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Distinct associations of different sedentary behaviors with health-related attributes among older adults

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ABSTRACT

Objective. Leisure-time sedentary behaviors (LTSBs) have been associated adversely with health outcomes. However, limited research has focused on different categories of LTSB. We aimed at identifying categories of LTSBs and examining their separate associations with indices of health among Japanese older adults.

Methods. A postal survey collected data on self-reported health, psychological distress, body mass index, moderate-to-vigorous physical activity (MVPA), LTSBs (five behaviors) and socio-demographic characteristics from 1,580 Japanese older adults (67% response rate; 65–74 years) in 2010. Exploratory factor analysis was used to classify LTSBs. Odds ratios (ORs) were calculated for associations of LTSB categories with self-reported health, psychological distress, overweight, and lower MVPA. Data were analyzed in 2013.

Results. Two categories of LTSB: passive sedentary time (consisting of TV time, listening or talking while sitting, and sitting around) and mentally-active sedentary time (consisting of computer-use and reading books or newspapers) were identified. Higher passive sedentary time was associated with a higher odds of being overweight (OR: 1.39, [95% CI: 1.08–1.80]), and lower MVPA (1.26, [1.02–1.54]). Higher mentally-active sedentary time was associated with lower odds of lower MVPA (0.70, [0.57–0.86]).

Conclusions. Two types of sedentary time—passive and mentally-active—may play different roles in older adults' well-being.

Introduction

Sedentary behaviors, which are distinct from lack of moderate-to-vigorous physical activity (MVPA), are associated with increased cardio-metabolic risk (Owen et al., 2010). Studies have shown relationships between higher sitting time and indices of poorer health in general adult samples (Hamilton et al., 2007). Furthermore this relationship has been observed among older adult samples (Gardiner et al., 2011; Inoue et al., 2012). Decreasing sedentary behavior, in addition to increasing physical activity, is now considered an important strategy to reduce health risk (Hamilton et al., 2008; Owen et al., 2011).

In assessing sedentary behaviors, many studies have used measures of television viewing (TV) and other screen time. TV viewing is a predominant sedentary behavior during leisure time (Sugiyama et al., 2008) and higher TV time has been consistently associated with cardiovascular disease (CVD) (Jakes et al., 2003), atherosclerosis (Kronenberg et al., 2000), the metabolic syndrome (Chang et al., 2008; Dunstan et al., 2005), and poor mental health (Hamer et al., 2010). Screen time can include watching TV, computer use, or video game playing. Higher screen time also shows significant associations with all-cause mortality (Ford, 2012), CVD events (Stamatakis et al., 2011; Warren et al., 2010), and obesity (Vandelanotte et al., 2009).

However, recent studies found that specific sedentary behaviors can be differently associated with MVPA and with indices of poorer health. A systematic review has shown that the associations of MVPA with

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sedentary time differ between TV viewing and computer use (Rhodes et al., 2012). In a study of 3,305 Singaporean adults, higher risk of cardio-metabolic diseases was associated with higher TV time, but not with computer-use and reading time (Nang et al., 2013). In a longitudinal study of 2,597 French older adults, increases in time spent using computers were associated with better cognitive performance (Kesse-Guyot et al., 2012). These findings suggest that all sedentary behaviors may not be similarly associated with health risk. Yet, limited research has examined how sedentary behaviors may be categorized into groups, and how categories of sedentary behaviors might be associated with MVPA or aspects of health and well-being. Understanding how different types of sedentary behaviors are related to health is particularly relevant to older adults, who tend to spend longer time sitting and who have greater availability of leisure time after retirement (Clark et al., 2010).

The aim was to identify categories of leisure time sedentary behaviors (LTSBs), and to examine their separate associations with indices of health and well-being among community-dwelling Japanese older adults.

Methods

Participants and data collection

Detailed sampling procedures were described in elsewhere (Inoue et al., 2012). Briefly, this population-based, cross-sectional study was conducted in three Japanese municipalities; Bunkyo Ward in Tokyo, Fuchu City in Tokyo, and Oyama Town in Shizuoka Prefecture. Older adults aged between 65 and 74 years old were randomly selected from the registry of residential addresses of each municipality, which were stratified by gender and age (65–69 years and 70–74 years).

In total, 2,700 community-living older adults were identified. Of those initially identified, 2,046 returned the survey. After data cleaning, the data from 1,701 participants were deemed valid for this study (response rate: 67.3%). Among these respondents, 121 participants who had difficulty performing daily activities assessed by the Japanese 8-item Short-Form Health Survey (SF-8) (Tokuda et al., 2009) were excluded from the present analyses. The final sample size was 1,580. All data were collected from February to March 2010.

This study received prior approval from the Tokyo Medical University Ethics Committee.

Measures

Indices of health and well-being

Body mass index (BMI) was derived from self-reported weight and height. Participants were categorized into normal weight (less than 25 kg.m-2) and overweight (25 kg.m-2 or more). Psychological distress was measured using the K6 scale (Kessler et al., 2003). The K6 scale consists of six items, including an item such as “During past 30 days, how often did you feel nervous?” Its response format ranges from 0 (none of the time) to 4 (all of the time), with the total score ranging from 0 to 24. The K6 has been translated into Japanese, and its internal consistency (Cronbach's alpha: 0.849) (Furukawa et al., 2008) and validity (100% sensitivity and 69.3% specificity for screening mood and anxiety disorder) have been reported (Furukawa et al., 2008). Participants were categorized into lower (<9) and higher (≥9) psychological distress by using the recommended cut-off point (Katsuki et al., 2011; Kawakami et al., 2002). Self-reported health was assessed using an item from the SF-8 (Tokuda et al., 2009): “Overall, how would you rate your health during the past 4 weeks?” Participants responded to the statement using a 6-point scale consisting of “excellent”, “very good”, “good”, “fair”, “poor”, and “very poor”. Participants were categorized into “good” [excellent, very good, or good] and “poor” [fair, poor, or very poor] health status. For MVPA, the Japanese version of the International Physical Activity Questionnaire Short-version was used (Murase et al., 2002). Participants were asked to report the frequency and duration of three types of physical activity: vigorous-intensity, moderate-intensity (excluding walking), and walking. Total time spent in MVPA including walking was calculated by adding these three activities together. MVPA was dichotomized at the median into lower (≤350 min/week) and higher (>350 min/week). This classification was used because a large proportion of participants (about 75%) reported 150 min/week or more of MVPA, the current recommendation for older adults (Nelson et al., 2007).

Leisure-time sedentary behaviors

Leisure time sedentary behaviors (LTSBs) were determined from participants' self-reported frequency and average duration (minutes/day) over the past 7 days. Participants were asked about five types of LTSBs—television viewing, computer use, reading books or newspapers, listening or talking while sitting, and sitting around. These question items were translated into Japanese from an Australian questionnaire on LTSBs (Salmon et al., 2003). The questionnaire is known to have good test–retest reliability (ICC = 0.56–0.82) and acceptable validity (correlation with a three-day log: r = 0.2–0.4) (Salmon et al., 2003).

Covariates

Age and gender were obtained from the registry of residential addresses of each municipality. Educational attainment (years of education), employment status (working hours per week), and living arrangement (living with others, living alone) were obtained through self-report by each respondent. Participants were categorized according to education (up to high school [<13 years], college degree or more [≥13 years]) and working hours (none or part-time work [<35 hours/week], full-time work [≥35 hours/week]).

Statistical analysis

Exploratory factor analysis was used to classify these five LTSBs. A non-orthogonal rotation method was employed as extracted factors may be correlated to each other. The number of factors was decided based on Kaiser's Eigenvalue (>1), scree plot, and the ease of interpretation. For each LTSB category, total sedentary time was calculated and dichotomized using median, as its distribution was expected to be skewed.

Multivariate logistic regressions were employed to calculate the odds ratios (ORs) and 95% confidence intervals (95% CI) of lower MVPA for each category of LTSBs, adjusting for gender, age, municipality, living arrangement, education, and employment status. Additional analysis using a cut-off value of 150 min.wk-1 for MVPA was conducted.

Then, multivariate logistic regressions were employed to calculate ORs for indices of poorer health, i.e. overweight, higher psychological distress and lower self-reported health. The ORs of being poorer in health status for higher sedentary time in each LTSB category were calculated, adjusting for gender, age, municipality, living arrangement, education, and employment status (Model 1), then further adjusting for MVPA (model 2).

For sensitivity analysis, logistic regression analyses were repeated after changing the cut-off value between both categories of LTSB. i.e., analyses were performed with different thresholds of passive sedentary time (3 hours/day instead of 1 hour/day) and mentally-active sedentary time (1 hour/day instead of 3 hours/day).

Before the multiple logistic regression analyses, we calculated Hosmer–Lemeshow's goodness of fit test, of which the null hypothesis is that the distribution fits the data. All statistical analyses were performed in 2013 by using STATA software (version 12); the level of significance was set at $p < 0.05$.

Results

Table 1 shows the characteristics of participants. The sample consisted of 52% men, and the mean age of participants was 69.5 years. About the same number of participants from each of the three municipalities participated in the study.

Factor analysis extracted two factors of LTSBs: one consisting of TV (factor loading: 0.45), sitting around (0.38), and listening or talking while sitting (0.30); and, the other consisting of computer use (0.37) and reading books or newspapers (0.31). The former was interpreted as “passive sedentary behavior” and the latter “mentally-active sedentary behavior”. The two-factor solution explained 88% of the total variance. Correlation between the two factors was 0.60.

Table 2 shows the summary statistics for the categories of LTSBs. On average, participants reported 3.62 hours/day of passive and 1.25 hours/day of mentally-active sedentary behaviors. Television viewing time accounted for 70% of the total passive sedentary time,