Published in final edited form as:

J Am Med Dir Assoc. 2010 November ; 11(9): 645–653. doi:10.1016/j.jamda.2009.12.084.

Does Self-Reported Function Correspond to Objective Measures of Functional Impairment?

Yuchi Young, DrPH¹, Cynthia M. Boyd, MD, MPH⁴, Jack M. Guralnik, MD, PhD^{3,5}, Karen Bandeen-Roche, PhD^{3,6}, and Linda P. Fried, MD, MPH^{2,3,4}

¹ State University of New York (SUNY) at Albany, School of Public Health ² Columbia University, Joseph L. Mailman School of Public Health ³ Center on Aging and Health, Johns Hopkins Medical Institutions ⁴ Division of Geriatric Medicine and Gerontology, Johns Hopkins Medical Institutions ⁵ National Institute on Aging, Bethesda, Maryland ⁶ Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health

Abstract

Introduction—The relationship between self-reported function and objective measures of physiological function among disabled older women was analyzed to determine the validity of self-reported function, and to identify the hierarchy of self-reported task difficulty most associated with loss of independence as a basis to inform treatment progress goals.

Methods—A randomly selected population of older women with moderate to high disability was selected from community-dwelling women 65–101 years old from the Women’s Health and Aging Study I baseline evaluation (N=987). Cross-sectional analyses evaluated the association of self-reported function with objective physiological impairment measures.

Results—The results indicated that: (a) disabled older women self-reported a broad range of physical function levels; (b) self-reported function correlated closely with objective measures of physiological impairments; (c) “preclinical disability,” as measured by self-reported modification of task performance in the absence of perceived difficulty, has validity even in a disabled population, and identifies a group intermediate between those who are high functioning in a task and those with difficulty, and (d) there is an apparent gradation in physiological impairment measures with reported loss of functional independence.

Conclusion—These findings suggest the validity of self-report functional disability measures and the potential to use these measures to identify already-disabled older adults at risk for further functional degradation and potential targets for intervention.

Keywords

Aging; disability; impairments

Corresponding Author: Yuchi Young, DrPH, Assistant Professor, Health Policy, Management and Behavior, School of Public Health, State University of New York (SUNY) at Albany, 1 University Place, Room 171, Rensselaer, NY 12144, phone: 518-402-2063, fax: 518-402-0414, yyoung@albany.edu.

Conflict of Interest: No

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

INTRODUCTION

Disabled older women in the community report difficulty or inability to perform activities of daily living,¹ yet despite disability, there will be tasks for which no difficulty is reported.^{1, 2, 3} Preclinical declines in performing such tasks might identify those at risk for further degradation of function. If the specific impairments causing such declines, such as lung function or knee strength, were known, targeted clinical interventions might minimize further loss of independence.

To pinpoint the most effective measures to capture such information, we evaluated the relationship between a spectrum of self-reported function categories with objective physiological function measures among a population-based sample drawn from the Women's Health and Aging Study I (WHAS-I). WHAS-I evaluated those women classified as the *one-third most disabled* women 65 years and older in the community studied to improve understanding of causes and course of disability.^{1, 4} This study complements previous work among the *two-thirds least disabled* which found that self-reported preclinical disability predicted onset of walking difficulty and was associated with poorer objective physiologic and performance status, intermediate between those for individuals who reported no difficulty and no preclinical changes and those who reported difficulty.⁴⁻⁸

In this study, we sought to test and refine these data among older women with moderate-to-severe disability using mobility-related tasks of varied levels of intensity and demand, which are typically included in three different functional groups: walking tasks, instrumental activities of daily living (IADL), and activities of daily living (ADL). We sought to test the hypothesis that self-reported function meaningfully reflects physiology in moderately to severely disabled older adults and to identify the hierarchy of task difficulties most associated with loss of independence as a basis for clinical targeting to prevent disability progression.

METHODS

Study sample—The WHAS-I is a population-based, observational study of moderately-to-severely disabled women 65 years and older. Sampling and study eligibility have been described previously.^{1, 9} In brief, an age-stratified random sample of community-dwelling women age 65 years and older, with oversampling of those 85 years and older, was drawn from the Medicare eligibility files for 12 zip codes of Baltimore city and county, Maryland. Of 6521 women identified, 5316 were eligible for screening and 4137 were screened. Of these, 1409 women met eligibility criteria: difficulty in two or more functional domains: (1) mobility, (2) upper extremity activities, (3) basic self-care, and (4) household management tasks, and a Mini-Mental State Exam (MMSE)¹ score above 17. Of these, 71% (N=1002) agreed to participate in our study. Baseline evaluation¹⁰ in participants' homes included standardized interviews ascertaining sociodemographic characteristics, diseases, cognition (MMSE score), self-reported function in tasks of daily life, and performance-based, objective measures of physiological function associated with diseases, impairments, and functional limitations.^{1,10} The Johns Hopkins Institutional Review Board approved the study, and all participants signed an informed consent.

Measurements

Measures were obtained by utilizing data from interviews, physical examination (including electrocardiography, ankle-arm blood pressure, and spirometry¹¹), the participant's current medications, medical records, blood tests, and questionnaires completed by the participant's primary physician.

Physiological measures—Standardized measures of disease severity included spirometry to measure *forced vital capacity* (FVC; in liters),¹² and the *ankle:arm blood pressure ratio* to assess peripheral arterial disease (Doppler stethoscope, Parks Model 841-A).¹³ *Maximal knee extensor strength* was measured using a hand-held dynamometer (Nicholas Manual Muscle Tester; Model #BK-7454, Fred Sammons Inc., Burr Ridge, IL) as kilograms of peak force applied to break the isometric contraction. The best of two of the three trials was used. A ratio of knee extensor strength (kg) to body weight (kg) was calculated; higher ratio indicates greater strength. *Functional reach*, indicating dynamic balance,^{15, 16} was measured as the distance (cm) reached with the third right metacarpal, standing and bending forward as far as possible without losing balance while keeping the arm parallel to starting level. The average of three measures (in cm) was used. A greater reach distance indicates a larger boundary of stability, and hence better dynamic balance ability. The Specific Activity Scale ascertains *exercise tolerance* through self-report of ability to perform a range of daily tasks, identifying the greatest endurance demands that an individual can perform.¹⁷ The modified Specific Activity Scale consists of 18 activities organized into six groups according to the estimated metabolic equivalents (METs) required to perform the activity:

- level 1 (<2 METs): sit quietly in a chair;
- level 2 (2–2.3 METs): dress, iron, stand for 2 hours, play cards;
- level 3 (3–5 METs): strip and make a bed, mop floors, hand wash clothes, walk 2.5 mph, bowl;
- level 4 (4.5–5.2 METs): walk down a flight of stairs;
- level 5 (5–6 METs): carry a light parcel up stairs, garden, dance a fox trot, walk 4 mph; and
- level 6 (7–9 METs): carry 24 lbs up 8 steps, shovel snow or spade soil, walk 5 mph or jog.

Participants were first asked if they could do the level 4 task (regardless of any symptoms experienced doing the task). If not able to do this task, they were asked their ability to do tasks in level 3, 2, and 1 until they identified the level of task they could do. If they were able to do level 4 tasks, then they were asked about level 5 and 6 tasks to identify the maximum level of function. Maximum level identified better exercise tolerance. *Usual walking speed*: time to walk 4 meters at usual pace (in seconds), using walking aids if needed (average of two trials). Walking time was converted to speed (meters/sec). A lower number indicated faster walking speed and better lower extremity function. *Time to do chair rise*: Time (in seconds) to rise from a chair and sit 5 times, as rapidly as possible, with arms crossed. Shorter chair rise time indicated better lower-extremity balance and strength.

Self-reported Functional disability measures—Self-reported difficulty or dependency doing mobility-related tasks included: heavy housework, walking up 10 steps, shopping, bathing, dressing, and transfers from bed to chair. If *difficulty* was reported, then probes asked the severity of difficulty: a little, some, a lot, or being unable to perform the task. If *no difficulty* was reported, participants were then asked if they (a) had modified the way they performed the task, and/or (b) performed the task less often, as a result of changes in health. These latter two measures were considered indicators of preclinical disability.^{4, 6} Three self-reported functions in walking up 10 steps, shopping, and bed transferring were classified into seven distinct subcategories for each task: (a) no difficulty/no modification (labeled as “High Function”), (b) no difficulty but with modification or frequency change, (c) no difficulty but with modification and frequency change [(b) and (c)] labeled as “Preclinical Task Modification (Preclinical disability)”, (d) a little difficulty, (e) some difficulty, (f) a lot of difficulty, and (g) unable (inability) to perform the task by oneself [(d) – (g)] labeled as “Difficulty.”

Data analysis

We first evaluated population characteristics overall and by ability to walk up 10 steps. Mean values of each physiological measure were compared across self-reported function levels for the three tasks (walking up 10 steps, shopping, and bed transferring) using analysis of variance (ANOVA), adjusting for age, race, and education; linear trend tests evaluated trends in objective physiological measure means across these seven categories.

We then tested the hypothesis that inability (unable) in different tasks is associated with specific levels of physiological functional measures, such as whether there was a hierarchical relationship between mean physiological measures (knee strength, walking speed, and exercise tolerance) and self-reported functional measures across six mobility-related tasks (i.e., heavy housework, walking up 10 steps, shopping, bathing, dressing, and bed transferring) representing a range of endurance demands.

Of the 1002 participants, 987 had complete data and were used for this analysis. According to chi-square tests for homogeneity, those with missing data were not significantly different from participants with complete data in age ($p=0.19$), race ($p=0.12$), or education ($p=0.31$).

RESULTS

The WHAS-I population consisted of 987 women 65–101 years of age at baseline, with a mean age of 78 years (Table 1). The majority (71.2%) were whites, 21% currently married, with an average of 9.9 years of education. Comparisons of sociodemographic characteristics across three categories of self-reported function in walking up 10 steps (high function, preclinical task modification (preclinical disability), and difficulty) revealed that ethnicity was most closely associated with functional level: those with difficulty were significantly more likely to be African Americans ($p<0.001$). Other demographic characteristics (age, education and marital status) were not associated with self-reported function in walking up 10 steps. Mean mini-mental scores of 26 indicating intact cognition across the three groups; although the mean differences among groups are statistically significant, the differences are not clinically meaningful.

The associations between physiological impairment measures and self-reported function in three different mobility-related tasks are presented in Tables 2, 3, and 4. These three tasks (walking up 10 steps, shopping, and bed transferring) range in mobility demand from higher to lower, respectively. In general, the results show all seven physiological measures (columns C through I of Table 2–4) and all three tasks (walking up 10 steps, shopping, and bed transferring) had adjusted means that corresponded to their functional group, and trended consistently between the highest functioning group to the lowest. For instance, means for those reporting No Difficulty but modification (preclinical disability) were consistently intermediate between the High Function group and those reporting Difficulty (P for trend <0.01).

The results for *walking up 10 steps* (Table 2) show a significant, step-wise decline in forced vital capacity, progressing from those with High Function (no difficulty and no modification), to those with Preclinical Disability (no difficulty but modification), to gradations of Difficulty, to those who reported being Unable to walk up 10 steps (p for trend $<.001$). Similar to forced vital capacity, self-reported function in walking up 10 steps was significantly associated with step-wise decline in ankle-arm blood pressure index, knee extensor strength, functional reach, exercise tolerance, and usual walking speed. Finally, for walking up 10 steps, there was a significant step-wise increase in time to do 5 chair stands—a longer time to indicate worse lower-extremity strength and balance. This dose-response association between worsening physiological function measures and worsening of self-reported function was replicated with self-reported *shopping* ($p <.001$ for each) presented in Table 3. A similar association was found

for *bed transferring* (Table 4) except for two measures: the stepwise decline of forced vital capacity and ankle-arm blood pressure was not associated with bed transfers (p for trend >0.05).

Interestingly, the category of “modification (but no difficulty) and (do the task) less often” generally showed physiological measurements more akin to those among persons reporting “a little difficulty” than to those reporting no difficulty but modification or doing the task less often. Theorizing that “modification and less often” might be an expression of difficulty without explicitly stating this, we explored whether combining this group with those reporting “a little difficulty” might provide an even stronger association with physiological measures. The tests for trend were comparably significant ($p < 0.001$) for both self-reported function walking up 10 steps, shopping, and bed transferring categorized in either the original seven groups or the collapsed (six) groups.

We then evaluated whether unable (inability) to do various mobility-related tasks (heavy house work, walking up 10 steps, shopping, bathing, dressing, and bed transferring) would be manifested at different levels of knee extensor strength, walking speed and exercise tolerance, depending on the task. That is, unable (inability) to do a less demanding task would occur at lower levels of knee strength, exercise tolerance or walking speed, and at higher levels for more demanding ones. The mean level of each physiological measure for those who self-reported being unable to do heavy housework, walk up 10 steps, shop, bathe, dress, or perform bed transfers was adjusted for age, race, and education (Figure 1). In each graph (Figure 1a–c), unable (inability) to do heavy housework occurred at a higher mean level of physiological performance than did unable (inability) to dress or transfer from bed to chair, with mean levels of physiological performance associated with unable (inability) to walk up 10 steps, shop, and bathe intermediate between these other tasks. The knee strengths (in kg/body weight in kg) at which unable (inability) was reported were: 0.16 for heavy housework, 0.15 for walking up 10 steps and for shopping, 0.14 for bathing, 0.11 for dressing, and 0.07 for bed transfers (Figure 1a). Mean walking speeds were 0.53 m/s for those unable to do heavy housework, 0.42 m/s for unable/inability to bathe, .40 m/s for inability to shop, 0.35 m/s for inability to walk up 10 steps, 0.25 m/s for inability to dress and 0.21 m/s for unable/inability to transfer (Figure 1b). Those who reported being unable to perform heavy housework experienced this at a mean exercise tolerance (3.8 METS) higher than that for inability to shop (3.3 METS), followed, in rank order, by mean exercise tolerances for inability to bathe (3.0 METS), walk up 10 steps (2.6 METS), dress (2.0 METS), and transfer (1.7 METS, Figure 1c).

DISCUSSION

This work indicates that, among moderately to severely disabled older women living in the community, there is a wide spectrum of functioning, with difficulty or unable (inability) in some tasks, but no difficulty in others. Further, among those with no difficulty in a task, such as walking up 10 steps, approximately 27% (264/987) reported preclinical changes in their functioning: They modified the way they do the task due to underlying health changes, although reported having no difficulty with the task. The observation of an intermediate level of physiologic or performance status associated with preclinical disability in mobility-related tasks suggests that preclinical disability has meaning in already-disabled older adults, and that this preclinical disability group may be those at high risk of progression to difficulty in that task, as is the case in non-disabled older women.^{18, 19} Previous work in non-disabled or minimally disabled older women showed that reporting preclinical disability identified women at high risk of becoming disabled in walking over 18 months.⁴ The differences in physiological measures between those preclinical disability (without difficulty but modifying) and those with difficulty also suggest potential targets for intervention to prevent disability onset in selected tasks among a population already disabled in other tasks. Thus, a prevention strategy for those already disabled in some tasks would be to identify other tasks in which preclinical

modifications are reported, where risk for disablement may be high, and intervene to prevent progression.

Further, we find here that specific levels of physiological function are associated with dependency in a task. Thus, if unable (inability) to walk up 10 steps (climb a flight of stairs) is reported, on average, at ankle-arm blood pressures of 0.95 but independence is reported at levels of 1.04 or better, this suggests possible clinical targets for intervention. Such findings are also observed for levels of knee strength, exercise tolerance and other physiological measures at which dependency is reported in a given task, offering a range of potential therapeutic targets.

Our findings that dependency occurs at higher levels of performance of more demanding tasks suggests that dependency in a given mobility-related task, such as climbing up 10 steps, may identify those at risk of future dependency in other mobility-related tasks that require less strength or less function in other measures. In this population at high risk for progression to severe disability and dependency,² these data offer insight into graded degrees of physiological measures at which loss of independence occurs. Such physiological measures could offer targets for preventing disability progression and loss of independence among already-disabled older women.

That these observations of a stepwise association between self-report and physiological measures pertain in this one-third *most* disabled of community-dwelling older women as well as in previous work, among the two-third *least* disabled,^{4, 18} provides further evidence for the validity of self-reported function—both among disabled older women as well as across the full spectrum of functioning among those not cognitively impaired. Further, rank ordering, by underlying physiologic status, of task dependency among mobility-related tasks drawn from different functional groups (mobility, IADLs, ADLs) supports the assumption that grouping tasks by underlying ability, rather than type of help needed, may offer a useful approach to identifying interventions to preserve mobility function.²⁰

The major limitation of this study is its cross-sectional design which cannot establish causal association. The validity of the implications suggested by predictions of disability progression and associated changes in physiologic status merits prospective evaluation. The results are generalizable to the more disabled older women living in the community who are not severely cognitively impaired, and may or may not apply to similarly-abled older men. These results complement prior findings in the two-thirds least disabled older women,^{4, 6, 18} suggesting applicability across the full functional spectrum of community-dwelling older women.

Overall, these findings support *a priori* hypotheses and findings that physical disability and dependency result from underlying disease and physiological performance decrements.^{20–29} They further indicate that there is validity to self-reported function across a broad gradient of mobility-related tasks; that there are predictable levels of severity for underlying physiologic states with varying levels of self-reported function; and these levels are specific to a given mobility-related task. The clear physiologic measures reported here, both for preclinical disability and those who are unable to do a task, support the meaningfulness of self-report terminology and its potential utility in clinical targeting. It suggests that preventing declines in pulmonary function, peripheral vascular disease, and strength and/or exercise tolerance beyond certain physiological targets may help prevent onset of disability or dependency in mobility-related tasks in already-disabled older women, an inference supported by previous work.¹⁹ The work reported here confirms that older adults at risk of disability progression may be identifiable based on self-report and thus amenable to interventions to prevent the progression of disability and loss of independence.

Acknowledgments

This work was supported by National Institutes of Health grant R37-AG19905 and contract N01AG1-2112. Supported in part by the Intramural Research Program, National Institute on Aging, National Institutes on Health. We thank Mr. Raymond Burchfield for his outstanding work in preparing the manuscript for submission.

References

1. Guralnik, JMFL.; Simonsick, EM.; Bandeen-Roche, K.; Kasper, JD. The Women's Health and Aging Study: Health and Social Characteristics of Older Women with Disability. Vol. 95-4009. Bethesda, MD: 1995. NIH publication
2. Gill TM, Robison JT, Tinetti ME. Difficulty and dependence: two components of the disability continuum among community-living older persons [see comments]. *Ann Intern Med* 1998;128(2):96–101. [PubMed: 9441588]
3. Gill TM, Gahbauer EA. Evaluating disability over discrete periods of time. *J Gerontol A Biol Sci Med Sci Jun*;2008 63(6):588–594. [PubMed: 18559633]
4. Fried LP, Bandeen-Roche K, Chaves PH, Johnson BA. Preclinical mobility disability predicts incident mobility disability in older women. *J Gerontol A Biol Sci Med Sci Jan*;2000 55(1):M43–52. [PubMed: 10719772]
5. Landgraft NC, Whitney SL, Rubinstein EN, Yonas H. Use of the physical performance test to assess preclinical disability in subjects with asymptomatic carotid artery disease. *Phys Ther Apr*;2006 86(4): 541–548. [PubMed: 16579670]
6. Fried LP, Bandeen-Roche K, Williamson JD, et al. Functional decline in older adults: expanding methods of ascertainment. *J Gerontol A Biol Sci Med Sci* 1996;51(5):206–214.
7. Petrella JK, Cress ME. Daily ambulation activity and task performance in community-dwelling older adults aged 63–71 years with preclinical disability. *J Gerontol A Biol Sci Med Sci Mar*;2004 59(3): 264–267. [PubMed: 15031311]
8. Manty M, Heinonen A, Leinonen R, et al. Construct and predictive validity of a self-reported measure of preclinical mobility limitation. *Arch Phys Med Rehabil Sep*;2007 88(9):1108–1113. [PubMed: 17826454]
9. Chu, A.; Maffeo, C.; Lo, A.; Morganstein, D. The Women's Health and Aging Study. Vol. 95-4009. Bethesda, MD: National Institute on Aging; 1995. Sampling design, weighting and estimation procedures, and computation of sampling errors; p. A1-13.NIH Pub
10. Simonsick EM, Maffeo CE, Rogers SK, et al. Methodology and feasibility of a home-based examination in disabled older women: the Women's Health and Aging Study. *J Gerontol A Biol Sci Med Sci Sep*;1997 52(5):M264–274. [PubMed: 9310080]
11. Fried, LPKJ.; Williamson, JD.; Skinner, EA.; Morris, CD. The Women's Health and Aging Study: Health and Social Characteristics of Older Women with Disability. Vol. 95-4009. Bethesda, MD: 1995. Hochberg MC for the disease ascertainment working group. Disease Ascertainment Algorithms. NIH publication; Appendix E
12. Salive, M.; Pahor, M.; Tockman, M. Women's Health and Aging Study: Health and Social Characteristics of older women with disability. Vol. 95-4009. Bethesda, MD: National Institute on Aging; 1995. Pulmonary Diseases and Conditions; p. 118-127.NIH Pub
13. Newman AB, Siscovick DS, Manolio TA, et al. Ankle-arm index as a marker of atherosclerosis in the Cardiovascular Health Study. *Cardiovascular Heart Study (CHS) Collaborative Research Group. Circulation Sep*;1993 88(3):837–845. [PubMed: 8353913]
14. Ferrucci L, Guralnik JM, Buchner D, et al. Departures from linearity in the relationship between measures of muscular strength and physical performance of the lower extremities: the Women's Health and Aging Study. *J Gerontol A Biol Sci Med Sci* 1997;52(5):275–285.
15. Duncan PW, Weiner DK, Chandler J, Studenski S. Functional reach: a new clinical measure of balance. *J Gerontol Nov*;1990 45(6):M192–197. [PubMed: 2229941]
16. Takahashi T, Ishida K, Yamamoto H, et al. Modification of the functional reach test: analysis of lateral and anterior functional reach in community-dwelling older people. *Arch Gerontol Geriatr Mar–Apr*;2006 42(2):167–173. [PubMed: 16125260]

17. Goldman L, Hashimoto B, Cook EF, Loscalzo A. Comparative reproducibility and validity of systems for assessing cardiovascular functional class: advantages of a new specific activity scale. *Circulation* Dec;1981 64(6):1227–1234. [PubMed: 7296795]
18. Fried LP, Young Y, Rubin G, Bandeen-Roche K. Self-reported preclinical disability identifies older women with early declines in performance and early disease. *J Clin Epidemiol* Sep;2001 54(9):889–901. [PubMed: 11520648]
19. Gill TM, Williams CS, Mendes de Leon CF, Tinetti ME. The role of change in physical performance in determining risk for dependence in activities of daily living among nondisabled community-living elderly persons. *J Clin Epidemiol* Jul;1997 50(7):765–772. [PubMed: 9253386]
20. Fried LP, Ettinger WH, Lind B, Newman AB, Gardin J. Physical disability in older adults: a physiological approach. Cardiovascular Health Study Research Group. *J Clin Epidemiol* 1994;47(7):747–760. [PubMed: 7722588]
21. Stuck AE, Walthert JM, Nikolaus T, Bula CJ, Hohmann C, Beck JC. Risk factors for functional status decline in community-living elderly people: a systematic literature review. *Soc Sci Med* Feb;1999 48(4):445–469. [PubMed: 10075171]
22. Fried LP, Guralnik JM. Disability in older adults: evidence regarding significance, etiology, and risk. *J Am Geriatr Soc* 1997;45(1):92–100. [PubMed: 8994496]
23. Organization WH. International classification of impairments, disabilities, and handicaps. Geneva: 1980.
24. Verbrugge LM, Jette AM. The disablement process. *Soc Sci Med* 1994;38(1):1–14. [PubMed: 8146699]
25. Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB. Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability [see comments]. *N Engl J Med* 1995;332(9):556–561. [PubMed: 7838189]
26. Fried LP, Bandeen-Roche K, Kasper JD, Guralnik JM. Association of comorbidity with disability in older women: the Women's Health and Aging Study. *J Clin Epidemiol* 1999;52(1):27–37. [PubMed: 9973071]
27. Seeman TE, Charpentier PA, Berkman LF, et al. Predicting changes in physical performance in a high-functioning elderly cohort: MacArthur studies of successful aging. *Journal of Gerontology Medical Sciences* 1994;49(3):M97–M108.
28. Guralnik JM, Kaplan GA. Predictors of healthy aging: prospective evidence from the Alameda County study. *Am J Public Health* Jun;1989 79(6):703–708. [PubMed: 2729467]
29. Gill TM, Allore HG, Hardy SE, Guo Z. The dynamic nature of mobility disability in older persons. *J Am Geriatr Soc* Feb;2006 54(2):248–254. [PubMed: 16460375]

Figure 1.
Association of physiological measures and self-reported inability/unable to perform each of six mobility-related tasks

Study population characteristics: Women's Health and Aging Study I (Baseline): self-reported function walking up 10 steps.

Table 1

Characteristics	Self-reported function in walking up 10 steps				
	Overall (N=987)	High Function No difficulty/No Modification		Preclinical Task Modification (Preclinical Disability)	
			(n=181)	(n=264)	Difficulty P-value
Age 65–74	39.2%		45.3%	38.3%	37.6% 0.3
75–84	31.3%		30.4%	29.9%	32.3%
85+	29.5%		24.3%	31.8%	30.1%
Race: Caucasian	71.2%		83.4%	75.0%	65.3% 0.001
African-American	28.3%		16.6%	24.6%	34.0%
Other	0.5%		0.0%	0.1%	0.7%
Education (mean no. yrs)	9.9		9.8	10.5	9.7 0.1
Married	21.4%		24.9%	23.1%	19.4% 0.2
Mini-Mental Score (MMSE, mean)	26.4		26.9	26.7	26.1 0.001

Table 2

Self-report of function walking up 10 steps: association with physiological impairment measures

— Women's Health and Aging Study I —

A	B	C	D	E	F	G	H	I
Self-report	(N=987)	Forced Vital Capacity (FVC)	Ankle-arm blood pressure index	Knee extensor strength (knee strength kg/body weight kg)	Functional reach (cm)	Exercise tolerance score (approximate range in METs)	Usual walking speed (4 meter) (m/sec)	Time to do 5 chair stands (sec)
Walk Up 10 Steps								
Hi Function:								
No difficulty/No modification	(n=181)	2.09	1.07	0.20	20.83	5.20	0.71	13.96
Preclinical task mod (Preclinical disability):								
Modification or less often	(n=143)	2.06	1.06	0.18	19.94	4.75	0.70	14.02
Modification and less Often	(n=121)	2.01	1.03	0.17	18.64	4.56	0.62	15.75
Difficulty:								
A little difficulty	(n=94)	2.00	1.09	0.17	20.66	4.50	0.66	15.18
Some difficulty	(n=152)	1.94	1.04	0.16	18.45	4.29	0.60	15.92
A lot of difficulty	(n=151)	1.89	1.04	0.15	17.40	3.52	0.50	17.52
Unable	(n=145)	1.66	0.95	0.15	16.44	2.65	0.41	16.86
<hr/>								
Trend test (t-value)		-5.66	-4.08	-6.50	-4.06	-19.21	-11.69	6.74
P-value (7 categories)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<hr/>								
Trend test (t-value)		-5.74	-4.44	-6.44	-4.29	-19.63	-12.20	6.83
P-value (6 categories) [/]		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

All models were adjusted for age, race, and education.

[/] 6 categories: Preclinical disability 2nd group (No Difficulty but modification and do it less often group) was combined with the group reported with a little difficulty in walking up 10 steps.

Table 3

Self-report of function in shopping: association with physiological impairment measures

— Women's Health and Aging Study I —

A	B	C	D	E	F	G	H	I
		Forced Vital Capacity (FVC)	Ankle-arm blood pressure index	Knee extensor strength (knee strength kg/body weight kg) ^I	Functional reach (cm)	Exercise tolerance specific activity scale score (approximate range in METs)	Usual walking speed (4 meter) (m/sec)	Time to do 5 chair stands (sec)
Shopping		Mean	Mean	Mean	Mean	Mean	Mean	Mean
HI Function:								
No Difficulty/No mod	(n=315)	2.07	1.07	0.19	20.39	4.98	0.74	14.03
Preclinical Task Modification (Preclinical disability):								
Modification or less often	(n=133)	2.03	1.05	0.18	18.85	4.53	0.63	15.45
Modification and less often	(n=83)	1.81	1.05	0.16	18.55	4.22	0.60	16.38
Difficulty:								
A little difficulty	(n=40)	1.94	1.05	0.17	19.34	4.64	0.62	15.23
Some difficulty	(n=55)	1.96	1.06	0.15	19.68	4.24	0.59	15.94
A lot of difficulty	(n=44)	2.10	1.00	0.15	16.79	3.72	0.56	17.38
Unable	(n=315)	1.80	1.00	0.15	17.26	3.31	0.44	16.96
<hr/>								
Trend test (t-value)		-4.40	-3.88	-6.70	-3.63	-15.37	-13.99	6.31
P-value (7 categories)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<hr/>								
Trend test (t-value)		-4.38	-3.82	-6.57	-3.78	-15.44	-14.17	6.69
P-value (6 categories) ^I		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

All models were adjusted for age, race, and education.

^I 6 categories: Preclinical disability 2nd group (No Difficulty but modification and do it less often group) was combined with the group reported with a little difficulty in shopping.

Table 4
Self-report of function in bed transferring: association with physiological impairment measures

Women's Health and Aging Study I									
A	B	C	D	E	F	G	H	I	
Self-report	(N=983)	Forced Vital Capacity (FVC)	Ankle-arm blood pressure index	Knee extensor strength (knee strength kg/body weight kg) ¹	Functional reach (cm)	Exercise tolerance specific activity scale score (approximate range in METs)	Usual walking speed (4 meter) (m/sec)	Time to do 5 chair stands (sec)	
Bed Transferring		Mean	Mean	Mean	Mean	Mean	Mean	Mean	
HI Function									
No difficulty/No mod	(n=421)	1.95	1.05	0.18	19.81	4.70	0.66	14.30	
Preclinical task modification (Preclinical disability)									
Modification or less often	(n=145)	2.02	1.04	0.18	19.17	4.48	0.60	15.41	
Modification and less often	(n= 68)	1.76	1.04	0.16	17.52	3.51	0.54	17.06	
Difficulty:									
A little difficulty	(n=129)	2.03	1.07	0.17	17.89	4.30	0.59	16.11	
Some difficulty	(n= 114)	1.97	1.03	0.15	18.34	3.74	0.53	17.16	
A lot of difficulty	(n= 79)	1.86	1.03	0.14	18.54	3.02	0.47	18.79	
Unable	(n= 27)	1.60	0.87	0.07	18.43	1.78	0.25	23.36	
Trend test (t-value)		-1.15	-1.63	-6.20	-2.16	-13.87	-7.70	7.52	
P-value (7 categories)		0.25	0.10	<0.001	0.03	<0.001	<0.001	<0.001	
Trend test (t-value)		-1.83	-2.21	-6.45	-1.81	-15.25	-8.07	7.69	
P-value (6 categories) ¹		0.07	0.03	<0.001	0.07	<0.001	<0.001	<0.001	

All models were adjusted for age, race, and education.

¹ 6 categories: Preclinical disability 2nd group (No difficulty but modification and do it less often group) was combined with the group reported with a little difficulty in bed transferring.