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Symptoms of depression are longitudinally associated with sedentary behaviors among young men but not among young women

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ABSTRACT

Objective. A habitual sedentary lifestyle is associated with adverse health outcomes; however, the predictors of sedentary behaviors have not been sufficiently explored to inform the development and delivery of effective interventions to reduce sedentary behaviors. This study examined whether reports of symptoms of depression could predict weekly time spent in sedentary behaviors (i.e., television watching, computer use) 4 years later.

Method. Self-reported symptoms of depression were assessed at age 20 years (2007–08), and television watching time and computer use were assessed at age 24 years (2011–12) in 761 adults (45% men) participating in the Nicotine Dependence in Teens study. Data were analyzed using linear regression analysis, with separate models for men and women.

Results. After controlling for past sedentary behavior, symptoms of depression at age 20 years predicted more computer use 4 years later in men ($R^2 = .21, \beta = .13, p < .05$), but not in women. Symptoms of depression did not predict television watching.

Conclusions. Results highlight the need to distinguish between types of sedentary behaviors as their predictors may differ. Further, they provide support for the hypothesis that psychological factors, in this case symptoms of depression, may relate to select sedentary behaviors in young men.

Introduction

Sedentary behavior is defined as any activity that requires very little or no energy expenditure (i.e., ≤1.5 metabolic equivalents), *and* that is done sitting or lying down while awake (Sedentary Behaviour Research Network, 2012). Common sedentary behaviors include television watching and computer use which are often labeled as screen-time behaviors (Sedentary Behaviour Research Network, 2012). Independent of moderate-to-vigorous physical activity (MVPA) levels, sedentary behaviors are associated with numerous adverse health outcomes such as an increased risk of type 2 diabetes mellitus, hypertension, hypercholesterolemia, cardiovascular disease, osteoarthritis, and certain types of cancer (Ford and Caspersen, 2012; Rhodes et al., 2012; Thorp et al., 2011; Tremblay et al., 2010).

Worldwide, adults spend a considerable percentage of their time engaged in sedentary behaviors (Bauman et al., 2011). Based on self-report measures, Chau et al. (2012) reported that adults spent 90% of their time sedentary—53% of which was spent in screen-time behaviors. Direct monitoring of activity levels using accelerometers supports these findings and indicates that men spend 68% (9.6 h) of their day being sedentary, and women spend 69% (9.8 h) of their day being sedentary (Colley et al., 2011). In light of these data, reducing sedentary behaviors in young adults has become a critical public health priority. Thus, identifying relevant determinants of sedentary behaviors to help inform the development and delivery of interventions to reduce sedentary behavior is an important research endeavor (Owen et al., 2010).

Symptoms of depression, a leading cause of disability that affects over 340 million people worldwide (Greden, 2001), may relate to increased time spent in leisure sedentary behaviors in young adults. The somatic symptoms of depression typically include reduced energy as a result of changes in appetite, sleep patterns, and poor sleep quality (American Psychiatric Association, 2010), such that symptomatic

Abbreviations: β, beta coefficient; CIs, confidence intervals; *M*, mean; MDI, Major Depression Inventory; MVPA, moderate-to-vigorous physical activity; NDIT, Nicotine Dependence in Teens; R^2, explained variance; *SD*, standard deviation.

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people may choose to undertake activities that require little or no energy expenditure. Also, the social withdrawal and isolation symptoms common to depression (Bell-Dolan et al., 1993) may lead people to choose activities that can be done alone. Last, according to Zillmann and Bryant's (1985) mood management theory, people may turn to the television and/or computer to avoid thoughts that produce dysphoric moods.

While the association between symptoms of depression and physical activity has been investigated in numerous publications (Dunn et al., 2001; Lawlor and Hopker, 2001; Rothon et al., 2010; Strawbridge et al., 2002; Teychenne et al., 2008a; Teychenne et al., 2008b), the association between symptoms of depression and sedentary behavior has received much less attention. Nevertheless, there is emerging evidence for a positive association between symptoms of depression and sedentary behavior based on Teychenne et al.'s (2010) recent review of five cross-sectional and two longitudinal observational studies published on this topic. Furthermore, de Wit et al. (2011) reported that depression was related to greater computer use in a cross-sectional study among adults. In another cross-sectional study, Vallance et al. (2011) showed that the odds of experiencing symptoms of depression were double for adults who were the most sedentary compared to those who were the least sedentary. However, most studies prior to this review used a cross-sectional design limiting the credibility of causal inference and investigation of directionality.

To address this gap in the literature, some researchers report, using longitudinal study designs, that select sedentary behaviors are associated with an increased risk of adverse mental health outcomes. Sanchez-Villegas et al. (2008) found that screen-time behavior (i.e., a combined score of television watching and computer use) was associated with a higher risk of depression at follow-up in university graduates (mean age at baseline = 42 years). Thomée et al. (2012) found a positive association between aspects of computer use and symptoms of depression at 1-year follow-up in a population-based sample of young adults 18–25 years of age. Their data suggested that using the computer at night, and losing sleep as a result of this activity, relates to adverse mental health outcomes, including depression. Finally, Lucas et al. (2011) showed that television watching was associated with higher risk of depression 10 years later in older women.

There are two main gaps in the literature on the longitudinal associations between symptoms of depression and sedentary behaviors. First, there are important methodological limitations in the measurement of sedentary behavior. Without assessment of different types of common sedentary behaviors, specific hypotheses about the effects of depression on particular behaviors cannot be advanced. Second, with the exception of Thomée et al.'s (2012) study, longitudinal studies examining this association in young adults are lacking. More research targeting young adults is needed because sedentary behavior increases as adolescents transition into young adulthood (Gordon-Larsen et al., 2004), and because symptoms of depression are most frequent in persons 15 to 25 years of age (Patten et al., 2006).

The present study aims to add to this emergent literature by using a prospective study design to investigate the longitudinal associations between symptoms of depression and screen-time sedentary behaviors in young adults. It was hypothesized that frequent symptoms of depression predict more engagement in television watching and computer use.

Methods

Participants

This investigation used data collected as part of the Nicotine Dependence in Teens (NDIT) study. Details of the NDIT study, which is an ongoing prospective cohort study that investigates the natural course of early cigarette use and nicotine dependence in novice smokers, have been previously published (O'Loughlin et al., 2009). Briefly, 22 waves of data have been collected between 1999 and 2012. The initial sample included 1293 students (52% girls) 12–13 years of age from all grade 7 classes in 10 secondary schools in Montreal, Quebec that vary in socioeconomic status, geographic location (urban, suburban, rural), and language (English, French). Data for the current study were collected in two self-report mailed questionnaires completed post-secondary school, when participants were age 20 and 24 years on average [i.e., data collection waves 21 (2007–08) and 22 (2011–12)]. Participants who completed both follow-up surveys were included in the analyses. The NDIT study was approved by the Montreal Department of Public Health, McGill University, and the Research Hospital Center of the Université de Montréal (CRCHUM) ethics review boards, and informed consent/assent was obtained for all participants.

Measures

Symptoms of depression

The Major Depression Inventory (MDI; Bech et al., 1997) was used to assess symptoms of depression at survey cycle 21. Participants reported the frequency with which they experienced 10 symptoms of depression in the past 14 days using a 6-point response scale ranging from 0 ("*at no time*") to 6 ("*all the time*"). Participants' responses were summed to create a continuous score ranging from 0 to 50, with higher scores reflecting more frequent symptoms. For items 8 and 10, each of which had two sub-items (a and b), only the highest of the two scores was used. The validity and reliability of the MDI scores have been established (Bech et al., 2001; Olsen et al., 2003).

Sedentary behaviors

In survey cycles 21 and 22, hours of television watching were obtained by asking participants two open-ended questions: (1) How many hours do you watch television or video movies on a "usual" weekday? and (2) How many hours do you watch television or video movies on a "usual" weekend day? Participants' responses were multiplied by 5 and 2, respectively, and then summed to obtain a score for usual number of hours of television watching per week. Similarly, hours of leisure time computer use at both time points were obtained by asking participants two questions: (1) How many hours do you spend playing computer games or using the Internet during your leisure time on a "usual" weekday? and (2) How many hours do you spend playing computer games or using the Internet during your leisure time on a "usual" weekend day? The usual number of hours of computer use per week was calculated by summing weekday responses multiplied by 5 and weekend day responses multiplied by 2.

Sociodemographic characteristics

Information on participants' sociodemographic characteristics were collected (i.e., age, sex, race, marital status, household income, work status, educational status), as well as parents' educational attainment.

Data analysis

All analyses were conducted using IBM SPSS version 20. Descriptive statistics [i.e., frequencies, means, standard deviations (*SDs*)] were calculated for all study variables. Variables correlated with both the exposure and outcome variables in a correlation matrix of all variables (i.e., exposure, outcome and all potential confounding variables) were identified as possible confounders, and were therefore entered in the first step of both of the adjusted regression models followed by the MDI scores in the second step. Unadjusted and adjusted linear regression analysis was used to examine if symptoms of depression at age 20 years predicted engagement in sedentary behaviors at age 24 years. Separate models were tested for television watching and computer use. Statistical significance was set at $p < .05$, and the precision of the estimates is reflected by the 95% confidence intervals (CIs) reported.

A 'symptoms of depression × sex' interaction term was tested in early modeling (not reported herein) since researchers suggest that men and women may have different ways of dealing with depression (Thayer et al., 1994), and because there is evidence of sex differences in the associations between symptoms of depression, television watching, and computer/Internet use (Dittmar, 1994; Morgan and Cotten, 2003; Potts and Sanchez, 1994). The 'symptoms of depression × sex' interaction on computer use was statistically significant ($p_{computer} < .01$; $p_{television} > .05$). Accordingly, all analyses were stratified by sex.

Results

The current analyses included 761 participants (45.2% men) who provided complete data on the exposure and outcome variables. The