Objectively Assessed Physical Activity Levels in Spanish Cancer Survivors

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Purpose/Objectives: To objectively assess physical activity (PA) levels in a cohort of Spanish cancer survivors.

Design: Descriptive, cross-sectional.

Setting: The Hospital Universitario de Fuenlabrada and two healthcare centers in Madrid, Spain.

Sample: 204 cancer survivors and 115 adults with no history of cancer.

Methods: Participants wore a triaxial accelerometer for seven or more consecutive days to assess PA levels. Body mass index (BMI), indirect indicators of adiposity (waist circumference, waist-to-hip ratio), and cardiorespiratory fitness also were determined.

Main Research Variables: Light, moderate, vigorous, and total PA (sum of the former).

Findings: Most (94%) of the cancer survivors met international recommendations for moderate PA, but very few (3%) fulfilled those (75 minutes or more per week) for vigorous PA. Except for lower total (minute per day, $p = 0.048$) and vigorous PA levels ($p < 0.001$ for both minute per day and minute per week) recorded in the cancer survivors group, no between-group differences were detected ($p > 0.05$). A high percentage of the survivors (33%) were obese (BMI greater than 30 kg/m^2), and many also showed poor cardiorespiratory fitness (45% were below the 8 metabolic equivalent threshold).

Conclusions: Although cancer survivors overall met international PA recommendations for a healthy lifestyle, their BMI and cardiorespiratory profiles were not within the healthy range.

Implications for Nursing: Cancer survivors need to be informed about healthy lifestyle habits and should be regularly monitored.

Key Words: exercise, oncology, accelerometry, cardiorespiratory fitness, adiposity

About 65% of adults with cancer will survive five years after diagnosis (National Cancer Institute, 2013). An estimated 13.7 million cancer survivors were living in the United States in 2012, and the figure continues to rise (Siegel et al., 2012), and the figure continues to rise. Despite this trend, cancer survivors do not routinely receive counseling by healthcare professionals on lifestyle habits linked to an improved quality of life and prolonged survival, particularly physical activity (PA) (Daley, Bowden, Rea, Billingham, & Carmicheal, 2008).

According to PA guidelines issued by the U.S. Department of Health and Human Services (2008) and the World Health Organization ([WHO], 2010), adults should undertake 150 minutes per week or more of moderate PA or 75 minutes per week or more of vigorous-intensity PA, or an equivalent combination of the two (i.e., 150 minutes per week of moderate-to-vigorous PA [MVPA]). The American College of Sports Medicine (Schmitz et al., 2010) concluded that regular PA is safe during and after cancer treatment, and that it leads to several improvements in the cancer sequelae, including better physical functioning and health-related quality of life (both during and after treatment) and reduced cancer-related fatigue (McClellan, 2013; Mishra et al., 2012). Such improvements have prompted recommendations for cancer survivors to avoid physical inactivity and to follow international PA guidelines (Demark-Wahnefried & Jones, 2008; Rock et al., 2012; Schmitz et al., 2010). Additional support for encouraging PA in this population is provided by the finding that cardiorespiratory fitness shows significant negative association with cancer mortality (Sui et al., 2007), and that supervised regular PA interventions are effective in improving cardiorespiratory fitness in adults with cancer (Jones et al., 2011). In addition to the independent protective role of cardiorespiratory fitness against cardiovascular risk, obesity tends to attenuate the protective value of fitness (Carnethon et al., 2003).

Therefore, to design effective PA interventions, PA levels and their relationship with cardiorespiratory fitness and adiposity indicators need to be accurately assessed in different population subsets (WHO, 2010). The conventional method of obtaining self-reported PA data through questionnaires is inexpensive and generally well accepted by study participants. However, the validity of such data is questionable (Tucker, Welk, & Beyler, 2011) because of biases arising from different levels of social desirability and the cognitive challenge of quantifying both the intensity and duration of PA (Adams et al., 2005; Welk, 2002). Biases such as these have prompted an interest in finding a less subjective way of monitoring PA. Accelerometers provide minute-by-minute recordings of PA and can be used to objectively quantify PA (Prince et al., 2008). For adults, three to five days of accelerometer monitoring is required to reliably estimate habitual PA (Trost, McIver, & Pate, 2005), and it generally is accepted that the device should be worn for a minimum of 10 hours per day (Matthews, Hagstromer, Pober, & Bowles, 2012). However, the accelerometry data available for cancer survivors still is limited (Jovanovic et al., 2011; Lynch et al., 2010, 2011).

In the current study, the authors use a cross-sectional design to objectively assess PA levels in cancer survivors receiving follow-up care at a large, suburban teaching hospital (Hospital Universitario de Fuenlabrada) in Madrid, Spain. Once PA levels were determined, the authors established whether they complied with international PA recommendations and how they compared with those of participants with no history of cancer living in the same area. An additional aim of the current study was to correlate cardiorespiratory capacity and indicators of adiposity in the cancer survivors with PA levels.

Methods

Data were collected from a group of cancer survivors and a control group with no cancer history. None of the participants had taken part in any prior investigation. The study protocol received Hospital Universitario de Fuenlabrada institutional review board approval and adhered to the tenets of the Declaration of Helsinki and the statements in Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (Vandenbroucke et al., 2007; von Elm et al., 2007). Written informed consent was obtained from all participants.

Participants

Cancer survivors were recruited from the oncology department of the Hospital Universitario de Fuenlabrada from May 2011 to June 2012. Inclusion criteria for eligibility were (a) aged 18–79 years, (b) able to walk independently (so that they could perform the one-mile walk test), (c) able to understand the requirements for valid accelerometry, (d) time after cancer diagnosis at one year or greater, (e) time after last anti-cancer treatment (chemotherapy, radiotherapy, or surgery) at three months or greater, (f) no evidence of tumor recurrence or metastasis, and (g) written informed consent provided.

The noncancer participants were recruited from November 2011 to June 2012 from two primary healthcare centers (Centro de Salud Francia and Centro de Salud Alicante) located in the same geographic area as the hospital. Inclusion criteria for the noncancer participants were (a) no history or present diagnosis of cancer, (b) aged 18–79 years, (c) able to understand the requirements for valid accelerometry, and (d) written informed consent provided. Of the noncancer participants, 48% had a chronic illness (mainly cardiopulmonary disease), 36% reported they had chronic pain, and 17% had a history of cardiovascular disease. When asked about their health state, 62% reported they were in good health.

Participants fulfilling the inclusion criteria were randomly invited to participate in the study. To this end, a computer-generated list of random numbers was sent by one of the authors every Friday afternoon to the hospital and healthcare centers to select potential candidates for the following week. Ten participants (cancer group) were selected from a list of 60 outpatients with hospital visits scheduled from Monday through Friday. At the healthcare centers (noncancer group), 10 participants were selected from a list of 154 potential candidates with visits scheduled for Thursday and Friday (6 of 88 at one center and 4 of 66 at the other center). Blinding of participants to the outcome measures was inappropriate for the design of the study because no experimental intervention was used.

Outcome Variables

Participant PA was monitored using a triaxial actigraph GT3X monitor device. This accelerometer is lightweight (27 g), compact (3.8 x 3.7 x 1.8 cm), and has a rechargeable lithium polymer battery. Previous research has shown its validity for PA determination (Santos-Lozano et al., 2012). The GT3X measures and records time-varying accelerations (range = 0.05–2.5 g). The accelerometer output is digitized by a 12-bit analog-to-digital convertor at a rate of 30 Hz; once digitized, the signal passes through a digital filter that limits the accelerometer frequency range to 0.25–2.5 Hz. Each sample is added over an epoch, and the output of the actigraph is given in counts. The counts obtained in a given time period are linearly related to the intensity of the participant's PA during this period.

Each accelerometer was attached to an elastic belt and positioned near the right iliac crest. Participants were instructed to wear the accelerometer for 7–10 consecutive days while awake and to remove it only for water activities. For each participant, a minimum of

Knowledge Translation

Cancer survivors are willing to participate in initiatives to evaluate their lifestyle and habits.

Cardiorespiratory fitness can be estimated in the hospital environment by specially trained nurses.

Keeping records of physical activity levels, body mass index (or other adiposity indicators), and cardiorespiratory fitness in cancer survivors might be useful to ensure healthy lifestyle habits are adopted.

five days of monitoring, including two weekend days and a minimum of 10 hours of complete accelerometry data per day, were considered necessary for PA assessment to be considered valid and, therefore, for their accelerometry data to be included in the study. This ensured that the authors quantified actual PA with less than a 5% error (Gretebeck & Montoye, 1992), and the authors recorded nonmissing counts over at least 80% of a standard measurement day (Catellier et al., 2005). For participants providing more than seven consecutive days of recordings, only the data for the last seven days, including two weekend days, were used. Data were analyzed using ActiLife5® LITE software. Outcome variables were expressed as average intensity (counts per minute). The authors calculated mean counts per minute by dividing the sum of the total counts per predefined epoch (15 seconds) for a valid day by the number of minutes of wear time in that day across all valid days. The authors excluded from the analysis bouts of 20 continuous minutes of activity counts of 0, considering these periods to be nonwearing time. Counts were converted to time (average minute per day and total minutes per week) engaged in sedentary behavior and light, moderate, and vigorous PA using the following cutoffs (Freedson, Melanson, & Sirard, 1998): sedentarism fewer than 100 counts per minute, light PA = 100–1,951 counts per minute; moderate PA = 1,952–5,724 counts per minute (corresponding to 3–5.9 metabolic equivalents [METs], where 1 MET is equivalent to an oxygen consumption of 3.5 ml/kg per minute); and vigorous PA = 5,725 counts per minute or greater (6 METs or greater). For any PA to be considered moderate PA, 10 consecutive minutes of observations had to exceed the moderate intensity cutoff, with allowance for a maximum of two observations falling below the cutoff during that period (8 of 10 minutes had to be above the cutoff).

All accelerometry data were analyzed by the same experienced observer and, to ensure the reliability of measurements, data from 18 randomly selected participants (nine participants per group) also were analyzed by an external observer not involved in this study who was blinded to the results obtained. A researcher with expertise in accelerometry recordings compared the results obtained by the two observers.

Body mass index (BMI) was determined as body mass divided by height (kg/m^2). Waist circumference was measured midway between the lower rib margin and the anterior superior iliac crest in a standing position (Perk et al., 2012). Waist-to-hip ratio was computed as the ratio of the circumference of the waist to the hip. All measurements were made according to International Standards for Anthropometric Assessment (Stewart, Marfell-Jones, Olds, & de Ridder, 2011). Cardiorespiratory fitness (peak oxygen uptake [VO_{2peak}]) in the cancer survivors group was assessed using the one-mile walk test. All tests were performed on the same flat terrain, and timed using a stopwatch to the nearest 0.1 seconds. VO_{2peak} was estimated according to age, gender, and body mass-specific equations detailed elsewhere (Kline et al., 1987).

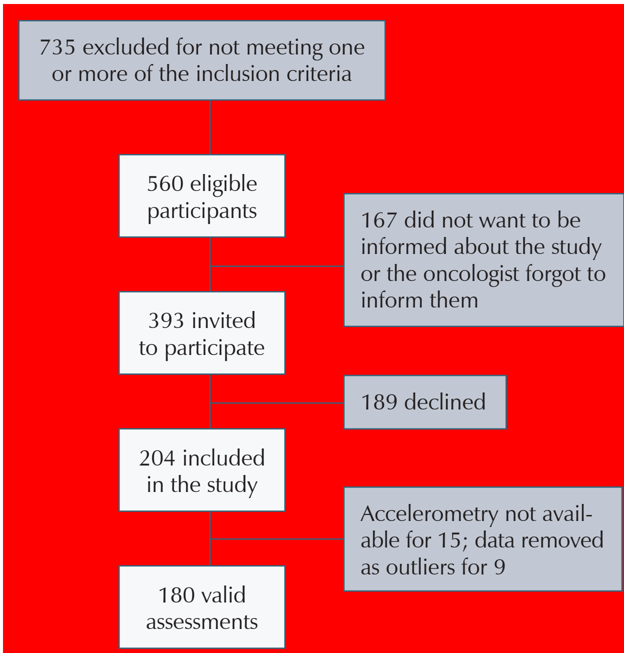
Information on socioeconomic and lifestyle or environmental variables was obtained by administering a personal questionnaire specifically developed by the authors of this article for this study. In the cancer survivor group, the questionnaire included a question about PA recommendations by any health practitioner (i.e., participants were asked to specify whether these recommendations had been made by their general practitioner, nurse, or oncologist). Health records were checked for written information on these recommendations.

Statistical Analysis

Descriptive data were expressed as frequencies (percents) and mean or median with standard deviation. For the main study outcome (accelerometry) data, outliers (i.e., individual data points outside the interquartile range) were removed by constructing box and whisker plots. The authors compared accelerometry data (daily and weekly results) between the two study groups using the unpaired Student t test. Fisher's exact test was used to compare the proportions of participants in each group fulfilling international PA guidelines. In the cancer survivor group, the authors used (a) ordinary least squares linear regression to determine the relationship between PA and cardiorespiratory fitness or adiposity indices, and (b) logistic regression to determine the relationship between PA levels and categorical variables (socioeconomic, environmental, and lifestyle factors). All statistical analyses were performed using PASW®, version 18.0.

Results

The flow diagrams in Figures 1 and 2 show how the cancer survivors and noncancer participants were recruited and the final numbers of individuals who



Note. 1,295 participants were potentially eligible after the randomization sequence was performed.

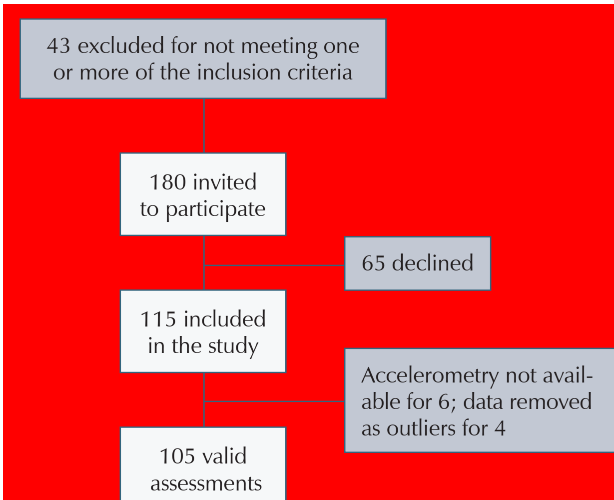
Figure 1. Cancer Survivors Treated in the Oncology Department of Hospital Universitario de Fuenlabrada

provided valid data for the study. Tables 1 and 2 show the main characteristics of the two groups and the distributions of the different cancer types, respectively. Of note was (a) the high prevalence of obesity (33%) among cancer survivors according to BMI data (45% of men and 53% of women exceeded the waist circumference cutoff value associated with an increased risk of cardiometabolic disease—greater than 102 cm and greater than 88 cm, respectively) (Nishida, Ko, & Kumanyika, 2010), and (b) their low level of cardiorespiratory fitness (i.e., mean VO_{2peak} of 26.8 ml/kg per minute or 7.7 METs, barely reaching the minimum threshold for optimal health [8 METs]) (Lucia, Foster, Perez, & Arenas, 2008). VO_{2peak} in the cancer survivors decreased with age, with the following mean values recorded according to age: 10.8 (SD = 2.9) for those younger than age 40 years, 7.8 (SD = 2.3) for those aged 40–60 years, and 6.2 (SD = 1.9) for those older than age 60 years. The total numbers of participants providing valid accelerometer data were 180 cancer survivors and 105 noncancer participants. Virtually total agreement was noted between the PA data obtained by the study researcher and external observer. Mean PA levels did not essentially differ between groups, except for lower total (minute per day, $p = 0.048$) and vigorous PA levels ($p < 0.001$ for both minute per day and minute per week) in the cancer survivor group (see Table 3). The vast majority of participants in the two groups (94% in the cancer group and 96% in the noncancer group) met international recommendations for moderate PA (i.e., 150 minute per week or more [$p = 0.15$] for between-group difference), but very few met recommendations when only considering vigorous PA (i.e., 75 minutes per week or more [$p = 0.278$]) (6% in the cancer group and 4% in the noncancer group).

Significant correlation was detected between the PA level of the cancer survivors and their cardiorespiratory fitness and both waist circumference and waist-to-hip ratio (see Table 4). However, no relationship was observed between cancer survivor PA and socioeconomic, lifestyle, or environmental variables (all $p > 0.1$), except for marital status. The likelihood of a married or cohabiting individual meeting moderate PA recommendations compared to an individual without a spouse or life partner was quantified with an OR = 0.28 (0.09, 0.78; $p = 0.015$).

Discussion

The current study is the first to determine habitual PA levels in survivors of different cancers, and the first similar study conducted in a non-U.S. cohort. The authors' main finding was that 94% of the Spanish cancer survivors examined met international PA guidelines (more than 150 minutes per week of moderate PA), and their PA levels did not essentially differ from those of the control (noncancer) group (96%), except for total (minutes per day) and vigorous PA (whose contribution to total PA was low in both groups). Despite the fact that their PA levels were overall compliant with current guidelines for a healthy lifestyle, cancer survivors had high BMI and waist circumference values that could have partly contributed to their low cardiorespiratory



Note. 223 participants were potentially eligible after the randomization sequence was performed.

Figure 2. Noncancer Patients Recruited From Two Healthcare Centers for Study Participation

Table 1. Sample Characteristics by Cohort

Characteristic	Cancer Survivors N	Cancer Survivors $\bar{X}$	Cancer Survivors SD	Noncancer Group N	Noncancer Group $\bar{X}$	Noncancer Group SD
Age (years)	204	54	11	115	47	15
Characteristic	**N**	**n**	**%**	**N**	**n**	**%**
Gender	204			115		
Men		73	36		38	33
Women		131	64		77	67
Marital status	203			115		
Single, separated, divorced, or widowed		36	18		19	17
Married or cohabitation		167	82		96	84
Highest education level	204			115		
No high school		18	9		2	2
Some high school		118	58		60	52
Completed high school		55	27		45	39
University		13	6		8	7
Employment status	200			115		
Active		73	37		55	48
Not active		127	64		60	52
Smoker	204			115		
Yes		45	22		26	23
No		159	78		89	77

Note. Because of rounding, not all percentages total 100.

capacity expressed relative to body mass (i.e., VO_{2peak} in ml/kg per minute). Of concern is that about one in two cancer survivors did not meet the threshold (8 METs). Anything lower than 8 MET indicates a substantial increased risk for mortality and cardiovascular and coronary heart events in both men and women (Kodama et al., 2009).

The cardiometabolic profile of the cancer survivor group (mean BMI = 27.9 kg/m^2, obesity prevalence = 33%, and mean VO_{2peak} = 7.7 METs) was similar to that of the four previous cohorts of cancer survivors (all from the United States) whose accelerometry-determined PA levels have been reported: mean BMIs of 27.6 and 28.2 kg/m^2 (obesity prevalence of 31% and 31%) in breast (n = 111) (Lynch et al., 2010) and prostate cancer (n = 103) survivors, respectively (Lynch et al., 2011); mean BMI of 30.9 kg/m^2 (with VO_{2peak} around 5.4 METs) in 19 endometrial cancer survivors (Jovanovic et al., 2011); and an obesity prevalence of 34% in a cohort (N not reported) of cancer survivors (at five years or longer of survivorship with various tumor types) in the National Health and Nutrition Examination Survey (NHANES) (Smith, Nolan, Robison, Hudson, & Ness, 2011). However, the PA levels reported by the cancer survivor group in the current study (356 minutes per week), using 1,952 counts per minute as the cutoff to distinguish light from moderate PA, were clearly higher than those reported by Lynch et al. (2010, 2011) using the same cutoff and an older generation of actigraph (7164 model) accelerometers. In the cohorts examined by Lynch et al. (2010, 2011), mean MVPA levels were clearly below the recommended 150 minutes per week (i.e., about 26 [breast] and about 42 minutes per week [prostate]). In addition, only 5% of the cancer survivors examined by Smith et al. (2011) met PA recommendations. Differences between the current results and the data reported for these North American cohorts could be partly attributable to the older ages in the North American groups. Mean ages were 69 years (breast) and 75 years (prostate) in the two studies by Lynch et al. (2010, 2011) and 61.6 years in the study by Smith et al. (2011), versus 55 years for the participants in the current study. However, if the data from those studies are compared with data from those recorded only for cancer survivors aged 60 years or older in the current study, PA levels for the cohort in the current study are still much higher (about 330 minutes per week of MVPA). The data reported by Lynch et al. (2010, 2011) and Smith et al. (2011) are consistent with research showing dramatically low PA levels for North American adults, with less than 5% meeting PA recommendations (Troiano et al., 2008). Levels of MVPA also were higher in the two groups (356 and 359 minutes per week for the cancer survivors and noncancer groups, respectively) compared to pooled accelerometry data from four countries (Norway, Portugal, Sweden, and the United States) in which 9,564 individuals showed mean cumulative MVPA levels of about 249 and 224 minutes per week for men and women, respectively (Hallal et al., 2012). For the Spanish population, research indicates a favorable trend in self-reported PA levels in the past few years (Palacios-Cena et al., 2011; Rodriguez-Romo et al., 2011),

Table 2. Cancer Type Distributions in the Cancer Survivors Group (N = 204)

Type of Cancer	n	Percent of Total	Percent of Men Affected
Breast	93	46	3
Colon	34	17	71
Rectal	19	9	68
Testicular or germinal	10	5	100
Ovarian	9	4	–
Lung	8	4	88
Head and neck	7	3	100
Bladder	4	2	100
Stomach	4	2	50
Uterine cervix	4	2	–
Pancreas	3	2	–
Sarcoma	3	2	67
Uterus	3	2	–
Other (renal, nasopharynx, thymus)	3	3	33

particularly in the Madrid area, with most (80%) adults in this region meeting PA recommendations (Rodriguez-Romo et al., 2011). The higher PA levels noted for individuals in Madrid compared to other cohorts of Western participants (particularly from North America or North European countries) could be explained by the good weather for outdoor sports and other activities added to less reliance on cars for activities such as shopping. Also, there is more of a tradition in Spain to spend time outdoors during leisure time. A large proportion of this study's group of cancer survivors (64%) was either on sick leave or retired/unemployed, so they would be more likely to spend part of the day doing some type of PA.

Table 3. Daily and Cumulative Weekly PA Levels by Group

Variable	Cancer Survivors (N = 180) $\bar{X}$	Cancer Survivors (N = 180) SD	Noncancer Participants (N = 105) $\bar{X}$	Noncancer Participants (N = 105) SD	p[a]
Minutes per day					
Sedentary time	548	83	540	86	0.515
Activity time	277	75	289	91	0.048
Light PA	228	66	236	84	0.256
Moderate PA	48	23	51	24	0.435
Vigorous PA	1	2	2	4	0.001
MVPA	49	24	53	25	0.261
Minutes per week					
Sedentary time	3,847	589	3,795	623	0.517
Activity time	1,958	540	2,046	650	0.089
Light PA	1,603	469	1,651	586	0.168
Moderate PA	351	170	378	178	0.162
Vigorous PA	5	15	17	37	< 0.001
MVPA	356	174	395	192	0.074

[a] Between-group differences

MVPA—moderate-to-vigorous physical activity; PA—physical activity

The medical interest in examining "cardiometabolic" profiles (cardiorespiratory fitness, adiposity) and PA levels in cancer survivors arises from the finding that cardiovascular disease is the leading cause of long-term morbidity and mortality among long-term cancer survivors (Horner et al., 2009). In addition, physical inactivity is, on average, held responsible for 10% of the disease burden of two of the most prevalent cancers among Western nations (14% and 15% of the burden of breast and colon cancer among the Spanish population) (Lee et al., 2012). Although convincing evidence exists that cardiorespiratory fitness is negatively associated with morbidity and mortality in men and women independently of other risk factors, the importance of cardiorespiratory fitness from a clinical perspective often is still ignored (Lee et al., 2012). In addition, epidemiologic evidence exists to support a protective role of cardiorespiratory fitness against bowel, colorectal, and liver cancer deaths in men (Peel et al., 2009). In particular, men with a VO_{2peak} below 8 METs were found to have a more than three-fold higher risk of dying from bowel cancer than those with higher MET levels (11 or greater) (Peel et al., 2009). The data suggest that an exercise capacity of at least 8 METs may be needed to provide sufficient protective benefits. A high proportion (45%) of the male cancer survivors examined in the current study had VO_{2peak} levels below 8 METs. While bearing in mind the limitation that the authors determined VO_{2peak} indirectly (using the one-mile walk test), the results emphasize the need to implement interventions to try to increase VO_{2peak} in cancer survivors. Despite the PA levels of the cohort being comparatively high (versus previous studies) and their positive relationship with VO_{2peak}, they did not, per se, lead to healthy VO_{2peak} levels. This could be partly attributable to the high BMI of the survivors. In effect, a 10% reduction in the BMI of the male cancer survivors would mean that METs would be greater than 8 and 11 in 66% and 28%, respectively. Therefore, it seems that both PA and diet interventions are needed to achieve actual weight loss (Church, Earnest, Skinner, & Blair, 2007). It could be stressed, then, that PA interventions should focus on vigorous PA (virtually null among the cancer survivors in the current study) to efficiently reduce obesity (Shaw, Gennat, O'Rourke, & Del Mar, 2006). To reduce adiposity in cancer survivors, drastic changes might not always be needed. Substantial benefits have been reported of simple messages targeted at minimizing the calories consumed, such as reducing meal portions and restricting soft drinks (Lajous, Mozaffarian, Mozaffarian, Schrag, & Adami, 2011). In addition, the health risks of sedentary behavior independently of meeting MVPA guidelines (as the cohorts in the current study did) are becoming evident (Gutin, 2008). Data support the life expectancy benefits of cumulative PA levels well above international guidelines, exceeding the PA levels of the participants in the current study (i.e., brisk walking for 450 minutes or more per week), even in people with a high BMI (Moore et al., 2012).

Limitations

The current study was not without limitations. First, despite effort to avoid bias in the selection process (including the use of a random list of candidates), it cannot be ruled out. In addition, the general health status of participants in each of the two groups differed. The authors did not specifically analyze the long-term complications of the survivors, which is a potential confounder when interpreting PA or cardiorespiratory fitness data. The authors also limited the study to a specific geographic area and, therefore, potentially limited

Table 4. Significant Correlations Between PA and Cardiorespiratory Fitness/Adiposity in the Cancer Survivors Group

	VO_{2peak} (ml/kg per minute)		Waist Circumference (cm)		Waist-to-Hip Ratio	
Variable	**r**	**p**	**r**	**p**	**r**	**p**
Light PA						
Minutes per day	0.18	0.021	–0.149	0.045	0.163	0.03
Minutes per week	0.212	0.006	–0.147	0.049	–0.161	0.032
Moderate PA						
Minutes per day	0.201	0.01	ns	ns	ns	ns
Minutes per week	0.204	0.009	ns	ns	ns	ns
MVPA				ns		ns
Minutes per day	0.186	0.006	ns	ns	ns	ns
Minutes per week	0.217	0.005	ns	ns	ns	ns
Total PA						
Minutes per day	0.228	0.003	–0.132	0.078	–0.153	0.042
Minutes per week	0.235	0.002	–0.132	0.078	–0.152	0.044

MVPA—moderate-to-vigorous physical activity; ns—not significant; PA—physical activity; VO_{2peak}—peak oxygen uptake

Note. No significant correlations were detected between PA indices and body mass index.

it to a particular education and socioeconomic level. In addition, the cross-sectional nature of the design with no longitudinal follow-up precludes drawing conclusions on any cause-and-effect relationship between exposure (PA levels) and the other study outcomes (cardiorespiratory fitness, BMI, or adiposity indices). The authors believe the major application of cross-sectional studies is to test preliminary hypotheses to provide direction for future interventional studies.

Conclusion

Although the cohort of cancer survivors examined was overall compliant with PA guidelines, the authors identified a fairly urgent need for lifestyle interventions aimed at reducing BMI while increasing participants' cardiorespiratory capacity. Although more research is needed to identify the main factors determining PA levels in this population subset, the data suggest that current moderate PA guidelines might not be sufficiently strict for cancer survivors. The findings prompt additional research aimed at addressing questions such as whether ambitious PA programs (perhaps focusing on vigorous PA or combining PA with other lifestyle changes, particularly diet) are feasible for cancer survivors and do they actually achieve healthy levels of VO_{2peak} (more than 8 METs) or adiposity. Given that the current MVPA guidelines (more than 150 minutes per week) could be insufficient, what is the minimum PA dose (intensity, frequency) recommended for cancer survivors to acquire a healthy cardiometabolic profile? In addition, cohorts of survivors should be followed over time to determine whether high PA levels are linked to a lower risk of disease recurrence. Oncology care providers should be aware of the potential mid- and long-term sequelae of a poor cardiorespiratory capacity. Monitoring PA (ideally by accelerometry, although this might not be feasible in nonresearch settings) along with indicators of cardiorespiratory fitness and adiposity in routine follow-up examinations could help healthcare professionals implement efficient lifestyle interventions.

Implications for Nursing

Nurses can play an important role in monitoring PA levels in cancer survivors by encouraging participation in daily exercise. As caregivers are close to cancer survivors, they too can provide valuable advice on healthy lifestyle habits and inform patients of the specific benefits of PA. Nurses could recommend the use of PA diaries, pedometers, or perhaps other tools (e.g., heart rate monitors) as feedback for patients. In addition, if accelerometers are available, patients and nurses can monitor both exercise duration and intensity. Nurses could determine cardiorespiratory fitness through a simple, indirect test (such as the one used here) as a health indicator along with other variables routinely assessed in nursing practice (e.g., blood pressure, pain, or distress thermometer). Lastly, but most importantly, nurses could be part of a multidisciplinary team (including medical oncologists, nutritionists, or physiotherapists) in charge of prescribing PA and educating cancer survivors on the specifics of this lifestyle intervention (recommended frequency, intensity, or modes of PA) as well as other important lifestyle habits such as maintaining a healthy BMI and adopting a balanced diet.

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