



Psychosocial health is associated with objectively assessed sedentary time and light intensity physical activity among lung cancer survivors

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ARTICLE INFO

Article history:

Received 21 November 2017

Received in revised form

2 February 2018

Accepted 4 February 2018

Available online 10 February 2018

Keywords:

Physical activity

Sedentary time

Psychosocial health

Lung cancer

Accelerometer

ABSTRACT

Statement of problem: Lung cancer survivors report among the highest levels of depression and anxiety compared to other tumor groups. To date, no studies have examined associations of accelerometer-assessed activity and sedentary time with psychosocial health outcomes among lung cancer survivors. The objective of this study was to determine associations of accelerometer-assessed light intensity physical activity, moderate-to-vigorous intensity physical activity (MVPA), and sedentary time with psychosocial health among lung cancer survivors.

Method: Lung cancer survivors in Southern Alberta completed a mailed survey that assessed measures of depressive symptoms (PHQ-9; Patient Health Questionnaire-9: range = 0–27), anxiety (State Anxiety Inventory: range = 10–40), satisfaction with life (SWL; Satisfaction With Life Scale: range = 5–35), and posttraumatic growth (PTG; Posttraumatic Growth Inventory: range = 0–105). Participants also wore an Actigraph® GT3X + accelerometer for seven days. Quantile regression was used to examine associations of depression, anxiety, SWL, and PTG with light intensity physical activity, MVPA, and sedentary time.

Results: A total of 127 lung cancer survivors participated for a 24% response rate. Total sedentary time min/day was associated with depressive symptoms at the 50th percentile ($\beta = 0.02$, 95% CI: 0.0–0.03), SWL at the 25th percentile ($\beta = -0.04$, 95% CI: -0.07–0.0) and 50th percentile ($\beta = -0.03$, 95% CI: -0.05 to -0.01). Total light-intensity physical activity mins/day was associated with SWL at the 25th ($\beta = 0.04$, 95% CI: 0.00–0.07) and 50th ($\beta = 0.03$, 95% CI: 0.0–0.05) percentiles, and depressive symptoms at the 50th percentile ($\beta = -0.02$, 95% CI: -0.03–0.00). Total MVPA min/day was not associated with any psychosocial health outcomes.

Conclusions: Sedentary time and light intensity physical activity were significantly associated with some psychosocial health outcomes. Reducing sedentary time and increasing light intensity physical activity may be a more appropriate recommendation for many lung cancer survivors given their older age, poorer functional status, and reduced pulmonary capacity.

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1. Introduction

Lung cancer is the leading cause of cancer death for both men and women in the United States. Five-year survival rates remain

low and survival has not improved significantly despite newer therapies (Wang et al., 2015). Depression and anxiety are common comorbidities among individuals diagnosed with lung cancer. Recent population-based estimates indicating lung cancer survivors report among the highest levels of depression and anxiety compared to other cancer groups (Jensen et al., 2017).

A small body of literature indicates regular and sustained moderate to vigorous physical activity (MVPA) is associated with better patient reported outcomes such as health-related quality of

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life and reduced fatigue among lung cancer survivors (Coups et al., 2009). However these studies have relied on self-reported estimates of physical activity, which may have a substantial impact on observed levels of physical activity given self-reported assessment of activity may be prone to recall error and over-reporting (Ainsworth et al., 2012). Our previous research reported lung cancer survivors spend the majority of their waking hours in sedentary pursuits (D'Silva et al., 2017) [behaviours that are performed in a seated or reclining posture and require very low energy expenditure (≤ 1.5 metabolic equivalents)].

To date, no studies have examined associations of accelerometer-assessed activity and sedentary time with psychosocial health outcomes in this population. The primary objective of this study was to determine the associations of objectively-assessed sedentary time, light intensity physical activity, and MVPA with psychosocial health outcomes including depression symptoms, anxiety symptoms, satisfaction with life, and post traumatic growth among lung cancer survivors.

2. Methods

2.1. Participants

The study was approved by the Health Research Ethics Board of Alberta and the Athabasca University Research Ethics Board. All lung cancer survivors were recruited from the Glans-Look Lung Cancer Database at the University of Calgary. The Glans-Look Database includes comprehensive medical information on all NSCLC patients diagnosed from 1999 to 2014 in Southern Alberta. Eligibility criteria for this study included (a) previous clinical and/or pathological diagnosis of NSCLC confirmed by chart review, (b) not currently receiving any treatment for lung cancer or any other cancer, (c) community dweller (not living in a hospice or long term care), and (d) ability to read and write English.

2.2. Data collection

Eligible survivors were mailed a study invitation package containing a letter describing the study and what will be required of the participant. Individuals who consented to participate were mailed (via express post) a study package including an Actigraph® GT3X + accelerometer (Actigraph, LLC, Pensacola, Florida) and a health survey. At the end of the seven-day monitoring period, participants returned the completed survey and accelerometer in a provided postage paid priority post envelope.

2.3. Measures

Demographic and clinical information such as age, gender, diagnosis date, stage, histology, and treatment received were obtained from the Glans-Look Database. Information not available from the database, including other medical information such as medical comorbidities, sociodemographic and lifestyle factors were collected by self-report. To assess comorbidities, participants were asked if a doctor or nurse has ever told them that they had any of the following (yes or no); angina, heart attack, diabetes, high blood pressure, high blood cholesterol, stroke, or other (participants entered response).

Physical activity and sedentary time estimates were derived from the Actigraph GT3X + accelerometer. Participants were provided with the accelerometer and instructed to wear it on their right hip during all waking hours for seven consecutive days. A pragmatic cutoff of <100 counts/minute was used to categorize sedentary time (Freedson, Melanson, & Sirard, 1998). Commonly accepted activity count cutoffs were used to differentiate MVPA (counts/

minute ≥ 1952) from light-intensity activity (100–1951 counts/minute) (Freedson et al., 1998). Participants were asked to record, in a daily log, the time they put on and took off the monitor each day. These recordings were used to confirm wearing start and end times, as well as non-wear time. To be included in the analysis, at least four valid days of accelerometer wear time was required. A valid day was defined as having at least 600 min (10 h) of wear time and no excessive counts ($>20,000$ counts per minute).

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9) (Kroenke, Spitzer, Williams, & Lowe, 2010). The PHQ-9 scores each of the nine DSM-IV criteria, and item responses range from “0” (not at all) to “3” (nearly every day). Total scores can be categorized as minimal depressive symptoms (1–4), mild depressive symptoms (5–9), moderate depressive symptoms (10–14), moderately severe depressive symptoms (15–19), and severe depressive symptoms (20–27). Higher scores indicate more frequent depressive symptoms.

State anxiety was assessed using Spielberger's State Anxiety Inventory (SAI) (Spielberger, Gorsuch, & Lushene, 1970). The 10-item SAI measures how participants feel at a particular time. The SAI state scale is scored on four levels of anxiety intensity ranging from 1 (not at all) to 4 (very much so). Scores on the SAI range from 10 to 40 with higher anxiety scores indicating greater feelings of anxiety.

Psychological growth was assessed using the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Calhoun, 1996). This 21-item scale assesses positive changes experienced after trauma (i.e., cancer diagnosis). The PTGI yields a total growth score and 5 subscale scores: new possibilities (5 items), relating to others (7 items), personal strength (4 items), spiritual change (2 items), and appreciation of life (3 items). Items were rated on a six-point Likert scale, ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis). Scores on the PTGI range from 0 to 105 with higher PTGI scores indicating more optimal posttraumatic growth.

Satisfaction with life was assessed using Diener's Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). The SWL is a short five-item instrument designed to measure global cognitive judgments of satisfaction with one's life. Participants were asked to indicate their degree of agreement or disagreement on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). Scores on the SWL scale range from 5 to 35 with higher scores indicating greater life satisfaction.

2.4. Statistical analyses

A common limitation in physical activity and health research in the cancer context is the presence of ceiling effects, where possible scores on variables (e.g., psychosocial variables, quality of life, fatigue) are at or near the highest possible score on a test or measure. Stated differently, cancer survivors participating in such research initiatives often already report high quality of life, low fatigue levels, little or no depressive symptoms, and high scores on other psychosocial health variables that are indicative of optimal health and/or functioning. Such ceiling effects may result in artificial nonlinearity or underestimated regression parameters (Wang, Zhang, McArdle, & Salthouse, 2009). Quantile regression allows comparison of non-normally distributed outcomes across MVPA and sedentary time levels, and because the population is not segmented into smaller samples sizes as it is in linear regression, increased power is gained to better detect any differences (Lê Cook et al., 2013). Quantile regression was used to examine associations of depressive symptoms, anxiety, SWL, and PTG with MVPA, light-intensity physical activity, and sedentary time at the 25th, 50th, and 75th percentiles of outcome scores. Quantile regression coefficients are interpreted similarly to those of ordinary linear regression

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