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Original Study

Sitting Time and Mortality in Older Adults With Disability: A National Cohort Study

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A B S T R A C T

Background: The progressive aging of the population has increased the number of older adults with disabilities. Regular physical activity has shown to improve health among these individuals, but the effects of sedentary behavior are mostly unknown. Thus, this study examined the association between sitting time and mortality in older adults with disability.
Methods: Prospective cohort of 2470 people aged ≥60 years. In 2000–2011, the study participants reported their sitting time and physical activity levels and were subsequently followed up through 2011 to ascertain mortality.
Results: During an average follow-up of 8.7 years, 982 deaths occurred. Compared with people who spent seated <4 hours/d, the hazard ratio (95% confidence interval) of mortality was 1.27 (1.07–1.51) in those seated during 4–6 hours/d and 1.55 (1.29–1.87) in those seated for >6 hours/d. Each increment of 1 hour/day in sitting time was linked to a 7% increase in mortality. Compared with active individuals who spent seated <4 hours/day, those who were inactive and spent seated >6 hours/d showed the highest mortality (hazard ratio 1.82, 95% confidence interval 1.37–2.42).
Conclusions: Sitting time is associated with higher mortality in older people with disability. Interventions combining the reduction of sedentary behavior with increased physical activity should be developed and evaluated in this group of population.

The increase in life expectancy has led to a progressive and rapid aging of the world population.[1,2] Because the frequency and degree of disability increases with age, a major public health challenge is to improve or maintain health of older adults with disability through cost-effective strategies.[3,4] Regular physical activity has shown to improve health among older adults with disabilities and, specifically, to protect against the processes that trigger and accelerate disability.[5–7]

In addition, there is accumulating evidence that sedentary behavior is an important risk factor for adverse health outcomes, regardless of the physical activity performed.[8] Sedentary behavior is defined as those activities done mostly in sitting or reclining positions during waking time that do not substantially increase energy expenditure (ie, between 1 and 1.5 metabolic equivalents).[8] Although the health effects of sedentary behavior are not well known, too much time spent seated has been associated with several disability-related indicators, such as sarcopenia, osteoporosis, cardiovascular diseases, cognitive impairment, and alterations in vision.[9–14]

To our knowledge, no study has yet examined the effect of sitting time on the health of older people with disabilities. Moreover, the joint health effect of low sitting time and physical activity in this population is also unknown. Therefore, the aim of this study was to examine the association between sitting time and long-term mortality in older adults with disability. In addition, we assessed the combined impact of sitting time and physical activity on mortality.

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Material and Methods

Study Design and Participants

We used data from the UAM cohort, comprising 4008 individuals representative of the noninstitutionalized population aged 60 years and older in Spain.[15,16] This cohort was established in 2000–2001 using probabilistic sampling by multistage clusters. The clusters were first stratified according to region of residence and size of municipality. Then, census sections and households were chosen randomly within each cluster. Finally, study participants were selected in sex and age (60–69, 70–79, and ≥80 years) strata. Information at baseline was collected in the participants' home through personal interviews and physical examination by trained and certified personnel. The study response rate was 71%. Thereafter, the individuals were followed up to 2012 to assess incident death. A total of 2741 individuals who at baseline reported having one or more of the disabilities studied in the present work (see next section) were selected for this analysis.

Written informed consent was obtained from study participants and from an attending family member. The study was approved by the Clinical Research Ethics Committee of the La Paz University Hospital in Madrid (Spain).

Disability

At baseline, disability was assessed by asking participants about the difficulty experienced or the need of help in performing 14 activities,[16] classified into the following 5 types: agility, mobility, restriction of daily activities, instrumental activities of daily living, and self-care.

Agility disability was ascertained with the question "Do you experience any difficulty in bending or kneeling?" Mobility disability was assessed with the following questions: "(1) Do you experience any difficulty in picking up or carrying a shopping bag? (2) Do you experience any difficulty in climbing one flight of stairs? (3) Do you experience any difficulty in walking several city blocks (a few hundred meters)?" Restriction of daily activities was obtained by asking participants, "During the past 4 weeks, did you have to refrain from doing any of your daily activities, because of your physical health?" Instrumental activities of daily living were measured using the Lawton and Brody's test[17]; because of cultural reasons, the questions on individuals' ability to prepare meals, do household chores, and the laundry were excluded in men. Finally, self-care disability was assessed with the following question taken from the Katz test[18]: "Do you experience any difficulty in bathing or dressing yourself without assistance?"

The above types of disability were deemed to be present when the response was affirmative for any of the preceding questions, or when Lawton and Brody's test score was ≤4 among men and ≤7 among women; these cutoffs correspond to the existence of disability in at least one instrumental activity in each sex.

Sitting Time

Sitting time was estimated by leisure time spent sitting down with the following question[19]: "How much time do you spend sitting down on weekdays? Please add up the total number of hours for all activities such as eating, listening to the radio, watching television, reading, sewing, driving, etc." The same question was asked for the weekend days. The average hours per day seated on a typical week was calculated as follows: [(weekday sitting time × 5 + weekend sitting time × 2)/7]. Participants were classified into tertiles of sitting time with cutoffs at 4 and 6 hours/d.

Mortality

The outcome variable was all-cause mortality from the study baseline (2000–2001) to the end of follow-up at December 31, 2011. After authorization from the Ministry of Health, the number and dates of deaths were obtained by a computerized search of the National Death Index. The vital status was successfully ascertained for 99.9% of the cohort.

Covariates

Age, sex, and the highest educational level attained (no formal education, primary, and secondary or higher) were recorded. Participants also reported their smoking and alcohol consumption status. Physical activity was assessed with a single global question that asked participants to rate their behavior as very active, moderately active, less active, or inactive in comparison with their age-peers.[19] Those belonging to the highest-active category were considered physically active. Also, weight and height were measured using standardized procedures,[15] and the body mass index (BMI) was calculated as weight (kg) divided by squared height (m^2). Waist circumference was measured with an inelastic belt-type tape at the midpoint between the lowest rib and the iliac crest after breathing out normally.[15] Blood pressure was measured 6 times in the right arm at the level of the heart using standardized methods.[20] Readings were taken at 2-minute intervals, with the mean of the measurements used in the analyses. Participants were also asked, "Has your doctor ever told you whether you have high (blood) cholesterol?" If the answer was affirmative, they were considered to have hypercholesterolemia. Cognitive function was assessed with the adapted Mini-Mental State Examination, which is valid for use in the Spanish population.[21] Finally, the following diseases diagnosed by a physician and reported by the study participant were also recorded: coronary heart disease, stroke, cancer at any site, diabetes mellitus, and depression.

Statistical Analysis

Of the 2741 study participants with at least 1 disability, 259 were excluded because of missing information on sitting time or the covariates. Also, 12 participants were excluded because of implausible reports of sitting time (0 and >20 hours/d), Thus, the final analyses were conducted with 2470 individuals (1541 women). Baseline characteristics of the study participants are presented as mean ± standard deviation or percentages.

The association of sitting time (<4, 4–6, >6 hours/d) with mortality were summarized with hazard ratios (HRs) and their 95% confidence intervals (CIs) obtained from Cox regression. Three models, with progressive adjustment for potential confounders, were fitted. The first model adjusted for age (years), and sex; the second model further adjusted for educational attainment (no formal education, primary, secondary or higher), body mass index, waist circumference (cm), systolic blood pressure (mm Hg), hypercholesterolemia (yes, no), smoking (currently, former, never), alcohol consumption (currently, former, never), Mini-Mental State Examination (score 0–30), coronary heart disease (yes, no), stroke (yes, no), cancer (yes, no), diabetes mellitus (yes, no), and depression (yes, no). A final model further adjusted for physical activity (being or not physically active). The dose-response association was tested with a *P* for trend estimated by modeling sitting time as a continuous variable; also, the association of 1 hour/day increase in sitting time with mortality was estimated, including a restricted cubic spline to graphically illustrate the relationship between both variables. We replicated the analyses for individuals with each type of disability (agility, mobility, restriction of daily activities, instrumental activities of daily living, and self-care)