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Responsiveness of the Index of Mobility Limitation: Comparison With Gait Speed Alone in the Longitudinal Aging Study Amsterdam

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Background. Interpreting self-reported disability differences between diverse older populations is complicated by differences in attitudes and environment. We have previously reported on the index of mobility-related limitation tests (MOBLI), and shown that it predicts mortality over 4 years. In this article, we examine whether the index is responsive to changes in self-reported mobility disability.

Methods. Data on gait speed, time to complete 5 chair stands, and peak expiratory flow rate, with self-reported difficulty walking for 5 minutes, were available from the baseline and two 3-year follow-ups in the Longitudinal Aging Study Amsterdam. Analysis used data on changes in the index (or walking speed alone) and corresponding change over 3 years in self-reported difficulty or inability with a medium-distance walk.

Results. During all follow-ups, groups reporting deterioration in functioning had relatively larger changes in gait speed and MOBLI score than did the ''no deterioration'' groups. In comparative analyses of responsiveness, the MOBLI score had a larger responsiveness index, higher odds ratios, and larger receiving operating characteristic area than gait speed alone.

Conclusions. The MOBLI index of mobility-related physical limitation tests is responsive to changes in self-reported mobility disability over two 3-year periods, and performs better than gait speed alone. This property is strongly supportive of its validity for epidemiological comparison of older populations across countries or over longer periods of time.

DISABILITY reflects physiological limitations, social and environmental barriers, and ''sickness'' behavior. Being able to measure these influences separately would greatly assist interpretation of disability comparisons between different older populations or over longer periods of time.

We previously reported the empirical identification of an index of mobility-related limitations (MOBLI), which is closely associated with reported mobility disability in the U.S. Third National Health and Nutrition Examination Survey (NHANES III) (1).

We have concentrated on mobility disability, as it is more common that other domains of physical disability (upper extremity, instrumental activities of daily living, and basic activities of daily living) (2,3). Mobility difficulty over medium distances (quarter mile or half mile) is also an early marker of the disablement process, and is predictive of severe disability (4). Finally, walking is a central part of daily functioning and is a universal activity little influenced by cultural differences. It is thus suitable for international or intercultural comparisons.

The MOBLI index includes three measures: gait speed, time to complete 5 chair stands, and peak expiratory flow rate. These three measures were selected, from a wider set of measures in NHANES III, as being economical to undertake in large epidemiological studies and providing the great majority of the information contained in the full set of relevant measures (1).

Having selected these measures based on their combined association with reported mobility disability in the cross-sectional NHANES III dataset, evidence was needed to show that the index has predictive validity and is sensitive to change over medium time periods. The short-term repeatability of the constituent tests have been assessed previously and have been reported as good (5,6). In another paper (Melzer D, Lan T-Y, Guralnik JM, unpublished observations), we showed that the index is indeed predictive of subsequent mortality over a 4-year period in the two sites of the Established Populations for Epidemiologic Studies of the Elderly (EPESE), which collected the necessary data. In this article, we examine whether the index is responsive to changes in the self-reported mobility disability status of the monitored population.

Sensitivity to change is the ability of an instrument to detect change when ''meaningful'' change has occurred. Substantial work has been done on the short-term responsiveness of newly developed instruments in evaluation of impairment and functional limitation (7–10) and disability (11,12) in clinical settings. However, responsiveness of an instrument using longer-term longitudinal population-based data has rarely been demonstrated. In this analysis, we used the Longitudinal Aging Study Amsterdam (LASA) (based in the Netherlands), which is one of the very few sources of the necessary repeated data from functional measures over time periods of 3 years, to determine the responsiveness of the MOBLI index. Gait speed alone has

been advocated as a good marker of mobility disability (13,14), and therefore we have compared the responsiveness of the MOBLI index with that of gait speed alone.

Methods

Study Design

Data were from the LASA, a longitudinal study of predictors and consequences of changes in well-being and autonomy in the older population of the Netherlands. Thus far, the LASA study has conducted 3 cycles of interviews and performance tests, with a time interval of approximately 3 years. The cohort was originally recruited for the NESTOR program, Living Arrangements and Social Networks of Older Adults (NESTOR-LSN) (15).

A random sample of older persons (aged 55 to 85 years), stratified by age and sex, was drawn from the population registers of 11 municipalities in 3 geographic areas in the west, northeast, and south of the Netherlands (16). The oldest-old (birth year between 1908 and 1917) were oversampled, but persons aged 85 years and older were excluded because of their high expected 10-year attrition rate. Initially 3805 respondents were interviewed by the NESTOR-LSN in 1992. About 10 months later, 3107 took part in the LASA baseline interview (T_1), conducted between September 1992 and September 1993. The second interview (T_2) was conducted between September 1995 and September 1996. Of those with complete baseline data, 2545 completed the second interview. Three years after the second interview (between 1998 and 1999), respondents were approached for the second follow-up interview (T_3). Complete follow-up data were then available for 2076 respondents. The details of follow-up results and recruitment design have been described elsewhere (17). Attrition between the three cycles was mainly caused by mortality (74.2% of attrition in T_1 and 73.3% in T_2) (18). Respondents who lived in nursing homes or hospitals, and those for whom follow-up data on the three physical measures (measured walk, 5 chair stands, and peak flow test) were unavailable, were also excluded from the analysis. Data on a total of 1034 respondents were available for this analysis.

The details of the methods used in the interviews have been described previously (19,20). In brief, all interviews (main and medical) were performed in the homes of respondents by specially trained and intensively supervised interviewers. The instructions of walking test, 5 chair stands, and peak flow test followed those used in the U.S. Established Populations for Epidemiologic Studies of the Elderly (EPESE) and were similar to those in the NHANES III.

Measurement of Variables

Physiological variables.—A gait speed test measured the time taken to walk a 3-meter course without help. Respondents were instructed to walk as fast as possible to the other end of the course, to turn around, and to walk back. They were allowed to use assistive devices if needed. Gait speed was calculated as the average speed for completing the whole walking course (21,22).

The 5 chair-stands test measured the time to stand from a sitting position 5 times, without using the arms. Respondents were asked to stand up and sit down on a straight-backed chair as quickly as possible. The time was measured from the initial sitting position to the final fully erect position at the end of the fifth stand (21,22).

Pulmonary function was assessed by the peak flow rates of respondents using a mini peak flow meter. The respondents were asked to take a deep breath and blow as fast and as hard as they could into the instrument while they were in a standing or sitting (for those who were unable to stand) position. The maximum of 3 trials was chosen as the peak flow (23,24).

The MOBLI index included an ''economical'' set of physiological measures associated with self-reported difficulty or inability in walking a quarter mile. These measures include average gait speed, time to do 5 chair stands, and peak flow rate. The score of MOBLI was the predicted probability calculated from the calibrated difficulty or inability logistic regression models including these 3 measures. Older people with a higher MOBLI score have a higher probability of mobility limitation and of reporting medium-distance walking difficulty or inability. [Details of the MOBLI equations and how to calculate the MOBLI score can be seen online (25).]

Self-reported physical functioning.—The MOBLI index was developed based on the NHANES III (4) as a marker of medium-distance mobility disability question asking about difficulty ''walking a quarter of a mile.'' In LASA, a related question on medium-distance mobility was asked, namely, ''Can you walk outside for 5 minutes without stopping?.'' (In the original LASA design, both version of this item—''walking a quarter of a mile'' and ''walking 5 minutes'' were considered together. For the study respondents in the Netherlands, the latter format conveyed a clearer concept of a medium-distance walk, and was chosen).

The LASA walking difficulty question had the following response categories: ''without difficulty,'' ''with some difficulty,'' ''with much difficulty,'' ''only with help,'' and ''not able to do.'' For comparability with the MOBLI formula, those who reported that they could only complete the walk with help were regarded as ''unable to do.'' Respondents were classified into 2 sets of dichotomized response groups: 1 based on reporting any difficulty and 1 based on an inability to walk for 5 minutes. For the difficulty classification, responses were recoded as follows: no difficulty (''without difficulty'') versus with difficulty (including ''with some difficulty,'' ''with much difficulty,'' ''only with help,'' and ''not able to do''). For the group reporting an inability to walk for 5 minutes, the coding was: no inability (''without difficulty,'' ''with some difficulty,'' and ''with much difficulty'') and with inability (''only with help'' and ''not able to do'').

Statistical Analysis

Because there is no ''gold standard'' for the physical components in disability, we have used changes in self-reported mobility disability as the standard against which to assess responsiveness of measures. Between study follow-ups, there are four possible changes of self-reported

Table 1. Descriptive Statistics of the Study Variables for All 3 Waves (T_1, T_2, and T_3)

Variable		T_1	T_2	T_3
n	(Unweighted)	1034		
	(Weighted)	1038		
Sex	Male (%)	448 (43.2)		
Age (y)	Mean (*SD*)	69.7 (5.4)		
	60–69	604 (58.2)		
	70–79	384 (37.0)		
	80 and older	49 (4.8)		
Gait speed (m/s)	Mean (*SD*)	0.86 (0.28)	0.85 (0.26)	0.74 (0.27)
	Unable (%)	3 (0.3)	1 (0.1)	6 (0.5)
	Missing (%)	101 (9.7)	105 (10.1)	162 (15.6)
5 chair stands (s)	Mean (*SD*)	12.2 (3.8)	12.8 (4.3)	13.9 (6.7)
	Unable (%)	56 (5.4)	78 (7.5)	105 (10.1)
	Missing (%)	28 (2.7)	19 (1.8)	35 (3.4)
Peak flow (ml/s)	Mean (*SD*)	6916.9 (1984.5)	6627.8 (2012.6)	6577.7 (2099.7)
	Missing (%)	7 (0.7)	11 (1.0)	7 (0.7)
MOBLI score				
Difficulty	Mean (*SD*)	0.1964 (0.1865)	0.2172 (0.2105)	0.2663 (0.2323)
Inability	Mean (*SD*)	0.0527 (0.0916)	0.0632 (0.1092)	0.0883 (0.1320)
Self-report walking*	Difficulty (%)	84 (8.1)	139 (13.4)	217 (21.0)
	Inability (%)	14 (1.4)	47 (4.5)	77 (7.5)
	Missing (%)	7 (0.7)	1 (0.1)	4 (0.4)

Notes: All statistics were weighted. *Difficulty and inability rates of self-report walking were without missing values. In gait speed, ''missing'' is defined as people who did not perform the test for reasons other than ''unable,'' and, for comparability reason, who performed the test with help from another person. MOBLI = mobility-related limitation index; *SD* = standard deviation.

difficulty or inability, namely ''no'' to ''no''; ''no'' to ''with''; ''with'' to ''no''; and ''with'' to ''with.''

The responsiveness of MOBLI score and gait speed test to changes of self-reported difficulty or inability was then compared based on the responsiveness indices. As suggested by Husted (26), the responsiveness index (RI), logistic regression models, and receiving operating characteristic (ROC) analysis were employed.

Responsiveness indices.—The RI, developed by Guyatt (27), is calculated by taking the ratio of the minimal estimated clinical change divided by the square root of twice the mean square error. Where there are only 2 observations of the measure (e.g., two waves of the measure), the mean square error in the equation is the standard deviation of the individual changes in the stable subgroup. In this analysis, the numerator equals the mean changes in response for change in self-reported difficulty or inability minus the mean changes in response for the stable disability status (total sample). The denominator is the standard deviation of change in response for the total sample. By its construction, RI characterizes the relative amount of change instead of direct change. A value of 0.20 or less conventionally represents small responsiveness, 0.50 reflects moderate responsiveness, and 0.80 or greater is considered as large responsiveness (28–32).

In logistic regression models and ROC analysis, changes in self-reported difficulty or inability between T_1 to T_2 and T_2 to T_3 were recoded as a binary variable: 0 or 1. For example, in the analysis of deterioration, those who reported ''no difficulty'' or ''no inability'' in both interviews were coded as 0 (no deterioration), whereas those who changed from ''no difficulty'' or ''no inability'' to ''with difficulty'' or ''with inability'' were coded as 1 (deterioration). In logistic regression models, all changes of measures between follow-ups were calculated in tenths, and odds ratios (ORs) therefore represented risk of deterioration in self-reported difficulty or inability per unit change of the measure (for example, 0.1 MOBLI score increased and 0.1 m/s of gait speed was lost). To reflect the sampling, all ORs were adjusted for sex, age (at baseline in 10-year age groups), and urbanization index. In ROC analysis, the area under the ROC curve (AUC) was calculated with combinations of sensitivity (probability of the measure of MOBLI score or gait speed correctly classifying people who deteriorated in self-reported difficulty or inability) and specificity (probability of the measure of MOBLI score or gait speed correctly classifying people who did not deteriorate in self-reported difficulty or inability).

All statistics were computed by using SPSS-PC version 10 (SPSS, Inc., Chicago, IL).

Results

Table 1 presents the descriptive statistics of all the variables used in the analysis. An increase in self-reported difficulty or inability rates and MOBLI scores, and a decrease in physiological ability including gait speed, chair stands, and peak flow, were found over the two follow-up periods.

Rates (%) for the four possible changes of self-report difficulty or inability in each transition were calculated for 1020 (out of total 1034) participants who completed the self-reported mobility question. For the measure of difficulty, percentages of the sample remaining with ''no difficulty,'' deteriorating to ''with difficulty,'' remaining ''with difficulty,'' and recovering from ''with difficulty'' were 82.8%, 8.4%, 6.5%, and 2.3%, respectively, in T_1 to T_2, and 73.4%,

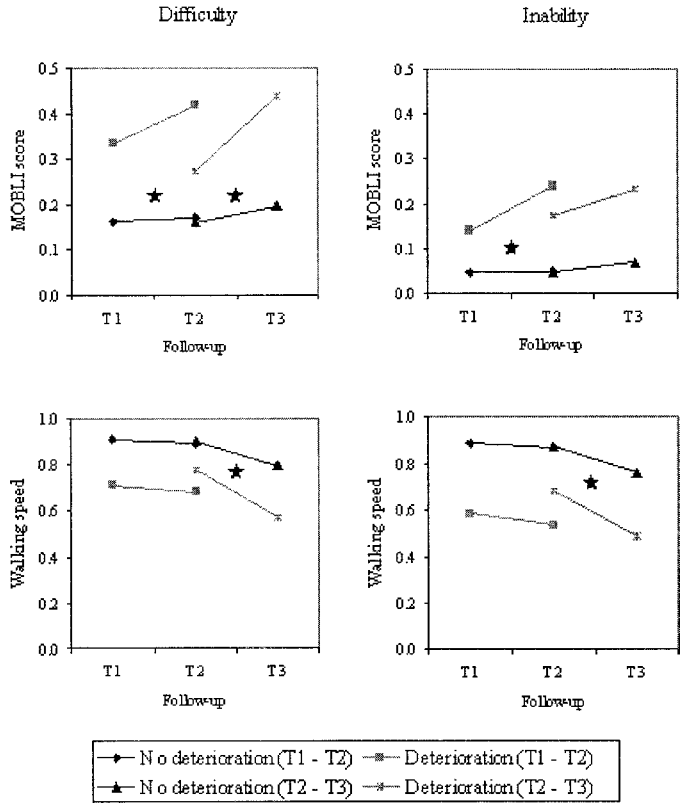

Figure 1. Diagrams showing mean changes of MOBLI (index of mobility-related limitation) score and gait speed in deterioration of self-report walking difficulty or inability T_1 to T_2 and T_2 to T_3. Total $n = 1025$ in measure of MOBLI score; 695 in measure of gait speed (because of exclusion of ''unable'' and ''missing'' in walking test); see numbers in Table 2. *Deterioration*: respondents who rated walking from ''no difficulty or inability'' to ''with difficulty or inability'' between T_1 and T_2 or T_2 and T_3; *No deterioration*: respondents who rated their mobility function remaining as ''no difficulty or inability'' between T_1 and T_2 or T_2 and T_3. An asterisk (*) marked between ''deterioration'' group and ''no deterioration'' group indicates that the difference of mean changes in the MOBLI score or gait speed between the 2 groups is statistically significant at $p < .05$ using the t test.

11.7%, 11.4%, and 3.5% respectively, in T_2 to T_3. Similarly, percentages remaining with ''no inability,'' deteriorating to ''with inability,'' remaining ''with inability,'' and recovering from ''with inability'' were 94.0%, 4.3%, 0.7%, and 1.0%, respectively, in T_1 to T_2, and 89.2%, 5.8%, 3.0%, and 2.0%, respectively, in T_2 to T_3. Clearly, remaining with ''no difficulty'' or ''no inability'' were the common transitions out of the four possibilities, with the other transitions affecting too few of the sample to provide robust estimates. Therefore, in this analysis, we only included the common transitions.

As walking disability was taken as the external criterion, we hypothesized that there would be significant change (responsiveness) for the group reporting deterioration, and relatively little change for those reporting no deterioration.

Relative Changes of MOBLI and Gait Speed in Reporting Deterioration

Figure 1 shows the changes of MOBLI score and gait speed alone for groups reporting deterioration or no deterioration, during the transitions from T_1 to T_2 and T_2 to T_3. Mobility-related physical functioning, including gait speed, has been found to decline with increasing age, including in non-disabled older persons (21,33). Similarly, the decline in gait speed and increase in MOBLI score with increasing age in the same cohort can also be seen in Figure 1. The change in scores is more obvious from T_2 to T_3 than in the first interval.

With regard to the deterioration of self-reported difficulty or inability, during all follow-ups ''deterioration'' groups had relatively larger reduction in gait speed and increase in MOBLI score than were evident in the ''no deterioration'' groups. (All mean changes of the MOBLI score and gait speed were larger in the ''deterioration'' groups than in the ''no deterioration'' groups (t tests of the differences between 2 groups reached statistical significance, $p < .05$, in asterisked comparisons; see Figure 1). In addition, although all people had the same self-reported mobility conditions (all with no difficulty or no inability) before transition (T_1 or T_2), there appears to be a clear difference between no deterioration and deterioration in MOBLI score and gait speed. In other words, the people who deteriorated already had lower mobility function than those who did not, even if both groups reported no difficulty or no inability at the beginning of follow-up.

Responsiveness Indices of MOBLI Compared With Gait Speed

Table 2 shows the responsiveness index for gait speed and the MOBLI score between T_1 to T_2 and T_2 to T_3.

Table 2. Relative Changes of the MOBLI Score and Gait Speed Reflecting Changes in Self-Reported Difficulty or Inability

		T_1 to T_2		T_2 to T_3	
Self-Report		MOBLI	WS	MOBLI	WS
Difficulty					
No deterioration	*n*	865	599	774	538
	Mean of change	0.0107	−0.0192	0.0370	−0.1092
	(*SD*)	(0.1439)	(0.2945)	(0.1531)	(0.2612)
	RI	−0.0615*	0.0049*	−0.0591*	0.0355*
Deterioration	*n*	78	48	113	71
	Mean of change	0.0835	−0.0294	0.1665	−0.2079
	(*SD*)	(0.3021)	(0.1955)	(0.2552)	(0.2335)
	RI	0.3491**	−0.0306*	0.5900**	−0.3537**
Total	*n*	1025	695	1025	695
	Mean of change	0.0216	−0.0206	0.0488	−0.1182
	(*SD*)	(0.1773)	(0.2879)	(0.1995)	(0.2536)
Inability					
No deterioration	*n*	970	666	927	640
	Mean of change	0.0053	−0.0205	0.0227	−0.1132
	(*SD*)	(0.0952)	(0.2917)	(0.0921)	(0.2580)
	RI	−0.0504*	0.0003*	−0.0137*	0.0197*
Deterioration	*n*	40	23	51	29
	Mean of change	0.1019	−0.0421	0.0613	−0.1983
	(*SD*)	(0.1910)	(0.1830)	(0.2726)	(0.2060)
	RI	0.8515***	−0.0747*	0.3179**	−0.3159**
Total	*n*	1025	695	1025	695
	Mean of change	0.0107	−0.0206	0.0243	−0.1182
	(*SD*)	(0.1071)	(0.2879)	(0.1164)	(0.2536)

Notes: All statistics were weighted. Changes = difference between T_1 and T_2 ($T_2 - T_1$) or T_2 and T_3 ($T_3 - T_2$); RI = Guyatt's Responsiveness Index; MOBLI = score of the mobility-related limitation index; WS = average gait speed; *SD* = standard deviation. For RI, the value of <0.2 represented small responsiveness and was marked "*," the value of near 0.5 reflected moderate responsiveness and was marked "**," and the value of >0.8 was taken as large responsiveness and was marked "***."

According to our hypothesis, the deterioration group should have a relatively large change (large responsiveness) and the no deterioration group a relatively small change (small responsiveness). As shown in Table 2, the responsiveness index is small in the no deterioration groups in both MOBLI score and gait speed (all far less than 0.20). In the groups reporting deterioration, the MOBLI score showed a moderate to large (from 0.32 to 0.85) response, more so than gait speed alone (from 0.03 to 0.35, i.e., from small to moderate responsiveness).

In the logistic regression analysis, the ORs represent the estimated magnitude of deterioration in self-reported difficulty or inability associated with a 1-unit change in the MOBLI score or gait speed. As shown in Table 3, the MOBLI score had more significant ORs than gait speed.

The ROC area represents the probability that the measure of MOBLI score or gait speed correctly classified the changes in self-reported difficulty or inability as deterioration or no deterioration. The MOBLI score had a similar area under the ROC curve (AUC) as gait speed for change of self-reported inability between T_2 and T_3, but higher AUC for the other changes.

Overall, the MOBLI score was better than gait speed in terms of discrimination in self-reported deterioration, with more responsive RIs, higher ORs, and larger ROC areas.

However, one potential "bias" in this analysis could arise because values for included cases who were missing or unable to complete a test were still entered into the calculation of the MOBLI score, as set out in the development of the index (1,25), whereas, for the walking speed test, those who were missing or unable to walk could not be included. To check if these results are affected by people who were missing or unable to complete tests, we excluded these people from the MOBLI measures, using an identical sample for both the MOBLI measures and the walking speed test. After excluding these people, the MOBLI index still shows better responsiveness than gait speed alone, with relatively high responsiveness indexes, higher ORs, and AUCs (further details available by request).

Discussion

In this analysis, we have examined the responsiveness of the MOBLI index and gait speed to changes in self-reported difficulty or inability to walk a medium distance. The analysis has covered two 3-year follow-up periods in a large longitudinal study of older people. Both the MOBLI score and gait speed showed change and also identified subgroups with differing prognosis within those with the same baseline self-report of disability. The results show, however, that the MOBLI score has greater responsiveness to change over two follow-ups than did gait speed alone.

However, a number of methodological issues need to be considered in examining these results. First, the self-reported mobility question in the LASA study is not identical to the question asked in the NHANES III study used to develop the MOBLI score. In the first study, the

Table 3. Logistic Regression and ROC Area for MOBLI Score and Gait Speed in Deterioration of Self-Reported Difficulty or Inability

	MOBLI				Gait Speed			
		Logistic Regression				Logistic Regression		
Follow-Up Self-Report	*n*(*)	OR (95% CI)	*p*	Area Under ROC Curve (95% CI)	*n*(*)	OR (95% CI)	*p*	Area Under ROC Curve (95% CI)
T_1–T_2								
Difficulty	943 (78/865)	1.21 (1.06–1.37)	.004	0.5928 (0.5136–0.6720)	647 (48/599)	1.01 (0.90–1.13)	.993	0.5392 (0.4674–0.6109)
Inability	1010 (40/970)	1.61 (1.28–2.01)	<.001	0.6567 (0.5493–0.7641)	689 (23/666)	1.02 (0.87–1.20)	.806	0.5911 (0.5014–0.6808)
T_2–T_3								
Difficulty	887 (113/774)	1.45 (1.30–1.61)	<.001	0.6961 (0.6364–0.7559)	609 (71/538)	1.17 (1.06–1.28)	.002	0.6119 (0.5462–0.6776)
Inability	978 (51/927)	1.21 (0.97–1.49)	.090	0.5826 (0.4784–0.6868)	669 (29/640)	1.12 (0.97–1.30)	.128	0.5877 (0.4911–0.6842)

Notes: All statistics were weighted. MOBLI = score of the mobility-related limitation index; WS = average gait speed; * = number of deterioration compared with number of no deterioration; AUC = area under receiver operating characteristic (ROC) curve; 95% CI = 95% confidence of interval. *Deterioration*: respondents who rated walking from "no difficulty or inability" to "with difficulty or inability" between T_1 and T_2 or T_2 and T_3; *No deterioration*: respondents who rated their mobility function remaining as "no difficulty or inability" between T_1 and T_2 or T_2 and T_3. In the logistic regression, odds ratios (ORs) were risk of deterioration in self-report difficulty or inability per 0.1 of MOBLI score increased or 0.1 m/s of gait speed lost. The ORs were adjusted for sex, age (at baseline in 10-year age groups), and urbanization index.

question relates to a 5-minute walk, while in the NHANES study it related to a distance. However both questions cover a similar concept of medium-distance walking.

A second methodological issue is the possible effect of the sample selection and attrition. We selected respondents who participated in the study throughout the 6-year follow-up, excluding those who died or dropped out of the study for other reasons. This approach provides valid estimates of change occurring over a relatively long period of time, on the same people. Of course, the included group is older and less healthy in the second follow-up, and this is the likely explanation for the greater change in the MOBLI score and gait speed in the second interval than in the first interval. In addition, as set out in the methods, only a limited number of respondents completed all three waves of performance testing in LASA. However, responsiveness analysis is based on the relative change of measures in individuals, rather than in-group rates with changing numbers of cases at each wave. The effect of sample selection and attrition on the validity of our estimates should therefore be limited.

In the development of the MOBLI index, we aimed to provide an economical set of measures that could be used in large-scale epidemiological studies. The MOBLI was designed to reflect mobility-related limitation, not from some arbitrary construct, but based on the average pattern of reporting of disability in the U.S. older population. Alternative constructs, for example, those based on latent variables from a range of apparently relevant tests (34), do not have an empirical link to the actual reporting of disability in a reference older population. Establishing the validity of the measure is also essential, and we have now shown that the MOBLI index has predictive validity for mortality (Melzer D, Lan T-Y, and Guralnik JM, unpublished observations), and responsiveness to change over medium periods of time. The MOBLI index must therefore be considered seriously in any future epidemiological attempts to compare mobility between older populations who may have different attitudes to reporting difficulties. The index should also be used in epidemiological efforts to separate the physical factors from the many other factors, including environmental barriers that affect the reporting of disability.

In summary, the MOBLI index of mobility-related physical limitation is responsive to changes in self-reported mobility disability over 3-year periods, and performs better than gait speed alone. This property is strongly supportive of the index's validity for its purpose of epidemiological comparison of older populations across countries or over longer periods of time.

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