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Research Article

Change in Mobility: Consistency of Estimates and Predictors Across Studies of Older Adults

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Abstract

Objectives: This study compares estimates and determinants of within-individual changes in mobility across surveys of older U.S. adults.

Methods: Data come from the Health and Retirement Study (HRS) and the Midlife in the United States (MIDUS) study. Measures of mobility comprise self-reported level of difficulty with walking several blocks, going up several flights of stairs, lifting and carrying 10 pounds, and stooping. Predictors include sociodemographic characteristics and indicators of health and health behaviors. We pool the datasets and estimate weighted lagged dependent variable logistic regression models for each activity, assessing cross-study differences using interaction terms between a survey indicator and relevant variables.

Results: Estimates of declines in mobility differ substantially across surveys for walking, lifting and carrying, and stooping, but there are no between-survey differences in the probability of (not) recovering from a limitation. With the exception of age, determinants of change are similar between studies. For lifting/carrying and stooping, the age-related increase in developing limitations is less steep at younger ages for HRS respondents than MIDUS respondents, but steeper at older ages.

Discussion: To compare estimates of mobility change across surveys, mobility measures would need to be harmonized. Determinants of mobility change, however, are more comparable.

Keywords: Decline, Measures, Physical functioning, Recovery, Risk factors

Impaired mobility function in later life is associated with adverse health outcomes. For instance, older adults who report difficulty with mobility-related activities have worse perceptions about their overall health (Singh-Manoux et al., 2006) and are at increased risk of falling, developing disability, being hospitalized, and dying earlier (Abellan van Kan et al., 2009; de Rekeneire et al., 2003; Hardy, Kang, Studenski, & Degenholtz, 2010; Newman et al., 2006; Simonsick et al., 2008). Understanding who is at risk for changes in mobility can help in creating strategies and protocols for preventing or adapting to such changes.

While there have been numerous studies that have examined changes in self-reported mobility in later life (e.g., Deshpande, Metter, Guralnik, Bandinelli, & Ferrucci, 2014; Gill, Allore, Hardy, & Guo, 2006; Swenor et al., 2015; Wolinsky et al., 2011), the studies often differ with regard to sample characteristics, measurement of function, and follow-up period. Given these differences, it is difficult to compare and validate results across surveys. There is no gold standard for measuring mobility function. Nonetheless, understanding the comparability of estimates of mobility change across surveys has implications for researchers and policy makers in estimating needs and costs of programs for older adults experiencing difficulty.

Analyses of changes in mobility also vary widely with respect to determinants. The choice of covariates depends on both the availability of variables in a dataset and on the primary interest of a study. Thus, it is difficult to compare the associations between predictors and mobility change across studies or assess the reasons for any differences that emerge. Comparing cross-survey associations between risk factors and mobility change within a single analysis that incorporates the same controls allows for drawing stronger conclusions about who is at risk for changes in mobility function.

To our knowledge, no study has used multiple surveys with longitudinal data to assess the comparability of estimates of mobility change or its determinants. Here, we use two nationally representative surveys of older U.S. adults to examine whether estimates of within-individual changes in mobility and the determinants of those changes are similar between surveys.

Background

A recent study demonstrated substantial variability in the estimated age-specific prevalence of self-reported physical limitations across four nationally representative surveys of older U.S. adults (Glei, Goldman, Ryff, & Weinstein, 2017). These differences across surveys could result from differences in survey mode, question wording, and/or response categories. For instance, the prevalence of mobility difficulty tends to be higher in self-administered questionnaires (SAQs) versus in-person-interviews (Picavet & van den Bos, 1996). Likewise, questions that explicitly exclude short-term difficulties tend to produce lower prevalence estimates than questions with no such qualification (Picavet & van den Bos, 1996). Questions that use a leading approach (how much difficulty do you have...?) produce higher prevalence than questions using a neutral approach (do you have difficulty...?—Freedman, Aykan, & Kleban, 2003). Estimated prevalence could also be affected by differences in the thresholds for reporting difficulty (e.g., Melzer, Lan, Tom, Deeg, & Guralnik, 2004); for example, respondents may be more or less willing to acknowledge "any difficulty" than to admit having "a little" difficulty.

Although these factors have produced differences across surveys in estimates of the prevalence of physical limitations, it is not clear whether such factors may also influence comparisons of estimates of *changes* in limitations. If the differences in prevalence between surveys reflect differences in intercept only (i.e., by a constant factor across age), then comparisons of *changes* in physical functioning may be more similar across surveys than absolute levels. In other words, it is possible that cross-study comparisons of intra-individual change measured using identical questions (within study) at two times may be less affected by these factors and result in similar estimates of change across studies.

Previous studies that have examined changes in self-reported mobility have used numerous measures. Across studies, mobility function is often defined by the level of difficulty with various combinations of mobility activities, including ability to walk ¼ mile or several city blocks, to climb up stairs, to lift and carry 10 pounds, and to stoop (Clark, Stump, & Wolinsky, 1998; Gill et al., 2006; Jacob et al., 2018; Latham, Clarke, & Pavela, 2015; Swenor et al., 2015; Wolinsky et al., 2011). These measures are indicators of underlying lower extremity functional capacity (Guralnik & Ferrucci, 2003; Verbrugge & Jette, 1994). In the disablement process, functional ability is theorized and has been shown to precede the development of disability, which is typically measured by difficulty with activities or instrumental activities of daily living (ADLs or IADLs; Freedman, 2009; Guralnik & Ferrucci, 2003; Verbrugge & Jette, 1994). Rather than focusing on mobility-related disability, we focus on mobility-related functional capacity (e.g., ability to walk a short distance or climb stairs) because it is influenced less by changes in the environment or by social expectations (Freedman & Martin, 1998; Guralnik & Ferrucci, 2003).

Risk factors included in studies of mobility also vary widely. To guide our review and selection of predictors, we take a social-ecological perspective as described in a review of the literature by Yeom, Fleury, and Keller (2008). This framework suggests that physical limitations are a function of intrapersonal, interpersonal, environmental, and organizational factors. The present analysis focuses primarily on intrapersonal factors (sociodemographic, socioeconomic, and psychosocial characteristics and lifestyle and physiological factors; Yeom et al., 2008) that are likely to be well reported and measured similarly across surveys. Demographic factors associated with an increased risk of developing a limitation or a decreased probability of recovery include age (Deshpande et al., 2014; Jacob et al., 2018; Latham et al., 2015; Wolinsky et al., 2011), being female (Deshpande et al., 2014; Jacob et al., 2018; Latham et al., 2015), and marital status (Latham et al., 2015). Compared with older white individuals, older black individuals are more likely to develop mobility difficulty (Jacob et al., 2018) but also more likely to recover from it (Latham et al., 2015). Higher education is associated with a lower risk of developing difficulty with mobility (Blazer, Hybels, & Fillenbaum, 2006; Clark et al., 1998; Shumway-Cook, Ciol, Yorkston, Hoffman, & Chan, 2005) and a higher probability of recovery (Clark et al., 1998; Latham et al., 2015). Some health behaviors or lifestyle choices, such as cigarette smoking (Clark et al., 1998; Wannamethee, Ebrahim, Papacosta, & Shaper, 2005; Wolinsky et al., 2011), increase the risk of developing mobility limitations while others, such as vigorous exercise (Clark et al., 1998; Rejeski et al., 2012; Wolinsky et al., 2011) and stopping smoking (Wannamethee et al., 2005) reduce the risk. Finally, numerous physical health indicators are associated with changes in limitations: Obesity, visual and hearing impairment, and chronic conditions have all been shown to increase the risk of developing mobility difficulty or reducing the likelihood of recovery (An & Shi, 2015; Clark et al., 1998; Latham et al., 2015; Rantakokko, Mänty, & Rantanen, 2013; Vincent, Vincent, & Lamb, 2010; Wannamethee et al., 2005; Wolinsky et al., 2011).

Methods

Data

Data come from the Health and Retirement Study (HRS) and the Midlife in the United States (MIDUS) study that were fielded in 2004 and 2014. We selected these surveys because they were conducted during the same time period, include comparable measures of mobility, and contain data for adults aged 50–64, an age group showing increasing difficulties with mobility over time (Freedman et al., 2013; Martin, Freedman, Schoeni, & Andreski, 2010). In addition, these studies allow us to examine change in mobility over the same follow-up period. Analyses presented here focus on the non-institutionalized population because MIDUS does not include the institutionalized population.

The HRS is a longitudinal study of adults aged 50 and older and their spouses of any age in the United States, although we do not include spouses of respondents under age 50 as they are not a representative sample. Data were first collected in 1992 for a sample of individuals born between 1931 and 1941 and in 1993 for a sample of individuals born in 1923 or earlier. In 1998, the two samples were merged and placed on a common interview schedule and two additional birth cohorts (1924–1930 and 1942–1947) were added. Since then, the sample has been refreshed every 6 years with a new 6-year birth cohort. Respondents have been interviewed every 2 years. Baseline interviews are conducted face-to-face and, since 2006, half the follow-up interviews are conducted face-to-face and half via telephone, with interview mode switching at each follow-up interview. Response rates have ranged between 81% and 91% over the course of the study. (See https://hrs.isr.umich.edu/sites/default/files/biblio/ResponseRates_2017.pdf and Sonnega and coworkers (2014) for more details.)

In the 2004 HRS wave, 18,701 eligible community-dwelling respondents were interviewed. For our main analysis, we exclude 5,964 (31.9%) respondents who died by 2014 and 1,406 (7.5%) who were lost-to-follow-up (LFU). We further exclude 456 respondents missing on any analysis variable, leaving a final sample of 10,875 HRS respondents with complete data.

MIDUS, first conducted in 1995–1996, is a longitudinal study of adults (aged 25–74 in 1995–1996) in the United States. Our analyses focus on respondents from the nationally representative random digit dialing (RDD) sample (n = 3,487). A second wave of the study (MIDUS 2) was conducted in 2004–2006 and a third wave in 2013–2014 (MIDUS 3). Data are collected by both a telephone interview and an extensive SAQ that is mailed to respondents' homes. In MIDUS 2, 2,257 of the original MIDUS 1 RDD respondents were interviewed, a mortality adjusted response rate of 71%. We exclude 452 of these respondents because they did not complete the 2004 SAQ—where respondents report on mobility—and an additional five respondents for whom a post-stratification weight was not calculated, leaving 1,800. Of these, 113 (6.3%) had died, and 459 (25.4%) were lost-to-follow-up. We exclude an additional 131 respondents who did not complete the 2014 SAQ and 109 missing on any of the analysis variables. The final sample is 988 MIDUS respondents who were alive in 2014 and completed the necessary segments of the survey. Below, we test the sensitivity of results to multiple imputation of missing data.

We also test the sensitivity of results to the different age composition of the HRS (aged 55–94) and MIDUS (aged 30–83) samples. We rerun analyses using samples that include only respondents in the overlapping age range (discussed below).

Measures

Our outcomes comprise the four self-reported measures of difficulty with mobility-related activities that are comparably measured in both the HRS and MIDUS: walking several blocks, going up stairs, lifting and carrying, and stooping/crouching (see Table 1 for the exact question wording and response categories). For all four measures, we examine respondents with any difficulty compared with those who have no difficulty. For MIDUS, having difficulty includes a *little*, *some*, and *a lot [of difficulty]* and for the HRS, it includes responses *yes*, *can't do*, and *don't do* (Freedman et al., 2013), which assumes that those

Table 1. Mobility Functioning Question Wording by Survey

	HRS	MIDUS
Question stem	Please tell me whether you have any difficulty doing each of the everyday activities that I read to you. Exclude any difficulties that you expect to last less than 3 months. Because of a health problem do you have any difficulty with...?	How much does your health limit you in doing each of the following?
Walking a short distance	Walking several blocks	Walking several blocks
Climbing stairs	Climbing several flights of stairs without resting	Climbing several flights of stairs
Lifting/carrying	Lifting or carrying weights over 10 pounds (>4.5 kg), like a heavy bag of groceries	Lifting or carrying groceries
Stooping/ crouching	Stooping, kneeling, or crouching	Bending, kneeling, or stooping
Responses categories	0: No 1: Yes 2: Can't do 9: Don't do	0: Not at all 1: A little 2: Some 3: A lot

Note: HRS = Health and Retirement Study; MIDUS = Midlife in the United States.

who do not do the activity refrain from doing it because they cannot. Below, we test the sensitivity of our results by re-estimating models excluding HRS respondents who "don't do" these activities (e.g., Clark et al., 1998).

We examine the effects of baseline (2004) sociodemographic characteristics and health indicators on mobility difficulty at follow-up (2014), controlling for any difficulty with the specified mobility task at baseline. Sociodemographic variables are age (and age-squared), sex, education (less than high school, GED/high school graduate, some college, college graduate and higher), marital status (currently married, not currently married), and race/ethnicity (non-Hispanic white, other). See Supplementary Table 1 for description of covariates by study.

Health indicators comprise ever having high blood pressure and body mass index (BMI) (underweight, normal, overweight, obese), which we calculate from self-reports of height and weight; these are the only health-related measures that are comparably measured across studies. We also include smoking status (never, current, or former smoker). There are some small differences in the wording of smoking questions between studies (see Supplementary Table 2), but we feel that these differences would have a minimal effect on our results.

Analysis Strategy

To assess whether estimates of change in mobility are similar across the HRS and MIDUS, we pool the two datasets and estimate a separate weighted lagged dependent variable (LDV) logistic regression model predicting difficulty with each activity. Models include age and age-squared, sex, a baseline measure of difficulty with the specified task, an indicator for the survey, and an interaction between difficulty and survey. The main effect for survey represents the difference between MIDUS and HRS in the probability of developing a limitation with a given task among those who reported no such limitation at baseline (e.g., incidence of mobility decline). We expect the odds ratio (OR) for the survey main effect to be close to 1.0 and not significant, indicating similarity in estimates of incidence of mobility decline between studies. The main effect of the LDV represents the odds of still having the limitation at follow-up versus having recovered from that limitation (i.e., it represents the probability of reporting the same limitation at follow-up among those who reported the limitation at baseline). We expect the OR to be significant and much greater than 1.0 (more likely to still have the limitation than to have recovered from the limitation). The interaction between survey and baseline difficulty represents the difference between MIDUS and HRS estimates in the stability of physical limitation, or lack of recovery. We expect the OR for the interaction term to be close 1.0 and not significant.

To evaluate whether determinants of changes in mobility are consistent between the HRS and MIDUS, we estimate an additional set of LDV logistic regression models. Using the pooled data, we run a model predicting difficulty at follow-up that includes difficulty at baseline and all predictors. Each predictor is interacted with the survey indicator to test whether the association with that variable differs between surveys. We do not expect these interaction terms to be significant because we assume that the association between a given predictor and change in mobility difficulty should be the same since both surveys represent the older U.S. national population in the same time period.

All models are estimated using Stata 15.1. HRS weights are post-stratified to the CPS population counts by study birth cohort, age, marital status, and race. MIDUS weights are post-stratified to the CPS population counts by region, age, and education.

Results

Results in Table 2 evaluate whether estimated changes in mobility (over a 10-year follow-up period) are similar between surveys. The main effect for survey represents the difference between MIDUS and HRS in the probability of developing a limitation with a given task among those who reported no such limitation at baseline. Counter to expectations, the main effects for survey indicate significant differences between MIDUS and HRS in the probability of developing difficulty with walking several blocks (OR = 0.61, $p < .01$), lifting and carrying (OR = 0.53, $p < .01$), and stooping (OR = 0.66, $p < .01$), but not with climbing stairs (OR = 0.86, $p > .05$). The results imply that among those with no limitation at baseline, respondents in HRS are less likely than their MIDUS counterparts to report that they have developed a limitation with the task by the follow-up wave.

The predicted probabilities presented in Table 3 demonstrate that the differences between surveys in the likelihood of developing difficulty with mobility are sizeable. For example, based on HRS (column 1), one would conclude that only 16% of women aged 50 will develop a walking limitation within 10 years (by the time they turn age 60), but the estimates from MIDUS suggest 24% will develop such a limitation. For lifting and carrying, the differential between HRS and MIDUS estimates is even greater, with the probabilities differing by as much as .15: among men aged 80, the probability of developing a lifting limitation by age 90 is .41 in HRS versus .56 in MIDUS. The difference in the probability of developing a stooping limitation ranges between .07 and .14.

The main effect of the LDV (Table 2) represents the odds of reporting a limitation at follow-up among those who reported that limitation at baseline, while the interaction term between survey and baseline difficulty reflects whether there are differences between MIDUS and HRS in the lack of recovery. As we would expect, respondents are more likely to still have a limitation than to have recovered from it (ORs range from 7.01 to 11.42, $p < .01$) and the

Table 2. Predicting Mobility Difficulty at T2 (2014): Odds Ratios (*SE*s) From Weighted Lagged Dependent Variable Logistic Regression Models

Variables	Walk several blocks	Go up several flights of stairs	Lift and carry ~10 pounds	Stoop
Survey: HRS (MIDUS omitted)	0.613**	0.861	0.534**	0.655**
	(0.073)	(0.105)	(0.068)	(0.083)
Any difficulty with specified task at T1	11.421**	8.354**	7.005**	7.301**
	(2.394)	(1.536)	(1.400)	(1.306)
Difficulty at T1 × HRS	0.834	0.944	1.115	0.922
	(0.184)	(0.181)	(0.237)	(0.172)
Age (centered at age 50)	1.028**	1.020*	1.015	1.011
	(0.011)	(0.010)	(0.011)	(0.010)
Age (centered at age 50) squared	1.001**	1.001**	1.002**	1.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Female	1.257**	1.388**	2.228**	1.238**
	(0.069)	(0.074)	(0.132)	(0.063)
Constant	0.245**	0.325**	0.153**	0.536**
	(0.024)	(0.033)	(0.016)	(0.055)
Observations	11,863	11,863	11,863	11,863
Model *F*-statistic (*p*-value)	265.97 (<.01)	289.41 (<.01)	252.22 (<.01)	258.24 (<.01)

Note: HRS = Health and Retirement Study; MIDUS = Midlife in the United States.
$^{**}p < .01$. $^{*}p < .05$.

probability of recovery does not differ between studies (e.g., none of the interaction terms between survey and baseline difficulty is significant).

We test the sensitivity of these results to a number of factors. First, we estimate the mobility change models on a sample that excludes HRS respondents who report not doing one or more of the activities. With one exception—a significant difference across surveys in mobility decline in going up stairs—results from these models do not differ greatly from the models presented (see Supplementary Table 3). Next, we test the effects of missing baseline covariate data (between 0.04% and 5.1% across predictors and surveys; see Supplementary Table 1) by estimating models using data for which missing data have been imputed using Stata 15.1 multiple imputation procedures (StataCorp, 2017). Results for the LDV models using the imputed data do not differ greatly from results based on complete data (see Supplementary Table 4). Third, we test the sensitivity of results to attrition (e.g., respondents dying and being LFU) by running multinomial logistic regression models that include death and LFU as additional outcomes at follow-up. Results are similar to the presented LDV models (see Supplementary Table 5). Finally, we test whether results could be sensitive to differences in the age and demographic composition of the HRS and MIDUS samples by re-estimating the models using: (a) a sample that limits both the HRS and MIDUS samples to the overlapping age range (i.e., ages 50–83, which excludes 31.6% of MIDUS respondents—those younger than age 50—but only 1.7% of HRS respondents—those older than 84); and (b) a sample that matched the HRS and MIDUS respondents on single year of age, sex, race, and education (n = 1,350). In both cases, results are similar to those based on the complete HRS and MIDUS samples (see Supplementary Tables 6 and 7).

Next, in Table 4 we examine whether sociodemographic characteristics and indicators of health and health behaviors have similar associations with changes in mobility between studies. First, the main effects of the predictors (which represent the associations within MIDUS) generally show relationships with mobility difficulty that are consistent with the literature. The probability of developing difficulty with mobility increases with age, is higher for females (except for stooping), decreases with increasing levels of education (walking, going up stairs), is higher for current versus never smokers (except stooping), and compared with normal weight individuals, is higher for those who are underweight (walking, stooping), overweight (only stooping), and obese (all outcomes). Within MIDUS, there are no differences in mobility decline by marital status, race, or having high blood pressure. With the exception of age effects for two outcomes, none of the interaction terms between study and each predictor is significant, indicating that the associations between these predictors and mobility change are similar in the two surveys. For lifting and carrying and stooping, the age-related increase in developing a limitation for HRS respondents is less steep at younger ages, but steeper at older ages (see Supplementary Table 8 for *SE*s of the ORs).

Discussion

Mobility is an important factor for maintaining independence and quality of life in later years. Previous research has shown that there are significant differences in the estimated prevalence of age-specific mobility-related function across

Table 3. Predicted Probability of Having Difficulty at Follow-up Among Individuals Who Had No Difficulty at Baseline by Sex, Age, and Study

	Women		Men	
Mobility activity/at age	HRS	MIDUS	HRS	MIDUS
Walking several blocks				
50	.16	.24	.13	.20
55	.18	.27	.15	.23
60	.22	.32	.18	.27
65	.27	.38	.23	.33
70	.35	.47	.30	.41
75	.45	.57	.39	.52
80	.57	.68	.51	.63
Lifting and carrying ~10 pounds				
50	.15	.25	.08	.13
55	.17	.28	.08	.15
60	.20	.32	.10	.18
65	.26	.39	.13	.23
70	.34	.49	.19	.30
75	.46	.61	.28	.42
80	.60	.74	.41	.56
Stooping				
50	.46	.53	.38	.52
55	.32	.42	.27	.37
60	.34	.44	.29	.39
65	.37	.47	.32	.42
70	.41	.52	.36	.46
75	.46	.57	.41	.51
80	.52	.62	.46	.57

Note: HRS = Health and Retirement Study; MIDUS = Midlife in the United States.

surveys of U.S. older adults (Glei et al., 2017). If these differences between surveys are differences in intercept only, then declines in mobility might be more comparable across surveys. Using two nationally representative surveys of U.S. adults, we examined whether estimates of individual changes in mobility and determinants of change are similar across the surveys.

Our results show that estimates of declines in mobility substantially differ across surveys for three out of the four mobility activities we examined (walking several blocks, lifting and carrying, and stooping). Although the measures seem comparable, Glei and coworkers (2017) noted several reasons why prevalence might differ across surveys that may also affect estimates of decline. Prevalence estimates from SAQs produce higher estimates of mobility limitations than estimates based on data collected face-to-face (Picavet & van den Bos, 1996; Walsh & Khatutsy, 2007), suggesting the possibility that respondents are more willing to acknowledge difficulty in SAQs. If this is the case, then over time, respondents reporting no difficulty at baseline may be less likely to report difficulty at follow-up in interviewer-administered surveys (e.g., the HRS) than in self-administered surveys (e.g., MIDUS), resulting in variations in the probability of decline across surveys with different modes of data collection.

Glei and coworkers (2017) also note that differences in question wording and response categories are likely to play a role in the variation in prevalence estimates. For example, the HRS asks about difficulty lasting 3 or more months and uses a neutral approach, while MIDUS does not specify length of difficulty and uses a leading approach. Previous research has shown that questions that focus on longer-term limitations and that use a neutral approach produce lower estimates of prevalence (Freedman et al., 2003; Picavet & van den Bos, 1996), which could help explain why we find lower incidence of mobility limitation in HRS than in MIDUS. There are also differences in HRS and MIDUS response categories, including the inclusion of "don't do" in the HRS, although excluding HRS respondents reporting "don't do" had little effect on results.

Sample selection, including differences in sampling frames (younger age range in MIDUS) and response rates (lower in MIDUS), could result in differences in representativeness. Analyses, however, were weighted to address some differences in response rates. In addition, analyses that limited the sample to the same age range or that were based on samples matched on demographic characteristics produced similar results to those presented.

While estimates of decline differ between surveys, our results show that there are no between-survey differences in the probability of recovering from a limitation at baseline. There are a number of possibilities for these results. First, recovery is relatively uncommon in both samples, particularly after age 70 when fewer than 20% show improvement (results not shown). Once a person has a limitation, they are very likely to continue to have a limitation, as exhibited by the large ORs in the models, so there may not be enough statistical power to detect differences between surveys. It could also be the case that MIDUS and HRS respondents have different thresholds for reporting difficulty (Melzer et al., 2004) that result in different estimates of baseline prevalence, but once an individual reaches that threshold, they are very likely to stay at or above the survey-specific threshold. Consequently, we find no between-survey difference in recovery. Finally, even though the inclusion of short-term limitations may initially affect the prevalence of limitations, a study of ADL disability has shown that individuals who have recovered from a short-term disability are likely to experience a recurrence of the disability in the future (Hardy & Gill, 2004). Thus, with a follow-up period as long as the one in this study—10 years—most difficulty experienced at baseline, short-term or otherwise may have evolved into a chronic limitation, reducing the effects of excluding reports of short-term difficulties on estimates of recovery.

Although it is somewhat discouraging to find that rates of decline in mobility differ between surveys, it is encouraging that our results show that, with one exception, all of the predictors we were able to examine are consistently associated with declines in mobility between studies. The

Table 4. Predictors of Mobility Difficulty at T2 (2014): Odds Ratios From Weighted Lagged Dependent Variable Logistic Regression Models

Variables	Walk several blocks	Go up several flights of stairs	Lift and carry ~10 pounds	Stoop
HRS	0.647	0.566	0.690	0.600
Any difficulty specified task at T1	8.039**	6.508**	6.085**	5.861**
Difficulty at T1 × HRS	0.876	0.934	1.031	0.952
Age (centered at age 50)	1.039**	1.031**	1.042**	1.041**
Age centered × HRS	0.983	0.985	0.966*	0.963*
Age (centered at age 50) squared	1.001	1.001	1.001	1.000
Age centered squared × HRS	1.001	1.001	1.002*	1.001
Female	1.600**	1.614**	2.069**	1.227
Female × HRS	0.802	0.948	1.116	1.052
Education (college graduate+ omitted)				
Less than high school	1.248	0.947	0.850	0.709
GED/high school graduate	2.279**	1.561*	1.105	1.445
Some college	1.504	1.537*	1.202	1.425
Less than high school × HRS	1.559	1.758	2.332	2.094
GED/high school graduate × HRS	0.691	0.960	1.256	0.963
Some college × HRS	0.957	0.869	0.990	0.841
Currently married (vs not currently married)	0.841	0.962	1.055	0.836
Currently married × HRS	0.945	1.020	0.765	1.086
Non-Hispanic white vs others	1.004	0.638	1.166	1.062
White × HRS	1.015	1.418	0.641	1.015
Ever been told has high blood pressure	1.330	1.249	1.206	1.221
Blood pressure × HRS	1.079	1.085	1.178	1.105
Body mass index (normal weight omitted)				
Underweight	4.444*	2.804	2.021	5.240*
Overweight	1.118	1.135	0.978	1.672*
Obese	2.638**	2.801**	2.175**	2.825**
Underweight × HRS	0.229	0.476	0.516	0.257
Overweight × HRS	1.178	1.190	1.051	0.830
Obese × HRS	0.953	0.885	0.793	0.811
Smoking behavior (never smoked omitted)				
Smokes now	2.041**	2.662**	2.346**	1.231
Quit smoking	1.313	1.074	1.338	1.001
Smokes now × HRS	1.094	0.738	0.871	1.196
Quit smoking × HRS	0.862	0.965	0.889	1.058
Constant	0.090**	0.217**	0.078**	0.281**
Observations	11,863	11,863	11,863	11,863
Model *F*-statistic (*p*-value)	59.87 (<.01)	62.06 (<.01)	58.98 (<.01)	55.80 (<.01)

Note: HRS = Health and Retirement Study.
$^{**}p < .01$. $^{*}p < .05$.

probability of experiencing declines in mobility increases significantly with age, being female, having lower educational attainment, and a higher BMI. Mobility decline was not associated with marital status, race, or having high blood pressure. One difference between MIDUS and HRS is the age-related increase in difficulty lifting and carrying, which appears to be steeper at older ages for HRS respondents. While we would not have expected this finding, it is consistent with the possibility that HRS and MIDUS respondents have different thresholds for reporting difficulty, specifically HRS respondents have a higher threshold. As a result, HRS respondents reach an older age before meeting the threshold, but catch up with (e.g., have higher incidence than) MIDUS respondents who reported difficulty at a younger age because of their lower threshold.

Unlike some previous studies, our results show that race, marital status, and having high blood pressure were not significantly associated with changes in mobility. There are some methodological differences between our study and the others that could be the source of these differences. Some of the studies that reported significant relationships examined incidence (Jacob et al., 2018) or recovery

(Latham et al., 2015) separately, whereas our analysis estimated both in the same model. The mobility outcomes also differed: Latham and coworkers (2015) examined difficulty walking one block or across a room and Jacob and coworkers (2018) defined a mobility limitation as having difficulty with either walking up 10 steps or walking half a mile. Finally, these studies and ours include different sets of predictors, which could lead to variation in the partial associations between predictors and outcomes. For instance, in LDV models that include only high blood pressure but not BMI (not shown), having high blood pressure emerges as a significant predictor of change in mobility difficulty. Including BMI in the models renders the association between blood pressure and mobility insignificant.

Our study has several limitations. First, because we wanted to include individuals between the ages of 50 and 64, a group for which the prevalence of physical limitations has been increasing over time (Freedman et al., 2013; Martin et al., 2010), we were limited to including only two studies of older U.S. adults. Relaxing this age restriction could allow for other datasets to be incorporated into the study, which should be considered in future research. Second, with only two surveys and multiple variables (sample selection/response, survey mode, question wording) that differ between those two surveys, we are not able to test how much of the difference is attributable to any one cause. Future studies comparing mobility change would benefit from analyzing more than two surveys to potentially allow for testing hypotheses about the source of differences. Third, only a limited number of predictors were measured consistently between the HRS and MIDUS. As a result, our conclusions about the consistency of predictors of mobility decline are limited. For instance, we were not able to examine the effects of many health behaviors or lifestyle choices, such as heavy drinking and exercise, all of which have been shown to be related to the risk of developing mobility limitations (Wannamethee et al., 2005; Wolinsky et al., 2011). Likewise, we have a limited number of chronic conditions that are similarly measured in the two surveys, which restricts leverage to draw conclusions about the effects of chronic conditions on mobility change.

Our findings have several implications for future research and clinical practice. It appears that between-survey differences in factors like question wording, response categories, survey mode, and perhaps differences in thresholds for reporting difficulty result in sizeable differences in the estimated rates of mobility decline. Although it is difficult to determine how much of the differences we found are true or are attributable to inconsistent measurement, one implication of these findings is the need to standardize measurement of mobility function across surveys in order to better estimate and evaluate the risk of developing mobility difficulty in later life. That said, there is no clear evidence as to the best approach to measure self-reported mobility function and different measures can serve different purposes. In addition, even though questions may seem similar, even slight differences in question wording or in survey methodology could affect the estimates. It may be difficult to truly harmonize measures of self-reported mobility function across surveys, making it important for researchers, clinicians, and policy makers to be clear about what aspects of mobility function are being addressed (e.g., long-term vs short-term difficulty, difficulty vs inability, any vs how much difficulty, etc.). A second, and perhaps more likely achievable, implication is the need to more consistently measure risk factors so that a more complete set can be explored. Nonetheless, our results show that age, sex, education, and BMI can be used to help identify individuals who might be at the greatest risk for developing mobility limitations. Finally, our study shows that declines in mobility do not appear to reverse very often, particularly after age 70. Because mobility limitations have been shown to be a risk factor for developing disability and other adverse health outcomes, this finding emphasizes the need to maintain and prevent the loss of mobility function.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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J. C. Cornman planned the study, wrote the paper, and performed all statistical analyses. D. A. Glei consulted on statistical analyses and contributed to revising the paper. M. Weinstein helped to plan the study and contributed to revising the paper.

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Conflict of Interest

None reported.

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