Physical activity levels in Atlantic Canadian cancer survivors

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INTRODUCTION

The incidence of cancer within the Canadian population has been slowly increasing since 2009.[1] Currently, it is expected that 2 in 5 Canadians will develop cancer in their lifetime, which equates to a national incidence rate of 515.5 new cancer diagnoses per 100,000 people.[2] In Atlantic Canada, the average incidence rate for Nova Scotia (627.3/100,000), New Brunswick (606.7/100,000), Newfoundland (631.6/100,000) and Prince Edward Island (556.9/100,000) combined is 605.6 new diagnoses per 100,000 people, which is markedly higher than the national incidence rate.[1] Of those diagnosed with cancer, 63% will survive at least 5 years after the initial cancer diagnosis.[2] This means, as the overall number of cancer diagnoses increases, a corresponding increase in cancer survivors can be expected. Although this is good news, it is also concerning as the long–term side effects of treatment and the development of comorbidities, such as heart disease, has become a much larger issue for cancer survivors.

One factor that contributes to an increased risk of chronic disease is low levels of physical activity. In fact, the World Health Organization states that physical activity is the fourth leading risk factor for global mortality.[3] Importantly, physical activity can lead to many improvements in physical functioning and quality of life following a cancer diagnosis.[4-7] These improvements include enhanced aerobic endurance, muscular strength, fatigue, depression, anxiety, self-esteem, functional ability, and overall quality of life.[4,7,8] Emerging research has also suggested a potential all-cause and disease-specific survival advantage.[9-11] Despite these benefits, many cancer survivors do not accumulate the recommended amount of physical activity per week.[12-14]

Numerous international bodies have developed physical activity guidelines to try and reduce the incidence of morbidity and mortality associated with low levels of physical activity. Current guidelines

recommend that an individual should complete 150 minutes per week of moderate-to-vigorous physical activity in order to accumulate health benefits and decrease the risk of morbidity and mortality.[3,15,16] Previous research among Canadian cancer survivors has found up to 78% can be inactive.[12-14] Therefore the purpose of this report is to use a population based sample from Atlantic Canada to describe and compare the physical activity levels of individuals with a self-reported history of cancer with those who have never had a cancer diagnosis.

METHODS

Study Design and Sample

This retrospective, population-based cohort study drew participant data from the Atlantic Partnership for Tomorrow's Health (PATH) study. Atlantic PATH is part of Canadian Partnership for Tomorrow Project, a national prospective cohort study examining the influence of genetic, environmental, and lifestyle factors in the development of cancer and chronic disease.[17] In brief, a total of 31,173 Atlantic PATH participants, ages 35-69 years, were recruited between 2009 and 2014 from the general population of the four Atlantic Canadian provinces (Nova Scotia, New Brunswick, Newfoundland and Labrador, and Prince Edward Island). Participants who did not provide valid responses to cancer history, physical activity behaviors (n=99), and potential confounders (sex, age, household income, smoking status, body mass index (BMI); n=5,058) were excluded for a total of 26,115 participants in the present analyses. Ethical approval was obtained by the appropriate regional and provincial research ethics boards prior to any baseline data collection.

Data Collection

Baseline sociodemographic information (age, sex, income, education), cancer history, and physical activity behaviors were captured through self-report. Physical measures (i.e., height and weight) were measured by a research nurse at a study assessment center. Where participants were unable to attend an assessments center, self-reported height and weight data was collected. Physical activity was assessed using both the short and long form of the International Physical Activity Questionnaire (IPAQ).[18] In accordance with the IPAQ scoring protocol[a] data from both forms were used to calculate categorical (low, moderate, high) physical activity scores. Participants

[a] IPAQ scoring protocol retrieved from https://sites.google.com/site/theipaq/scoring-protocol

with low levels of activity reported less than 600 metabolic equivalent task (MET) minutes/week[b] of physical activity and were classified as not meeting recommended physical activity guidelines. Moderately and highly active participants reported 600 to 1500 MET minutes/week and greater than 1500 MET minutes/week of physical activity, respectively, and both were classified as meeting minimum physical activity guidelines.[19] The presence/absence of cancer was dichotomized as yes/no. For smoking status, participants who reported never having smoked 100 cigarettes in their life or had not used other types of tobacco on a regular basis for at least six months were defined as "never smokers". "Former smokers" were defined as those who reported having smoked at least 100 cigarettes in their lifetime, but did not use any type of tobacco within the previous 30 days. "Current smokers" were defined as those who reported smoking at least 100 cigarettes in their lifetime and smoked during the past 30 days. Participant responses were reclassified as never smoked or ever smoked (former and current smokers). BMI was calculated as weight in kilograms divided by height in meters squared. Overweight was defined as a BMI between 25.0-29.9 kg/m^2 and obesity was defined as a BMI 30.0 kg/m^2 or greater.

Statistical Analyses

Analyses were conducted using SAS 9.4 for Windows (SAS, Carey, NC). Descriptive statistics for the cohort were calculated as frequency and percentage or mean and standard deviation where appropriate. Logistic regression analyses were used to determine the relationship between cancer status and physical activity in a univariate and multivariable model while controlling for potential confounders (sex, age, household income, smoking status, BMI). Individuals with no prior history of cancer were chosen as the reference group. For the primary outcome variable, physical activity, the probability of ***not*** meeting physical activity guidelines was modelled.

[b] A metabolic equivalent task (MET) is a commonly used unit of measure of physical activity expenditure. One MET is equivalent to the rate of energy expenditure while at rest. A MET value of 5 means an individual is expending 5 times the energy than at rest. A MET minute is calculated by multiplying the MET value by the total number of minutes engaged in the activity. For example, if an individual engages in a 5 MET activity for 30 minutes, then they have done 150 MET minutes (5 x 30 minutes).

RESULTS

This study cohort included 26,115 Atlantic PATH participants between 35 and 69 years old. Descriptive statistics are presented in Table 1. The prevalence of cancer (excluding skin cancer) in this cohort was 5.6 % (n=1,397). A higher proportion of cancer survivor participants (22.2 %) were classified as inactive, compared to those who had never had cancer (16.9 %). Compared to those who have never had cancer, cancer survivor participants were older and more likely to be overweight/obese and to be former smokers (Table 1).

In the univariate logistic regression analyses, cancer survivors were more likely to fail to meet minimum physical activity guidelines (OR=1.4, 95% CI: 1.23,1.6) than non-cancer participants. These findings remained significant after adjusting for sex, age, smoking status, BMI, and household income (OR=1.3, 95% CI:1.14,1.48 (Table 2).

Table 1. Characteristics of participants by cancer status

Characteristic	Never had cancer N=24718		Cancer survivors N=1397		Total N=26115	
	n	%	N	%	N	%
Sex						
Male	7565	30.6	379	27.1	7944	30.4
Female	17153	69.4	1018	72.9	18171	69.6
Physical activity[†]						
Inactive	4181	16.9	310	22.2	4491	17.2
Moderately Active	6870	27.8	386	27.6	7256	27.8
Active	13667	55.3	701	50.2	14368	55
Age	Mean age=57.1, SD=8.1		Mean age=52.8, SD=9.1		Mean age=53, SD=9.1	
35-39	2427	9.8	46	3.3	2473	9.5
40-59	15472	62.6	729	52.2	16201	62
60-69	6819	27.6	622	44.5	7441	28.5
Household income						
$<25 000	1066	4.3	82	5.9	1148	4.4
$25 000–49 999	3918	15.9	281	20.1	4199	16.1
$50 000–74 999	4974	20.1	302	21.6	5276	20.2
$75 000–149 999	10135	41	479	34.3	10614	40.6
$>150 000	3047	12.3	121	8.7	3168	12.1
Unknown	1578	6.4	132	9.4	1710	6.5
Smoking status						
Never smoked	12646	51.2	598	42.8	13244	50.7
Former smoker	9711	39.3	662	47.4	10373	39.7

Current smoker	2361	9.6	137	9.8	2498	9.6
Body mass index						
Low/normal weight (≤24.9kg/m^2)	7793	31.5	315	22.5	8108	31
Overweight (≥25.0 <30.0kg/m^2)	8931	36.1	530	37.9	9461	36.2
Obese (≥30.0kg/m^2)	7994	32.3	552	39.5	8546	32.7

[†] Physical activity levels: Inactive was classified as not meeting guidelines. Moderately active and active were classified as meeting guidelines.

Table 2. Unadjusted and adjusted odds ratios and 95 % confidence intervals from logistic regression for relationship between physical activity level and cancer status (probability of "not meet minimum PA guidelines" was modeled)

	Physical activity (PA)			
Cancer status	Meeting minimum PA guidelines N (%)	Not meeting minimum PA guidelines N (%)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)[£]
Never had cancer	20537(83.09)	4181(16.91)	Reference	Reference
Cancer survivors	1087(77.81)	310(22.19)	1.4 0(1.23,1.60)	1.30 (1.14,1.48)

[£]Adjusted for sex, age, smoking status, body mass index, and household income.

DISCUSSION

Our data show those with a history of cancer were more likely to be less physically active than those without a history of cancer. Interestingly, self-reported physical activity behaviors in both survivors and controls in the present cohort are substantially higher in comparison to similar population-based studies. For example, using data from the Canadian Community Health Survey (CCHS), Courneya et al.[12] found that while there was little difference between those with a cancer diagnosis and those without a history of cancer, 46% of cancer survivors and 51% of those without cancer reported meeting minimum activity guidelines. Although slightly higher, a more recent survey similarly found that approximately half of the respondents were meeting minimum physical activity guidelines (48% of cancer survivors and 53% of those without cancer).[20] In contrast, our data show that as many as 78% of cancer survivors and 83% of those without a cancer diagnosis report being moderately active or active. While seemingly impressive, the inconsistencies found in self-reported physical activity are likely a result of the different measures of physical activity used in these studies. Specifically, the CCHS assessed only recreational physical activity (e.g., walking, running, cycling), whereas participants in the Atlantic PATH cohort were asked to self-report physical activity across several domains, including recreational physical activity, domestic and

gardening activities, work-related physical activity, and transport-related physical activity. Moreover, while the IPAQ is a valid and widely used measure of physical activity, the limitations of self-reported health behaviors are well-established. That is, self-report are subject to recall and social desirability bias and as such have often been shown to over-report desirable health behavior such as physical activity.[21] Of note, Garriguet et al.[22] found that 90% of respondents met minimal physical activity guidelines using the self-report IPAQ questionnaire, while objectively assessed physical activity data revealed that fewer than 30% met guidelines based on accumulated 10-minute bouts of physical activity. These findings are consistent with studies of cancer survivors which have shown a poor agreement between self-reported physical activity objective measures of physical activity.[23.24] When comparing total physical activity using the IPAQ to objectively assess physical activity, Johnson-Kozlow et al.[24] found that the IPAQ overestimated physical activity by 2.5 times as compared to accelerometer data. While these data suggest that the self-reported physical activity levels in the current cohort are likely inflated, our data is consistent with the bulk of the literature that shows that cancer survivors are not as active as those without a history of cancer. Given the often intensive treatment regimes and potential lingering effects of a cancer diagnosis and its associated treatments (e.g., fatigue), this finding is perhaps not surprising. Notwithstanding, cancer survivors are at an increased risk of co-morbid disease and pre-mature mortality and current evidence indicates that physical activity is a safe and effective means of improving a multitude of physical and psychological treatment and disease-related sequelae across the cancer trajectory.[9,10,25,26]

CONCLUSIONS/IMPLICATIONS

Cancer survivors have much to gain by being physically active.

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