Published in final edited form as:

J Am Geriatr Soc. 2010 March ; 58(3): 539–544. doi:10.1111/j.1532-5415.2010.02727.x.

Biopsychosocial Characteristics of Community-dwelling Older Adults with Limited Ability to Walk ¼ Mile

Susan E. Hardy, MD, PhD^{*}, David J. McGurl^{*}, Stephanie A. Studenski, MD, MPH^{*,†}, and Howard B. Degenholtz, PhD[‡]

^{*} University of Pittsburgh School of Medicine, Pittsburgh, PA

[†] GRECC, Pittsburgh Veterans Affairs Health Care System, Pittsburgh, PA

[‡] University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA

Abstract

Objectives—To establish nationally representative estimates of the prevalence of self-reported difficulty and inability to walk ¼ mile among older adults and to identify the characteristics independently associated with difficulty or inability to walk ¼ mile.

Design—Cross-sectional analysis of data from the 2003 Cost and Use Medicare Current Beneficiary Survey.

Corresponding Author: Susan Hardy, MD, PhD, Division of Geriatric Medicine, University of Pittsburgh, 3471 Fifth Avenue, Suite 500, Pittsburgh, PA 15213, Phone: (412) 692-2360, Fax: (412) 692-2370, hardys@dom.pitt.edu.

Conflict of Interest

Financial/Personal Conflict Elements	S Hardy		D McGurl		S Studenski		H Degenholtz	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X	X			X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X	X			X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

COI Details: Stephanie Studenski: Recipient of grants from Lilly Pharmaceuticals and Merck. Consultant for Amgen, Asubio, Eli Lilly, GTx Inc, Humana, Merck, National Health & Medical Research Council, NicOX and Pfizer.

Author Contributions

Dr. Hardy participated in the study concept and design, analysis and interpretation of data, and preparation of manuscript. Mr. McGurl participated in the analysis and interpretation of data and revised the manuscript critically for important intellectual content. Dr. Degenholtz participated in the study concept and design and analysis and interpretation of data, and revised the manuscript critically for important intellectual content.

Setting—Community.

Participants—9563 community-dwelling Medicare beneficiaries aged 65 years or older, representing an estimated total population of 34.2 million older adults.

Measurements—Self-reported ability to walk ¼ mile, sociodemographics, chronic conditions, body mass index, smoking, and functional status.

Results—In 2003, an estimated 9.5 million aged Medicare beneficiaries had difficulty walking ¼ mile and 5.9 million were unable. Among the 20.2 million older adults with no difficulty in basic or instrumental activities of daily living (ADL), an estimated 4.3 million (21%) had limited ability to walk ¼ mile. Having difficulty or being unable to walk ¼ mile was independently associated with older age, female sex, non-Hispanic ethnicity, lower educational level, Medicaid entitlement, most chronic medical conditions, current smoking, and being overweight or obese.

Conclusion—Almost half of older adults, and 20% of those reporting no ADL limitations, report limited ability to walk ¼ mile. Among functionally independent older adults, reported ability to walk ¼ mile can identify vulnerable older adults with greater medical problems and fewer resources, and may be a valuable clinical marker in planning their care. Future work is needed to determine the association between ¼ mile walk ability and subsequent functional decline and healthcare utilization.

Keywords

mobility disability; older adults; prevalence

INTRODUCTION

Numerous studies have shown that limitations in activities of daily living (ADLs) are associated with institutionalization, death, and high health care costs.^{1–3} Because of this, assessment of ADL function has become a key component of geriatric assessment.⁴ However, ADL difficulty represents a fairly advanced stage of functional decline, and identification of older adults at risk for future ADL disability is important for prevention.⁵ Difficulty in mobility tasks such as walking ¼ mile or climbing stairs is considered a precursor to ADL disability.⁶ The time required to walk 400 meters (approximately ¼ mile) has been associated with subsequent ADL disability and other adverse outcomes.^{6, 7} Increasingly, mobility disability is being defined as self-reported inability to walk ¼ mile,⁸ but the prevalence of limitations in ability to walk ¼ mile and its ability to identify a high risk subset of older adults have not been characterized in a nationally representative sample.

The purpose of our study is to establish nationally representative estimates of the prevalence of self-reported difficulty and inability to walk ¼ mile in Medicare beneficiaries aged 65 years or older and to describe the characteristics independently associated with having difficulty or being unable to walk ¼ mile. Because mobility disability may be most useful as a marker of risk among older adults without difficulty in basic and instrumental ADLs, we also examine walking ability and associated characteristics in this higher functioning subgroup.

METHODS

Data Source

Data for this study are from the 2003 Medicare Current Beneficiary Survey (MCBS) Cost and Use files. The MCBS is a nationally representative sample of aged, disabled, and institutionalized Medicare beneficiaries sponsored by the Center for Medicare and Medicaid Services (CMS). The stratified, three-stage area probability sample is selected to be representative of the Medicare population as a whole and within age groups, and therefore uniquely allows extrapolation to the entire Medicare population. A detailed description of the

methods and survey questions in the MCBS is available from CMS.⁹ Of the 12486 participants in the 2003 MCBS survey, we excluded 2100 who were younger than age 65, 795 who lived in a nursing facility, and 28 who had missing data for walking disability, resulting in an analytic sample of 9563. Proxy respondents were used for 12% of the sample; participants requiring a proxy were older and had a higher burden of chronic disease, greater basic and instrumental ADL disability, and more limitations in walking ¼ mile. Although proxy respondents are known to overestimate disability, this effect is small for observable activities such as mobility.¹⁰ We felt it was important to include respondents who used a proxy to avoid underestimating the prevalence of walking difficulty.

Ability to Walk ¼ Mile

MCBS participants were asked to rate how much difficulty they had “walking a quarter of a mile -- that is, about 2 or 3 blocks” on the following scale: no difficulty at all, a little difficulty, some difficulty, a lot of difficulty, or not able to do it. To ensure that there were sufficient observations for analysis, we collapsed ‘a little’, ‘some’, and ‘a lot’ of difficulty into a single category “any difficulty”.

Other Measures

We selected biopsychosocial characteristics which we hypothesized would be associated with difficulty or inability to walk ¼ mile. In addition to ability to walk ¼ mile, the MCBS survey includes data on demographic characteristics (age, gender, race/ethnicity, and marital status), self-reported chronic conditions, smoking status, basic and instrumental activities of daily living (B/IADLs), and self-rated health (presented as fair or poor versus good, very good, or excellent). The six BADLs assessed were bathing, dressing, eating, transferring, walking, and using the toilet, and the six IADLs assessed were using the telephone, light housework, heavy housework, preparing meals, shopping, and managing money. Socioeconomic status was measured with annual income, education, and insurance status (enrollment in a health maintenance organization (HMO), Medicaid entitlement, and private insurance). Body mass index (BMI) was calculated from self-reported height and weight, and categorized using clinical cutpoints to account for the non-linear relationship between BMI and function. Participants were considered to have psychiatric comorbidity if they reported: 1) being told by a doctor that they had a psychiatric or mental condition; 2) feeling sad, blue, or depressed most or all of the time; or 3) two weeks or more when they lost interest or pleasure in things that they usually cared about or enjoyed. Participants were considered to have lower body arthritis if they reported arthritis in the back, hips, knees, feet, anywhere on legs or all over. We categorized both BADL and IADL function as difficulty or inability in no, one, or two or more activities.

Statistical Analysis

Because our goal was to identify characteristics independently associated with difficulty or inability walking ¼ mile rather than to completely explain differences in walking ability, we chose to ordinalize some continuous variables (e.g. BMI and income) and collapse some categories within ordinal variables (e.g. education and B/IADL function). We selected standard clinical cutpoints for BMI (<20, 20–25, 26–30, >30), cutpoints implemented in the MCBS for income (<\$10,000, \$10,000–25,000, >\$25,000) and education, and cutpoints selected to combine groups with few participants for self-reported health and B/IADLs. Use of categorical rather than continuous variables allows for non-linear relationships and provides easily interpretable odds ratios. We compared the characteristics of participants who had no difficulty, any difficulty, or were unable to walk ¼ mile using unadjusted multinomial logistic regression models. We then identified those demographic, clinical, and health behavior characteristics independently associated with difficulty or inability walking ¼ mile using multivariable

multinomial logistic regression; these models determine the independent association of each characteristic with having difficulty and with inability, using no difficulty walking as the reference group for both. Results are presented as adjusted odds ratios with 95% confidence intervals (OR, 95% CI). Because many of the beneficiaries with difficulty walking ¼ mile may also be limited in their ADLs, we also adjusted our models for basic and instrumental ADL ability.

We conducted a subset analysis of the characteristics associated with ability to walk ¼ mile among those beneficiaries with no difficulty in basic or instrumental ADLs. In this analysis, we combined the small number of those who reported being unable to walk ¼ mile with those reporting any difficulty.

In order to produce nationally representative estimates for the aged Medicare population, sampling weights provided by the producers of the MCBS data were used in all analyses to account for the complex multistage sample design and the oversampling of particular groups, such as the oldest old.¹¹ All means and percentages presented are weighted to reflect the sample design. All analyses were conducted SAS version 9.2 (SAS Institute Inc., Cary, NC) and SAS-callable SUDAAN, version 9.0.0 (Research Triangle Institute, Research Triangle Park, NC).

RESULTS

The 2003 MCBS Cost and Use survey included 9563 community-dwelling beneficiaries aged 65 years or older with data on difficulty walking ¼ mile, representing an estimated 34.2 million Medicare beneficiaries nationally. Almost half of aged Medicare beneficiaries reported limited ability to walk ¼ mile, with an estimated 9.5 million (28%) having difficulty and 5.9 million (17%) being unable. Compared to beneficiaries able to walk ¼ mile without difficulty, those beneficiaries with difficulty or inability are older, more likely to be women, black, unmarried, and enrolled in Medicaid, less likely to have private insurance, and reported lower income and education, higher rates of obesity and smoking, and worse health and functional status (Table 1). After adjustment for ADL ability, demographics, and clinical factors, the majority of these associations remained statistically significant (Figure 1). Functional status was strongly associated with ability to walk ¼ mile after adjusting for other factors. Compared to those with no BADL difficulty, participants with difficulty were much more likely to have limited ability to walk ¼ mile [OR (95% CI) for 1–2 BADLs 5.90 (4.87–7.13) for difficulty and 14.2 (11.2–18.1) for inability; for 3 or more BADLs 8.96 (5.76–13.9) for difficulty and 32.6 (20.0–53.1) for inability]. Similar associations were found for difficulty with IADLs [OR (95% CI) for 1–2 IADLs 2.23 (1.94–2.68) for difficulty and 4.47 (3.61–5.54) for inability; for 3 or more IADLs 3.62 (2.63–4.98) for difficulty and 15.7 (11.0–22.6) for inability].

Of the 9563 beneficiaries in our analyses, 5292 reported the ability to perform all of the basic and instrumental ADLs without any difficulty, representing an estimated 20.2 million beneficiaries. In this high-functioning subpopulation, an estimated 15.9 million (79%) reported ability to walk ¼ mile without difficulty, 3.8 million (19%) reported difficulty, and 0.5 million (2%) were unable. For this analysis, we combined the small number of participants unable to walk ¼ mile (sample n=141) with those who reported difficulty. Having difficulty or being unable to walk ¼ mile was independently associated with older age, female sex, Medicaid entitlement, most chronic medical conditions, current smoking, and being overweight or obese. Participants with Hispanic ethnicity and post-secondary (i.e. post-high school) education were less likely to report limited ability to walk ¼ mile (Figure 2).

DISCUSSION

In a nationally representative sample, difficulty or inability walking ¼ mile (about 400 meters or one lap around a standard track) is reported by almost half of Medicare beneficiaries aged 65 years or older. Among beneficiaries who report no difficulty with either basic or instrumental ADLs, more than one in five have difficulty with or are unable to walk ¼ mile. Those beneficiaries who report difficulty walking ¼ mile represent are older, have lower socioeconomic status, and have more chronic disease, more obesity, and higher rates of smoking.

Ability to walk ¼ mile, measured either subjectively or objectively, has been increasingly considered an indicator of mobility disability.⁸ A question about walking approximately ¼ mile is part of many large epidemiologic studies, including the Longitudinal Studies on Aging,¹² the National Health Interview Survey,¹³ and the Asset and Health Dynamics among the Oldest Old study.¹⁴ The Health, Aging, and Body Composition Study has incorporated both self-reported difficulty walking ¼ mile¹⁵ and a timed 400 meter walk.¹⁶ The Lifestyle Interventions and Independence for Elders pilot study used ability to complete a 400-meter walk within 15 minutes as the definition of mobility disability, and demonstrated the ability of an exercise intervention to improve 400-meter walk times and decrease the incidence of mobility disability (although the latter effect was not statistically significant).¹⁷

Epidemiologic studies have shown that performance on a 400-meter walk is associated with subsequent disability.^{7, 15} However difficulty walking ¼ mile has more often been used as an outcome measure^{7, 15, 18, 19} rather than a risk factor for worsening disability. This is the first study to examine the clinical characteristics associated with difficulty walking ¼ mile among a nationally representative population of older adults. Disability rates are higher among older adults who have difficulty walking ¼ mile, just as slower 400 meter walk times are associated with higher disability rates.

While longitudinal studies are needed to determine the association of difficulty walking ¼ mile with subsequent functional decline, this cross-sectional association suggests that this simple question could be used to identify older adults at high risk for subsequent disability and morbidity, who could then be targeted for preventive interventions. Potentially modifiable risk factors associated with limitations in walking ability include obesity and smoking, for which there are multiple evidence-based interventions.^{20–22} In addition, walking ability itself can improve with exercise intervention.¹⁷

Several limitations should be noted. First, this study is cross-sectional and no causal relationships can be inferred. Second, we collapsed ‘a little’, ‘some’, and ‘a lot’ of difficulty walking ¼ mile into a single category. There are likely differences among those reporting different levels of difficulty, which should be further investigated. Third, 12% of the interviews were completed by a proxy. However, despite the significant differences between respondents with or without a proxy in walking ability, exclusion of proxy responses did not substantively alter the results (data not shown). Finally, all of the data included are self-reported. We are unable to relate self-reported ability to walk ¼ mile to any measures of physical performance. However, previous studies have shown that performance-based and self-report measures provide complementary information about function.^{23, 24}

In conclusion, almost half of aged Medicare beneficiaries, including 21% of those with no basic or instrumental ADL limitations, report difficulty or inability to walk ¼ mile, a task important for independent community mobility. Among functionally independent older adults, reported ability to walk ¼ mile can identify vulnerable older adults with greater medical problems and fewer resources, and may be a valuable clinical marker in planning their care.

Future work is needed to determine the association between ¼ mile walk ability and subsequent functional decline and healthcare utilization.

Acknowledgments

Sponsor's Role

The sponsors had no role in the design, methods, analysis or preparation of the manuscript.

Funding Sources: National Institute on Aging (R03AG032291); Beeson Career Development Award (K23AG030977); Pittsburgh Claude D. Pepper Older Americans Independence Center (NIA P30 AG-024827); and the Hartford Foundation's Pittsburgh Center of Excellence in Geriatric Medicine.

References

1. Harrow BS, Tennstedt SL, McKinlay JB. How costly is it to care for disabled elders in a community setting? *Gerontologist* 1995;35:803–813. [PubMed: 8557207]
2. Manton KG. A longitudinal study of functional change and mortality in the United States. *J Gerontol* 1988;43:S153–S161. [PubMed: 2971088]
3. Wolinsky FD, Callahan CM, Fitzgerald JF, Johnson RJ. Changes in functional status and the risks of subsequent nursing home placement and death. *J Gerontol* 1993;48:S94–101. [PubMed: 8482831]
4. Palmer RM. Geriatric assessment. *Med Clin North Am* 1999;83:1503–1523. vii–viii. [PubMed: 10584605]
5. Fried LP, Herdman SJ, Kuhn KE, Rubin G, Turano K. Preclinical disability: hypotheses about the bottom of the iceberg. *J Aging Health* 1991;3:285–300.
6. Fried LP, Guralnik JM. Disability in older adults: evidence regarding significance, etiology, and risk. *J Am Geriatr Soc* 1997;45:92–100. [PubMed: 8994496]
7. Newman AB, Simonsick EM, Naydeck BL, et al. Association of long-distance corridor walk performance with mortality, cardiovascular disease, mobility limitation, and disability. *JAMA* 2006;295:2018–2026. [PubMed: 16670410]
8. Buchner DM. One lap around the track: the standard for mobility disability? *J Gerontol A Biol Sci Med Sci* 2008;63:586–587. [PubMed: 18559632]
9. Center for Medicare and Medicaid Services. Technical Documentation for the Medicare Current Beneficiary Survey. Medicare Current Beneficiary Survey Data Tables. 2003
10. Magaziner J, Zimmerman SI, Gruber-Baldini AL, Hebel JR, Fox KM. Proxy reporting in five areas of functional status. Comparison with self-reports and observations of performance. *Am J Epidemiol* 1997;146:418–428. [PubMed: 9290502]
11. Ciol MA, Hoffman JM, Dudgeon BJ, Shumway-Cook A, Yorkston KM, Chan L. Understanding the use of weights in the analysis of data from multistage surveys. *Arch Phys Med Rehabil* 2006;87:299–303. [PubMed: 16442990]
12. Kovar, MG.; Fitti, JE. Working Paper Series. Vol. 31. Hyattsville, MD: National Center for Health Statistics; 1987. The Longitudinal Study of Aging: A description of the study.
13. Blackwell DL, Collins JG, Coles R. Summary health statistics for U.S. adults: National Health Interview Survey, 1997. National Center for Health Statistics. *Vital Health Stat* 2002;10(205)
14. Soldo BJ, Hurd MD, Rodgers WL, Wallace RB. Asset and health dynamics among the oldest old: an overview of the AHEAD study. *J Gerontol* 1997;52B:1–20.
15. Simonsick EM, Newman AB, Visser M, et al. Mobility limitation in self-described well-functioning older adults: importance of endurance walk testing. *J Gerontol A Biol Sci Med Sci* 2008;63:841–847. [PubMed: 18772472]
16. Simonsick EM, Montgomery PS, Newman AB, Bauer DC, Harris T. Measuring fitness in healthy older adults: the Health ABC Long Distance Corridor Walk. *J Am Geriatr Soc* 2001;49:1544–1548. [PubMed: 11890597]
17. Pahor M, Blair SN, et al. Life Study Investigators. Effects of a physical activity intervention on measures of physical performance: Results of the lifestyle interventions and independence for Elders Pilot (LIFE-P) study. *J Gerontol A Biol Sci Med Sci* 2006;61:1157–1165. [PubMed: 17167156]

18. Mor V, Murphy J, Masterson-Allen S, et al. Risk of functional decline among well elders. *J Clin Epidemiol* 1989;42:895–904. [PubMed: 2778468]
19. Bowen ME, Gonzalez HM, Bowen ME, Gonzalez HM. Racial/ethnic differences in the relationship between the use of health care services and functional disability: the health and retirement study (1992–2004). *Gerontologist* 2008;48:659–667. [PubMed: 18981282]
20. Joyce GF, Niaura R, Maglione M, et al. The effectiveness of covering smoking cessation services for medicare beneficiaries. *Health Serv Res* 2008;43:2106–2123. [PubMed: 18783459]
21. Bales CW, Buhr G, Bales CW, Buhr G. Is obesity bad for older persons? A systematic review of the pros and cons of weight reduction in later life. *J Am Med Dir Assoc* 2008;9:302–312. [PubMed: 18519110]
22. McTigue KM, Hess R, Ziouras J, McTigue KM, Hess R, Ziouras J. Obesity in older adults: a systematic review of the evidence for diagnosis and treatment. *Obesity* 2006;14:1485–1497. [PubMed: 17030958]
23. Kempen GI, van Heuvelen MJ, van den Brink RH, et al. Factors affecting contrasting results between self-reported and performance-based levels of physical limitation. *Age Ageing* 1996;25:458–464. [PubMed: 9003883]
24. Reuben DB, Seeman TE, Keeler E, et al. Refining the categorization of physical functional status: the added value of combining self-reported and performance-based measures. *J Gerontol A Biol Sci Med Sci* 2004;59:1056–1061. [PubMed: 15528778]

Figure 1. Association of Biopsychosocial Characteristics with Difficulty or Inability Walking ¼ Mile among Community-dwelling Older Adults

The analytic sample includes 9563 participants representing an estimated 34.2 million beneficiaries. Diamonds represent adjusted odds ratios (OR) and lines 95% confidence intervals (CI). Odds ratios represent the relative odds of having difficulty and of being unable to walk ¼ mile (versus no difficulty) associated with each characteristic, adjusted for all other characteristics listed plus basic and instrumental activities of daily living.

Figure 2. Association of Biopsychosocial Characteristics with Difficulty or Inability Walking ¼ Mile among Community-dwelling Older Adults with No Difficulty in Basic or Instrumental Activities of Daily Living

The analytic sample includes 5292 participants representing an estimated 20.2 million beneficiaries. Diamonds represent adjusted odds ratios and lines 95% confidence intervals. Odds ratios represent the relative odds of having difficulty or being unable to walk ¼ mile (versus no difficulty) associated with each characteristic, adjusted for all other characteristics listed.

Table 1

Characteristics of Aged Medicare Beneficiaries by Ability to Walk ¼ Mile (sample N=9563, population estimate=34.2 million).*

Characteristic	No Difficulty n= 4905; pop. estimate= 18.8 million [†]	Difficulty n= 2785 pop. estimate= 9.5 million	Unable n= 1873 pop. estimate= 5.9 million	p-value [‡]
Age in years, mean (±SE)	73.4 (±0.1)	76.2 (±0.2)	78.6 (±0.2)	<0.001
Female, %	51	61	67	<0.001
Race/Ethnicity, %				<0.001
Non-Hispanic White	82	78	79	
Non-Hispanic Black	6	10	10	
Hispanic	8	8	7	
Other	4	4	4	
Married, %	63	50	42	<0.001
Annual Income, %				<0.001
< \$10,000	11	19	26	
\$10,000 – \$25,000	38	46	48	
> \$25,000	51	35	26	
Education, %				<0.001
Not high school graduate	22	35	43	
High school graduate	30	32	28	
Any post-secondary	48	33	29	
Insurance Status, %				
Medicaid	7	16	22	<0.001
Private	71	63	62	<0.001
Health maintenance organization	27	22	19	<0.001
Chronic conditions, %				
Coronary artery disease	17	31	39	<0.001
Hypertension	53	69	73	<0.001
Congestive heart failure	3	10	18	<0.001
Other cardiac disease	26	38	46	<0.001
Diabetes	14	25	31	<0.001
Cancer	17	20	23	<0.001
Chronic lung disease	9	18	25	<0.001
Neurological disease	8	17	29	<0.001
Lower-body arthritis	34	56	66	<0.001
Osteoporosis	17	24	33	<0.001
Psychiatric comorbidity	14	26	41	<0.001
Smoking status, %				0.001
Former	50	47	48	
Current	10	13	12	
Body mass index, %				<0.001
Underweight (<20)	5	6	11	
Normal (20–25)	37	30	29	

Characteristic	No Difficulty n= 4905; pop. estimate= 18.8 million [†]	Difficulty n= 2785 pop. estimate= 9.5 million	Unable n= 1873 pop. estimate= 5.9 million	p-value [‡]
Overweight (26–30)	42	37	29	
Obese (>30)	16	28	32	
IADLs [§] with difficulty or dependence, %				<0.001
None	88	57	23	
1–2	11	31	35	
3 or more	2	12	42	
BADLs [¶] with difficulty or dependence, %				<0.001
None	95	61	24	
1–2	4	30	45	
3 or more	1	8	32	
Self-rated health fair or poor, %	7	29	57	<0.001

* Values represent weighted % for categorical variables or estimated population mean ($\pm$ SE) for continuous variables.

[†] The numbers presented represent the sample n and the corresponding national population estimate for Medicare beneficiaries aged 65 years or older.

[‡] P-values represent Wald F tests from unadjusted multinomial logistic regression models.

[§] IADL: instrumental activities of daily living (using the telephone, light housework, heavy housework, preparing meals, shopping, and managing money)

[¶] BADL: basic activities of daily living (bathing, dressing, eating, transferring, walking, and using the toilet)