Assessing Mobility Difficulties for Cross-National Comparisons: Results from the World Health Organization Study on Global Ageing and Adult Health

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OBJECTIVES: To assess the correspondence between self-reported and measured indicators of mobility disability in older adults in six low- and middle-income countries (LMICs).

DESIGN: Cross-sectional analysis of Study on Global AGEing and Adult Health (SAGE).

SETTING: Household surveys in China, India, Russia, South Africa, Ghana, and Mexico.

PARTICIPANTS: Community-dwelling SAGE respondents aged 65 and older (N = 12,215).

MEASUREMENTS: Objective mobility was assessed according to a 4-m timed walk at normal pace conducted in the respondent's home; slow walking speed was defined according to the Fried frailty criteria (lowest quintile of walking speed, adjusted for age and height). Self-reported mobility difficulty was assessed according to a question about ability to walk 1 km; this response was dichotomized into any versus no self-reported difficulty walking 1 km (reference no difficulty). The age- (5-year groups) and sex-specific probability of self-reporting difficulty walking 1 km was estimated in those with a measured slow walk using logistic regression.

RESULTS: Between 42% and 76% of people aged 65 and older reported any difficulty walking 1 km. Average walking speed was slowest in Russia (0.61 m/s) and fastest in China (0.88 m/s). The probabilities of reporting any difficulty walking 1 km in women aged 65 to 69, for example, with a slow walk varied (China = 0.35, India = 0.90, Russia = 0.68, South Africa = 0.81, Ghana = 0.91, Mexico = 0.73; test of country differences $P < .001$). There was significant variation at older ages, albeit smaller in magnitude. Patterns were similar for men.

CONCLUSION: Although correspondence between an objective and self-reported measure of mobility was generally high, correspondence differed significantly between LMICs. International comparisons of self-reported disability measures for clinical, prevention, and policy guidelines in LMICs should consider that self-reported data may not correspond to objective measures uniformly between countries. **J Am Geriatr Soc 62:329–335, 2014.**

Key words: disability; mobility; gait; measurement; developing countries

There are large gaps in the understanding of measurement of disability in and between low- and middle-income countries (LMICs), where nearly two-thirds of the world's population aged 65 and older lives. Recent meta-analyses of mobility disability indicate that slower walking speed is associated with greater mortality risk.[1,2] Walking speed has also been associated with onset of self-reported disability[3] and was established as a highly sensitive measure of self-reported disability in a cohort of older adults in the United States.[4] Nearly all of the evidence on older adult disability comes from higher-income countries.

Basic information on prevalence and best measures of mobility disability and physical function in LMICs are lacking. Although it is important to recognize physical function and disability as distinct concepts, it is also important to understand how much the self-reported disability varies relative to an objectively measured task between countries. If self-reported mobility difficulty is a close reflection of one's actual measured ability in one country, but these self-reported and objective measures are weakly associated in another country, the self-reported measure may be much less useful for comparing disability between countries. Few studies have evaluated the correspondence between self-reported and observed mobility function assessments between multiple LMICs. Having

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comparable self-reported measures in multiple countries is critical for providing evidence to researchers and clinicians evaluating disability prevalence and developing treatment guidelines for rapidly aging LMICs.

The correspondence between self-reported and objectively measured indicators of disability has not been well evaluated in LMICs because there have been few appropriate data sources. The current study took advantage of newly available data from the World Health Organization (WHO) Study on Global AGEing and Adult Health (SAGE) to address these gaps. Specifically, the correspondence between self-reported mobility disability (difficulty walking across a room) and directly measured functional mobility limitation (timed walk) was estimated in a sample of adults aged 65 and older from China, India, Russia, South Africa, Ghana, and Mexico. Because the goal of this study was to compare a measure of self-rated mobility with an objectively measured mobility task, the correspondence was assessed as the probability that someone self-reported mobility difficulty given that they had low performance on the objective walking task.

METHODS

Study Population

SAGE is a multicountry study on aging and adult health in LMICs.[5] These cross-sectional data were collected between 2007 and 2010 in six countries: China, India, Russia, South Africa, Ghana, and Mexico. SAGE used a multistage, clustered, stratified sampling strategy to draw the sample; when sampling weights are applied, these weights allow statistical inferences to nationally representative samples of adults aged 50 and older. Technical details on the sample are provided elsewhere.[5–8] The University of North Carolina at Chapel Hill's Office of Human Research Ethics determined that this analysis was exempt.

This study was restricted to SAGE respondents aged 65 and older at the interview (because mobility limitations are less common at younger ages) with complete data on self-reported mobility limitations and timed walk (see Tables S1 and S2 for missing data description), recruited from China (n = 4,761), India (n = 2,175), the Russian Federation (n = 1,299), South Africa (n = 1,172), Ghana (n = 1,785), and Mexico (n = 1,023).

Measures

Self-Reported Mobility Disability

Self-reported difficulty walking 1 km was used to measure mobility disability. This distance is closest to one-quarter of a mile, which is a common mobility question in the United States.[9–11] Respondents were asked "In the last 30 days, how much difficulty did you have in walking a long distance such as a kilometer?" This question comes from the WHO Disability Assessment Scale, which has been evaluated in many countries.[12] Answers were reported on a Likert scale (none, mild, moderate, severe, extreme/cannot do, not applicable; Figure S1). To be consistent with other studies with similar questions, a binary indicator of any self-reported difficulty versus none (reference) was created. Few respondents (<0.05%) in each country responded "not applicable"; such responses were assumed to indicate difficulty.

Performance-Based Assessment of Functional Mobility Limitation: Timed Walk

Functional mobility limitation was assessed using a 4-m timed walk completed at the interview site. Participants were asked to walk at a normal pace and were allowed to use any mobility aids they typically used while walking. Interviewers recorded the time it took the respondent to complete the 4-m course; for consistency with other research in this area, this information was converted to walking speed (m/s).

A dichotomous variable of "slow" walking speed was created based on the Fried frailty criteria.[13] Specifically, the lowest quintile of walking speed was estimated for each 5-year age group, standardized for measured height, for all countries. On average, slow gait thresholds were roughly 0.59 m/s for men and 0.51 m/s for women; age- and sex-specific thresholds are presented in Table S3. This definition of slow walking speed was compared with another definition based on age- and sex-specific distributions of gait speed,[14] which yielded similar thresholds of slow walking speed (Table S3). A dichotomous, rather than a continuous, measure of slow gait makes most sense to compare measured difficulty with self-reported difficulty.

Analysis

For all countries, the distributions of categories to self-reported difficulty walking 1 km and the distribution of any self-reported difficulty walking 1 km was assessed by age and sex (Figures S1 and S2).

The primary analysis was the extent to which the self-reported difficulty corresponded to differences in measured slow walking speed between countries. Logistic regression was used to estimate the correspondence between measures. Specifically, the odds of any self-reported disability walking 1 km in those with a slow walking speed was estimated according to age group, sex, and country. For clarity, the estimated odds were converted into probabilities (e.g., probability (any self-reported difficulty given slow walking speed)). In models with all countries pooled, a joint Wald test of the country fixed effects was used to test whether there was a significant difference in the probability between countries.

A number of sensitivity analyses reported in supplementary material were conducted to test the robustness of the findings. To test the sensitivity of the self-reported measure, the probability of reporting difficulty with other self-reported mobility tasks (walking across the room, walking 100 m) and at higher thresholds of difficulty walking 1 km (extreme or severe difficulty vs moderate, mild, or none) was also assessed. To test the robustness of the slow gait definitions, the correspondence was also assessed when gait speed was defined based on thresholds within individual countries rather than for all countries, as well as for at the full range of gait speed. The estimates were also considered for all ages (≥50) and according to average cognitive status (lower average cognitive status defined as 1 standard deviation below the mean of three standardized (z-scores) cognitive measures: verbal fluency, word recall, and digit span; average cognitive status at or above 1-standard deviation below mean was the reference).

All estimates were calculated stratified according to country; primary estimates were also stratified according to age (5-year groups) and sex. Some sensitivity analyses adjust for age and sex statistically rather than by stratification for ease of presentation of results. Unless labeled as unweighted, all analyses used *svy* procedures in Stata 12 (Stata Corp., College Station, TX) to account for complex sampling design and have sampling weights applied.

RESULTS

Participant characteristics are reported in Table 1. The country cohorts had an average age of 71.0 to 73.8; 12% to 30% of respondents were aged 80 and older. In South Africa, Mexico, and Russia, more than 60% of the samples were female (Russia 69%).

Between 42% and 76% of people aged 65 and older reported any difficulty walking 1 km (Figure S2). Average walking speed was slowest in Russia (0.61 m/s) and fastest in China (0.88 m/s). The distribution of walking speed according to self-reported disability is presented in Figure 1, and prevalence of slow walking speed is reported in Tables S3 and S4.

The probability of self-reporting difficulty walking given that the respondent had a slow walking speed was typically greater than 0.6 for all sexes, age groups, and countries. In other words, those who had a measured slow walking speed had a high probability of self-reporting difficulty in walking, although these probabilities differed according to country; the probability was often low in China and higher in India, South Africa, and Ghana (Figure 2). In Mexico and Russia, the probabilities were generally low (<0.6) for men but high (≥0.8) for women. These cross-national differences were statistically significant for men and women at all ages ($P < .05$) except 75 to 79 ($P > .1$, Table S5). The probability of reporting difficulty given a slow walk speed increased through middle and older age, although the probability of reporting difficulty given slow walk speed was high ($P > .7$) for Indian women at all ages (≥50) (Figure S3).

These results were fairly consistent in various sensitivity analyses. These probabilities were lower when those missing the gait assessment were classified as having slow gait speed, although the patterns of country differences remained (Figure S4). Regarding the definition of slow walking speed, generally similar patterns were seen using a country-specific definition of gait speed (Figure S5), using alternative definitions of slow walking speed based on age- and sex-specific average walking speeds (Figure S6), and across the full distribution of gait speed (Figure S7). For the sensitivity of the self-reported measure, although different magnitudes of probabilities were seen, between-country differences persisted when different mobility tasks were considered (walking across the room, walking 100 m; Figure S6). In addition, the patterns were similar at higher thresholds of difficulty walking 1 km (extreme or severe difficulty vs moderate, mild, none; Figure S8). The results did not vary significantly according to cognitive status (Table S6).

Table 1. Sample Characteristics According to Country and Sex: Study on Global Ageing and Adult Health, 2007–2010

	China (%)		India (%)		Russia (%)		South Africa (%)		Ghana (%)		Mexico (%)	
Characteristic	Male n = 2,233	Female n = 2,528	Male n = 1,207	Female n = 968	Male n = 406	Female n = 893	Male n = 465	Female n = 707	Male n = 865	Female n = 920	Male n = 405	Female n = 618
Age												
65–69	35	35	44	46	37	29	41	40	33	26	36	32
70–74	31	31	30	29	29	31	28	26	29	35	22	27
75–79	21	21	15	13	20	22	14	20	17	19	22	23
≥80	13	13	12	12	15	18	16	15	21	20	20	19
Marital status												
Married	84	60	82	38	78	30	73	23	78	16	77	39
Widowed	14	38	17	61	19	62	17	60	11	66	16	45
Other	2	2	1	1	3	8	10	17	11	18	7	16
Education												
None	22	53	39	77	0	2	24	32	60	81	19	28
<High school	42	28	33	17	17	18	40	42	19	12	67	59
High school	28	16	22	5	64	67	15	12	18	5	8	4
>High school	8	3	6	1	19	13	4	3	3	1	6	9
Rural	47	44	76	72	31	19	35	36	66	57	29	26
Father's education												
Any	26	21	32	25	71	73	29	26	11	11	35	33
Missing	5	7	2	7	13	13	33	28	2	2	17	19

Cells include the percentage of the sex-specific sample size. Analyses are unweighted.

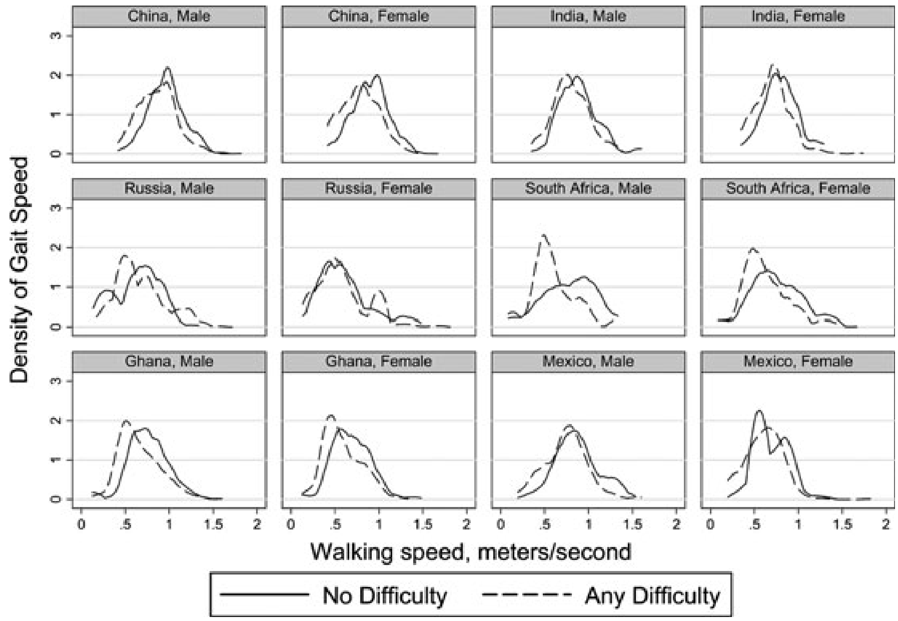

Figure 1. Distribution of gait speed according to any self-reported difficulty walking 1 km according to sex and country: Study on Global Ageing and Adult Health, 2007–2010.

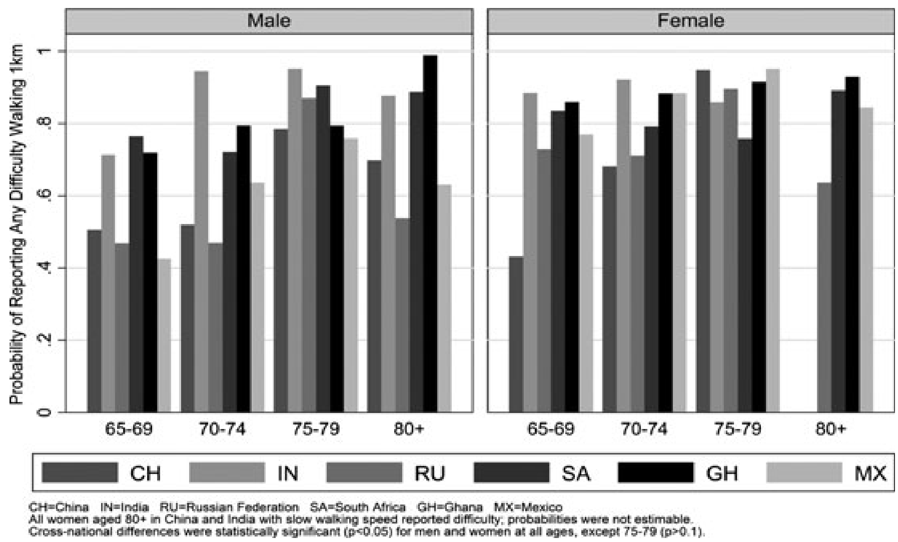

Figure 2. Predicted probabilities and 95% confidence intervals of self-reporting difficulty walking 1 km in those with slow walking speed according to sex, age, and country, Study on Global Ageing and Adult Health, 2007–2010.

DISCUSSION

This comparative study of adults aged 65 and older from China, India, Russia, South Africa, Ghana, and Mexico found the correspondence between self-reported difficulty walking 1 km and measured walking speed to be generally high. Specifically, people with slow walking speed also typically reported having difficulty walking, although the magnitude of this probability of self-reporting difficulty given a measured slow walking speed varied significantly between countries, which has important implications for cross-national and cross-cultural studies of disability relying on self-reported measures of disability alone.

Strengths and Limitations

Although SAGE offers a unique opportunity to examine disability measurement in older adults in multiple LMICs, there are limitations of this study to consider. Although some timed walk data were missing, results were similar when those missing walking speed data were reclassified as having a slow walking speed. Although there are not international standards for clinically relevant gait speed to have used to define slow gait in this study,[15] well-established definitions were used, and similar results were found with other definitions of gait speed. There was no information on the specific floor surface on which the walk was conducted.

Similarly, a 4-m walk was somewhat limiting; having other measures, such as chair-stand time, gait measures, or a longer distance walk, would have been more informative.

These limitations notwithstanding, this study has a number of important strengths. First, it used standardized measures in all of the study countries, which avoids measurement concerns that many cross-national analyses of secondary data face.[12] Second, these data are from nationally representative samples of adults aged 50 and older, which greatly enhances the generalizability of these results. The results account for age and sex, which creates comparable estimates of correspondence between these countries. The results were robust to a number of sensitivity analyses, including other definitions of slow gait speed and self-reported mobility disability. Last, this study used novel data to fill a noted gap in the literature on disability and physical function in LMICs.

Comparisons with Previous Findings

There is little relevant literature on disability and physical performance in the SAGE study countries. Thus, these results were compared with those of studies conducted in more-industrialized countries in the West and, whenever possible, with evidence from LMICs.

A higher prevalence of self-reported disability and a slower timed walk was found in adults aged 50 and older in SAGE than in similar aged cohorts in the developed West. For example, 49% of respondents aged 80 and older in the U.S. National Health and Nutrition Examination Survey (NHANES) reported having any difficulty walking one-quarter of a mile,[16] compared with 60% to 80% having difficulty walking 1 km in SAGE. Average walking speeds were also slower in SAGE countries than commonly reported in the United States. In a recent meta-analysis of gait speed in adults aged 65 and older, seven of the nine cohorts had mean gait speeds of 0.83 m/s or faster.[2] By comparison, five of six SAGE countries had average walking speeds of 0.83 m/s or slower. Others suggested, after a review of gait speed studies, that a “normal” walking speed would be 1.0 to 1.4 m/s;[15] according to this definition, all SAGE countries have slower than “normal” average walking speeds. Although data on a timed walk is rare in the SAGE study countries, a recent study of Russian community-dwelling adults aged 65 and older[17] found a median gait speed of 0.60 m/s for men and women aged 65 to 74. The current results are fairly similar—the median walking speed of Russians aged 65 to 74 in SAGE was 0.65—which suggests that the data from the current study may be valid relative to other data from SAGE countries.[18,19]

Although the self-reported and objective measures generally had high correspondence, the variation between countries may reflect that self-reported disability and physical performance are perceived as different constructs[20–24] more in some places than others. Self-reported difficulty may offer unique information in addition to physical performance and vice versa. In a study of oldest old in China, adults with self-reported and physical performance disability had lower survival than people with either or none.[20] Nevertheless, many empirical studies, including the current one, have found self-reported and performance measures to have high correspondence.[21,23,25]

In the absence of an objective or criterion standard measure, many studies employ anchoring vignettes[26,27] or item response theory[28] to adjust for cross-country differences in self-reported data. When a directly measured alternative exists, responses from the self-reported data can be evaluated against the objective measure. Often, biomarker and clinical tests are too costly or time and labor intensive for epidemiological surveys to complete; this is especially true for large studies that operate across multiple countries. Studies in the developed West have assessed self-reported outcomes against directly measured counterparts, including for mobility. For example, one found a high sensitivity and specificity; walking speed had a high sensitivity (0.71 for men, 0.82 for women) for self-reported difficulty walking.[4] The results of the current study are similar to this literature from the United States.

Implications for Future Research

These results identify gaps that future studies could address regarding physical function and disability in LMICs. Differences in correspondence between self-reported and measured difficulty at younger ages could mean that self-reported difficulty has various meanings, especially over the life course. With longitudinal data, future research should examine incidence and change in mobility throughout middle and older age based on both self-report and physical performance. In addition, one could establish how well-timed walk and self-reported disability predict future health outcomes, including mortality; these findings could inform clinical practice, interventions for disability,[29,30] and public health surveillance.

CONCLUSIONS

The prevalence of self-reported disability and observed functional limitations is high in China, India, Russia, South Africa, Ghana, and Mexico. Those with a slow walking speed had a high probability of also reporting self-reported mobility difficulty, and these probabilities varied between these six countries. Self-reported and performance-based assessments may have different meanings in different settings, and cross-national comparisons using self-reported disability should consider also using objective or other measures to account for this difference. Future research should identify the best measures of mobility disability and functional mobility limitations in LMICs to measure, anticipate, and address the needs of their rapidly aging populations.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Prevalence of missing mobility data, SAGE: 2007–2010.

Table S2. Differences in covariates by missing status (non-missing as reference).

Table S3. Slow gait speed thresholds (m/s) and prevalence (%/n) by gait speed definition.

Table S4. Prevelance of slow walking speed (Fried definition) by gender, age, and country.

Table S5. Probabilities and tests of cross-national differences in probabilities of self-reporting difficulty walking 1 km among those with a slow walk.

Table S6. Odds ratios and (*t*-statistic) of cognitive impairment on reporting difficulty given a slow walking speed.

Table S7. Differences in gait speed across countries, by age and gender.

Figure S1. Distribution of self-reported difficulty walking 1 km.

Figure S2. Prevalence of any self-reported difficulty walking 1 km by gender, age, and country.

Figure S3. Probabilities of reporting difficulty walking 1 km among those with a slow walking speed by age group (50+), gender, and country.

Figure S4. Probabilities of reporting difficulty walking 1 km among those with a slow walking speed by missing status.

Figure S5. Probability of any self-reported difficulty walking among those with a slow walking speed when slow walking speed is defined by country rather than pooled, by gender, age, and country.

Figure S6. Probability of any self-reported difficulty walking among those with a slow walking speed by definition of slow gait speed and self-reported mobility activity by gender, age, and country.

Figure S7. Probability of self-reported difficulty walking 1 km by gait speed quintile, gender, and country.

Figure S8. Probability of severe/extreme self-reported difficulty walking among those with a slow walking speed by gender, age, and country.

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