Short Communication

Motivation for physical activity and the moderating effect of cancer diagnosis: A nationally representative cross-sectional study

M.C. Robertson[a,b], Y. Liao[a], J. Song[a], E.J. Lyons[c], K.M. Basen-Engquist[a,*]

[a] Center for Energy Balance, Department of Behavioral Science, MD Anderson Cancer Center, Cancer Prevention Building, Unit 1330, 1155 Pressler St, Houston, TX 77030, United States of America
[b] Health Promotion & Behavioral Sciences, University of Texas School of Public Health, 1200 Pressler Street, Houston, TX 77030, United States of America
[c] Department of Nutrition and Metabolism, School of Health Professions, University of Texas Medical Branch at Galveston, 301 University Boulevard, Galveston, TX 77555-1124, United States of America

A B S T R A C T

The aim of this study was to investigate associations between types of motivation for physical activity and self-reported weekly aerobic moderate-to-vigorous physical activity (MVPA) in the 2012 and 2014 waves of the nationally representative Health Information National Trends Survey 4 ($n = 7307$). We further explored differential associations between MVPA and types of motivation for physical activity by cancer survivor status.

We found that those who were more motivated by "*getting enjoyment from exercise*" reported 26.4% more MVPA ($+49.8$ min/week) than those who were less motivated by this factor, adjusting for covariates ($p = 0.025$). Conversely, those who were more motivated by "*concern over the way you look*" reported 22.1% less MVPA (-55.5 min/week) than those who were less motivated by this factor, adjusting for covariates ($p = 0.002$). We found no evidence for a relationship between motivation from either "*pressure from others*" or "*feeling guilty when you skip exercising*" and MVPA. We identified a significant interaction for "*feeling guilty when you skip exercising*" and cancer survivor status, adjusting for covariates ($p = 0.034$). Cancer survivors who reported being more motivated by "*feeling guilty when you skip exercising*" reported 36.2% less MVPA (-71.75 min/week) than those who were less motivated by this factor; there was no statistically reliable difference in those without a history of cancer.

Findings are concordant with previous literature highlighting the primacy of enjoyment for physical activity adherence. There is a need for further inquiry into guilt-related motivation for physical activity among cancer survivors, as it may have a unique, negative impact in this population.

1. Introduction

Physical activity has been linked to primary prevention benefits for numerous types of cancer and can confer a host of tertiary prevention benefits for cancer survivors (Lee, 2003). Despite the health benefits physical activity levels both in the general population (Troiano et al., 2008) and among cancer survivors (Ottenbacher et al., 2015) are sub-optimal (Physical Activity Guidelines Advisory Committee, 2008; Schmitz et al., 2010). A growing literature, arising from Self-Determination Theory (SDT), (Ryan and Deci, 2000) has begun to appreciate the influence of *quality of motivation* in shaping physical activity patterns. At the most basic level, SDT classifies motivations as either *intrinsic* (i.e., behavior is inherently enjoyable) or *extrinsic* (i.e., behavior is a means to an end). *Extrinsic* motivations are further divided into

discrete categories along an underlying continuum reflecting the degree to which the source of the motivation is *external* (e.g., rewards/punishment) vs. *internal* (e.g., valuing its outcomes). Compelling evidence supports the utility of understanding one's motivation for increasing physical activity, (Teixeira et al., 2012) but cancer survivors face challenges to physical activity that may influence the dynamic between motivation and physical activity (Pinto and Ciccolo, 2011; Blaney et al., 2013). There is a need to evaluate whether different types of motivation influence physical activity patterns in cancer survivors distinctly.

The aim of the present study was to investigate how various types of motivation for physical activity are associated with physical activity levels in nationally representative data, and to test whether these relationships are moderated by cancer survivor status. An exploratory aim was to similarly investigate effect modification by three other prevalent

chronic conditions: arthritis, diabetes, and hypertension. We hypothesized that *intrinsic* motivation would be positively associated with physical activity levels in the general U.S. population, and that this relationship would be especially pronounced in cancer survivors.

2. Methods

2.1. Study design and population

The Health Information National Trends Survey (HINTS) 4 was a series of nationally representative cross-sectional surveys administered by the National Cancer Institute (NCI) to provide insight on cancer risk-related variables in non-institutionalized U.S. residents (U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, 2012; U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, 2014). Taking into account HINTS 4's complex, weighted survey design, we combined: HINTS 4 Cycle 2 (conducted October 2012–January 2013; response rate 40.0%; sample size 3630), and HINTS 4 Cycle 4 (conducted August 2014–November 2014; response rate 34.4%; sample size 3677).

2.2. Measures

2.2.1. Physical activity

We obtained participants' self-reported typical weekly minutes of aerobic moderate-to-vigorous physical activity (MVPA) by multiplying (1) weekly frequency of MVPA with (2) typical time spent in MVPA. The first item asked, "*In a typical week, how many days do you do any physical activity or exercise of at least moderate intensity, such as brisk walking, bicycling at a regular pace, and swimming at a regular pace?*" The second asked, "*On the days that you do any physical activity or exercise of at least moderate intensity, how long do you typically do these activities?*" The latter was free response; to handle illogical responses on this item (e.g., > 24 h of MVPA daily) we truncated the hours of MVPA per day at 16 h, as is recommended for a similar measure (IPAQ Research Committee, 2005). We modeled MVPA as count data, using standard cut points to interpret outcomes.

2.2.2. Motivations for physical activity

Four types of motivation for physical activity were captured by four Likert-type items. These items were introduced with the text, "*People start or continue exercising regularly for lots of reasons. How much do each of the following reflect why you would start or continue exercising regularly?*" The four motivation types were "*pressure from others*" (which may be understood in SDT terms to reflect an extrinsic motivation from an external source), "*concern over the way you look*" (extrinsic motivation, somewhat external source), "*feeling guilty when you skip exercising*" (extrinsic motivation, somewhat external source), and "*getting enjoyment from exercise*" (intrinsic motivation).(Ryan and Deci, 2000) Respondents indicated whether each motivation type influenced them: "Not at all", "A little", "Some", and "A lot". Since these response choices represent ordinal level data (i.e., not equal spacing between responses), and for clarity of interpretation, we dichotomized responses into *less motivation* ("Not at all" or "A little") and *more motivation* ("Some" or "A lot"). To investigate how this decision may have influenced the results, we repeated all analyses using orthogonal polynomials to model the ordinal-level predictor variables (thus modeling answer choices as if there was equal spacing between responses). These results evidenced concordant trends, and are not presented here.

2.2.3. Non-communicable disease status

Cancer survivor status was measured as a dichotomous variable that asked, "*Have you ever been diagnosed as having cancer?*" Similar items were used to ascertain participant's "*diabetes or high blood sugar*", "*high blood pressure or hypertension*", and "*arthritis or rheumatism*" statuses.

2.3. Statistical methods

We combined the two HINTS waves, arraying survey and replicate weights as recommended by NCI (Moser et al., 2013). Only *income range* had > 10% missing data. We replaced this variable with a singly imputed variable provided by NCI and used casewise deletion to handle other missing data. We conducted Wald's design-based chi-square tests of independence to test for differences by cancer survivor status, and quasi-Poisson regression models to investigate our research questions. This approach allowed us to model our outcome variable (MVPA minutes) as count data in a way that is robust to model misspecification and overdispersion. This procedure is comparable to a negative binomial approach, but can more readily handle the HINTS 4's complex, weighted survey design (Ver Hoef and Boveng, 2007). We investigated the associations between MVPA and the four types of motivation for physical activity, adjusting for potentially confounding variables. We further evaluated each model by adding an interaction term for the motivator and cancer survivor status. Finally, using the whole sample, we similarly explored effect modification in separate models by arthritis/rheumatism, diabetes/high blood sugar, and hypertension/high blood pressure statuses. All models adjusted for self-reported age, gender, race (white, non-white), ethnicity (Hispanic, non-Hispanic), combined annual income (< \$50,000, ≥ \$50,000), health status (poor, fair, good, very good, excellent), and HINTS survey wave. Additionally, we adjusted for each of the other prevalent non-communicable diseases of interest. We conducted all analyses in R version 3.3.2 using the *survey*, *psych*, *gmodels*, and *effects* packages (R Core Team, 2017).

3. Results

3.1. Participant characteristics

Wald design-based chi-square tests of independence indicated that cancer survivors were significantly older and less physically active than those without a history of cancer (Table 1). A higher proportion of cancer survivors were married, non-Hispanic white, insured, in poorer health, and retired. Health status, arthritis/rheumatism status, diabetes/high blood sugar status, hypertension/high blood pressure status were only weakly correlated (range: −0.29 to 0.34). We observed no statistically significant differences for education level or body mass index. Weighted percentages indicated that 16.8%, 59.8%, 42.2%, and 59.0% cited *more motivation* to start or continue exercising regularly due to "*pressure from others*", "*concern over the way you look*", "*feeling guilty when you skip exercising*", and "*getting enjoyment from exercise*", respectively. There were no statistically significant differences in these proportions by cancer survivor status.

3.2. Motivations for physical activity and physical activity levels

Generalized linear regression models indicated that those who were more motivated by "*getting enjoyment from exercise*" reported 26.4% more MVPA (+49.8 min/week; $n = 5555$, $B = 0.23$, $t(78) = 2.28$, $p = 0.025$) than those who were less motivated by this factor, adjusting for potentially confounding variables. Conversely, those who were more motivated by "*concern over the way you look*" reported 22.1% less MVPA (−55.5 min/week, $n = 5525$, $B = −0.25$, $t(78) = −3.22$, $p = 0.002$) than those who were less motivated by this factor, adjusting for potentially confounding variables.

3.3. Effect modification by cancer survivor status

Results differed for cancer survivors for one type of motivation: the relationship between "*feeling guilty when you skip exercising*" and MVPA (Fig. 1; $n = 5468$, $B = −0.38$, $t(76) = −2.16$, $p = 0.034$). Cancer survivors who reported being more motivated by "*feeling guilty when you skip exercising*" reported 36.2% less MVPA (−71.75 min/week) than