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Assessing Mobility Difficulties for Cross-National Comparisons: Results from the WHO Study on AGEing and Adult Health

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Abstract

Objective—To assess the correspondence between self-reported and measured indicators of mobility disability among older adults across six low and middle income countries [LMICs].

Design—Cross-sectional analysis of Study of Ageing and Adult Health [SAGE]

Setting—Household surveys in China, India, Russia, South Africa, Ghana, and Mexico

Participants—Community-dwelling SAGE respondents aged 65+ (total n= 12,215)

Measurements—Objective mobility was assessed by a 4-meter timed walk at normal pace conducted in the respondent's home; we defined slow walking speed per the Fried frailty criteria (lowest quintile of walking speed, adjusted for age and height). Self-reported mobility difficulty was assessed with a question about ability to walk 1 kilometer (km); we dichotomized this response into any/no self-reported difficulty walking 1 km (reference: no difficulty). We estimated the age (5-year groups) and gender-specific probability of self-reporting difficulty walking 1 km among those with a measured slow walk with logistic regression.

Results—Across the countries, between 42% and 76% of people aged 65+ 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 1km among women aged 65–69, 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-value<0.001. There was significant variation at older ages, albeit smaller in magnitude. Patterns were similar for men.

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Conflicts of Interest:
The authors have no conflicts to declare.

Author Contributions: All authors were involved in the study concept and design, analysis and interpretation of data, and preparation of manuscript. These data had already been collected; no authors were involved in the acquisition of subjects and/or data.

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Conclusion—Although correspondence between an objective and self-reported measure of mobility was generally high, correspondence differed significantly across 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 across countries.

Keywords

disability; mobility; gait; measurement; developing countries

INTRODUCTION

There are large gaps in our understanding of measurement of disability in and across low and middle-income countries [LMICs], where nearly 2/3rds of the world's aged (65+) population lives. Recent meta-analyses of mobility disability indicate slower walking speeds are associated with elevated mortality risk.[1,2] Walking speed has also been associated with increased onset of self-reported disability[3] and is established as a highly sensitive measure of self-reported disability in a cohort of older adults in the U.S.[4] Notably, nearly all of the evidence on older adult disability to date comes from higher income countries.

We lack basic information on prevalence and best measures of mobility disability and physical function in LMICs. 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 cross-nationally. 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 across countries. Few studies have evaluated the correspondence between self-reported and observed mobility function assessments across multiple LMICs. Having comparable self-reported measures across 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 very few appropriate data sources. We take advantage of the newly available data from the World Health Organization [WHO] Study on Global Ageing and Adult Health [SAGE] to address these gaps. Specifically, we estimated the correspondence between self-reported mobility disability (difficulty walking across a room) and directly measured functional mobility limitation (timed walk) in a sample of adults age 65+ from China, India, Russia, South Africa, Ghana, and Mexico. Because the goal of this study was to evaluate a measure of self-rated mobility relative to an objectively measured mobility task, we assessed the correspondence as the probability someone self-reported mobility difficulty given that they had low performance on the objective walking task.

METHODS

Study Population

SAGE is a multi-country 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 multi-stage, clustered and 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+. Technical

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details on the sample are provided elsewhere.[5–8] This analysis was deemed exempt by the University of North Carolina at Chapel Hill's Office of Human Research Ethics.

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

Measures

Self-Reported Mobility Disability—We used self-reported difficulty walking 1 kilometer to measure mobility disability. This distance is closest to one-quarter of a mile, which is a common mobility question in the U.S.[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 across many countries.[12] Answers were reported on a Likert scale (none, mild, moderate, severe, extreme/cannot do, not applicable; see Supplemental Figure 1). To be consistent with other studies with similar questions, we created a binary indicator of any self-reported difficulty versus none (reference). Very 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 with a 4-meter 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 4m course; for consistency with other research in this area, we converted this information to walking speed (meters/second).

We created a dichotomous variable of a "slow" walking speed based on the Fried frailty criteria.[13] Specifically, we estimated the lowest quintile of walking speed for each 5-year age group, standardized for measured height, across all countries. On average, slow gait thresholds were roughly 0.59m/s for men and 0.51m/s for women; age and sex-specific thresholds are presented in Supplemental Table 3. We compared this definition of slow walking speed to another definition based on age and gender-specific distributions of gait speed,[14] which yielded similar thresholds of slow walking speed (Supplemental Table 3). A dichotomous, rather than a continuous, measure of slow gait makes most sense to compare measured difficulty to self-reported difficulty.

Analysis

For all countries, we assessed the distributions of walking speed stratified by self-reported difficulty walking 1km and the distribution of self-reported difficulty walking 1km by age and gender (Supplemental Figures 1–2).

The primary analysis was the extent to which the self-reported difficulty corresponded to measured slow walking speed across countries. We used logistic regression to estimate the correspondence between measures. Specifically, we estimated the odds of any self-reported disability walking 1km among those with a slow walk time by age group, gender, and country. For clarity, the estimated odds were converted into probabilities (e.g. Probability(any self-reported difficulty | slow walking speed)). In models pooled across all countries, we tested whether there was a significant difference in the probability between countries with a joint Wald test of the country fixed effects.

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We conducted a number of sensitivity analyses reported in supplementary material to test the robustness of our findings. To test the sensitivity of the self-reported measure, we also assessed the probability of reporting difficulty with other self-reported mobility tasks (walking across the room, walking 100m) and at higher thresholds of difficulty walking 1km (extreme/severe difficulty vs. moderate/mild/none). To test the robustness of the slow gait definitions, we also assessed the correspondence when gait speed was defined based on thresholds within individual countries rather than across all countries as well as across at the full range of gait speed. We also considered the estimates for all ages (50+) and by 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 by country; primary estimates are also stratified by age (5-year groups) and gender. Some sensitivity analyses adjust for age and gender statistically rather than by stratification for ease of presentation of results. Unless labeled as unweighted, all analyses used *svy* procedures in Stata 12 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 between 71.0 and 73.8 years old; between 12–30% of respondents were aged 80+. In South Africa, Mexico and Russia, more than 60% of the samples were female (Russia: 69%).

Between 42% and 76% of people aged 65+ reported any difficulty walking 1 km (Supplemental Figure 2). Average walking speed was slowest in Russia (0.61 m/s) and fastest in China (0.88 m/s). The distribution of walking speed by self-reported disability is presented in Figure 1 and prevalence of slow walking speed is reported in Supplemental Tables 3–4.

The probability of self-reporting difficulty walking given that the respondent had a slow walking speed was typically above 0.6 across gender, age groups, and countries. In other words, those who had a measured slow walking speed had a generally high probability of self-reporting as having difficulty walking. These probabilities, however, differed by 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 ($p<0.05$) except 75–79 ($p>0.1$, Supplemental Table 5). The probability of reporting difficulty given a slow walk increased through middle and older age, though notably, the probability of reporting difficulty given a slow walk was high (probability>0.7) for Indian women at all ages (50+) (Supplemental Figure 3).

These results were fairly robust to 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 (Supplemental Figure 4). Regarding the definition of slow-walking speed, we saw generally similar patterns using a country-specific definition of gait speed (Supplemental Figure 5), using alternative definitions of slow walking speed based on age and gender-specific average walking speeds (Supplemental Figure 6), and across the full distribution of gait speed (Supplemental Figure 7). For the sensitivity of the self-reported measure, though we saw different magnitudes of probabilities, between-country differences persisted when different mobility tasks were considered (walking across the room, walking 100m; Supplemental Figure 6). In addition,

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the patterns were similar at higher thresholds of difficulty walking 1km (extreme/severe difficulty vs. moderate/mild/none, Supplemental Figure 8). The results did not vary significantly by cognitive status (Supplemental Table 6).

DISCUSSION

In this comparative study of adults aged 65+ from China, India, Russia, South Africa, Ghana, and Mexico, we found the correspondence between self-reported difficulty walking 1 kilometer relative to measured walking speed was generally high. Specifically, people with a slow walking speed also typically reported having difficulty walking. However, 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/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 among older age adults across multiple LMICs, there are limitations of this study to consider. Although there was missing walk, results were similar when those missing the walking speed were reclassified as having a slow walk. Although there are not international standards for clinically relevant gait speed to have employed to define slow gait in this study,[15] we used well-established definitions and found similar results with other definitions of gait speed. There was no information on the specific floor surface on which the walk was conducted. Similarly, we were somewhat limited by a 4-meter walk; having other measures, such as standing to walk time or gait measures, or a longer distance walk, would have been more informative.

These limitations notwithstanding, this study has a number of important strengths. First, this study uses standardized measures across the study countries, which avoids measurement issues many cross-national analyses of secondary data face.[12] Second, these data are from nationally representative samples of adults aged 50+, which greatly enhances the generalizability of these results. The results account for age and gender, which creates comparable estimates of correspondence across these countries. The results were robust to a number of sensitivity analyses, including other definitions of slow gait speed and self-reported mobility disability. Lastly, this study uses 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, we compare these results to studies conducted in more industrialized countries in the West, and wherever possible, to evidence from LMICs.

Compared to similar aged cohorts in the developed West, we find higher prevalence of self-reported disability and a slower timed walk among adults 50+ in SAGE. For example, 49% of respondents aged 80+ in the U.S. NHANES reported having any difficulty walking a quarter-mile, [16] compared to 60–80% having difficulty walking 1km in SAGE. Average walking speeds were also slower in SAGE countries than commonly reported in the U.S.. In a recent meta-analysis of gait speed among adults aged 65+, 7 of the 9 cohorts had mean gait speeds of 0.83 m/s or faster.[2] By comparison, 5 of 6 SAGE countries had average walking speeds of 0.83 m/s or *slower*. Others suggested, after a review of gait speed studies, a "normal" walking speed would be 1.0–1.4 m/s[15]; by this definition, all SAGE countries have slower than "normal" average walking speeds. Although data on timed walk is rare in the

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SAGE study countries, a recent study of Russian community-dwelling adults aged 65+ [17] found median gait speed of 0.60 m/s for men and women aged 65–74. Our results are fairly similar—the median walking speed of Russians aged 65–74 in SAGE was 0.65—which suggests that our data may be valid relative to other data from SAGE countries.[18,19]

Although the self-report and objective measures generally had a high correspondence in our sample, 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 and physical performance may indeed offer unique information above and beyond the other. In a study of oldest old in China, adults with both self-reported and physical performance disability had lower survival than people with either or none.[20] Nevertheless, many empirical studies, including ours, have found self-report and performance measures had a high correspondence.[21,23,25]

In the absence of an objective or gold-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 does exist, responses from the self-reported data can be evaluated against the objective measure. Very often, biomarker and clinical tests are too costly or time and labor-intensive for epidemiologic 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] Our results are similar to this literature from the U.S.

Implications for Future Research

These results identify gaps 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 self-reported difficulty has varied meanings, especially over the life course. With longitudinal data, future research should examine incidence and change in both 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. Although self-reported those with a slow walking speed had a high probability of also reporting self-reported mobility difficulty, these probabilities varied across 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 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 in order to measure, anticipate, and address the needs of their rapidly aging populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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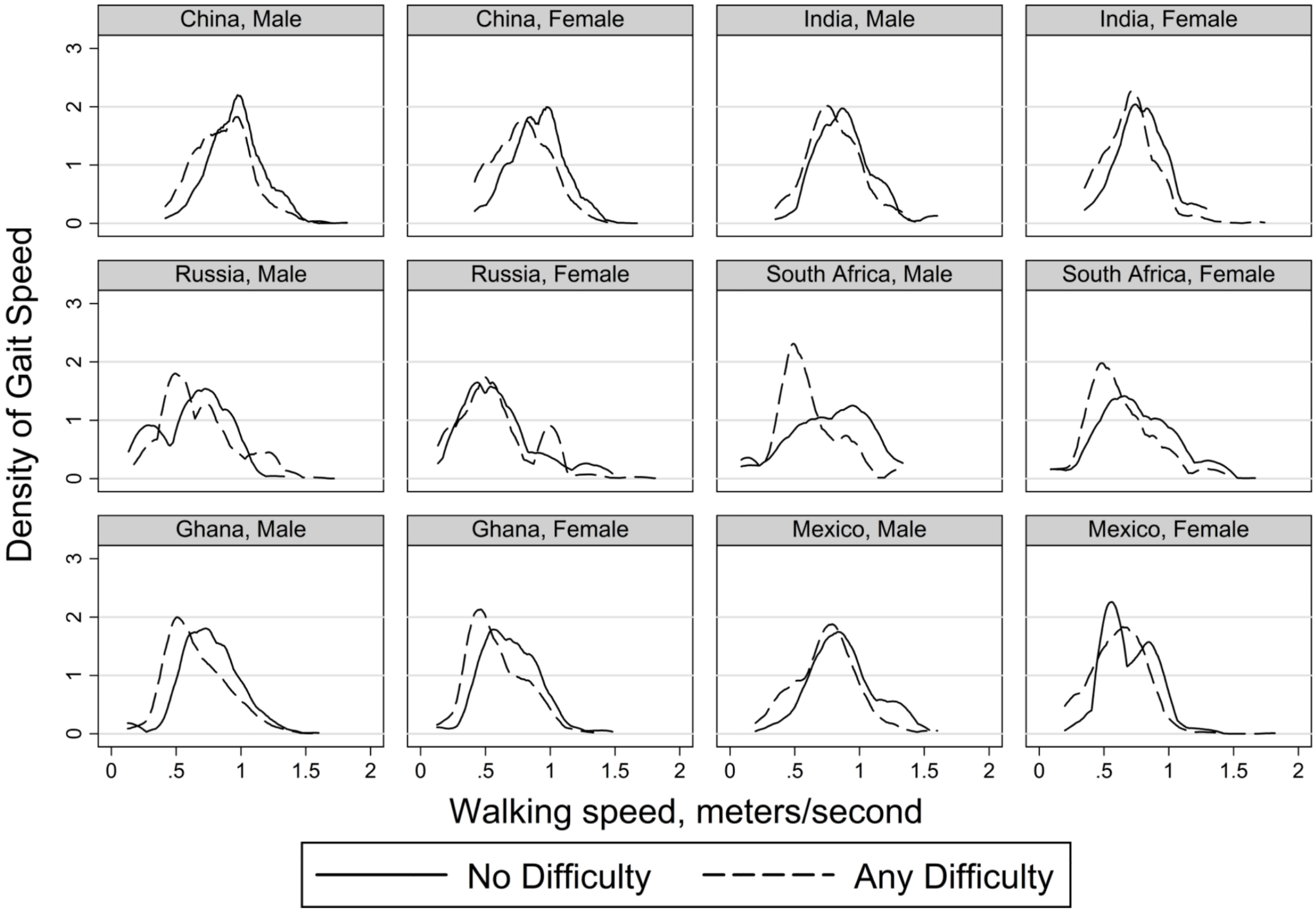

Figure 1.
Distribution of Gait Speed by Any Self-Reported Difficulty Walking 1 Kilometer by Gender and Country, SAGE (2007–2010)

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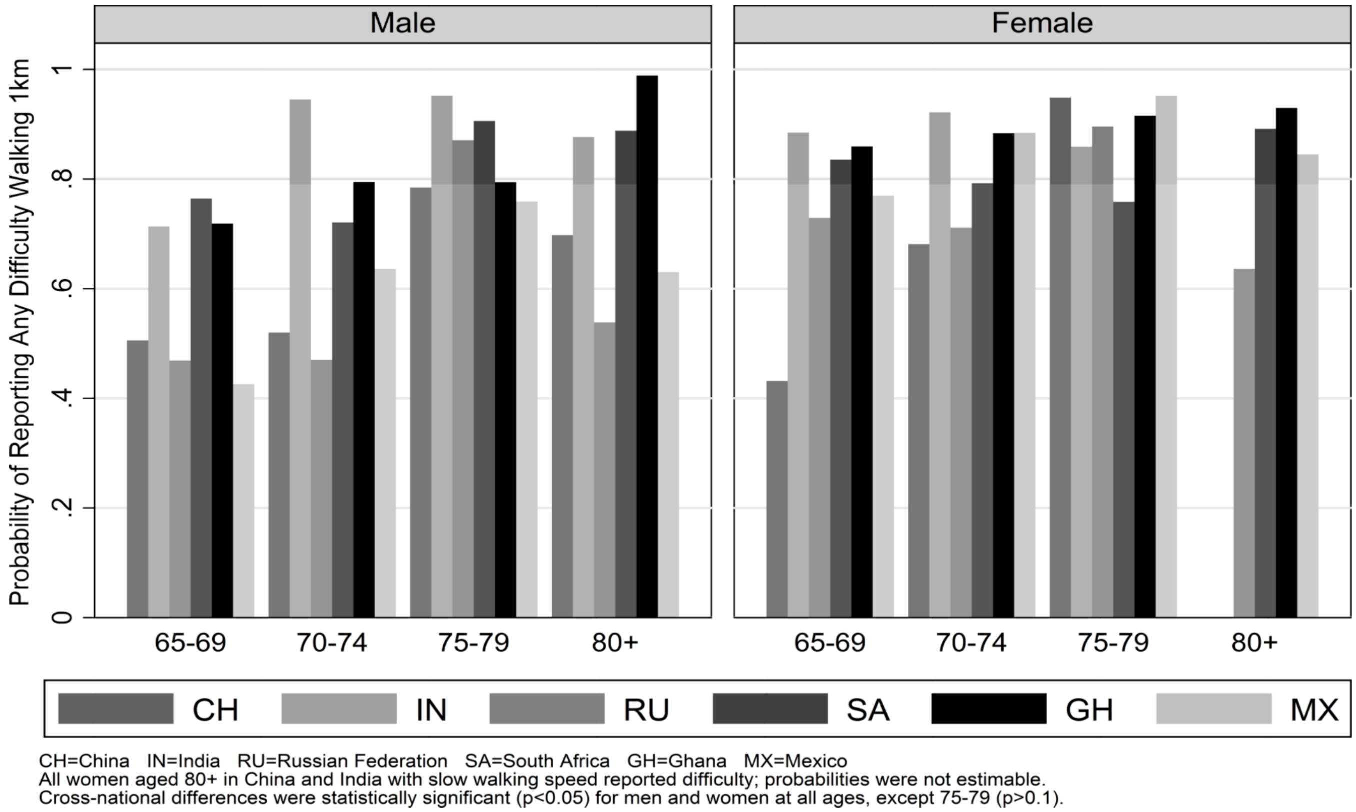

Figure 2.

Predicted Probabilities and 95% Confidence Intervals of Self-Reporting Difficulty Walking 1km among Those with Slow Walking Speed by Gender, Age, and Country, SAGE (2007–2010)

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Table 1

Sample Characteristics by Country and Gender, SAGE (2007–2010)

	China		India		Russia		South Africa		Ghana		Mexico	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Sample Size	**2233**	**2528**	**1207**	**968**	**406**	**893**	**465**	**707**	**865**	**920**	**405**	**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%

Note: Cells include the percent of the gender specific sample size. Analyses are unweighted.