Report of Having Slowed Down: Evidence for the Validity of a New Way to Inquire About Mild Disability in Elders

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Abstract

Background. Mild disability in elderly persons may be detected by eliciting reports of modified task performance, even in the absence of reported difficulty. This study provides evidence for the validity of one type of task modification, namely, slowing, as a measure of mild walking disability.

Methods. Community-dwelling elders (N = 287) were questioned about whether they were walking indoors as quickly as they had 1 year before and 10 years before. Construct validity was assessed by the degree to which responses to these two questions were logically consistent with a general decline in walking speed, and by determining whether reported slowing was associated with concurrent reports of difficulty walking and with measured gait speed. Predictive validity in subjects without reported difficulty walking was gauged by the association of reported slowing with adverse walking outcomes at 1-year follow-up.

Results. Reports of slowing over 10- and 1-year periods were almost uniformly consistent with a general decline in speed. Reported slowing was significantly associated with reported difficulty walking and with slower gait speed. In the subgroup of elders initially reporting no difficulty walking, reported slowing significantly predicted incident difficulty walking at follow-up, as well as other adverse walking outcomes. For example, among elders who reported slowing, 7%, 10%, and 19% developed new difficulty walking indoors, new difficulty walking outdoors, or stopped walking for pleasure, compared with 0%, 0%, and 3% for those who had not reported slowing (p < .05).

Conclusions. This study provides evidence for the construct and predictive validity of one type of task modification, namely, slowing in indoor walking. This work contributes to the development of new methods for measuring mild disability, which may in turn form the basis for clinical interventions based on the early identification of functional problems.

The functional status of elders is often assessed by inquiring about difficulty with various tasks (1). Evidence that difficulty often precedes dependency (2) supports this approach but begs the question of whether still milder forms of functional problems may in turn precede reports of difficulty. An affirmative answer is suggested by recent work showing that modification in task performance, even among those without reported difficulty, is associated with reduced functional ability as measured by performance tests (3).

In this study, we examine a particular type of task modification, namely, self-reported slowing, as applied to the ascertainment of disability in walking. Using data from a population-based cohort study of community-dwelling elders, we assess the validity and potential usefulness of this novel approach for detecting mild disability. Subjects were asked whether they walked indoors as quickly as they had 1 year before and 10 years before. We refer to elders who responded that they did not move as quickly as having slowed down. We tested three hypotheses. Hypothesis 1: Few elders will report having slowed down in the last year but not in the last 10 years. This finding would support the construct validity of self-reported slowing because walking speed generally decreases with aging (4). Hypothesis 2: Reported slowing will be associated with reported difficulty walking and with slower measured walking speed. These findings would further support the construct validity of self-reported slowing by showing its association with two commonly used measures. Hypothesis 3: Even among elders reporting no difficulty walking, those reporting that they have slowed down will be more likely in the future to develop difficulty walking. This finding would support the predictive validity of self-reported slowing, providing evidence that such reports can detect preclinical disability in persons not reporting difficulty walking. Finally, among elders who reported no difficulty walking, we compared those who reported slowing with those who did not to determine if self-reported slowing identifies a clinically different group.

Methods

Subjects and General Design

We studied 287 elderly subjects enrolled in the Northern Manhattan Aging Project/Active Life Expectancy Among Urban Minority Elderly Study (NMAP/ALE) (5). The NMAP/ALE cohort, assembled in 1992, underwent in-
home interviews at ~1-year intervals. From January 1995 to January 1998, all surveyed NMAP/ALE subjects without severe cognitive impairment (see Measures, below), and not requiring an ambulette for transportation, were invited to participate in a substudy, which was performed in the Stroud Laboratory on Functioning (Function Lab). Subsequent to the Function Lab visit, as part of the ongoing NMAP/ALE study, follow-up survey data were obtained for 146 (65%) of the 224 Function Lab subjects not reporting difficulty walking. Thus, data in this study come from three time points: survey prior to the Function Lab visit, at the visit, and survey subsequent to the visit. The median time from prior survey to Function Lab visit was 85 days (IQR 46-167) and from Function Lab visit to subsequent survey was 360 days (IQR 306-565).

Measures

Self-reports.— Self-reports about walking were obtained from NMAP/ALE surveys prior to and subsequent to the Function Lab visit, using the following items: “Do you have any difficulty walking indoors?”; “Do you have any difficulty walking outdoors?”; “How many blocks can you walk without resting?”; and “In the last month, have you gone out for a walk (for pleasure)?” NMAP/ALE interviewers surveying subjects in follow-up after the Function Lab visit were blinded to all Function Lab data.

In the Function Lab, subjects responded to questions about indoor walking, preceded by the following introduction: “Now I’m going to ask you about the way you walk in a straight line indoors. When I say ‘walk in a straight line’ I mean walking straight ahead, without making turns.” The questions were: “When you walk in a straight line indoors, do you move as quickly as you did 10 years ago?”; “When you walk in a straight line indoors, do you move as quickly as you did 1 year ago?”; and “Do you have difficulty walking in a straight line indoors?” The research assistant asking these questions was blinded to all data from each subject’s prior NMAP/ALE survey.

We used responses from the NMAP/ALE survey prior to the Function Lab visit to determine ethnicity, education, marital status, living situation (alone or with others), monthly income, cognitive status, self-rated health, and the presence of 10 health conditions. Cognitive status was determined from the CARE Cognitive Screen, a 15-item summed scale that has been shown to have superior test characteristics for dementia screening and to be less prone to education and ethnicity bias than the Mini-Mental State Examination (6). Basic activities of daily living (ADLs) were assessed from the prior NMAP/ALE survey using reported problems or difficulties with bathing, dressing, and toileting and with independence in transfers and feeding.

Performance testing.— In the Function Lab, after self-reports of slowing and difficulty were obtained, comfortable walking speed was measured using a 20-m walking task with a single 180° turn at the midpoint. Walking times for the central 6-m portion of each 10-m straight segment were determined from time-coded videotapes, then averaged and divided into 6 to yield speed in meters per second. The research assistant coding the videotapes was blinded to each subject’s responses to Function Lab questions about slowing and difficulty, and to all data from the NMAP/ALE survey.

Statistical Analysis

To evaluate the construct validity of the two Function Lab questions about having slowed down, we first checked whether responses to the two questions were logically consistent with a general decline in walking speed (Hypothesis 1). The two questions about slowing were used to form three subject groups: those not having slowed down in the last 10 years, those having slowed down in the last 10 years but not in the last year, and those having slowed down in the last 10 years and in the last year. We then determined whether these categories of slowing were associated with Function Lab self-reports of difficulty walking (using the chi-square statistic) and with comfortable walking speed as measured in the Function Lab (using analysis of variance) (Hypothesis 2).

We assessed the predictive validity of reported slowing (Hypothesis 3) as follows. In the subset of elders reporting no difficulty walking indoors at the Function Lab visit, we determined whether those who nonetheless reported slowing down in the last 10 years were more likely to report new difficulty walking indoors in the subsequent survey. We also examined other adverse walking outcomes: incident difficulty walking outdoors, decrement in number of blocks walked without resting, and discontinuation of walking for pleasure. Associations between reports of slowing down in the last 10 years and walking outcomes were assessed using relative risks with 95% confidence intervals.

Finally, among those subjects who had not reported difficulty walking at the Function Lab visit, we compared those with and without slowing with regard to ADLs, self-reported health, cognition (CARE Cognitive Screen), and health conditions. Comparisons were made using the chi-square test (dichotomous measures), two-tailed t test (continuous measures), or Mann-Whitney U test (ordinal measure of self-rated health).

Results

Subject Characteristics

The subjects in this study were not significantly different from those in the initial NMAP cohort whom we did not study in age, gender, marital status, or whether they were living alone (Table 1). However, more of our subjects were African American (40% vs 33%) and Caucasian (31% vs 18%), and fewer were Latino (29% vs 50%). Our subjects were more educated (mean of 10 years of education vs 8 years) and had higher monthly incomes (proportion earning $650 or less, 36% vs 53%). We excluded subjects with severe cognitive impairment from our study; in the initial NMAP cohort, 10% of the subjects had severe cognitive impairment. Among the Function Lab subjects reporting no difficulty walking, the group of subjects with follow-up data were not significantly different from those without follow-up data with regard to age, gender, or the proportion reporting slowing down over 10 years (47% vs 46%).
Construct Validity of Reports of Slowing Down

Subjects more often reported having slowed down in the last 10 years (56%) than in the last year (18%) (Table 2). Only one subject’s responses were inconsistent with the expected pattern of general decline, in that she reported having slowed in the last year but not in the last 10 years.

Subjects reporting not slowing down in the last 10 years were least likely (2%) to report difficulty walking indoors and had the fastest comfortable walking speed. Those reporting slowing down in the last 10 years and the last year were most likely (56%) to report difficulty walking indoors and had the slowest comfortable walking speed. Intermediate between these two categories were those reporting that they had slowed down in the last 10 years but not in the last year (Hypothesis 2; Tables 3 and 4).

Predictive Validity of Reports of Slowing Down for Subsequent Adverse Walking Outcomes

A large percentage (47%) of subjects who reported no difficulty walking nevertheless reported slowing down in the last 10 years. Subsequently, these subjects were much more likely than those who had not reported slowing to develop new difficulty walking. In addition, they were more likely to report other adverse walking outcomes at follow-up (Hypothesis 3; Table 5).

Characteristics of Subjects Reporting Slowing But Not Reporting Difficulty Walking

Among subjects without reported difficulty walking indoors, those who nonetheless reported slowing down in the last 10 years had worse self-rated health, worse cognitive status, and a higher number of health conditions than those reporting no slowing (Table 6). They were also more likely to be under treatment for hypertension, arthritis, or joint/muscle pains.

Discussion

This study provides evidence for the validity and potential usefulness of a novel approach for assessing walking disability: asking subjects whether they have slowed down. Reports of slowing over 1- and 10-year periods were logically consistent with a general decline in walking function. As hypothesized, reported slowing was also associated with reported difficulty walking and with slower gait speed. In addition to this evidence for construct validity, we also provide substantial support for predictive validity: in the subgroup of elders initially reporting no difficulty walking indoors, reported slowing predicted incident difficulty walking indoors as well as other adverse walking outcomes.

This study complements recent research to develop measures that are sensitive to the full spectrum of disability. Our results indicate that those without difficulty walking may be
usefully divided into those with and without reported slowing. Slowing may be an adaptation to physiological impairment, which may preempt a report of difficulty. As demonstrated by Fried and coworkers, reports of modified task performance are highly prevalent among elders not reporting task difficulty, and these reports identify a subgroup with reduced functional performance compared with those reporting no modification (3). Our work extends these findings, supporting the construct validity of a specific type of task modification, namely, slowing, as a measure of walking disability. Furthermore, because we followed subjects longitudinally, we were able to demonstrate that self-reports of slowing down, even among those not reporting difficulty, predicted adverse mobility outcomes later. Finally, we show that a particular self-reported task modification (slowing down) is associated with measured task modification in the same task (slower gait speed).

New methods for ascertaining disability at very mild stages may aid the development of clinical interventions based on early identification of functional problems. A recent review of preventive screening in elderly people noted little evidence to support functional screening using traditional methods (7), and clinical interventions using traditional functional assessment in outpatient programs have had mixed success (8). To improve the effectiveness of such programs, some have advocated targeting frailer subjects, based on difficulty with functional activities (9). An alternative approach might be to target elders with very mild disability, intervening early in the cycle of functional decline (10,11). Measures based on task modification could be used not only to identify elders needing intervention but also to detect functional outcomes more sensitively. Furthermore, an elder with severe disability in one domain (e.g., walking) may exhibit very mild disability in another domain (e.g., feeding). Thus, measures based on task modification may be useful not only in screening and following relatively healthy outpatients, but also in implementing targeted programs for those elders who are more ill or disabled (12).

Table 5. Predictive Validity of Self-Reported Slowing in Subjects Without Difficulty Walking Indoors

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number (%) of Cases With Incident difficulty walking indoors</th>
<th>Number (%) of Cases With Incipient difficulty walking outdoors</th>
<th>Decrement in number of blocks walked without resting</th>
<th>Stopped walking for pleasure</th>
<th>Any of the above outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slowing Over the Past 10 Years</td>
<td>5 (7)</td>
<td>7 (10)</td>
<td>18 (26)</td>
<td>13 (19)</td>
<td>31 (46)</td>
</tr>
<tr>
<td>No Slowing Over the Past 10 Years</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>8 (11)</td>
<td>2 (3)</td>
<td>10 (13)</td>
</tr>
<tr>
<td>Relative Risk (95% CI)</td>
<td>Infinite*</td>
<td>Infinite**</td>
<td>2.5 (1.2–5.4)</td>
<td>7.3 (1.7–31.0)</td>
<td>3.5 (1.8–6.5)</td>
</tr>
</tbody>
</table>

*Note: Infinite relative risks are reported when all cases with the outcome occurred among those with slowing over the last 10 years.
*p < .05, Fisher’s exact test, two tailed.; **p < .005, Fisher’s exact test, two tailed.

Table 6. Characteristics of Subjects Without Reported Difficulty Walking

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Slowing Over the Past 10 Years</th>
<th>No Slowing Over the Past 10 Years</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>78 (5)</td>
<td>77 (4)</td>
<td>0.14</td>
</tr>
<tr>
<td>Female</td>
<td>69/105 (66%)</td>
<td>70/120 (58%)</td>
<td>0.26</td>
</tr>
<tr>
<td>Basic ADL deficit prior to lab study†</td>
<td>6/105 (6%)</td>
<td>3/120 (3%)</td>
<td>0.31</td>
</tr>
<tr>
<td>Self-rated health prior to lab study‡</td>
<td>20/103 (19%)</td>
<td>61/119 (51%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Excellent</td>
<td>60/103 (58%)</td>
<td>45/119 (38%)</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>2/103 (2%)</td>
<td>1/119 (1%)</td>
<td></td>
</tr>
<tr>
<td>Cognitive status‡</td>
<td>1.5 (1.3)</td>
<td>1.1 (1.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Health Conditions in Past Month Taking medicine or injections prescribed for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart condition</td>
<td>22/104 (21%)</td>
<td>17/120 (14%)</td>
<td>0.16</td>
</tr>
<tr>
<td>Hypertension</td>
<td>63/105 (60%)</td>
<td>56/120 (47%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Lung or chest condition</td>
<td>7/104 (7%)</td>
<td>3/120 (3%)</td>
<td>0.19</td>
</tr>
<tr>
<td>Diabetes</td>
<td>17/105 (16%)</td>
<td>13/120 (11%)</td>
<td>0.23</td>
</tr>
<tr>
<td>Arthritis or joint/muscle pains</td>
<td>22/105 (21%)</td>
<td>13/120 (11%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>0/105 (0%)</td>
<td>1/120 (1%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Mental or emotional problems</td>
<td>3/105 (3%)</td>
<td>3/120 (3%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Any other condition</td>
<td>38/104 (37%)</td>
<td>39/120 (32%)</td>
<td>0.53</td>
</tr>
<tr>
<td>Told about malignant tumor</td>
<td>5/105 (5%)</td>
<td>7/120 (6%)</td>
<td>0.24</td>
</tr>
<tr>
<td>Had a stroke or transient ischemic attack</td>
<td>8/105 (8%)</td>
<td>3/120 (3%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Mean number of health conditions (0–10)</td>
<td>1.7 (1.0)</td>
<td>1.3 (1.1)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

†Any problems or difficulties with bathing, dressing, or toileting, or needing assistance with transfers or feeding.
‡CARE Cognitive Screen Score (0–7, 0 = no impairment).
Among subjects without reported difficulty walking indoors, those who had slowed down were more likely to have worse cognitive status and more likely to be under treatment for arthritis or joint/muscle pains and hypertension. It is notable that these same three conditions have also been associated with walking disability in studies using more traditional measures. For example, an association between cognitive impairment and slower measured gait speed has been reported (13). In a community-dwelling cohort study, arthritis was the most often reported cause of difficulty walking indoors (14). In another study, baseline joint impairment predicted decline in measured gait speed over 2- and 4-year periods, even controlling for age and other factors (15). Finally, hypertension has been previously identified as a predictor of mobility decline in one major longitudinal study, even after controlling for stroke and myocardial infarction (16).

Our work not only furthers understanding of the natural history of walking disability but also contributes to the science of disability measurement in general. A uniform approach to measurement is not ideal, given the variety of goals of measurement and the varying practical considerations such as time, space, and expense. For a given goal, however, and with given practical constraints, information is emerging about the influence of measurement techniques on the ascertainment of disability (1,17). For example, measurement approaches based on self-reported dependence, difficulty, and task modification are complementary in detecting the full spectrum of disability, when viewed as mutually exclusive hierarchical categories (2,3). In fact, dependence, difficulty, and task modification may not reflect mutually exclusive hierarchical categories of functioning: Verbrugge and Jette argue that dependency actually measures the presence of an intervention to reduce difficulty (10), and Fried and coworkers regard dependency as one type of task modification (3). Our findings suggest that task modification and difficulty are not mutually exclusive hierarchical categories: of those reporting difficulty, 6% reported no slowing. Thus, whereas reports of dependence, difficulty, and task modification are complementary in detecting the full spectrum of disability, they clearly reflect overlapping but not identical constructs. Qualitative research to understand what elders mean by these various forms of self-report will be essential to inform the development of specific and meaningful self-report tools.

We showed that slowing down in the last 10 years was predictive of adverse walking outcomes. What mechanisms underlie this predictive quality? It is unlikely that subjects accurately recall their gait speed from 10 years prior and then make an explicit comparison with their current gait speed. Rather, these self-reports probably reflect an integration of a variety of perceptions and experiences. For example, an elder’s past and present walking capability, his or her general functioning, mood, social and environmental circumstances, general health, and history of falls might each contribute to the perception of slowing down and to a likelihood of the development of frank disability. Indeed, we showed that poorer self-rated health was associated with reports of slowing in our study. The predictive quality of poor self-rated health itself has been partially attributed to the fact that these ratings capture past declines in health and not simply current health status (18). This trajectory hypothesis, supported by several studies (18,19), contends that the past health trajectory continues in the future, contributing to the predictive quality of self-rated health. That past and future health trajectories are similar appears reasonable for the progressive declines caused by many age-associated conditions. When elders in our study reported slowing down, they were in fact making explicit statements about the trajectory of walking function. Because reports of slowing over 1- and 10-year time periods were logically consistent with general declines in walking speed, it is reasonable that self-reported slowing predicted future adverse walking outcomes.

The subset of elders we studied cannot be considered representative of the original population-based cohort. A related concern is further selection bias through our loss to follow-up of 35% of the Function Lab subjects who reported no difficulty walking. In terms of important baseline characteristics, however, including our main predictor variable—reported slowing over 10 years—those lost to follow-up were comparable to those studied at follow-up. Finally, the relatively small numbers of elders with adverse walking outcomes resulted in very wide confidence intervals for our estimates of risk associated with self-reported slowing. Nevertheless, the lower limits of the confidence intervals support the validity of this type of approach, irrespective of the precise degree of risk conferred by self-reported slowing.

We are not able to address some important aspects of disability measurement in this study. For example, we could not examine the relationship between cognitive status and self-reported function in this study of mostly cognitively intact subjects. Similarly, because we studied only the domain of walking, our conclusions about slowing down as a type of task modification may not apply to other domains of function. Nevertheless, because traditionally measured mobility disability is a marker for general functional decline (20), it may be that slowing in walking will also prove to be a marker for decline in other domains.

In conclusion, this study shows that self-reports of slowing down reflect early walking disability, even among subjects who report no difficulty in walking. For clinicians seeking to improve patients’ quality of life through the early identification of functional problems (21), our findings indicate that it may not be sufficient simply to inquire about difficulty with functional tasks, but that task modifications such as slowing down may indicate both current disability and a risk for future decline. For researchers seeking a better understanding of disability and disability measurement, our findings indicate that the causes of very mild disability in walking may be similar to the causes of more substantial walking problems. Moreover, very mild disability in walking may be detected by inquiries about task modifications such as slowing. A better understanding of the mechanisms by which self-reported task modification predicts future disability could serve as a foundation for clinical interventions based on early identification of functional problems.

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References

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