡

Objective: Breast cancer survivors do not engage in appropriate levels of physical activity, despite the known benefits of such activity. This study aims to describe physical-activity levels and the barriers to it in a group of Puerto Rican breast cancer survivors, as well as detailing their preferences for an intervention.

Methods: Participants who finished their chemotherapy and/or radiotherapy for breast cancer at least 4 months prior to the study were included. Demographic, anthropometric, and clinical data were obtained. The Godin Leisure-Time Exercise Questionnaire (GLTEQ) and questionnaires on exercise self-efficacy, barriers to self-efficacy, modeling, and social support were filled out by study participants. Data on access to exercise equipment and preferences regarding a physical-activity intervention were collected. Descriptive statistics and correlation analyses were performed.

Results: Fifty breast cancer survivors were recruited. Almost all the participants reported that they did not engage in any kind of strenuous physical activity (94%), with more than three fourths (76%) reporting that they did not even participate in any kind of moderate physical activity. The GLTEQ score was associated with barriers to self-efficacy, while the association with exercise self-efficacy approached significance ($p = 0.055$). Nearly half of the patients (44%) had access to exercise equipment. Preferred methods for the delivery of physical-activity interventions were participating in group settings (72%) and receiving material in the postal mail (44%).

Conclusion: The study described herein reports on the low levels of physical activity being practiced by a group of Puerto Rican breast cancer survivors, despite the fact that many of them had access to exercise equipment and facilities. Further studies aimed at understanding breast cancer survivors' barriers to physical activity and at developing culturally competent interventions to increase the levels of such activity are warranted. [*P R Health Sci J 2016;35:62-68*]

Key words: Physical activity, Breast cancer, Social cognitive theory

Breast cancer is the most common malignancy diagnosed in Puerto Rican women. Approximately 1,766 women are diagnosed with breast cancer annually. From 1987 through 2010, breast cancer incidence rates in Puerto Rico increased by an average of 1.3% per year, while mortality rates decreased by an average of 0.1% per year during the same period (1). In Puerto Rico, female cancer survivors are more likely to have had breast cancer than any other type of cancer; in 2010 alone, 13,736 such survivors were reported on the island (2).

The increased survival rates among breast cancer patients are related to progress in screening and detection as well as to improvements in treatment (3). However, breast cancer survivors face psychological and physical short- and long-term adverse effects, such as depression, anxiety, musculoskeletal limitations, weight gain, heart disease, metabolic syndrome, and secondary malignancies, as a result of their having had cancer and of the treatments they endured because of it (4–7).

Physical activity, defined by the WHO as any bodily movement produced by skeletal muscles that require energy expenditure, has been shown in several studies to improve health-related outcomes in breast cancer survivors. Breast cancer survivors who engaged in relatively higher levels of physical activity after diagnosis had a reduced risk of breast cancer recurrence and breast cancer–related mortality (8–14).

*The University of Puerto Rico Cancer Center, San Juan, PR; †The University of Texas Health Science Center at San Antonio, Institute for Health Promotion Research, Department of Epidemiology and Biostatistics, San Antonio, TX; ‡The University of Texas M.D. Anderson Cancer Center, Department of Behavioral Science, Houston, TX

The authors have no conflicts of interest to disclose.

Address correspondence to: Maribel Tirado-Gómez, MD, PMB 371, PO Box 70344, San Juan, PR 00936-8344. Email: maribel.tirado1@upr.edu

Other benefits of physical activity include improved physical and emotional well-being; reduced risk of cardiovascular disease, diabetes mellitus, and osteoporosis; and improved weight management (15–20). Despite the known benefits of physical activity, breast cancer survivors do not engage in appropriate levels of such activity. Approximately 4 of every 5 breast cancer survivors do not meet national exercise recommendations at 10 years post-diagnosis (21–25)

The factors responsible for the low levels of physical activity among breast cancer survivors are complex and can be linked to perceptions about their disease and treatment sequelae, psychological functioning, and social responses (26). Specific ethno-cultural groups such as Puerto Rican breast cancer survivors may require specialized approaches, because of both their unique experiences as cancer survivors and the cultural factors that affect physical-activity behaviors. Thus, understanding the barriers to physical activity among Puerto Rican breast cancer survivors is fundamental to the development of culturally competent physical-activity interventions that could result in the adoption and maintenance of more active lifestyles, thereby leading to the improvement of individual quality of life.

The purpose of this study was to describe the physical-activity levels of and barriers to physical activity in a group of Puerto Rican breast cancer survivors and to describe, as well, both their access to physical-activity equipment and the kinds of interventions that they might prefer.

Methods

Recruitment of study participants

The research protocol was approved by the Institutional Review Board of the University of Puerto Rico Medical Sciences Campus and the Dr. Isaac Gonzalez Martinez Oncologic Hospital. Patients were identified in the oncology clinics and invited to participate in the study if they 1) had a diagnosis of invasive breast cancer or ductal carcinoma in situ 2), were older than 21 years 3), read and spoke Spanish, and 4) had finished their chemotherapy and/or radiotherapy at least 4 months before the date of the study (hormonal therapy at the time of the survey was allowed). Informed consents were obtained, and patients filled out the study questionnaires in the presence of the clinical study coordinator, who was available to clarify any doubts and answer any questions.

Demographic and clinical data

Study participants completed a questionnaire, providing information regarding age, education, marital status, and employment. Anthropometric measurements of height (m), weight (kg), waist (cm), and hip circumference (cm) were obtained by a trained study coordinator. These data were used to calculate BMIs and waist-to-hip ratios.

The study participants were also asked about comorbidities. To assess their levels of comorbidity, an index based on the comorbidities reported by the study participants was developed. A total of 17 comorbidities were included (the diagnosis of a heart attack, heart failure, a heart condition, circulation problems, blood clots, hypertension, a stroke, lung problems, diabetes, kidney problems, rheumatoid arthritis, osteoarthritis, anemia, thyroid problems, neuropathy, fibromyalgia, and hepatitis). The comorbidity index was calculated by adding the number of comorbidities reported by the participant (range of score, 0–17). In addition, participants were asked about other cancers and if they were diagnosed with lymphedema. This information was treated separately from the comorbidity index.

Physical-activity evaluation

To measure current levels of exercise activity, the Godin Leisure-Time Exercise Questionnaire (GLTEQ) was used (27). The Godin is a simple, self-administered questionnaire that is designed to measure an individual's leisure-time activity during a typical week to provide a global impression of that individual's activity status. The GLTEQ has been successfully used with adult cancer survivors (28–35). This questionnaire asks participants to estimate the frequency with which they engage in various levels (light, moderate, vigorous) of leisure-time exercise activity. The first item of the questionnaire reads "During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time" and is followed by 3 choices: strenuous exercise (heart beats rapidly), moderate exercise (not exhausting), and mild exercise (minimal effort). Each of the choices includes a list of examples of activities that might be considered strenuous, moderate, or mild, as the case may be. Participants list the number of times per week that they practice each level of activity for 15 minutes or longer. The following formula is used to calculate total weekly leisure-activity levels: (9 × strenuous score) + (5 × moderate score) + (3 × mild score).

Self-efficacy measures

Exercise self-efficacy was measured with a questionnaire previously used by McAuley (36–38), which questionnaire assesses how confident participants are that they can sustain various durations of a specific exercise, in our case, walking. The following is a typical question: "How confident are you that you can walk briskly without stopping for 5 minutes?" The range of responses is from 1 (not at all confident) to 5 (extremely confident). The range of the time frame for walking was from 2 minutes to 1 hour: 2 minutes, 5 minutes, 10 minutes, 20 minutes, 30 minutes, 45 minutes, and 1 hour. Responses to the 7 individual items were summed to obtain an overall score, with a range of 7 to 35. Internal consistency (Cronbach's alpha) for our survey was r = 0.97.

To measure barriers to exercise self-efficacy, we adapted a questionnaire originally developed by Marcus and colleagues and then modified (by us) after interviews with breast cancer survivors and the pilot testing of the questionnaires (39–40). The following is a typical question: "How confident are you that

you can exercise . . . When you are concerned about your medical condition?" Participants indicate their level of confidence using a scale ranging from 1 (not at all confident) to 5 (extremely confident). Responses to the 14 individual items were summed to obtain an overall score, with a range of 14 to 70. Internal consistency (Cronbach's alpha) for our survey was r = 0.90.

Social support and Modeling

Social support for exercise was evaluated by adapting Sallis's Social Support and Exercise Survey (41) and creating a 10-item survey. Participants were asked how often they received support from family/friends for exercise. A typical question being "During the past 3 months, my family (or members of my household) or friends: Helped plan activities around my exercise." The possible responses were none (indicated with the numeral 1), rarely (indicated with the numeral 2), a few times (indicated with the numeral 3), often (indicated with the numeral 4), and very often (indicated with the numeral 5). Responses to the individual items were summed to obtain an overall score, with a range of 10 to 50. We analyzed the responses about social support from family members separately from those coming from friends. Reliability estimates for our survey (using Cronbach's alpha) for social support from family and friends were 0.93 and 0.94, respectively.

Modeling was assessed with 8 questions asking the participants to relate their observations of people in their social environment or in the media engaging in or discussing exercise activities. Participants were asked to respond "yes" or "no" (as applicable and respectively) to the following statements: "Today, the following happened: 1) I noticed people like me exercising; 2) A friend or family member offered to exercise with me; 3) I read or heard one or more news stories about people exercising; 4) I was aware that a member of my family exercised today; 5) A friend or family member exercised with me; 6) A friend or family member talked to me about their exercise program; 7) A friend or family member shared their experience of keeping to an exercise program; and, 8) I noticed people walking in my neighborhood." The total number of "yes" responses was added up to obtain a total score (which ranged from 0 to 8). Internal consistency (Cronbach's alpha) for our survey was r = 0.79.

Exercise equipment and Intervention preferences

A questionnaire on accessibility to exercise equipment (and detailing the types of exercise equipment available) was also administered. Participants were also asked their preferred format for a physical-activity intervention and their preference for either individual, group, or family participation.

Treatment of data and Statistical analysis

All data were analyzed using SPSS (Statistical Package for the Social Sciences) (SPSS v19.0 Inc., Chicago, Ill). Descriptive statistics were run on participant demographics, activity levels, SCT variables, and anthropometric measures. Bivariate, two-tailed Pearson Product Moment Correlations analyses were run for the variables of age, body mass index, waist-to-hip ratio, comorbidity index, current exercise activity (GLTEQ), and SCT variables (exercise self-efficacy, barriers to self-efficacy, social support, and modeling).Significance was set at a p-value less than 0.05. Frequency analyses were run on questions addressing exercise equipment, preferred methods for having an exercise intervention delivered, and preferences regarding exercise setting (individual, non-family group, family).

Results

Demographic and Clinical data

A total of 50 breast cancer survivors completed the survey. The participants' characteristics are shown in Table 1. The mean age of the participants was 57 years (range, 30–77 years). About three fourths of the participants had at least a high school education (72%), and only about a fourth (25.5%) were employed full-time. About 33% of the participants were married or living with a significant other. Eight participants reported that

Table 1. Participants' demographic and Clinical characteristics

Characteristic	Value
Age (average)	57.2 (SD = 12.2) (range, 30–77)
Education Level	
Less than high school	14 (28%)
High school	12 (24%)
Vocational degree	4 (8%)
Some college	4 (8%)
Bachelor's or greater	16 (32%)
Employment	
Full time	13 (25.5%)
Unemployed seeking work	3 (5.9%)
Unemployed not seeking work	1 (2.0%)
Retired	7 (13.7%)
Homemaker	20 (39.2%)
Volunteer	3 (5.9%)
More than one choice	2 (3.9%)
Marital Status	
Single	14 (27.5%)
Living with significant other	4 (7.8%)
Married	13 (25.5%)
Separated	4 (7.8%)
Divorced	10 (19.6%)
Widowed	5 (9.8%)
Have lymphedema	8 (12%)
Have/had other cancer	4 (6%)
Comorbidity index	1.84 (SD = 3.8; range, 0–5)
Body mass index (BMI)	29.4 (SD = 3.8; range, 23.6–39.9)
BMI 18.5–24.9	5 (10%)
BMI 25–29.9	26 (52%)
BMI≥30	19 (38%)
Waist circumference (cm)	89.9 (SD = 10.2; range, 65.4–121.4)
Waist-to-Hip Ratio	0.83 (SD = 0.06; range, 0.68–0.94)

Note: Numbers may not equal 50 because of missing data. Data are presented as the mean (standard deviation) for continuous variables and frequency (percentage) for categorical variables.

they had lymphedema, and 4 participants reported that they had a second cancer. Of those reporting a second malignancy, 2 participants reported that they had bone cancer, 1 reported that she had received a diagnosis of a parathyroid adenoma, and 1 participant had uterine and ovarian cancer. Anthropometric measurements revealed that 10% of the participants were normal weight (BMI<25), 52% were overweight (BMI 25–29.9), and 38% were obese (BMI≥30). Fifty-two percent had a waist circumference greater than 88 cm. The most common comorbidities were hypertension (48%), arthritis and/or osteoarthritis (40%), a mental health diagnosis (30%), diabetes (24%), lung problems (22%), peripheral neuropathy (22%), and anemia (20%).

The mean GLTEQ index score was 13.98 (SD: 19.2: range, 0–75). In terms of current activity (according to the GLTEQ) (Table 2), 38% of the participants reported taking part in light-intensity activity, 24% reported taking part in moderate-intensity activity, and 6% reported taking part in strenuous-intensity activity.

Table 2. Godin LTEQ: Participant-reported levels of mild, moderate, and strenuous leisure-time exercise activity

Activity level	% Reporting activity	Weekly frequency* M (SD)	Weekly frequency range	(25th, 75th percentile)
Light	38%	1.76 (2.49)	0, 5	0, 3
Moderate	24%	1.06 (2.20)	0, 7	0, 0.25
Strenuous	6%	0.26 (1.1)	0, 5	0, 0

*Exercise bouts of at least 15 minutes in duration

Table 3 shows the descriptive statistics for the hypothesized determinants of physical activity along with the Spearman's correlations with the GLTEQ score. In our sample, a high GLTEQ score was associated with barriers to self-efficacy, while the association with exercise self-efficacy approached significance (p = 0.055).

Almost half (44%) of our participants reported having access to exercise equipment, with over a third (35.4%) owning a stationary cycle and about a fourth (27.1%) owning a treadmill (Table 4).

Table 3. Pearson's correlations with Godin Leisure-time Exercise Questionnaire (GLTEQ) score

	Mean (SD)	Correlation with GLTEQ	*p*
Age	57.2 (12.2)	-0.18	0.208
BMI	29.4 (3.4)	-0.19	0.184
Waist circumference (cm)	89.9 (10.2)	-0.21	0.146
Waist-to-Hip ratio	0.83 (0.06)	-0.24	-0.094
Comorbidity index	1.84 (1.36)	-0.17	0.244
Barriers to self-efficacy	36.9 (13.9)	0.44*	0.002
Exercise self-efficacy	22.4 (11.2)	0.27*	0.055
Social support – Family	20.4 (11.5)	0.05	0.716
Social support – Friends	18.7 (10.8)	0.09	0.520
Modeling	3.33 (2.4)	0.05	0.712

Six of our participants reported owning both a treadmill and a stationary cycle. Four participants reported having a treadmill, a stationary cycle, and weights. Participants who did and did not have access to exercise equipment did not have significantly different distributions and medians of the GLTEQ scores, as evaluated by the Mann–Whitney U test and the independent samples median test (– X2 = 0.57, p = 0.449; owning a treadmill – X2 = 0.04, p = 0.838; owning a stationary bicycle – X2 = 0.90, p = 0.342; owning weights – X2 = 0.11; p = 0.741).

For exercise program intervention delivery, about half (44%) of our participants endorsed the postal mail as a preferred method of delivery, followed by video (31.4%) and a personal trainer (27.5%). Other methods for delivery, such as the phone and a newsletter, were less preferred, (24% and 12%, respectively). Almost three fourths endorsed a group environment for exercise (77%).

Table 4. Access to exercise equipment & preferences for an exercise-related behavior intervention

Item	Frequency (%)
Exercise equipment (multiple responses possible)*	
Access to exercise equipment	22 (44%)
Have stationary cycle	17 (35.4%)
Have treadmill	13 (27.1%)
Have weights	6 (12%)
Delivery method for a program (multiple endorsements allowed)*	
Postal mail	22 (44%)
Video	16 (31.4%)
Personal trainer	14 (27.5%)
Phone	12 (24%)
Email	11 (22%)
Web page	9 (18%)
Newsletter	6 (12%)
Audio recording	4 (8%)
Delivery environment for a program*	
Prefer group setting	36 (72%)
Prefer family setting	13 (26%)
Prefer individual setting	9 (18%)

*Multiple responses possible

Discussion

The present study of a group of Puerto Rican breast cancer survivors revealed that most of the participants were overweight or obese and over half had a waist circumference indicating a high level of abdominal adiposity. In addition, the vast majority of the participants reported not engaging in appropriate levels of physical activity, such as are suggested by public health organizations (42–43).

Around three fourths (76%) of the study participants reported taking part in no moderate or vigorous intensity activity, which indicates that only a small proportion (<24%) were meeting the American Cancer Society's physical activity guidelines for cancer survivors (43). This is lower than the percentage of breast

cancer survivors meeting physical activity recommendations in a survey of cancer survivors from a cross-sectional survey of cancer survivors appearing in 16 different state cancer registries (American Cancer Society's Study of Cancer Survivors-II; ACS SCS-II). In this study (in which fewer than 10% of the participants were Hispanic), 37% of the breast cancer survivors were meeting physical-activity recommendations (44).

Several factors may be responsible for the low activity levels of our participants. In published results of focus-group sessions we conducted with Puerto Rican and Mexican-American breast cancer survivors (45), we report that both groups expressed a lack of knowledge of the safety of exercise after breast cancer. Although most of the participants reported being quite active before their diagnoses, many added that they did not know what exercise activities they could or could not do after treatment. Our focus-group members expressed a desire for more information, but few reported having received any guidance or direction from health care providers with regard to exercise activity. Moreover, our Puerto Rican focus groups reported not believing that adequate physical activity could help prevent cancer. The link between activity and reduced cancer risk may not have been clear to our Puerto Rican participants, possibly leading to their doubting the salience of physical activity as it pertains to cancer prevention.

Many behavioral models have been employed to explain why people remain inactive, despite the demonstrable benefits of an active lifestyle. One of the more frequently utilized models is social cognitive theory (SCT) (46), which was used as the guiding model in this exploratory study. Using SCT we were able to gain an understanding of how social (e.g., family support) and individual (the awareness of the importance of physical fitness) factors can influence an individual's self-efficacy with regard to exercise behavior. Individual exercise self-efficacy has been shown to be an important predictor of exercise behavior in several studies with cancer survivors (47–48). Consistent with this published research, our study found that self-efficacy for overcoming barriers to engaging in exercise-related activity was significantly associated with GLTEQ score.

Almost half (44%) of our participants disclosed that they had access to exercise equipment; nevertheless, their reported exercise levels were very low. This dissociation between access and action is a prime area for future investigation. With our results, an initial hypothesis can be constructed. It is possible that our breast cancer survivors felt limited in terms of their activity because of their past surgeries, the effects of chemotherapy on their cardiovascular health, and/or their lack of knowledge as to what activities can be performed safely, all of which were mentioned in our focus groups (45). Another hypothesis might be that our participants lack knowledge on how to safely use the equipment they own and may not have access or know how to access resources to provide training. These knowledge-related factors could in turn affect their perceptions of self-efficacy regarding specific exercises and activities.

Because of the specific ethno-cultural factors associated with our population and exercise behaviors (45), our current study asked about personal preferences regarding an exercise intervention. Specific questions focused on the participants' preferred delivery methods and group environment options. The fact that the majority of our participants expressed a preference for exercising in group settings seems somewhat contrary to their professed desires to receive information about potential exercise programs via the US mail. This is another potential area for further research: investigating which delivery methods, or combination of methods, enhance exercise self-efficacy in this population and thereby translate into more exercise.

Our results need to be viewed in light of certain limitations. First of all, we have a convenience sample size of 50 participants who were recruited in the same setting (a clinic). Patients were not stratified according to their menopausal status or the type of hormone therapy they were receiving (when such was the case), factors that could influence their levels of physical activity (49–50). There is of course the question of generalizability to Puerto Rican breast cancer survivors living outside the San Juan area, such as those residing in other urban and rural settings. Furthermore, the study participants were slightly younger (mean age of 57 years) than their non-participating counterparts: the mean age of breast cancer patients at diagnosis in Puerto Rico is 61 years (1). Interestingly, almost three quarters of our participants had at least a high school education, indicating that the reading skills of these patients are almost certainly advanced enough for them to be able to understand and follow written instructions, in support of which is the fact that most of them had specified that they would prefer to receive exercise interventions in the mail. Another limitation is the cross-sectional nature of our design; therefore, it is not possible to determine cause and effect in terms of factors associated with exercise habits. However, given that there are few reports on physical activity among Puerto Rican breast cancer survivors, our study makes an important contribution, while also identifying areas of further research.

Our results indicate that our patient population could greatly benefit from an intervention aimed at increasing their levels of physical activity, especially given their high levels of inactivity coupled with the high rates of obesity, central adiposity, and comorbid health problems. Our results also indicate that social cognitive theory is a powerful model that can be employed to develop exercise-related interventions for this population, given the association between self-efficacy and exercise. Increasing exercise-related behavior in this population will almost certainly greatly help to reduce the associated health-related burden that the lack of same imposes on an already strained public health system, while greatly improving the health outcomes and individual qualities of life for island-dwelling Puerto Rican breast cancer survivors.

Resumen

Objetivos: Las sobrevivientes de cáncer de mama no mantienen niveles apropiados de actividad física a pesar de los beneficios de ésta. Este estudio describe los niveles de actividad

física y las barreras a esta en un grupo de sobrevivientes de cáncer de mama. Además se evaluaron las preferencias de las participantes con respecto a una intervención para realizar actividad física. Métodos: Pacientes con cáncer de mama que terminaron su radioterapia y/o quimioterapia al menos 4 meses antes del estudio fueron incluidas. Se obtuvieron datos demográficos, antropométricos y clínicos. Se le administró el cuestionario de Godin de Ejercicio en Tiempo Libre (CGTL), el cuestionario de auto-eficacia del ejercicio, el cuestionario de barreras a la auto-eficacia, el cuestionario de modelaje y el cuestionario de apoyo social. Se preguntó sobre acceso a equipo de ejercicio y preferencias sobre una intervención dirigida a estimular la actividad física. Se obtuvieron estadísticas descriptivas y análisis de correlación. Resultados: Se reclutaron 50 sobrevivientes de cáncer de mama. Casi todas las participantes reportaron no tener actividad física vigorosa (94%) con más de tres cuartas partes sin realizar actividad física moderada (76%). La puntuación del CGTL correlacionó con barreras de auto-eficacia mientras que la asociación con auto-eficacia del ejercicio alcanzó significancia marginal (p=0.055). Casi la mitad de los participantes tenían acceso a equipo de ejercicio (44%) y prefirieron que la intervención se realizase en grupos (72%) con material educativo a través del correo (44%). Conclusión: El estudio encontró bajos niveles de actividad física en este grupo de sobrevivientes de cáncer de mama; esto a pesar de que muchas de ellas tenían acceso a equipo y facilidades para realizar actividad física. Es necesario realizar estudios para entender las barreras a la actividad física y para desarrollar intervenciones que estimulen ésta en esta población.

Acknowledgments

The authors would like to acknowledge the participants for their commitment to the study. The project described herein was supported by award numbers K22CA154626, U54 CA153511, U54CA96297, and U54CA96300 from the National Cancer Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute or the National Institutes of Health. The authors gratefully acknowledge the support of the Center for Energy Balance and Survivorship Research, Duncan Family Institute, the Patient-Reported Outcomes, Survey, and Population Research (PROSPR) Shared Resource, NCI-funded CA16672, and the Cancer Therapy and Research Center at the University of Texas Health Science Center at San Antonio, an NCI-designated Cancer Center (P30CA054174).

References

1. Tortolero-Luna G, Zavala-Zegarra D, Pérez-Ríos N, et al. Cancer in Puerto Rico, 2006–2010. San Juan, PR: Puerto Rico Central Cancer Registry; 2013:79–83.
2. Centeno-Girona H, Cotto-Negrón C, Flores-Febo M, et al. Sobrevivientes de cáncer en Puerto Rico: Una guía informativa sobre aspectos relacionados a la sobrevivencia de cáncer. San Juan, PR: Puerto Rico Central Cancer Registry; 2013:18.
3. Siegel R, DeSantis C, Virgo K, et al. Cancer treatment and survivorship statistics, 2012. CA Cancer J Clin 2012;62:220–241.
4. Ganz PA, Kwan L, Stanton AL, et al. Physical and psychosocial recovery in the year after primary treatment of breast cancer. J Clin Oncol 2011;29:1101–1109.
5. Hooning MJ, Botma A, Aleman BM, et al. Long-term risk of cardiovascular disease in 10-year survivors of breast cancer. J Natl Cancer Inst 2007;99:365–375.
6. Matesich SM, Shapiro CL. Second cancers after breast cancer treatment. Semin Oncol 2003;30:740–748.
7. Protani M, Coory M, Martin JH. Effect of obesity on survival of women with breast cancer: systematic review and meta-analysis. Breast Cancer Res Treat 2010;123:627–635.
8. Ballard-Barbash R, Friedenreich CM, Courneya KS, et al. Physical activity, biomarkers, and disease outcomes in cancer survivors: a systematic review. J Natl Cancer Inst 2012;104:815–840.
9. Chen X, Lu W, Zheng W, et al. Exercise after diagnosis of breast cancer in association with survival. Cancer Prev Res (Phila) 2011;4:1409–1418.
10. Holick CN, Newcomb PA, Trentham-Dietz A, et al. Physical activity and survival after diagnosis of invasive breast cancer. Cancer Epidemiol Biomarkers Prev 2008;17:379–386.
11. Holmes MD, Chen WY, Feskanich D, et al. Physical activity and survival after breast cancer diagnosis. JAMA 2005;293:2479–2486.
12. Irwin ML, McTiernan A, Manson JE, et al. Physical activity and survival in postmenopausal women with breast cancer: results from the women's health initiative. Cancer Prev Res (Phila) 2011;4:522–529.
13. Bertram LA, Stefanick ML, Saquib N, et al. Physical activity, additional breast cancer events, and mortality among early-stage breast cancer survivors: findings from the WHEL Study. Cancer Causes Control 2011;22:427–435.
14. Irwin ML, Smith AW, McTiernan A, et al. Influence of pre- and post-diagnosis physical activity on mortality in breast cancer survivors: the health, eating, activity, and lifestyle study. J Clin Oncol 2008;26:3958–3964.
15. Alfano CM, Smith AW, Irwin ML, et al. Physical activity, long-term symptoms, and physical health-related quality of life among breast cancer survivors: a prospective analysis. J Cancer Surviv 2007;1:116–28.
16. Thomas GA, Alvarez-Reeves M, Lu L, et al. Effect of exercise on metabolic syndrome variables in breast cancer survivors. Int J Endocrinol 2013:168797.
17. Murtezani A, Ibraimi Z, Bakalli A, et al. The effect of aerobic exercise on quality of life among breast cancer survivors: a randomized controlled trial. J Cancer Res Ther 2014;10:658–664.
18. Saxton JM, Scott EJ, Daley AJ, et.al. Effects of an exercise and hypocaloric healthy eating intervention on indices of psychological health status, hypothalamic-pituitary-adrenal axis regulation and immune function after early-stage breast cancer: a randomised controlled trial. Breast Cancer Res 2014;16:R39.
19. Nuri R, Kordi MR, Moghaddasi M, et.al. Effect of combination exercise training on metabolic syndrome parameters in postmenopausal women with breast cancer. J Cancer Res Ther 2012;8:238–242.
20. Winters-Stone KM, Dobek J, Nail L, et al. Strength training stops bone loss and builds muscle in postmenopausal breast cancer survivors: a randomized, controlled trial. Breast Cancer Res Treat 2011;127:447–456.
21. Courneya KS. Exercise in cancer survivors: an overview of research. Med Sci Sports Exerc 2003;35:1846–1852.
22. Mason C, Alfano CM, Smith AW, et al. Long-term physical activity trends in breast cancer survivors. Cancer Epidemiol Biomarkers Prev 2013;22:1153–1161
23. White A, Pollack LA, Smith JL, et al. Racial and ethnic differences in health status and health behavior among breast cancer survivors--Behavioral Risk Factor Surveillance System, 2009. J Cancer Surviv 2013;7:93–103.
24. Smith SG, Chagpar AB. Adherence to physical activity guidelines in breast cancer survivors. Am Surg 2010;76:962–965.
25. Blanchard CM, Denniston MM, Baker F et al. Do adults change their lifestyle behaviors after a cancer diagnosis? Am J Health Behav 2003;27:246–256.

26. Brown JC, Winters-Stone K, Lee A, Schmitz KH. Cancer, physical activity, and exercise. Compr Physiol 2012;2:2775–2809.
27. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci 1985;10:141–146.
28. Badr H, Paxton RJ, Ater JL, et al. Health behaviors and weight status of childhood cancer survivors and their parents: similarities and opportunities for joint interventions. J Am Diet Assoc 2011;111:1917–1923.
29. Faul LA, Jim HS, Minton S, et al. Relationship of exercise to quality of life in cancer patients beginning chemotherapy. J Pain Symptom Manage 2011;41:859–869.
30. Jeffreys M, McKenzie F, Firestone R, et al. A multi-ethnic breast cancer case-control study in New Zealand: evidence of differential risk patterns. Cancer Causes Control 2013;24:135–152.
31. Jones LW, Hornsby WE, Goetzinger A, et al. Prognostic significance of functional capacity and exercise behavior in patients with metastatic non-small cell lung cancer. Lung Cancer 2012;76:248–252.
32. McAuley E, White SM, Rogers LQ, et al. Physical activity and fatigue in breast cancer and multiple sclerosis: psychosocial mechanisms. Psychosomatic Med 2010;72:88–96.
33. Stephenson LE, Bebb DG, Reimer RA, Culos-Reed SN. Physical activity and diet behaviour in colorectal cancer patients receiving chemotherapy: associations with quality of life. BMC Gastroenterol 2009;9:60.
34. Valenti M, Porzio G, Aielli F, et al. Physical exercise and quality of life in breast cancer survivors. Int J Med Sci 2008;5:24–28.
35. Courneya KS, Keats MR, Turner AR. Physical exercise and quality of life in cancer patients following high dose chemotherapy and autologous bone marrow transplantation. Psychooncology 2000;9:127–136.
36. Duncan TE, McAuley E. Social support and efficacy cognitions in exercise adherence: a latent growth curve analysis. J Behav Med 1993;16:199–218.
37. McAuley E. Self-efficacy and the maintenance of exercise participation in older adults. J Behav Med 1993;16:103–113.
38. McAuley E, Jerome GJ, Marquez DX, et al. Exercise self-efficacy in older adults: social, affective, and behavioral influences. Ann Behav Med 2003;25:1–7.
39. Marcus BH, Selby VC, Niaura RS, Rossi JS. Self-efficacy and the stages of exercise behavior change. Res Q Exerc Sport 1992;63:60–66.
40. Basen-Engquist K, Baum G, Hughes DC, et al. Validity and reliability of a cancer survivors' exercise barriers self-efficacy scale. Ann Behav Med 2009;37(Suppl):S185(#D–07).
41. Sallis JF, Grossman RM, Pinski RB, et al. The development of scales to measure social support for diet and exercise behaviors. Prev Med 1987;16:825–836.
42. Garber CE, Blissmer B, Deschenes MR, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. Med Sci Sports Exerc 2011;43:1334–1359
43. Doyle C, Kushi LH, Byers T, et al. Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. CA Cancer J Clin 2006;56:323–353.
44. Blanchard CM, Courneya KS, Stein K; American Cancer Society's SCS-II. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II. J Clin Oncol 2008;26:2198–2204.
45. Treviño RA, Vallejo L, Hughes DC, et al. Mexican-American and Puerto Rican breast cancer survivors' perspectives on exercise: similarities and differences. J Immigr Minor Health 2012;14:1082–1089.
46. Bandura A. Social Foundations of Thought and Action. 1st ed. Upper Saddle River, NJ: Prentice-Hall, Inc.; 1986.
47. Mosher CE, Fuemmeler BF, Sloane R, et al. Change in self-efficacy partially mediates the effects of the FRESH START intervention on cancer survivors' dietary outcomes. Psychooncology 2008;17:1014–1023.
48. Pinto BM, Rabin C, Dunsiger S. Home-based exercise among cancer survivors: adherence and its predictors. Psychooncology 2009;18:369–376.
49. Hojan K, Molińska-Glura M, Milecki P. Physical activity and body composition, body physique, and quality of life in premenopausal breast cancer patients during endocrine therapy--a feasibility study. Acta Oncol 2013;52:319–326.
50. de Glas NA, Fontein DB, Bastiaannet E, et al. Physical activity and survival of postmenopausal, hormone receptor-positive breast cancer patients: results of the Tamoxifen Exemestane Adjuvant Multicenter Lifestyle study. Cancer 2014;120:2847–2854.