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Individual and Combined Associations of Cognitive and Mobility Limitations on Mortality Risk in Older Adults

Emily Frith, MS; Ovuokerie Addoh, MBBS; Joshua R. Mann, MD, MPH; B. Gwen Windham, MD, MHS; and Paul D. Loprinzi, PhD

Abstract

Objective: To evaluate the potential independent and combined associations of cognitive and mobility limitations on risk of all-cause mortality in a representative sample of the US older adult population who, at baseline, were free of cardiovascular and cerebrovascular disease.

Patients and Methods: Data from the 1999 to 2002 National Health and Nutrition Examination Survey were used to identify 1852 adults (age, 60-85 years) with and without mobility and/or cognitive limitations. Hazard ratios (HRs) for mortality risk were calculated for 4 mutually exclusive groups: no limitation (group 1 as reference), mobility limitation only (group 2), cognitive limitation only (group 3), both cognitive and mobility limitations (group 4).

Results: Compared with group 1, the adjusted HRs (95% CI) for groups 2, 3, and 4 were 1.72 (1.24-2.38), 2.00 (1.37-2.91), and 2.18 (1.57-3.02), respectively. The mortality risk when comparing group 4 (HR, 2.18) with group 3 (HR, 2.00), however, was not statistically significant (P=.65). Similarly, the mortality risk when comparing group 4 (HR, 2.18) with group 2 (HR, 1.72) was not statistically significant (P=.16).

Conclusion: Although the highest mortality risk occurred in those with both limitations (group 4), this point estimate was not statistically significantly different when compared with those with cognitive or mobility limitations alone.

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From the Physical Activity Epidemiology Laboratory, Exercise Psychology Laboratory, Department of Health, Exercise Science and Recreation Management, The University of Mississippi, University (E.F., O.A.); Department of Preventive Medicine (J.R.M.) and Department of Medicine, Division of Geriatrics, Memory Impairment and Neurodegenerative Dementia Center (B.G.W.), University of Mississippi Medical Center, Jackson; and Jackson Heart Study Vanguard Center of Oxford, Jackson; and the Physical Activity Epidemiology Laboratory, Exercise Psychology Laboratory, Department of Health, Exercise Science and Recreation Management, The University of Mississippi, University (P.D.L.).

Certain facets of cognition may be closely linked to physical capacity. Ambulatory activities requiring a high degree of attentional focus have been suggested to correlate specifically with executive function.[1,2] Such ambulatory activity may include walking, which has been shown to have a facilitative effect on task performance specific to executive function.[3] Furthermore, higher levels of fitness are suggested to promote increased vigilance in situations involving complex task demands.[4,5] However, limitations in physical capacity complicate efforts to maintain physical fitness. Individuals with the ability to regularly engage in physical movement have shown marked improvements in executive functioning parameters.[4] Tasks related to executive functioning are typically challenging, autonomous, and are directed by planned, yet readily adaptive behaviors. In adults with cognitive limitations, activities of daily living may be difficult to accomplish, as they inherently comprise actions necessary to function independently.[6] Frontal brain regions are integral to executive functioning,[7,8] as well as maintenance of functionality with age,[9] and ability to successfully complete activities of daily living.[1] It is plausible that a combination of cognitive and physical mobility limitations may result in increased sedentary time and increased risk of chronic disease and all-cause mortality.

Cognitive decline is often associated with advanced age, and even mild levels of reduced cognition have been associated with incident mortality in the elderly.[10] Irrespective of objective memory, even subjective perceptions of cognitive limitations may relate to the widespread prevalence of mortality.[11] Strategies to achieve early detection of mild cognitive impairment may help identify risk of prospective declines in mobility and consequent

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mortality. Similarly, early detection of cognitive dysfunction may better inform public health policy and treatment prescription for at-risk elderly populations. To date, few studies have examined the potential independent and combined effects of having both cognitive and mobility limitations on mortality.[12] Thus, the purpose of this brief report was to evaluate the potential independent and combined associations of cognitive and mobility limitations on mortality risk in a representative sample of the US older adult population.

PATIENTS AND METHODS

Design and Sample

Data from the 1999 to 2002 National Health and Nutrition Examination Survey (NHANES) were used. Data from participants in these cycles were linked to death certificate data from the National Death Index via a probabilistic algorithm, as previously described.[13] Person-months of follow-up were calculated from the date of the interview until date of death or censoring on December 31, 2011, whichever came first. Study procedures were approved by the National Center for Health Statistics Research Ethics Review Board, with informed consent obtained before data collection.

As described elsewhere,[13] the NHANES is an ongoing survey conducted by the Centers for Disease Control and Prevention that uses a representative sample of noninstitutionalized (community-dwelling) US civilians selected by a complex, multistage, stratified, clustered probability design. The multistage design consists of 4 stages, including the identification of counties, segments (city blocks), random selection of households within the segments, and random selection of individuals within the households. Further information on NHANES methodology and data collection is available on the NHANES website (http://www.cdc.gov/nchs/nhanes.htm). Briefly, each year, in the continuous NHANES, new participants are recruited across 15 geographic areas in the United States. National Health and Nutrition Examination Survey personnel go to participants' homes, and among those eligible and selected for participation, they complete various surveys. Then, within a few weeks, they attend a follow-up examination at a mobile examination center in their county. During this examination, they are asked to complete additional surveys and are also offered phlebotomy and additional objective assessments.

In the 1999 to 2002 NHANES, 3706 older adults (age, 60-85 years) were enrolled. After excluding those with a self-reported physician diagnosis of coronary artery disease, congestive heart failure, or stroke at the baseline assessment, the resultant sample was 2961. Of these, 519 were missing cognition data, 172 were missing mobility function data, and 418 were missing covariate data, leaving 1852 older adults (age, 60-85 years) for the analytical sample.

Cognitive Function

The Digit Symbol Substitution Test (DSST) was used to assess cognitive function, which has been described elsewhere.[14] The DSST, a component of the Wechsler Adult Intelligence Scale and a test of visuospatial and motor speed of processing, has a considerable executive function component and is frequently used as a sensitive measure of frontal lobe executive function.[15,16] The DSST was used to assess participant cognitive function tasks of pairing (each digit 1-9 has a symbol it is associated with). Participants were asked to draw as many symbols as possible that were paired with numbers within 2 minutes. One point is given for each correctly drawn and matched symbol, and 1 point is subtracted for each incorrectly drawn and matched symbol, with a maximum score of 133.

Mobility Function

Mobility function was modeled after previous NHANES work on this topic, exhibiting evidence of convergent validity by associating with objectively measured ambulatory movement.[17] Participants were considered to have a mobility limitation if they self-reported difficulty (some, much, or unable to do the activity) in any of the following activities: walking without special equipment use; walking 0.25 miles (to convert to kilometer, multiply by 1.6); walking 10 steps without stopping; stooping, crouching, or kneeling; walking from one room to another on the same level;