HHS Public Access
Author manuscript
J Am Geriatr Soc. Author manuscript; available in PMC 2017 June 02.

Published in final edited form as:
J Am Geriatr Soc. 2016 June ; 64(6): 1287–1292. doi:10.1111/jgs.14138.

Fatigued, But Not Frail: Perceived Fatigability as a Marker of Impending Decline in Mobility-Intact Older Adults

Eleanor M. Simonsick, PhD[*], **Nancy W. Glynn, PhD**[†], **Gerald J. Jerome, PhD**[‡], **Michelle Shardell, PhD**[*], **Jennifer A. Schrack, PhD**[§], and **Luigi Ferrucci, MD, PhD**[*]

[*]Intramural Research Program, National Institute on Aging, Baltimore, MD

[†]Department of Epidemiology, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA

[‡]Department of Kinesiology, College of Health Professions, Towson University, Towson, MD

[§]Department of Epidemiology, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD

Abstract

Objectives—To evaluate perceived fatigability as a predictor of meaningful functional decline in non-mobility limited older adults.

Design—Longitudinal analysis of data from the Baltimore Longitudinal Study of Aging (BLSA).

Setting—National Institute on Aging, Clinical Research Unit, Baltimore, Maryland

Participants—Five hundred forty men and women aged 60 to 89 participating in the BLSA with concurrent perceived fatigability and functional assessments and follow-up functional assessment within one to three years.

Measurements—Perceived fatigability was ascertained using the Borg rating of perceived exertion (RPE) after 5 minutes of treadmill walking at 1.5 miles per hour. Functional measures included usual and fast gait speed, the Health ABC physical performance battery (HABC PPB) and reported walking ability. Reported tiredness and energy level were examined as complementary predictors. Covariates included age, age-squared, race, follow-up time and baseline function. Meaningful decline was defined as 0.05 m/s/year and 0.07 m/s/year for usual and fast gait speed, 0.12 points/year for HABC PPB and ≥ 1 point for walking ability index.

Results—Over a mean 2.1 years, 20 to 31% of participants declined across functional assessments. Fatigability was associated with a 13 to 19% greater likelihood of meaningful decline

Address correspondence to: Eleanor M. Simonsick, PhD, 3001 S. Hanover Street, 5th Floor, Baltimore, MD 21225 simonsickel@mail.nih.gov 410-350-3965.

Conflict of Interest: None.

Author Contributions: Simonsick: study concept and design, analysis and interpretation of data, preparation of manuscript. Glynn, Jerome, Schrack: interpretation of data, critical review of manuscript. Ferrucci: acquisition of participants and data, interpretation of data, critical review of manuscript.

The results of earlier, preliminary analyses were presented at the Gerontological Society of America Annual Meeting, New Orleans, LA in November 2013.

across all measures (P = .002 to .02) per 1 unit RPE increase. After considering tiredness and energy level separately, findings were essentially unchanged and neither was associated with gait speed or physical performance decline. In contrast, each separately predicted decline in reported walking ability independent of fatigability (P = .03 and P < .001, respectively).

Conclusion—Routine assessment of fatigability may help identify older persons vulnerable to greater than expected functional decline.

Keywords

Fatigability; Mobility Decline; Aging

INTRODUCTION

Fatigue is among the most common presenting complaints in older adults;[1,2] yet, biological onset of the fatigue process likely precedes perception and may be interpreted as normal aging. Several treatable and manageable conditions may initiate and/or exacerbate fatigue[1,3] including fatigue itself.[4,5] Fatigue is frequently a prodromal symptom of more serious illnesses[6-8] which further argues for the importance of early identification. Unfortunately, the central response to fatigue – slowing down and/or reducing activity often in subtle ways not only accelerates deconditioning but also complicates recognition of fatigue as persons tend to equilibrate activity levels to avoid, diminish or delay fatigue.[9,10]

The concept of fatigability, performance deterioration or perceived exertion while performing a standardized activity has recently emerged[9] and a few performance-based measures have been developed and validated.[2,11] Poor fatigability has been concurrently associated with a higher frequency of fatigue symptoms (e.g., unusual tiredness and lower energy levels) in the past month[11] as well as poorer physical performance.[2,4,11] Whether fatigability can help identify persons at heightened risk of mobility decline; that is, greater than would be expected for a given age, sex, and functional level is unknown, yet important to ascertain as early recognition may be key to arresting or slowing the decline process.[1]

This study evaluates the association between one of these validated measures which has been labeled perceived fatigability[11] and the likelihood of meaningful decline in usual and fast gait speed, physical performance and self-reported walking ability within the subsequent one to three years in mobility intact men and women aged 60 to 89 participating in the Baltimore Longitudinal Study of Aging (BLSA). Given that simply asking about unusual tiredness or energy level may also be informative[12-14] the analysis examines perceived fatigability with and without consideration of reported tiredness and energy level. Additionally, to evaluate whether fatigability differentially predicts functional decline in younger-old versus older-old, the main analyses were repeated in two age-strata, 60-74 and 75-89 years.

METHODS

Participants

The study population consisted of 540 men and women aged 60 to 89 participating in the BLSA who reported no difficulty walking for ¼ mile and had perceived fatigability and functional assessment at baseline and follow-up functional assessment one to three years later. The BLSA is a continuous enrollment cohort established in 1958 with age-specific preferred follow-up schedules of 1 year for persons aged 80 and older and 2 years for persons aged 60 to 70. The fatigability assessment was fully implemented in September 2007 and data were available for this study through December 2014. Some participants had multiple eligible visits and whenever this occurred, the two visits closest to two years (730 days) apart were selected. An additional 240 participants with a qualifying initial visit did not have a qualifying follow-up visit. Of this group, 30 were deceased, 16 had achieved a study endpoint of either dementia or severe debility, 51 were seen outside of 1 to 3 years later, 88 were not seen, but were not overdue and 55 were overdue. This group did not differ from the analytic sample of 540 with regard to sex distribution (49.2 vs 50.0% male), mean age (71.4 vs. 72.2 years, p=.17), mean usual gait speed (1.16 vs. 1.14 m/s, p=.45) or mean fatigability score (8.75 vs. 8.77, p=.91*)*. Recent targeted recruitment of individuals aged 70 years and older with no chronic diseases, mobility limitation or cognitive impairment[15] has enriched the BLSA cohort with exceptionally healthy older adults which facilitates investigation of early markers of impending decline in overtly well-aged individuals. Examination visits take place at the National Institute on Aging Clinical Research Unit in Baltimore, Maryland and typically occur over three days. The BLSA study protocol was approved by the National Institute of Environmental Health Sciences Internal Review Board and all participants provided written informed consent.

Data Collection

Perceived Fatigability—Perceived fatigability was assessed using the Borg rating of perceived exertion (RPE)[16] immediately after walking for 5 minutes on a treadmill at 1.5 miles per hour (0.67 m/s) at zero percent grade.[11] Holding on to handrails was discouraged but permitted as a safety precaution. A large chart with the Borg rating levels from 6 to 20 hung on the wall to the left of the treadmill in full view of participants. In addition to numerals, word anchors were provided for odd numbered ratings. For example, 7 was labeled “Very, very light”, 9 “Very light”, 11 “Fairly light” and 13 “Somewhat light”. In examining the distribution, it became evident that participants preferentially selected exertion levels with word anchors. Of the 237 who selected 6 or 7, 75% selected 7; likewise, of the 161 who choose 8 or 9, 79% choose 9. Also, less than 9% rated their exertion as 12 or greater. For the main analysis, the full RPE rating from 6 to 20 was examined, but given the distribution, an alternative four category (6-7, 8-9, 10-11, 12+) measure was also evaluated. The 15-point Borg RPE is considered to be a valid indicator of exertional effort and has been found to have excellent test-retest reliability across a variety of testing conditions and populations.[17]

Physical Function—Usual and rapid gait speeds were assessed over a 6-meter course with participants asked to walk at their “usual walking pace” for two trials and then “as fast as [they] can" for two trials. Total time recorded to the hundredth of a second was divided into 6 to obtain respectively usual and rapid gait speed in meters per second (m/s). The fastest of each trial was used in the analyses. The HABC PPB is a composite measure of physical performance[18] derived from the Short Physical Performance Battery[19] with four components: usual gait speed as described above, time to stand-up from and sit back down on an armless chair five times, ability to hold three progressively more challenging balance-related stances: semi-tandem, full-tandem and single-leg for up to 30 seconds each, and ability and time to walk a narrow (20 cm wide) 6 meter course. Each test was scored on a ratio scale with maximal performance as the denominator and actual performance as the numerator. Maximal performance for usual gait speed is 2.0 m/s, for five chair stands it is 5 seconds and for the standing balance test, it is 90 seconds. For the narrow walk, three attempts were permitted to walk without stepping on or outside the tape lines marking the 20 cm width more than twice. If two or more attempts were successful the fastest was used with 2.0 m/s considered maximal. If all three attempts failed, a score of zero was assigned. Any performance exceeding the defined maximum was assigned a score of 1.0 for that test. The HABC PPB score constitutes the sum of these four ratio scores for a maximum total of 4.0.

Walking ability index score was determined from responses to a series of questions beginning with, "Because of a health or physical problem, do you have any difficulty walking a quarter of a mile that is about 2 or 3 blocks, without stopping?" Those reporting difficulty were asked whether they had a little, some or a lot of difficulty or were unable to walk. Persons denying difficulty were asked how easy it is for them to walk a quarter of a mile – very, somewhat, or not so easy – followed by whether they have any difficulty walking one mile and the ease of walking one mile if no difficulty was reported. Responses were combined to create a walking ability index ranging from 0 to 9, where 0 represents unable to walk ¼ mile and 9 indicates walking one mile is very easy.[11,20]

Reported Tiredness and Energy Level—Tiredness and energy level were assessed using an interviewer-administered questionnaire. For tiredness, the question (and response code) was, "In the past month, on average how often have you felt unusually tired during the day, all (3), most (2), some (1) or none (0) of the time?" For energy level, the question was, "During the past month, what category best describes your usual energy level, using a scale from 0 to 10, where 0 is no energy at all and 10 is the most energy you have ever had?

Covariates—Covariates included years of age and age squared to account for accelerated decline with increasing age, sex, self-defined race as black or non-black as few non-black BLSA participants identify as other than Caucasian, time between functional assessments and baseline value of the specific function evaluated.

Statistical Analyses

Meaningful functional decline, was largely defined on the basis of work conducted by Perera and colleagues.[21,22] Since a reference time period was not identified, the value signifying small decline was used and treated as an annual rate. For usual gait speed and the HABC PPB, meaningful decline was defined as a loss of 0.05 m/s/year and 0.12 points/year, respectively. Meaningful loss of fast gait speed (not evaluated by Perera et al,[21,22]) was defined as 0.07 m/s/year to yield a similar rate of decline as observed for usual gait speed in the current study. For the walking ability index, a loss of one or more points constituted meaningful decline.[20] Since persons reporting difficulty walking ¼ mile were excluded at baseline, the walking index ranged from 4 to 9.

Odds of meaningful decline for each functional measure associated with perceived fatigability over the full range from 6 to 20 were determined from logistic regression analyses controlling for the covariates noted above in all analyses. To evaluate whether asking about unusual tiredness or energy level is also informative, responses to those questions were included in separate analyses with the covariates and full range perceived fatigability. Given the response distribution of fatigability ratings (described above), a four category version was also examined. Analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC).

To evaluate whether perceived fatigability predicts meaningful decline in young-old and old-old, additional analyses were conducted separately in persons aged 60 to 74 years and those aged 75 to 89 years, involving 312 and 228 participants, respectively.

RESULTS

Participant characteristics are shown in Table 1 by perceived fatigability category. The mean age was 73 years and was higher with increasing fatigability. Percent reporting tiredness at least some of the time was greater, mean energy level lower and mean baseline levels of all physical function measures worse with increasing fatigability. The percentage of men was proportionately lower with increasing fatigability category, but race and follow-up time did not differ.

Over a mean 2.1 years of follow-up, 20 to 31% of the study population experienced meaningful decline across the functional areas assessed. As shown in Table 2, each unit increase in fatigability was associated with a 13 to 19% increased likelihood of meaningful decline for usual and fast gait speed, physical performance and walking index ($P = .002$ to $.02$) which did not change materially after considering tiredness or energy level; neither of which predicted decline in any objective performance assessment (all $P \geq .10$). In contrast, both tiredness and energy level predicted decline in subjectively assessed walking ability independent of fatigability with ORs of 1.53 (95% CI = 1.04-2.25, $P = .03$) and 0.78 (0.68-0.89), $P < .001$), respectively. The four category version of perceived fatigability performed well, but not substantially better than the full range measure. The ORs were higher after merging response levels, but significance levels were essentially unchanged.

Except for usual gait speed, rates of meaningful functional decline were higher in old-old than young-old persons (Table 3), but perceived fatigability predicted meaningful decline only in the younger group. This association was specific to the performance tests with ORs of 1.24, 1.23 and 1.36, respectively, for usual and fast gait speed and physical performance. The overall association with walking index decline was not retained in either age group ($P = .07$ for both) after age-stratification.

DISCUSSION

In non-mobility limited adults aged 60 to 89 higher ratings of perceived exertion following slow walking (1.5 miles per hour) for 5 minutes covering 1/8 of a mile (about 200 meters) is associated with an increasingly greater likelihood of meaningful functional decline over approximately two years. This particular assessment of fatigability is a highly acceptable, quick, low demand test[23] that can be safely administered by well-trained technicians to even very old adults who report no difficulty walking ¼ mile. As many older adults may be unaware of impending functional loss[24] possibly due to gradual activity reduction to reduce or avoid fatigue,[9,10] evaluating fatigability as part of a standard health assessment may provide valuable diagnostic information, but further research is necessary to evaluate the feasibility, utility and effectiveness of implementing such a measure in clinical practice.

Little prior work has examined perceived fatigability as a predictor of functional decline; nonetheless, findings from the current study compare favorably to those using exertion-based performance tests, such as the 400-meter and 6-minute walks to estimate future risk of mobility limitation or disability. In functionally limited persons aged 70 to 89 years, Vestergaard et al[25] found taking rest-stops during a normal pace 400-meter walk predicted inability to walk 400 meters 6 to 12 months later; in non-mobility limited 70-year-olds, Simonsick et al[24] found inability and slower time to complete a fast 400-meter walk predicted onset of difficulty walking ¼ mile within 2 years; and Minneci et al[26] found distance covered during a 6-minute walk in persons aged 65 and older predicted incident ADL disability within 3 years. The fatigability assessment examined here requires less and space time to administer, but these and other approaches[2] may be viable alternatives when a treadmill is unavailable and space and time are adequate.

Consistent with the purported limitations of typical fatigue measures,[9] responses to simple questions covering unusual tiredness and energy level in the past month were not informative predictors of decline in measured performance, but were nonetheless independent predictors of decline in self-reported walking ability. The few prospective studies specifically examining fatigue symptoms and functional decline have yielded mixed findings. For example, Hardy and Studenski[12] found persons aged 65 and older reporting tiredness had persistently worse function but no greater rate of decline over 3 years; while Moreh et al.[27] found tiredness associated with a higher rate of developing difficulty in activities of daily living (ADL) between age 70 and 78 and likewise Avlund et al[28] found task-specific fatigue in 75 year-olds predicted onset of mobility and ADL disability over 5 years. The current study extends these findings to non-mobility limited individuals and loss of walking reserve, as only 20 out of 135 (15%) persons with walking ability decline reported difficulty walking ¼ mile at follow-up.

The age-stratified analyses revealed a critically important observation that the association of fatigability with meaningful decline was most pronounced in young-old persons, those aged 60-74, who typically are on a less steep decline trajectory.[29,30] This finding suggests that older persons least likely to expect decline may benefit most from routine fatigability assessment and further that such testing may be most appropriate for younger and seemingly robust older adults. It is important to note that the study is underpowered to definitively demonstrate the lack of association in the older group.

The primary limitation of this work concerns the generally better fitness and health status of BLSA participants relative to similarly aged adults.[14,18,19] Thus findings are most applicable to non-mobility limited individuals who project exceptional health. A second limitation concerns the perceived fatigability measure itself which requires in-person testing and a treadmill. As noted above, viable in-person alternatives for fatigability testing exist[2,11,24-26] and a self-report instrument, the Pittsburgh Fatigability Scale, has been recently validated.[31]

In summary, even in mobility-intact older adults, walking at a slow pace for 1/8 mile is frequently perceived as more than very light activity and these gradations of feelings of exertion appear to predict mobility decline well-above limitation and disability thresholds. Assessing fatigability using a standardized task and querying perceived effort may help identify persons in the initial stages of mobility loss and restriction.

ACKNOWLEDGMENTS

Funding Source: Intramural Research Program, National Institute on Aging, National Institutes of Health

The BLSA is supported by the Intramural Research Program of the National Institute on Aging.

Sponsor's Role: None.

REFERENCES

1. Avlund K. Fatigue in older adults: An early indicator of the aging process? Aging Clin Exp Res. 2010; 22:100–115. [PubMed: 20440097]
2. Schnelle JF, Buchowski MS, Ikizler TA, et al. Evaluation of two fatigability severity measures in elderly adults. J Am Geriatr Soc. 2012; 60:1527–1533. [PubMed: 22860899]
3. Murphy SL, Smith DM. Ecological measurement of fatigue and fatigability in older adults with osteoarthritis. J Gerontol Biol Sci Med Sci. 2010; 65A:184–189.
4. Gonzales JU, Wiberg M, Defferari E, et al. Arterial stiffness is higher in older adults with increased perceived fatigue and fatigability during walking. Exp Gerontol. 2015; 61:92–97. [PubMed: 25482474]
5. Schrack JA, Simonsick EM, Ferrucci L. The energetic pathway to mobility loss: An emerging framework for longitudinal studies on aging. J Am Geriatr Soc. 2010; 58:S329–336. [PubMed: 21029063]
6. Appels A, Mulder P. Excess fatigue as a precursor of myocardial infarction. Eur Heart J. 1988; 9:758–764. [PubMed: 3169045]
7. Schuitemaker GE, Dinant GJ, Van Der Pol GA, et al. Vital exhaustion as a risk factor for first stroke. Psychosomatics. 2004; 45:114–118. [PubMed: 15016924]
8. Williams JE, Mosley TH, Kop WJ, et al. Vital exhaustion as a risk factor for adverse cardiac events from the ARIC study. Am J Cardiol. 2010; 105:1661–1665. [PubMed: 20538111]
9. Eldadah BA. Fatigue and fatigability in older adults. PM R. 2010; 2:406–413. [PubMed: 20656622]
10. Alexander NB, Taffet GE, Horne FM, et al. Bedside-to-Bench conference: Research agenda for idiopathic fatigue and aging. J Am Geriatr Soc. 2010; 58:967–975. [PubMed: 20722821]
11. Simonsick EM, Schrack JA, Glynn NW, et al. Assessing fatigability in mobility-intact older adults. J Am Geriatr Soc. 2014; 62:347–351. [PubMed: 24417536]
12. Hardy SE, Studenski SA. Fatigue and function over three years among older adults. J Gerontol Biol Sci Med Sci. 2008; 63:1389–1392.

13. Mänty M, Mendes de Leon CF, Rantanen T, et al. Mobility-related fatigue, walking speed and muscle strength in older people. J Gerontol Biol Sci Med Sci. 2012; 67A:523–529.
14. Vestergaard S, Nayfield SG, Patel KV, et al. Fatigue in a representative population of older persons and its association with functional impairment, functional limitation and disability. J Gerontol Biol Sci Med Sci. 2009; 64A:76–82.
15. Schrack JA, Knuth ND, Simonsick EM, et al. "IDEAL" aging is associated with lower resting metabolic rate: The Baltimore Longitudinal Study of Aging. J Am Geriatr Soc. 2014; 62:667–672. [PubMed: 24635835]
16. Borg G. Psychophysical scaling with applications in physical work and the perception of exertion. Scan DJ Work Environ Health. 1990; 16:55–58.
17. Robertson RJ, Noble BJ. Perception and physical exertion: Methods, mediators and applications. Exerc Sport Sci Rev. 1997; 25:407–452. [PubMed: 9213100]
18. Simonsick EM, Newman AB, Nevitt MC, et al. Measuring higher level physical function in well-functioning older adults: Expanding familiar approaches in the Health ABC study. J Gerontol A Biol Sci Med Sci. 2001; 56A:M644–M649. [PubMed: 11584038]
19. Guralnik JM, Ferrucci L, Simonsick EM, et al. Lower extremity function in persons over the age of 70 years as a predictor of subsequent disability. N Engl J Med. 1995; 332:556–561. [PubMed: 7838189]
20. Simonsick EM, Newman AB, Ferrucci L, et al. Subclinical hypothyroidism and functional mobility in older adults. Arch Intern Med. 2009; 169:2011–2017. [PubMed: 19933964]
21. Perera S, Studenski S, Newman A, et al. Are estimates of meaningful decline in mobility performance consistent among clinically important subgroups? J Gerontol Biol Sci Med Sci. 2014; 69:1260–1268.
22. Perera S, Mody SH, Woodman RC, et al. Meaningful change and responsiveness in common physical performance measures in older adults. J Am Geriatr Soc. 2006; 54:743–749. [PubMed: 16696738]
23. Schrack JA, Simonsick EM, Ferrucci L. The relationship of the energetic cost of slow walking and peak energy expenditure to gait speed in mid-to-late life. Phys Med Rehabil. 2013; 92:28–35.
24. 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]
25. Vestergaard S, Patel KV, Walkup MP, et al. Stopping to rest during a 400-meter walk and incident mobility disability in older persons with functional limitations. J Am Geriatr Soc. 2009; 57:260–265. [PubMed: 19170785]
26. Minneci C, Mello AM, Mossello E, et al. Comparative study of four physical performance measures as predictors of death, incident disability and falls in unselected older persons: The Insufficienza Cardiaca negli Anziani Residenti a Dicomano study. J Am Geriatr Soc. 2015; 63:136–141. [PubMed: 25597564]
27. Moreh E, Jacobs JM, Stressman J. Fatigue, function and mortality in older adults. J Gerontol Biol Sci Med Sci. 2010; 65:887–895.
28. Avlund K, Damsgaard MT, Sakari-Rantala R, et al. Tiredness in daily activities among nondisabled old people as determinant of onset of disability. J Clin Epidemiol. 2002; 55:965–973. [PubMed: 12464372]
29. Buracchio T, Dodge HH, Howieson D, et al. The trajectory of gait speed preceding mild cognitive impairment. Arch Neurol. 2010; 67:980–986. [PubMed: 20697049]
30. Reinders I, Murphy RA, Koster A, et al. Muscle quality and muscle fat infiltration in relation to incident mobility disability and gait speed decline: The Age, Gene/Environment Susceptibility-Reykjavik study. J Gerontol Med Sci. 2015; 70:1030–1036.
31. Glynn NW, Santanasto AJ, Simonsick EM, et al. The Pittsburgh Fatigability Scale for older adults: Development and validation. J Am Geriatr Soc. 2015; 63:130–135. [PubMed: 25556993]

Table 1

Baseline Characteristics According to Fatigability Rating Score Category

Characteristic	RPE 6-7 n = 270	RPE 8-9 n = 161	RPE 10-11 n = 94	RPE ≥ 12 n = 48	P-Value[a]
Age, mean ± SD	71.1 ± 7.5	73.8 ± 7.5	74.4 ± 7.6	78.2 ± 6.5	<.001
Men, %	54.9	50.3	42.6	39.6	.01
Black race, %	22.7	21.7	29.8	25.0	.34
Unusual tiredness, %	33.3	33.5	42.6	64.6	<.001
Energy level, mean ± SD	7.87 ± 1.42	7.73 ± 1.47	7.34 ± 1.47	6.50 ± 1.83	<.001
Usual gait speed, mean ± SD	1.22 ± 0.20	1.16 ± 0.20	1.06 ± 0.19	0.99 ± 0.22	<.001
Fast gait speed, mean ± SD	1.86 ± 0.34	1.75 ± 0.31	1.58 ± 0.33	1.47 ± 0.32	<.001
HABC PPB score, mean ± SD	3.01 ± 0.36	2.83 ± 0.50	2.74 ± 0.44	2.36 ± 0.72	<.001
Walking index, mean ± SD	8.58 ± 0.97	8.25 ± 1.24	7.80 ± 1.51	7.52 ± 1.66	<.001
Years of follow-up, mean ± SD	2.10 ± 0.33	2.07 ± 0.31	2.04 ± 0.36	2.03 ± 0.41	.06

RPE = Rating of Perceived Exertion; SD = standard deviation; HABC PPB = Health ABC Physical Performance Battery

[a]For trend, unadjusted

Table 2

Association Between Perceived Fatigability Rating and Clinically Meaningful Functional Decline with and without Consideration of Reported Tiredness and Energy Level (N=540)

Function	Usual Gait Speed	Fast Gait Speed	HABC PPB	Walking Index
		Meaningful Decline, %		
	30.9	28.9	20.4	25.0
		Odds Ratio (95% Confidence Interval) P-Value [a]		
Fatigability	1.19 (1.07-1.32) .002	1.13 (1.02-1.25) .02	1.17 (1.05-1.30) .004	1.14 (1.04-1.26) .008
Fatigability[b] plus	1.20 (1.08-1.33) <.001	1.12 (1.01-1.25) .03	1.16 (1.05-1.29) .006	1.12 (1.02-1.24) .02
Tiredness	0.71 (0.48-1.07) .10	1.20 (0.81-1.78) .36	1.09 (0.72-1.65) .69	1.53 (1.04-2.25) .03
Fatigability[c] plus	1.18 (1.06-1.31) .002	1.12 (1.01-1.25) .03	1.17 (1.05-1.30) .005	1.11 (1.00-1.23) .04
Energy Level	0.96 (0.83-1.10) .54	0.95 (0.83-1.09) .45	1.00 (0.86-1.16) .99	0.78 (0.68-0.89) <.001
Fatigability Category	1.42 (1.13-1.79) .003	1.28 (1.02-1.60) .03	1.42 (1.13-1.79) .003	1.31 (1.06-1.62) .02

HABC PPB = Health ABC Physical Performance Battery

[a] Adjusted for age, age squared, sex, race, time between baseline and follow-up visit and baseline value of the specific physical function assessed. The odds ratios indicate the likelihood of meaningful decline per 1 unit increase in perceived fatigability.

[b] Using the same model described in footnote a, but with the addition of tiredness. Odds ratios, 95% confidence interval and p-values are for fatigability and tiredness in the same model.

[c] Using the same model described in footnote a, but with the addition of energy level. Odds ratios, 95% confidence interval and p-values are for fatigability and energy level in the same model.

Author Manuscript

Author Manuscript

Author Manuscript

Table 3

Association Between Perceived Fatigability Rating and Clinically Meaningful Functional Decline Stratified by Age Group

Function	Usual Gait Speed	Fast Gait Speed	HABC PPB	Walking Index
		Meaningful Decline, %		
Age 60-74 N=312	28.9	25.3	12.2	18.0
Age 75-89 N=228	33.8	33.8	31.6	34.7
		Odds Ratio (95% Confidence Interval) P-Value [a]		
Age 60-74	1.24 (1.08-1.44) .003	1.23 (1.05-1.43) .009	1.36 (1.14-1.62) <.001	1.15 (0.99-1.32) .07
Age 75-89	1.12 (0.95-1.30) .17	1.06 (0.92-1.23) .40	1.07 (0.93-1.22) .34	1.13 (0.99-1.30) .07

HABC PPB = Health ABC Physical Performance Battery

[a]Adjusted for age, age squared, sex, race, time between baseline and follow-up visit and baseline value of the specific physical function assessed. The odds ratios indicate the likelihood of meaningful decline per 1 unit increase in perceived fatigability.