

Research Paper

Body weight status and onset of functional limitations in U.S. middle-aged and older adults

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Abstract

Background: The sweeping obesity epidemic could further increase the incidence of functional limitations in the U.S. rapidly aging population.

Objective: To examine the relationship between body weight status and onset of functional limitations in U.S. middle-aged and older adults.

Methods: Study sample came from 1992 to 2010 waves of the Health and Retirement Study, a nationally representative longitudinal survey of community-dwelling middle-aged and older adults. Body mass index (BMI) was calculated from self-reported height/weight. Functional limitations were classified into physical mobility limitation (PM), large muscle function limitation (LMF), activities of daily living limitation (ADL), gross motor function limitation (GMF), and fine motor function limitation (FMF). Mixed-effect logistic regressions were performed to estimate the relationship between prior-wave body weight status and current-wave onset of functional limitations, adjusted for individual characteristics and survey design.

Results: Prior-wave body weight status prospectively predicted onset of functional limitation, and the relationship showed a U-shaped pattern. Compared with their normal weight counterparts, the odds ratios (ORs) in underweight (BMI < 18.5) and obese (BMI ≥ 30) adults were 1.30 (95% confidence interval, 1.05–1.62) and 2.31 (2.11–2.52) for PM, 1.20 (0.96–1.50) and 1.63 (1.49–1.79) for LMF, 2.02 (1.66–2.46) and 1.40 (1.28–1.54) for ADL, 1.96 (1.60–2.39) and 1.77 (1.62–1.93) for GMF, and 1.66 (1.37–2.02) and 1.34 (1.22–1.46) for FMF, respectively. For PM, LMF and GMF, the impact of obesity appeared more pronounced in women, whereas that of underweight more pronounced in men.

Conclusions: Proper weight management during aging is crucial in preventing functional limitations in middle-aged and older adults. © 2015 Elsevier Inc. All rights reserved.

Keywords: Disability; Functional limitation; Underweight; Obesity; Older adult

Functional limitation, a substantial impairment in an individual's ability to effectively perform major life activities, is strongly associated with reduced quality of life and elevated risk for morbidity and mortality.^{1–3} Based on data from the National Health and Nutrition Examination Survey (NHANES) 2007–2008 and 2009–2010 waves, over a quarter of U.S. adults had one or more self-reported functional limitations.⁴ Increasing evidence suggests people with obesity are at higher risk for functional limitations, especially those related to mobility.^{5,6} In addition to the associated chronic illnesses including type 2 diabetes mellitus, hypertension, dyslipidemia, heart disease, and certain

types of cancer,⁷ obesity may directly influence physical functions through its detrimental impact on lower limb muscular strength and power, plantar foot pressure, inflammatory milieu, sarcopenia, and knee osteoarthritis.^{5,8,9} Between 1976–1980 and 2011–2012, the prevalence of adult obesity more than doubled and that of morbid obesity quadrupled.¹⁰ The sweeping obesity epidemic is expected to further increase the incidence of functional limitations in the U.S. middle-aged and older population.^{11,12}

Existing studies on the relationship between body weight status and functional limitations typically focused on physical mobility^{13–18} or activities of daily living,^{12,13,19–21} whereas the impacts of weight on large and small muscle functioning are less well known. A U-shaped relationship between body weight and mortality has been documented,²² which alludes to the hypothesis on a similar association linking weight with functional limitations.

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However, concurrent research predominantly concentrates on obesity,^{5,23,24} whereas the effect of underweight on physical functioning is understudied. There is some preliminary evidence on the differential relationship between body weight status and functional limitations by gender,^{25–27} but relevant studies remain scarce.

Using data from a nationally representative longitudinal survey, this study added a new data point to the literature by examining the relationship between body weight status (classified by underweight, normal weight, overweight, and obesity) and onset of functional limitations in U.S. middle-aged and older adults. Besides outcome measures on physical mobility and activities of daily living, other functional limitation domains such as large muscle function and gross/fine motor skills were also assessed. Population heterogeneity in the relationship between body weight status and functional limitations was explored in subgroup analysis by gender.

Methods

Study participants

Individual-level data came from the Health and Retirement Study (HRS), an ongoing longitudinal panel study that surveys a representative sample of U.S. community-dwelling adults aged 50 years and older since 1992. Follow-up interviews are conducted every other year, with overall response rates over 80% across waves. HRS collects rich information including income, employment, assets, pension plans, health insurance, disability, physical health and functioning, cognitive functioning, and health care expenditures. Survey design, questionnaires, and other details about HRS can be found on its web portal (<http://hrsonline.isr.umich.edu/>). This study used HRS longitudinal dataset constructed by the RAND Corporation (RAND HRS Version M), which compiled HRS data from 1992, 1993, 1994, 1995, 1996, 1998, 2000, 2002, 2004, 2006, 2008, and 2010 waves.²⁸ It included the original HRS cohort (born between 1931 and 1941) entering in 1992, the Asset and Health Dynamics Among the Oldest Old (AHEAD) cohort (born before 1924) entering in 1993, the Children of Depression (CODA) cohort (born between 1924 and 1930) and the War Baby (WB) cohort (born between 1942 and 1947) entering in 1998, and the Early Baby Boomer (EBB) cohort (born between 1948 and 1953) entering in 2004. HRS was approved by the University of Michigan Human Subjects Review Committee, and this study used de-identified publicly available HRS data and thus was exempt from human subjects review.

The sampling unit in the HRS is household. A married household was considered age eligible as long as one spouse in the household was age eligible (e.g., 50 years of age and above). Therefore, it is possible that both spouses in a household were interviewed but only one of

them met the age criterion whereas the other spouse did not. We restricted the study samples to HRS participants born during 1900–1953 (50 years and older in 1992) with no reported functional limitation of a specific category at base-year interview, defined as the first interview an individual participated when entering the survey (or the first interview when relevant data became available). Participants were excluded from the analyses on the basis of age ineligibility, presence of a specific functional limitation in the base year, and/or missing covariates.

Functional limitations

Functional limitations in the HRS were classified into five categories based on validated indices. These indices were adopted for their comparability with other studies that measured functional limitations, their validity and reliability, and consistency across survey waves.²⁸ The five categories of functional limitations include: physical mobility limitation (PM), large muscle function limitation (LMF), activities of daily living limitation (ADL), gross motor function limitation (GMF), and fine motor function limitation (FMF). Each question asked whether a participant had any difficulty (coded as “Yes” or “No”) in performing a specific activity. PM consists of five activities: walking one block, walking several blocks, walking across a room, climbing one flight of stairs without resting, and climbing several flights of stairs without resting. LMF consists of four activities: sitting for about 2 h, getting up from a chair after sitting for long periods, stooping or kneeling or crouching, and pulling or pushing large objects like a living room chair. ADL consists of five activities: bathing or showering, eating, dressing, walking across a room, and getting in or out of bed. GMF consists of four activities: walking one block, walking across a room, climbing one flight of stairs without resting, and bathing. FMF consists of three activities: eating, dressing, and picking up a dime from a table. Functional limitation of a specific category is defined as having difficulty (i.e., an answer of “Yes”) in performing at least one of the activities included in that category.

The exact question wordings varied slightly across survey waves. The responses defined by the HRS were rather different in the first wave (1992) compared to all other waves, so that data on functional limitations in the first wave were not used in the analyses. Instead, we used the information on functional limitations in the second wave (1994) to determine the study sample in the original HRS cohort who did not have functional limitation of a specific type at the base-year (1994). Detailed information on functional limitations variable construction can be found elsewhere (<http://hrsonline.isr.umich.edu/modules/meta/rand/randhrsm/randhrsM.pdf>). In the RAND HRS Version M dataset, a total of 16166, 12641, 24143, 21665, and 24658 age-eligible participants reported no functional limitation of PM, LMF, ADL, GMF, and FMF at their base-year

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