



Original article

Identification and prediction of physical activity trajectories in women treated for breast cancer



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ABSTRACT

Purpose: In this study, we aimed to identify trajectories of physical activity in a cohort of women over a 1-year period after treatment for breast cancer. We also examined factors that could predict trajectory group membership.

Methods: We collected data from 199 women using questionnaires at baseline (mean = 3.46 months after treatment), and 3, 6, 9, and 12 months thereafter.

Results: Based on semiparametric group-based modeling, there were five trajectories: consistently inactive, decreasing levels, inactive with increasing levels, somewhat active, and consistently sufficiently active. Based on logistic regression analysis, women who reported higher levels of depressive symptoms and fatigue were less likely to remain consistently sufficiently active, and women who reported higher levels of cancer worry were more likely to remain consistently sufficiently active. Age, stage of cancer, time since treatment, number of treatment types received, and number of physical symptoms did not predict trajectory group membership.

Conclusions: Women do not have uniform physical activity trajectories after treatment for breast cancer. Identification subgroups of women who do not remain consistently sufficiently active, and factors that predict these trajectories, can aid in the development of targeted behavior change interventions.

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Introduction

An estimated 88% of women diagnosed with breast cancer are expected to live at least 5 years after being diagnosed [1]. Many will experience physical, psychological, and social challenges [2–4]. Complementary therapies should therefore be part of integrative health care programs to help women minimize the sequelae caused by cancer and the series of associated treatments. Considerable evidence supports the effectiveness of promoting physical activity (PA) as a complementary therapy after treatment for cancer. Based on recent reviews of the literature [5–10], PA can reduce clinical symptoms, improve quality of life, and decrease cancer-related morbidity and mortality risk. Moreover, a recent Cochrane Review revealed that PA at moderate-to-vigorous intensity provides greater health benefits than low-intensity PA [7]. Unfortunately, many women tend to settle into a physically inactive lifestyle after being treated for breast cancer

[11,12]. To develop and implement interventions that are effective in increasing PA, the natural patterns of PA and related personal and cancer-related characteristics associated with various patterns need to be identified. Such an understanding would allow for the detection of high-risk subgroups for targeted interventions.

Based on the teachable moment hypothesis, which suggests that cancer can serve to motivate people to adopt health-promoting behaviors [4], women may engage in PA after treatment for breast cancer. However, there is consensus that PA levels are low after treatment [11–16]. Bellizzi et al. [11] reported that more than 71% of women were not following PA recommendations, defined as accumulating at least 30 minutes of moderate activity at least 5 d/wk or 20 minutes of vigorous PA at least 3 d/wk. Similarly, Blanchard et al. [12] showed that nearly 63% of women were not following PA guidelines, defined as accumulating at least 150 minutes of moderate-to-vigorous physical activity (MVPA) or 60 minutes of vigorous PA per week. Reporting on objectively determined PA collected in the National Health and Nutrition Examination Survey 2003–2004 and 2005–2006 data, Lynch et al. [16] demonstrated that survivors spent less than 4 min/d engaged in MVPA. Although these evidence-based findings suggest that few women are active enough to obtain health benefits after treatment for breast cancer,

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studies examining PA in this population are based predominantly on cross-sectional data that can only provide a snapshot of PA behavior. Consequently, the extent to which women's PA levels change during the first few months after treatment has ended is not well understood. This reentry phase is particularly important to study because "posttreatment care is less well developed than care during the early phases of diagnosis and treatment" [17]. Characterizing women's MVPA levels during this phase can help researchers and health professionals know when interventions may have greater effects.

To date, only a few longitudinal studies have been conducted, and different patterns of PA have been reported [15,18–24]. The focus in these studies has generally been on understanding the average pattern of change in PA over time (i.e., identifying a uniform trajectory of change across all women), rather than on identifying different patterns of change that might be present within a cohort of women. Consequently, the potential heterogeneity of change in women's PA levels over time remains unexplored. The use of analytical techniques such as growth mixture modeling can help advance the understanding of the natural patterns of PA in women recently treated for breast cancer. Such techniques, which consider that multiple patterns of change might be present within a single sample, have advantages for the development and delivery of interventions during the reentry phase. Specifically, the identification of women who either remain inactive or become inactive during this phase of survivorship could be classified as a high-risk group for negative health consequences and thus would be particularly important targets for interventions.

Therefore, our main objective in this study was to identify distinct trajectories of leisure time PA in a cohort of women who reported PA levels five times over a 1-year period after primary treatment for breast cancer. MVPA was the focus in the present study because of recommendations for PA which focus on MVPA [25], and results showing that higher intensity PA has more important health outcomes than lighter intensity PA [7]. We hypothesized that at least three MVPA trajectories would be identified: one that shows stable levels, one that shows declining levels, and one that shows increasing levels. In addition, we aimed to identify personal and cancer-related characteristics that could predict MVPA patterns over time. Based on previous research [18–21,26], we examined if age, stage of cancer, time since treatment, and treatments received predicted women's trajectory group membership. Finally, given that fatigue, physical symptoms, cancer worry, and depressive symptoms are frequent problems related to breast cancer and its treatment that can interfere with women's ability to function in their roles and activities [17,27,28], we examined if these factors could also predict women's trajectory group membership.

Materials and methods

Participants and procedures

We recruited women diagnosed and treated for breast cancer through oncologist referrals and print advertisements at local medical clinics and hospitals in Montreal, QC to participate in a prospective study focused on the investigation of natural developmental changes in lifestyle behaviors. Women interested in the study contacted the research team via telephone to obtain additional details about the study and were then screened for eligibility on the basis of the following inclusion criteria: (1) an age of 18 years or older, (2) able to read, write, and understand English or French, (3) diagnosed with stage I to III breast cancer, and (4) had received and completed chemotherapy and/or radiation therapy within the previous 20 weeks. Women were excluded if they had (1) self-reported health concerns that prevented participation in PA, (2) metastatic disease, and/or (3) more than one cancer diagnosis.

Our sample included 199 women who provided data at baseline (Time 1) via questionnaires. Follow-up data collection occurred at 3 (Time 2), 6 (Time 3), 9 (Time 4), and 12 (Time 5) months thereafter via questionnaires. The retention rate was 89% ($n = 177$). We credit our high rate to our extensive retention strategies, including sending (1) holiday and birthday cards, (2) newsletters with quotes from participants, data findings, and summaries of recently published relevant articles, and (3) bookmarks with our contacts and self-addressed cards to inform us of contact detail changes. Financial compensation to women for their time, as well as mailing study materials to their homes to reduce participant burden, may have also resulted in high retention. We obtained ethics approval from appropriate University and Hospital Ethics Committees before recruitment, and informed consent from women before data collection. All procedures were in accord with ethical standards outlined in the Declaration of Helsinki of 1975, as revised in 2000.

Measures

Physical activity

PA was assessed at each time point using the Leisure Time Exercise Questionnaire [29]. Similar to previous research (e.g., a study by Courneya et al. [30]), we modified the Leisure Time Exercise Questionnaire instructions to assess the average duration of PA and frequency in an average week. Participants reported the amount of light, moderate, and vigorous PA during their leisure time in a typical week. As mentioned earlier, we focused on total weekly minutes of MVPA in this study given current guidelines [25], and evidence that MVPA provides greater health benefits than low-intensity PA [7]. We computed total weekly minutes of MVPA by multiplying the respective frequency and duration scores for moderate and vigorous activity, and then adding the resulting scores.

Predictors

At Time 1, we collected information on participants' current age, stage of cancer at diagnosis (I, II, and III), treatment exposure (lumpectomy [no/yes], single and/or double mastectomy [no/yes], chemotherapy [no/yes], radiation [no/yes], hormonal therapy [no/yes]), and dates of diagnosis and treatment completion using a self-report questionnaire. For our analyses, we calculated the total number of treatment types women received for cancer based on the specified treatment types reported (i.e., surgery, chemotherapy, radiation, and hormonal therapy).

Depressive symptoms, fatigue, and cancer worry were assessed using the 10-item Center for Epidemiological Studies Depression [31], five-item fatigue subscale of the Profile of Mood States [32], and the six-item Assessment of Cancer Concerns scale [33], respectively. For each measure, a mean score was calculated. Physical symptoms were assessed by asking participants to report if they had experienced 12 symptoms during the day for three nonconsecutive days during the past week (no/yes). The symptoms were selected from the Patient Health Questionnaire-15 [34] and included: (1) stomach pain, (2) back pain, (3) pain in the arms, legs, or joints, (4) headaches, (5) chest pain, (6) dizziness, (7) fainting spells, (8) feeling heart pound or race, (9) shortness of breath, (10) constipation, loose bowels, or diarrhea, (11) nausea, gas, or indigestion, and (12) pain or problems during sexual intercourse. The number of physical symptoms was averaged across the 3 days.

Additional data on ethnicity, education attainment, past year household income, marital status, menopausal status, height, and weight were self-reported at Time 1 to describe the sample.

Data analysis

After descriptive analyses, main analyses proceeded in two phases. In the first phase, semiparametric group-based modeling

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