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Activity engagement and physical function in old age sample

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ABSTRACT

Objectives: To describe the patterns of engagement in mental, physical, and social activity (MA, PA, and SA) and to examine the relationship between combined activity engagement and physical function among community-dwelling older adults.
Design: Cross-sectional correlational study.
Setting: Multiple communities.
Participants: A total of 466 individuals aged 55 years or older.
Measurements: Physical function was assessed using grip strength and gait speed. Engagement in PA, MA and SA was obtained from self-report questionnaires.
Results: We identified four classes ("Active PA and MA", "Active MA", "Active PA", and "Inactive") that significantly differed in the frequency of engagement in MA and PA using latent class analysis. SA didn't differ across classes. Controlling for age, the "Active PA and MA", "Active MA", "Active PA" groups displayed similar grip strength that was superior to the "Inactive" group. "Active PA and MA" group had best gait speed relative to other groups, especially "Active MA" and "Inactive" group, while the "Active PA", "Active MA", and "Inactive" group were similar in gait speed.
Conclusion: Combined physical and mental activity engagement was associated with better physical function, especially in gait speed. Future interventional research should investigate the combination of both physical and cognitive training to prevent decline of physical function in older adults.

1. Introduction

Physical function is defined as the ability to perform the basic actions (i.e., mobility, strength, and endurance) that are essential for maintaining independence and carrying out more complex activities (Painter, Stewart, & Carey, 1999). Decline in physical function is common among older adults and has been shown to increase the risk of falls, hospitalization, nursing home admissions, dependence, and poor quality of life (Brown and Flood, 2013). Hence, promoting physical function is critical for preventing its associated adverse health outcomes and constitutes one of the hallmark signs of successful aging.

One way to prevent functional decline is to engage in physical, mental, and/or social activities, although the amount and level of evidence for each activity varies. Physical activity (PA) is the most studied with accumulating evidence indicating that engaging in PA improved strength, endurance, balance and overall physical functions in older adults (Gomes-Neto, Conceicao, Oliveira Carvalho, & Brites, 2013; Gomes Neto, Ogalha, Andrade, & Brites, 2013; Taylor, 2014). The relationship between mental activities (MA) and physical function has been less studied. However, emerging interventional research suggests that engaging in MA (e.g., cognitive stimulation) can enhance physical function by improving gait and balance (Smith-Ray et al., 2015; Smith-Ray, Makowski-Woidan, & Hughes, 2014). Further, older adults who are socially active experienced less decline in physical function (e.g., as measured by their ability to perform daily tasks) compared to socially inactive counterparts (Mendes de Leon, Glass, & Berkman, 2003; Rosso, Taylor, Tabb, & Michael, 2013). Overall, more studies are needed to examine the relationship between engagement in these activities and physical function.

Moreover, it remains unclear whether combined activity engagement would be associated with better physical function. Learning from the cognition literature and the Enriched Environment Theory suggest a simultaneously effect of PA, MA, and SA on cognitive function in old age (Hertzog, Kramer, Wilson, & Lindenberger, 2008). Combined activity engagement such as PA

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and MA (Theill, Schumacher, Adelsberger, Martin, & Jancke, 2013) or MA and SA (Wang, Karp, Winblad, & Fratiglioni, 2002) indeed led to significantly greater cognitive improvement compared to engaging in a single activity. However, it is unknown whether there is any similar synergistic impact of combined activity engagement on physical function among older adults.

This study addresses the aforementioned gaps. We evaluated the relationship of engagement in individual and combined PA, MA, and SA and physical function. First, we described the patterns of engagement in PA, MA, and SA among older adults. Next, we identified the latent classes of activity engagement (clusters of participants with similar activity engagement). Last, we examined the association between activity engagement and physical function. We hypothesized that combined activity engagement would link to better physical functions than any single activity.

2. Methods

2.1. Design and procedure

The present study used a cross-sectional design to analyze data from the Survey of Midlife Development in the United States (MIDUS) II. MIDUS is a longitudinal study of community-dwelling adults' well-being, including two waves that were 10 years apart (MIDUS I, 1995–1996; MIDUS II, 2004–2009). Of note, a twenty-year follow-up was just completed (MIDUS III), but is not yet available publicly. MIDUS I only collected psychosocial behavioral data, which had no physical function assessments needed in the study. MIDUS II consisted of five projects covering different domains: 1) psychosocial and health, 2) daily diary, 3) cognitive assessment, 4) clinical and biomarker assessment, and 5) neuroscience. Data used in the present study were drawn from three of the projects: Project 1: participants self-administered questionnaires on socio-demographic and health information; Project 3: a series of cognitive tests were administered to participants over the telephone; and Project 4: physical function assessment obtained from a two-day visit to one of the participating General Clinical Research Centers (GCRCs). Data from individuals 55 years or older who have data from all three projects were used for the current study (n = 466). Of note, the sample from MIDUS I was considered a nationally representative sample, while participants who remained in MIDUS II (75% from MIDUS I) tended to have socioeconomic bias (e.g., being white, female, married, more educated), but not necessarily healthy status bias (Radler and Ryff, 2010). Institutional Review Boards from each study site approved the study. Institutional Review Boards from each study site approved the study.

2.2. Measures

Physical function was operationalized using two of the clinical assessment variables from MIDUS II Project 4: grip strength and gait speed. Grip strength was determined using a hand grip dynamometer, while subjects held the dynamometer in the hand to be tested with the elbow positioned at 90° on the side of the body. An average of three readings (in kg/force) of the dominant hand was taken. Hand grip dynamometer is a reliable instrument to measure grip strength with interclass correlation coefficient greater than 0.80 (Guerra and Amaral, 2009; Hamilton, McDonald, & Chenier, 1992).

Gait speed was assessed using the time in seconds required for an individual to walk 50 ft in their usual pace without an assistive device. An average of two readings (in feet/second) was taken. The interclass correlation coefficient was 0.97 in previous studies (Dobson et al., 2013; Unver, Kalkan, Yuksel, Kahraman, & Karatosun, 2015).

Activity engagement was measured using three distinct questionnaires: physical, mental and social. Participants were asked about frequency of engagement of these activities as part of the MIDUS II Project 1. The questionnaire of moderate PA asked about the frequency of engaging in 6 types of leisurely sports (i.e., light tennis, slow or light swimming, low impact aerobics, golfing without a power cart, brisk walking, mowing the lawn with a walking lawnmower). Participants were asked to respond to each item on a 6-point ordinal scale ranging from 1 (several times a week) to 6 (never). In the MIDUS II survey, three types of PA were available – light, moderate, and vigorous, which are highly correlated (r = 0.34–0.69) (Lee et al., 2015). We decided to use the moderate type PA to balance the amount of exercise and feasibility of doing the exercise in old age. MA engagement included 6 types of activities (i.e., read, do word games, play card, attend lectures, do writing, use a computer). Each participant indicated the frequency of engaging in these activities using a 6-point ordinal scale ranging from 1 (daily) to 6 (never). For PA and MA, the ratings were reversely coded and averaged with higher scores indicating more frequent engagement. SA engagement was measured with three items quantifying the frequency of attending meetings and group gatherings (i.e., union, sports, or social groups) outside the workplace in a typical month. The total number of times involved in these SA was calculated. MA engagement scale was significantly correlated to SA engagement scale ($r = 0.29$, $p < 0.001$). PA engagement scale did not correlate to MA or SA engagement scales. The three activity engagement scales were created in the MIDUS II, although formal validation evaluation has not been conducted, evidence has been accumulated to support the validity in outcomes related to the present study. For example, the three scales have been correlated to memory complaints, cognitive function and education (Lachman, Agrigoroaei, Murphy, & Tun, 2011; Lin, Heffner, Mapstone, Chen, & Porsteisson, 2014), or perceived physical health (Fujiwara and Kawachi, 2008; Lee et al., 2015) in previous studies of older adults.

Demographic and health characteristics included age, sex, education, medications, and smoking behaviors. Education was grouped into three categories: "high school graduate or less", "some college" and "college graduate or more". The use of medications such as anti-hypertension, anti-depressants and/or corticosteroids were recorded based on the original medication bottles the participants brought with them to the GCRC. Data on smoking was collected using a single question on whether the participant had ever smoked regularly. Abdominal obese was defined as waist circumference >02 cm in men and >88 cm in women.

2.3. Data analysis

Across the entire sample, descriptive data on all main and background variables were analyzed, and the correlations between activity engagement and physical function was analyzed with Pearson's correlation in IBM SPSS 22.0.

Latent class analysis (LCA), a form of mixture modeling, was performed using Mplus version 7.0 to find the smallest number of classes (participants with similar activity engagement). LCA is a method of identifying unique classes within a set of heterogeneous individuals by examining the mean of individual cases. In the present study, we determined the number of classes controlling for the influence of age on each activity engagements. A series of models were evaluated beginning with a 1-class solution and ending with a 5-class solution. The optimal number of classes was decided based on Bayesian, Akaike, and Adjusted Bayesian Information Criteria in which lower values indicate a more parsimonious model; entropy in which higher values indicate a better model, and the Lo-Mendell-Rubin (LMR) adjusted likelihood