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Walking Ability and Its Relationship to Self-Rated Health in Later Life

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Abstract

This study investigated the relationship between self-assessed overall health (SRH) and walking ability among older adults ($n = 239$) gauged using three well-established measures of walking ability (“normal” and “fast” walking speeds, and perceived walking difficulty). Logistic regression models adjusted for health, behavioral, and sociodemographic variables were used to estimate the relationship between the three measures of walking ability and SRH. Walking ability was significantly associated with SRH; notably, only normal walking speed discriminated between participants in all three SRH comparisons (good versus poor/bad, good versus fair, or excellent versus good). Health care providers, family, and friends should be attentive to reduced walking speed or complaints about difficulty walking because these are harbingers of health decline.

Keywords

gerontology; older adult; self-rated health; walking ability

Despite a growing literature on determinates of health and health outcomes, including mortality later in life, fundamental puzzles remain. One enduring puzzle is why an older person's subjective assessment of his or her overall health (self-rating of health [SRH]) is a powerful predictor of future survival. The single-item measure: “How would you rate your health today? Excellent, good, fair, or poor/bad?” elicits a subjective, holistic evaluation of one's condition, and predicts mortality more accurately than age, physician ratings, or even reported symptoms. Indeed, no other single measure of health can so easily identify individuals at high risk for mortality. The clinical value is that beyond mortality, SRH in later life is well documented to significantly predict morbidity, and many other important

outcomes such as disability (Mansson & Rastam, 2001). These associations with SRH have been extensively replicated in national and international datasets (Ford, Spallek, & Dobson, 2008; Idler & Benyamini, 1997; Lyyra, Heikkinen, Lyyra, & Jylha, 2006; Mossey & Shapiro, 1982) and are confirmed in meta-analyses (Idler & Benyamini, 1997; Jylha, 2009).

These relationships between SRH and health outcomes have spurred research to discover those factors that shape an elder's answer to this brief measure. We do know that a broad spectrum of factors are related to SRH such as chronic conditions (Hoeymans, Feskens, Kromhout, & van den Bos, 1999; Molarius & Janson, 2002), depression (Molarius & Janson, 2002; Mulsant, Ganguli, & Seaberg, 1997), pain (Mantyselka, Turunen, Ahonen, & Kumpusalo, 2003; Reyes-Gibby, Aday, & Cleeland, 2002) and symptoms such as tiredness and weakness (Hoeymans et al., 1999; Molarius & Janson, 2002) and respiratory symptoms (Hoeymans et al., 1999), or even physical activity (Fylkesnes & Forde, 1991; Jylha, Leskinen, Alanen, Leskinen, & Heikkinen, 1986). Also subjective measures of physical functioning such as ADL and IADL (Gama et al., 2000; Hoeymans et al., 1999; Leinonen, Heikkinen, & Jylha, 1999; Vuorisalmi, Lintonen, & Jylha, 2006) as well as performance-based measures are linked to SRH (Hoeymans, Feskens, Kromhout, & van den Bos, 1997; Jylha et al., 1986; Leinonen et al., 1999; Schulz et al., 1994). However, to date, a great many questions remain about what SRH captures.

Recently attention is turning to walking ability as a component of SRH, in part because walking ability seems to share some characteristics with SRH. A growing literature has linked walking ability to a range of outcomes including onset of functional dependence (Cesari, Kritchevsky et al., 2009; Guralnik et al., 2000; Shinkai et al., 2000), hospitalization (Cesari, Kritchevsky, et al., 2009; Cesari et al., 2005; Studenski et al., 2003), and most importantly death (Cesari, Kritchevsky et al., 2009; Cesari et al., 2005; Cesari, Pahor et al., 2009; Dumurgier et al., 2009; Newman et al., 2006; Ostir, Kuo, Berges, Markides, & Ottenbacher, 2007; Rolland et al., 2006). In addition, several studies report that walking ability, in particular walking speed, alone is as predictive of health outcomes as more comprehensive assessments of physical functioning (Guralnik et al., 2000; Ostir et al., 2007; Rolland et al., 2006).

Thus, because SRH and walking ability are both strongly related to important health outcomes, we posit a conceptual model of SRH components where walking ability may be one key factor individuals consider when they rate their health and, if this is the case, an indication of substantial links between walking ability and SRH. Walking ability embodies the effects of multiple systems (e.g., cognition, balance, motor, perception) which are also connected to one's overall health, which is why walking ability may be a significant marker for global health ratings. Yet, the connection between walking ability and SRH is examined in only a few studies, leaving largely unanswered, or little replicated, important questions such as, "to what extent does walking ability influence SRH?" and "are some measures of walking ability more strongly related to SRH than others?"

Indeed, despite the documented importance of walking ability for many aspects of health, to our knowledge only one study has directly investigated how walking ability is related to SRH. In that study, Jylha and colleagues (Jylha, Guralnik, Balfour, & Fried, 2001) reported

on older (65 years of age or older) disabled (at least 2 dependencies in activities of daily living [ADL] or instrumental activities of daily living [IADL] tasks) women, and assessed their “fast” walking speed (over a 4-meter course) and self-rated walking difficulty. They found that both of these factors contributed significantly and independently to these women's SRH, suggesting that walking ability is an important factor in SRH but that these two measures of walking ability are not capturing the same aspects of mobility. This limits our ability to evaluate these findings.

The study reported here evaluated three measures of walking ability, each addressing a different component—self-perceived walking ability and observed performance of both “fast” and “normal” walking speeds—in their relationship to SRH. This evaluation is needed because different assessments of walking ability may exhibit different degrees of association with SRH, and these differences may reflect underlying conceptual differences.

Our goal in this study was to: (a) investigate the relationship between walking ability and SRH with a sample of independently functioning older adults; and (b) compare our three measures of walking ability (self-assessed walking ability, and “fast” and “normal” walking speeds) on the strength of their relationship to SRH. Knowledge is needed to clarify which aspect of walking ability is most strongly tied to SRH. A gap exists due to divergent findings partly related to different aspects measured (e.g., fast, normal). This gap limits progress to clarify which mechanism, among several in the multiple systems that walking engages (e.g., perception, cognition, motor and balance), signals risk factors and, especially, best serves to guide intervention design and evaluation. Walking ability tests are simple and inexpensive to administer even with older adults in field research or clinical settings.

METHODS

Participants and Recruitment

Study participants were from the Philadelphia Healthy Aging Study designed to determine factors that contributed to global SRH by older, community dwelling individuals. The study (NIA Grant R01AG15730) used a stratified quota randomized sample derived from the US Center for Medicare and Medicaid Services Names and Address file of all age eligible individuals (age 65 to 74 years) residing in Philadelphia County. A detailed discussion of sample construction and frame, recruitment, yields, and characteristics are provided in Rosso and colleagues (Rosso, Gallagher, Luborsky, & Mossey, 2008). The stratified quota sample ensured adequate sex and race representation of persons with the distinct SRH ratings of “excellent,” “good,” “fair,” and “poor/bad,” to the single question: “How do you rate your health today?” Persons aged 65 to 74, to represent “young elderly,” were selected to increase the likelihood of a wide range across the health/illness continuum. The sampling strategy yielded a sample of size $N = 239$. Institutional Review Boards of each university approved the study.

Study Measures

Self-rated health—Participants were asked, “How do you rate your health today?” with possible responses “excellent,” “good,” “fair,” or “poor/bad.”

Measures of walking ability—Walking speed, both normal and fast, were measured by trained staff over a marked course in the home, with no obstructions at either end. Normal walking speed was computed from the time taken to walk 3 meters at the participant's usual pace using a standardized protocol (Guralnik et al., 1994). Four-meter courses are common (Jylha et al., 2001) but so are shorter courses, and the correlation between velocities on an 8-foot (<3 meters) versus a 4-meter walk is reported to be .97 (Guralnik et al., 2000). Prior to testing, participants made a trial walk of the whole length. During the test, participants were directed, “Walk to the other end of the course at your usual walking pace, just as if walking down the street to a shop. Walk all the way past the other end of the tape before you stop.” Standing with feet together at the course start, they were told to begin when properly positioned. Timing started when their foot hit the floor after the starting line and stopped when their foot hit the floor past the end of the walking course. The test was repeated twice, and time on the second walk was used for these analyses. Static starts are more common in research on elderly (Graham, Ostir, Kuo, Fisher, & Ottenbacher, 2008). Next, fast walking pace was measured on the same 3-meter course by directing participants to “Walk as fast as you can without running,” and fast walking speeds were computed. Since the measurement unit (meters/second) resulted in a low value for gait speed (generally <1 m/s), we multiplied the speed by 10 for the purposes of analysis to make the odds ratios more interpretable. Those who could not complete the walking task were assigned a speed of 0 m/s.

Subjective walking ability was assessed by asking participants whether they experienced difficulty walking 2 to 3 city blocks; participants responded “Yes” or “No.”

Covariates

Number of health conditions: Subjects reported having or having had any of 10 medical conditions (e.g., high blood pressure, diabetes, cancer, stroke, heart attack, neurological diseases, emphysema or chronic lung disease) which are among the 10 leading causes of death at ages 65 to 74 (Rosso et al., 2008). A variable reflecting the number of conditions reported was computed.

Depressive symptoms: The 30-item, dichotomously coded Geriatric Depression Scale (GDS) was used. The GDS is used extensively to assess depressive symptoms in older populations (Yesavage et al., 1982). The scale has good sensitivity and specificity, is highly correlated with other depression measures such as the Beck Depression Inventory and has good internal consistency (Cronbach's alpha >.80) (Montorio & Izal, 1996). Following Judd and Akiskal (Judd & Akiskal, 2000; Judd et al., 1998) symptom level was treated as a continuous variable.

Health habits: Berkman's health habits questionnaire (Berkman & Breslow, 1983) was adapted to assess amount of physical exercise and smoking. Physical exercise participation was determined by asking, “How often do you walk, swim, do physical exercise or do sports for exercise?” with responses “never,” “less than once a week,” “once a week,” “2–3 days a week,” or “4 or more days a week.” Participants were asked if they smoke, and the number of cigarettes each day on average. For the purposes of analysis, participants were classified as smokers or non-smokers.

Symptoms: Pain, and activity interference due to pain, were assessed by Parmelee and coworkers' (Judd et al., 1998) adapted McGill Pain Questionnaire. Internal consistency is good (Cronbach's $\alpha = .91$) for the composite scale and test-retest reliability is .84 (Rosso et al., 2008). Two questions, using 6-point Likert scales, asked: "How much bodily pain have you had in the past few weeks?" and "How much has this pain interfered with your day to day activities?" We computed a 3-level pain and activity interference variable, with 1 = no pain/no activity interference, 2 = pain present/no activity interference, and 3 = pain present/activity limitations present.

ADL and IADL independence: Ability to perform basic ADL was assessed by six questions about independence in eating, dressing, bathing, grooming, indoor mobility, and bed transfers (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). The widely used Katz ADL scale has excellent inter-rater reliability and is recommended as an additive scale (Hartigan, 2007). Performance of IADL was assessed by six questions focused on independence in basic daily tasks such as meal preparation, housework, ability to get to distant places, laundry, shopping (Lawton, Moss, Fulcomer, & Kleban, 1982). Internal consistency is good (Cronbach's $\alpha = .91$) and test-retest reliability is .73 (Lawton et al., 1982). ADL and IADL scores represent the number of activities performed independently, ranging from 0 to 6.

Cognition: The Short Orientation Memory Concentration Test (OMCT), a 6-item version of Blessed's Mental Status Test developed by Katzman and coworkers (1983) was used. The total score, a weighted sum of mistakes made in answers to six questions, has a possible range of 0 to 28 with higher scores indicating worse cognition (Blessed, Tomlinson, & Roth, 1968). The OMCT appears to be equivalent to the Mini Mental State Examination in identifying dementia. It is reportedly reliable when given at 1-month intervals and serial evaluations do not appear to show significant practice effects (Davous, Lamour, Debrand, & Rondot, 1987).

Sociodemographic characteristics: Age, gender, race, education, and marital status were reported.

Data Analysis

Person-specific descriptive statistics were obtained for demographics, health, physical functioning, and walking ability. T-tests, chi-square tests, and Spearman's correlation coefficients were calculated to examine relationships between SRH and relevant predictors, as appropriate. Multinomial logistic regression models were used to obtain odds ratios (OR) and their 95% confidence intervals (CI) for both walking speeds and walking difficulty as predictors of SRH, adjusted for other indicators of health, sociodemographic status, and physical function. In this analysis "good" SRH served as the reference category because this was the most often selected category in the study population. Multinomial logistic regression is appropriate when, as here, the dependent variable has more than two response categories, and it permits more fine-grained analysis of the influence of independent variables on various levels of the dependent variable. We follow the specifications of Hosmer and

Lemeshow (2000) in selecting the number of independent variables in relation to sample size.

RESULTS

Sample Characteristics

Participants were aged 65 to 74 with a mean (SD) of 71.5 (3.2) years. Reflecting the quota recruitment strategies, the sample was composed of roughly equal men (49.4%) and women (50.6%) with a slight majority of African Americans (54.4%). Study participants were generally physically active (43% reported exercising more than 4 days per week), nonsmoking (88.3%), and had few (5.4%) ADL limitations, although a sizable minority (41%) reported difficulty in at least one IADL task. The average score on the cognition test was 3.2 out of 28, which suggests very good mental status. Nearly half of the sample was married (47.7%) and one third was widowed (30.5%). The rest of participants were either never married (5%), divorced (12.6%), or separated (4.2%). The mean (SD) normal walking speed was 0.68 (0.26) m/s and the mean (SD) fast walking speed was 0.94 (0.41) m/s. Walking speed varied considerably, ranging from 0 m/s to 1.25 m/s for normal walking speed, and from 0 m/s to 2.29 m/s for fast walking speed. Almost one half of the participants reported difficulty with walking two or three blocks (47.7%). Fast and normal walking speeds were highly correlated with each other (Spearman $r = .82$) but more modestly correlated with self-assessed walking ability (Spearman $r < .54$). The majority rated their health good (41%) or fair (30.5%). Excellent SRH was reported by 18% and poor or bad was reported by 10.5% of participants. SRH was significantly correlated with all three measures of walking ability (Spearman $r = -.56$ to $r = -.59$). Table 1 presents basic demographic characteristics (age, gender, race, education) and the variables (chronic conditions, depression, pain & pain interference, exercise, walking difficulty, walking speed) included in the regression analyses.

Relationship of Walking Ability to SRH

Unadjusted analysis showed that self-rated difficulty with walking 2 to 3 blocks and slower walking speed (both normal and fast) were all significantly associated with worse SRH (Spearman $r = .56$ for all three correlations). We also observed (see Table 1) that both normal and fast walking speeds declined monotonically as SRH worsened, as did the proportion of individuals who reported no difficulty walking 2 to 3 blocks. These observations and the high degree of correlation between walking ability and SRH led us to further investigate the relationship between walking ability and SRH by estimating a series of multinomial logistic regression models, where the relationship between walking ability and SRH is adjusted for demographics and relevant behavioral and health variables.

Multinomial Logistic Regression Models

Selection of variables—For inclusion in the regression models we considered independent determinants of SRH already established in the literature as well as other variables that in our sample were significantly related to SRH in unadjusted analysis: number of chronic conditions, depressive symptoms, pain and activity interference due to pain, exercise, and education.

Description of regression models—A stepped sequence of models was constructed, each with SRH as the dependent variable. The first model (Model 1) included the variables discussed in the previous paragraph to determine the significance of this set of important covariates in relation to SRH. The second set of models (Model 2a, 2b, and 2c) built on Model 1 to ascertain the potential contribution of walking ability: self-rated walking difficulty (Model 2a), normal walking speed (Model 2b), or fast walking speed (Model 2c). The third set of models (Model 3a, 3b) expanded on Model 2a by including either normal walking speed (Model 3a) or fast walking speed (Model 3b). The purpose here was to determine whether ‘objective’ mobility performance measures remain associated with SRH even after controlling for a subjective assessment of walking ability.

Model 1: As Table 2 shows, a lack of activity interference from pain was positively associated with an excellent (vs. good) health rating and with a lower likelihood of fair or poor/bad (vs. good) health. Participants with more chronic conditions or more depressive symptoms were more likely to rate their health fair or poor/bad versus good. Individuals with lower education were more likely to rate their health fair (vs. good). Increased physical exercise was associated with excellent (vs. good) health ratings.

Model 2: Table 3 depicts associations between walking ability and SRH, after adjustment for the variables in Model 1. In Model 2a, individuals reporting no walking difficulty were much more likely to rate their health good than fair (OR = .30; 95% CI = 0.11 to 0.83) or poor/bad (OR = .13; 95% CI = 0.02 to 0.96). In Model 2b, as normal walking speed increased, participants were more likely to rate their health excellent (OR = 1.35; 95% CI = 1.04 to 1.77) and less likely to rate their health fair (OR = .76; 95% CI = 0.59 to 0.97) or poor/bad (OR = .64; 95% CI = 0.47 to 0.86) compared to good. Fast walking speed (Model 3a) was generally not associated with SRH, except that faster walking diminished the likelihood that individuals would rate their health as poor/bad rather than good (OR = .75; 95% CI = .62 to .91).

Model 3: As seen in Table 4, controlling for the covariates in Model 1 and self-rated walking difficulty (Model 2a), had minimal effect on the direction or strength of the association between normal walking speed and SRH or the association of fast walking speed and SRH. Only normal walking speed discriminated between all SRH categories.

In summary, all three measures of walking ability were significantly associated with SRH. Normal walking speed was most strongly associated with SRH, irrespective of which combination of previously established significant determinants of SRH were adjusted for, including a subjective measure of walking difficulty.

DISCUSSION

Our results help establish walking ability as an important factor that shapes subjective health ratings. Further, our findings shed light on the relative significance of different measures of walking ability for SRH. To our knowledge, few studies have directly investigated how walking ability is related to SRH (except, e.g., Jylha et al., 2001) and only one study

(focused on functional dependence, not SRH) also measured both fast and normal walking speeds (Shinkai et al., 2000).

Normal walking speed was most strongly related to SRH, although each walking measure was associated with SRH in unadjusted analysis and was statistically significant in our regression models (Tables 3 and 4). Notably, normal walking speed was the only measure, which discriminated between participants in all SRH groups (good vs. poor/bad, good vs. fair, and excellent vs. good) and its statistical significance increased monotonically, in the expected direction, from the excellent vs. good comparison to the good versus poor/bad comparison. Our findings demonstrate that while depression and chronic health conditions remain importantly correlated with SRH, walking ability measures, especially the simple measure of normal walking speed, are strong, robust determinants of SRH.

Our results contribute by extending Jylha's work (Jylha et al., 2001) to a sample of independently functioning older men and women, and by differentiating between normal and fast walking speed in their relationships to SRH. Consistent with Jylha and colleagues (Jylha et al., 2001) we found that self-assessed walking difficulty was a significant independent predictor of SRH, and that its inclusion in regression models did not diminish the strength of the association between walking speed (either normal or fast) and SRH. This indicates that walking difficulty taps a dimension of walking ability divergent from that of measured walking speed. This is not unsurprising, as asking individuals to assess their walking ability (often framed as "Do you have difficulty walking 2 or 3 blocks?") can produce the same ratings for a host of objectively measured abilities, and thus these ratings are unlikely to map neatly onto performance-based walking speeds.

Why does normal walking speed predict SRH better than fast walking? One possible explanation is that normal walking speed represents the pace an individual chooses and feels comfortable with, a pace that likely integrates a host of unmeasured factors such as balance, strength, cognition, personality, and other psychosocial variables. Normal walking speed may therefore reflect an individual's general health status, as suggested by a recent study of skeletal muscle and mortality (Cesari, Pahor et al., 2009). Fast walking speed, on the other hand, involves maximal effort and is related to short-burst physical ability. We postulate, therefore, that fast walking speed requires an engagement of different physiological and psychological processes and reflects more closely physical fitness than general health, which would explain why it is not as strongly related to SRH in our sample as normal walking speed.

However, additional research is needed to establish whether and in what respect there are conceptual differences between various measures of walking ability and how these differences may contribute to SRH. Current research, which uses various measures of walking ability, does not consider the possibility that they may represent different aspects of the construct.

The specific characteristics of the participants in our sample, who were young-elderly and in generally good health and active, may also explain the observed significance of normal walking speed relative to fast walking speed with respect to SRH. Further research may find

that the relationship between various measures of walking ability and SRH is different for samples who are older or younger or who are less healthy.

These findings have some limitations. First, the sample narrow age range (65 to 78 years) limits our ability to explore these findings in older persons. Yet, our sample was balanced by gender and ethnicity. Second, the measured distance for walking speed (3 meters) was shorter than some studies; Jylha and colleagues (2001) used a 4-meter course. However, we note that even shorter 8-foot (2.4 meters) courses are commonly used (Guralnik, Seeman, Tinetti, Nevitt, & Berkman, 1994). As in most studies, acceleration was included in the overall time. Thus, the length of the walking course in our study and the procedures for administering the test might have resulted in slower speeds relative to studies using longer distances. In our sample, a normal (fast) walking pace of less than 0.6m/s (0.8m/s) was associated with fair or poor/bad SRH. However, more research is required to establish the appropriate thresholds that may signal poor or worsening SRH. Third, our SRH variable consisted of only four categories instead of the more commonly used five categories (excellent, very good, good, fair, poor). However, research has shown that the two versions of the SRH question represent parallel assessment of the same phenomenon, and show basically concordant answers (Jurges, Avendano, & Mackenbach, 2008). And fourth, while our sample size was relatively modest ($N = 239$), it is a population based sample, which enhances generalizability of our results. Nonetheless, the number of variables in our logistic regression models was restricted to those most relevant.

Performance-based measures, such as walking speed, offer vital information about one's physical capacities, and their ease of administration offers great potential for both research and clinical settings. They demand neither special equipment nor space—nor are they taxing for most older adults—yet they are sensitive enough to detect small yet practical clinically important changes.

Overall, this study adds new insight into how walking ability contributes to self-assessments of one's own health. The results confirm the pragmatic significance for clinicians and caregivers to listen attentively should an older person express difficulties with walking or appear to slow his or her walking pace because these portend both lowered ratings of his or her overall health and subsequent health losses. Because walking engages multiple systems (e.g., perception, cognition, motor, balance), an understanding of the connection between walking ability and SRH is needed to specify risk factors and to guide design and evaluation of interventions. Findings here support progress on such next steps in clinical practice and interventions design. Conversely, a report of fair or poor SRH should spur inquiry into walking difficulty or slowness because these may signal potentially remedial factors in the SRH report and indicators of future health declines. Thus, both walking ability and SRH need to be measured in conjunction in the clinical care of the older patient.

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TABLE 1

Characteristics of the Study Sample by Self-Rated Health

	Total sample N = 239 (100%) Mean ± SD		Excellent self-rated health N = 43 (17.6%) Mean ± SD		Good self-rated health N = 98 (40.0%) Mean ± SD		Fair self-rated health N = 73 (30.2%) Mean ± SD		Poor/bad self-rated health N = 25 (10.2%) Mean ± SD		ANOVA p value
Age: years	71.5 ± 3.2		71.4 ± 3.0		71.1 ± 3.0		72.3 ± 3.3		70.8 ± 3.5		NS
Cognition	3.2 ± 2.6		3.1 ± 2.6		2.9 ± 2.7		3.4 ± 2.6		3.5 ± 2.9		NS
Chronic conditions	3 ± 1.9		1.7 ± 1.4		2.2 ± 1.5		4.3 ± 1.6		4.6 ± 1.9		<.001
Depression	5.2 ± 5.7		1.6 ± 2.5		2.8 ± 3.1		8.4 ± 6.0		11.3 ± 6.9		<.001
Normal walking speed	.68 ± .26		.87 ± .15		.76 ± .16		.55 ± .28		.39 ± .26		<.001
Fast walking speed	.94 ± .41		1.21 ± .27		1.09 ± .26		.75 ± .43		.48 ± .41		<.001

	N (%)	N (%)	N (%)	N (%)	N (%)	Chi-square p value
Gender: male	118 (49.4%)	24 (55.8%)	49 (50%)	36 (49.3%)	9 (36.0%)	NS
Race: African American	130 (54.4%)	19 (44.2%)	56 (57.1%)	42 (57.5%)	13 (52.0%)	NS
Education						<.001
Less than high school	58 (24.3%)	7 (16.3%)	10 (10.2%)	29 (39.7%)	12 (48.0%)	
High school	72 (30.1%)	10 (23.3%)	38 (38.8%)	20 (27.4%)	4 (16.0%)	
More than high school	106 (44.4%)	26 (60.5%)	50 (51.0%)	22 (30.1%)	8 (32.0%)	
Difficulty walking 2/3 blocks:						
None	124 (51.9%)	40 (90.0%)	66 (67.3%)	16 (21.9%)	2 (8.0%)	<.001
Exercise per week						<.001
Never	41 (17.2%)	0 (0.0%)	11 (11.2%)	17 (23.3%)	13 (52.0%)	
Less than once	23 (9.6%)	2 (4.7%)	8 (8.2%)	8 (11.0%)	5 (20.0%)	
1 day	20 (8.4%)	3 (7.0%)	10 (10.2%)	6 (8.2%)	1 (4.0%)	
2 to 3 days	51 (23.1%)	8 (18.6%)	26 (26.5%)	16 (21.9%)	1 (4.0%)	
4 or more days	103 (43.1%)	30 (69.8%)	43 (43.9%)	25 (34.2%)	5 (20.0%)	
Pain and pain interference						<.001
No pain or interference	61 (25.5%)	18 (41.9%)	31 (31.6%)	10 (13.7%)	2 (8.0%)	
Pain but no interference	88 (36.8%)	24 (55.8%)	43 (43.9%)	18 (24.7%)	3 (12.0%)	
Pain and interference	88 (36.8%)	1 (2.3%)	22 (22.4%)	45 (61.6%)	20 (80.0%)	

TABLE 2

Multinomial Regression Model Estimating the Effects of Education and Several Health-Related Variables on Self-Rated Health: Model 1

	<u>Excellent Vs. Good</u>		<u>Good Vs. Fair</u>		<u>Good Vs. Poor/Bad</u>	
	OR	95% CI	OR	95% CI	OR	95% CI
Education						
Less than high school	1.33	0.42–4.16	4.30**	1.45–12.76	3.93	0.96–16.18
High school	0.61	0.25–1.52	0.64	0.25–1.65	0.26	0.06–1.21
Higher education (ref)						
Health conditions	0.94	0.69–1.26	1.83***	1.37–2.45	1.80**	1.21–2.67
Depression	0.91	0.76–1.09	1.19**	1.07–1.33	1.25**	1.10–1.42
Physical exercise	1.56*	1.03–2.36	1.07	0.81–1.42	0.73	0.49–1.07
Pain and pain interference						
No pain/interference	8.39	0.99–71.26	0.49	0.16–1.45	0.44	0.07–2.75
Pain and no interference	8.48*	1.04–69.52	0.37*	0.14–0.98	0.21*	0.04–0.99
Pain and interference (ref)						

Note: The reference category for self-rated health is "good." OR = odds ratio.

*
 $p < .05$

**
 $p < .01$

 $p < .001$.

TABLE 3

Multinomial Regression Models Estimating the Effect of Walking Ability on Self-Rated Health, Adjusted for the Covariates in Model 1

	<u>Excellent Vs. Good</u>		<u>Good Vs. Fair</u>		<u>Good Vs. Poor/Bad</u>	
	OR	95% CI	OR	95% CI	OR	95% CI
<i>Model 2a</i>						
Walking difficulty						
Not at all	3.14	0.81–12.16	0.30 [*]	0.11–0.83	0.13 [*]	0.02–0.96
Yes (ref)						
<i>Model 2b</i>						
Normal walking speed ^a	1.35 [*]	1.04–1.77	0.76 [*]	0.59–0.97	0.64 [*]	0.47–0.86
<i>Model 2c</i>						
Fast walking speed ^a	0.99	0.95–1.03	0.88	0.76–1.02	0.73 [*]	0.62–0.91

Note: Reference category for self-rated health is “good.” OR = odds ratio.

*
 $p < .05$

**
 $p < .01$.

^aIn this analysis walking speeds were multiplied by 10; therefore, these ORs represent the factors by which the odds of the SRH outcome increases for each 0.1m/s increment in walking speed, after adjusting for the effects of the other covariates in the regression model.

TABLE 4

Multinomial Regression Models Estimating the Effect of Walking Speed on Self-Rated Health, Adjusted for Walking Difficulty and the Covariates in Model 1

	<u>Excellent Vs. Good</u>		<u>Good Vs. Fair</u>		<u>Good Vs. Poor/Bad</u>	
	OR	95% CI	OR	95% CI	OR	95% CI
<i>Model 3a</i>						
Normal walking speed ^a	1.33 *	1.01–1.76	0.78 *	0.61–0.99	0.66 **	0.47–0.89
Walking difficulty						
Not at all	2.72	0.70–10.55	0.33 *	0.11–0.96	0.12	0.01–1.04
Yes (ref)						
<i>Model 3b</i>						
Fast walking speed ^a	0.99	0.95–1.04	0.93	0.80–1.08	0.80 *	0.66–0.97
Walking difficulty						
Not at all	2.94	0.75–11.52	0.28 *	0.09–0.81	0.12	0.01–1.07
Yes (ref)						

Note: Reference category for self-rated health is “good.” OR = odds ratio.

*
 $p < .05$

**
 $p < .01$.

^aIn this analysis walking speeds were multiplied by 10; therefore, these ORs represent the factors by which the odds of the SRH outcome increases for each 0.1m/s increment in walking speed, after adjusting for the effects of the other covariates in the regression model.