

Lower Body Function and Mortality in Mexican American Elderly People

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Background. The purpose of this analysis was to examine the differential impact of performance-based and self-reported lower body measures on 2-year mortality in Mexican American elderly persons.

Methods. Data employed are from the Hispanic Established Population for Epidemiological Studies of the Elderly, a probability survey of 3050 community-dwelling Mexican Americans aged 65 and older from the five Southwestern states interviewed in 1993 and 1994. Of the baseline sample with complete data, 198 persons were confirmed deceased 2 years later. A three-task, performance-based, lower body function measure consisting of a short walk, balance, and repeated chair stands tests was used. Self-reported lower body function was measured by a 4-item Activities of Daily Living (ADL) measure involving the lower body.

Results. The three-task, lower body function measure was a significant predictor of 2-year mortality. The short walk alone was as predictive as the summary measure. The predictive ability of both measures was minimally reduced by the inclusion of the self-reported ADL measure and life-threatening medical conditions. Finally, the ADL measure was not a significant predictor of mortality with all the other variables in the analysis.

Conclusion. Objective measures of lower body function were significant predictors of mortality in Mexican American elderly persons, as found in the general population. Unlike previous studies, the ADL measure was not an independent predictor of mortality after controlling for the objective measure and other risk factors. Additional research is needed to address why objective measures of function are such strong predictors of death.

IT is becoming increasingly clear that poor lower body function is a major contributor to disability and loss of independence among elderly persons. It has been found to be associated with disability in Activities of Daily Living (ADL), both cross-sectionally and prospectively (1–4), and is also a major predictor of self-ratings of health, depressive symptomatology (4), and institutionalization (5).

Despite its importance as a major predictor of the health status of older people, few studies have examined the association of lower body function to mortality (6,7). In an analysis of data from three of the Established Populations for Epidemiological Studies of the Elderly (EPESE) studies, Brock and colleagues (6) found that self-report measures of lower body function were stronger predictors of mortality than were measures of ADLs. Specifically, a portion of the Rosow-Breslau (8) scale of lower body function (ability to walk a half mile, to walk up and down stairs, and to perform heavy housework) was a significantly stronger predictor of 3-year mortality than was the ADL scale developed by Katz and colleagues (9), with Branch's additions (10). The latter scale covers bathing, dressing, walking, grooming, transferring from bed to chair, using the toilet, and eating. Similar results were obtained for both men and women in models that included the measures of function separately as well as

when they were included in the same model. In the latter, only the Rosow-Breslau predicted mortality, while the ADL measure as well as a measure of function derived from Nagi (11) did not.

In a separate analysis of the same three EPESE data sets, Guralnik and colleagues (5) examined whether a short performance-based measure of lower body function predicted mortality over an average period of 1.39 years. They also examined whether presence of one or more ADL limitations that require lower body function (walking across a room, bathing, transferring from bed to chair, and using the toilet) predicted mortality. The performance-based measure was a summary score of three lower body functions: standing balance, walking speed over an 8-ft distance, and repeated chair stands. When performance and self-reported measures were entered in the same equation, both were significant predictors of mortality among men. However, only the performance score predicted mortality among women. Thus, at least among women, this analysis provided evidence that a performance-based measure of physical function was more predictive of mortality than was an ADL measure of lower body limitations.

The purpose of this analysis was to examine the extent to which performance-based and ADL measures of lower body

function differentially predict mortality in a unique cohort of Mexican American elderly persons. We have previously shown (12) that performance-based measures of lower body function predict the incidence of ADL and mobility-related disability over two years in Mexican American elderly persons as has been found in the general population (5).

In attempting to predict 2-year mortality in Mexican American elderly persons, we hypothesized that performance-based measures of lower body function would be stronger predictors of mortality than self-reported lower body function. Given what little is known about self-reported physical function (13–15) as well as more objective measures of physical function in older Mexican Americans (16), assessing their differential impact on mortality in this population should generate much-needed knowledge. Finally, we went beyond past research to examine the extent to which performance measures of physical function continue to be predictive of mortality after controlling for the presence of major life-threatening diseases.

METHODS

Sample

Data employed are from the Hispanic EPESE. At baseline, 3050 community-dwelling Mexican Americans aged 65 and older were interviewed in their homes during 1993 and 1994. The sample was drawn using area probability sampling procedures to be representative of the Mexican American elderly population in five Southwestern states: Texas, New Mexico, Colorado, Arizona, and California. The sample and its characteristics have been described elsewhere (17,18).

The initial sample was followed up 2 years later in 1995 and 1996. Of the original 3050 persons, 2439 were reinterviewed, 2167 in person and 272 (8.9%) by proxy. Of the remaining subjects, 224 (7.3%) were confirmed deceased through the National Death Index and reports from relatives, 109 (3.5%) refused to be reinterviewed, and 5 (0.2%) were reported to be living in Mexico. The status of 273 (8.9%) persons could not be determined (12).

In the analysis below we include persons with complete data on the performance measures of physical function and other variables of interest at baseline; the subjects were determined to be living or deceased at Time 2, two years later. Of the 2636 eligible subjects, 198 (7.5%) were deceased by Time 2.

Measures

Our performance-based measure of lower body function was identical to the one employed by Guralnik and colleagues (5) with other EPESE data sets [see also (19,20)]. Basically, three separate tasks were assessed, and a combined score was created to represent lower body function. The tasks were a timed 8-ft walk, timed repeated chair stands, and standing balance. The two timed tasks were divided into quartiles each and scored 1 (slowest) to 4 (fastest). Subjects unable to complete each task were assigned a value of 0. The standing balance tests included tandem, semitandem, and side-by-side stands. Individuals were scored 1 to 3, with 3 indicating the highest performance. Those unable to perform any of the balance tests were assigned a

value of 0 (12). The three scores were combined to form a total lower body function score ranging from 0 to 11. The scale was further categorized from 0 to 4 to approximate the timed walk categorization (Table 1).

Self-reported lower body function was assessed with four ADLs requiring lower body action: transferring from bed to chair, using the toilet, walking across a small room, and bathing [same as in (5)]. In the analysis reported below, subjects were considered ADL disabled if they were unable to perform any of the four tasks without help.

Other variables assessed were age ($75+ = 1$, $65-74 = 0$), gender (male = 1), and presence of a number of self-reported potentially life-threatening conditions. These were assessed by asking respondents if they had ever been told by a doctor that they had any of the following conditions: heart attack, cancer, diabetes, hip fracture, stroke, and hypertension.

Analysis

Two-year mortality was assessed through a series of multiple logistic regression models. Two sets of analyses were performed, one involving the combined performance score and one involving the short walk. The latter was conducted because it has been suggested that the short walk is the most predictive of the three performance tasks of subsequent disability (2,12,21).

RESULTS

Table 1 presents the distributions of all variables included in the analysis. Of the total sample of 2636, 34.9% were 75

Table 1. Categories of All Variables in the Analysis ($n = 2636$)

	<i>n</i>	%
Age		
65–74 y	1715	65.1
75+ y	921	34.9
Gender		
Men	1106	42.0
Women	1530	58.0
Performance Score		
0 (unable)	334	12.7
1	179	6.8
2	689	26.1
3	707	26.8
4	727	27.6
Short Walk		
0 (unable)	389	14.8
1	479	18.2
2	557	21.1
3	591	22.4
4	620	23.5
Any ADL [†]	326	12.4
Medical Conditions		
Hypertension	1132	42.9
Heart attack	302	11.5
Cancer	149	5.7
Diabetes	594	22.5
Hip fracture	96	3.6
Stroke	175	6.6
Deceased	198	7.5

[†]Any ADL: unable to or needing help to perform any of the following four tasks involving the lower body: transferring from bed to chair, using the toilet, walking across a room, bathing.

years and older, and 58.2% were women. On the summary performance score, 12.7% were unable to perform any of the three tasks and were assigned a value of 0. Similarly, 14.8% were unable to perform the short walk. Approximately 12.4% were ADL dependent at baseline, and 7.5% were deceased by Time 2.

As in previous work (5), scores on the three performance tasks were significantly correlated: walk and balance, 0.53; walk and chair stands, 0.49; balance and chair stands, 0.49 ($p < .0001$ for all three). The internal consistency of the 3-item scale was 0.75 using Cronbach's alpha. In addition, the ADL item was significantly correlated with each performance task (-0.55 with balance, -0.47 with short walk, and -0.41 with chair stands) as well as with the combined performance score (-0.57). These correlations are similar to those previously reported in the literature (22).

Table 2 presents results of logistic regression analyses predicting 2-year mortality using the summary performance measure of function. Model 1 included as independent variables the summary performance score of lower body function along with age and gender serving as controls. The performance score was entered as four dummy variables with scores 9 to 11 (best function) serving as the reference category. As can be seen, persons in lower categories were all significantly more likely to experience 2-year mortality. Moreover, there appeared to be a linear trend with persons in the 0 category (unable to perform any of the tasks) considerably more likely to die than persons in the highest category (odds ratio [OR], 11.80; 95% confidence interval [CI] = 6.80–20.48). Model 2 included only the self-reported lower body ADL measure along with age and gender. Persons reporting disability in any one of the four ADLs were significantly more likely to die within 2 years than persons reporting no disability (OR, 4.06; 95% CI = 2.90–5.69). Model 3 included both the summary performance measure and the ADL measure to examine whether both continue to significantly predict mortality. Even though the ORs declined somewhat, the performance measure continued to significantly affect

mortality, and a linear trend continued to be observed. However, the ADL measure was no longer a significant predictor (OR = 1.52; 95% CI = 0.96–2.42). Clearly, our data show the clinical utility of the short performance battery of lower body function in predicting mortality in Mexican American elderly persons as has been found in the general elderly population (5). At the same time, the self-reported ADL measure lost its predictive ability when the performance measure was entered into the equation.

Previous research linking performance measures of lower body function adverse outcomes including mortality (5,23) typically stops at this stage. We went a step further by repeating our analyses controlling for common life-threatening conditions (hypertension, heart disease, cancer, diabetes, hip fracture, and stroke) in model 4. Interestingly, even though the ORs for the performance measure declined somewhat, the general pattern remained the same. As in the previous model, the ADL measure was not a significant predictor of mortality.

It has been suggested that the short walk component of the three-task summary measure of lower body function might be as predictive or almost as predictive of subsequent disability as the summary measure and that it may be more predictive than either chair stands or balance (2,12,21). However, the predictive ability of the short walk has not been investigated with respect to mortality. We examined this relationship and report the results in Table 3.

Model 1, which includes only the short walk in addition to age and gender, yielded results almost identical to those yielded by the summary performance measure (Table 2). Significant ORs were computed for each of the four categories rising to 11.52 (CI = 6.35–20.90) for category 0, which contained subjects unable to complete the task.

Model 3 included the addition of the ADL measure. The ORs were reduced somewhat, but, again, the results were almost identical to those for the summary measure in Table 2, with the ADL measure being only marginally significant. Finally, when the medical conditions were added to the equa-

Table 2. Logistic Regression Models Predicting Mortality from Summary Performance Score, ADL Disability, Chronic Conditions, Gender, and Age ($n = 2636$)

	Model 1	Model 2	Model 3	Model 4
Age				
(75+ y vs 65–74 y)	1.43 (1.05–1.96)	1.62 (1.19–2.20)	1.38 (1.01–1.89)	1.42 (1.02–1.97)
Gender (male)	1.75 (1.29–2.37)	1.58 (1.17–2.12)	1.76 (1.30–2.38)	1.84 (1.34–2.52)
Summary Performance Score (vs 9–11)				
7–8	2.11 (1.18–3.84)		2.11 (1.18–3.80)	2.02 (1.12–3.64)
4–6	3.44 (1.98–5.96)		3.41 (1.96–5.92)	3.25 (1.86–5.67)
1–3	3.56 (1.74–7.30)		3.17 (1.52–6.60)	2.87 (1.37–6.05)
0	11.80 (6.80–20.48)		8.93 (4.72–16.91)	7.39 (3.86–14.13)
Lower Body ADL Disability (any ADL)		4.06 (2.90–5.69)	1.52 (0.96–2.42)	1.46 (0.90–2.36)
Chronic Conditions				
Hypertension				1.09 (0.79–1.51)
Heart disease				1.59 (1.07–2.38)
Cancer				3.18 (2.02–5.01)
Diabetes				1.78 (1.29–2.51)
Hip fracture				1.35 (0.73–2.50)
Stroke				0.81 (0.48–1.36)

Notes: Values represent odds ratios and 95% confidence intervals. ADL = Activity of Daily Living.

Table 3. Logistic Regression Models Predicting Mortality From Short Walk, ADL Disability, Chronic Conditions, Gender, and Age ($n = 2636$)

	Model 1	Model 2	Model 3	Model 4
Age				
(75+ y vs 65–74)	1.51 (1.11–2.06)	1.62 (1.19–2.20)	1.43 (1.04–1.95)	1.46 (1.06–2.03)
Gender (male)	1.67 (1.23–2.26)	1.58 (1.17–2.12)	1.69 (1.24–2.29)	1.76 (1.29–2.42)
Short Walk (vs 4)				
3	2.34 (1.22–4.46)		2.34 (1.23–4.47)	2.16 (1.12–4.14)
2	2.78 (1.45–5.32)		2.76 (1.44–5.30)	2.57 (1.33–4.94)
1	3.79 (2.02–7.09)		3.69 (1.97–6.93)	3.64 (1.93–6.85)
0	11.52 (6.35–20.90)		8.62 (4.56–16.66)	7.47 (3.83–14.55)
Lower Body ADL Disability (any ADL)		4.06 (2.90–5.69)	1.62 (1.04–2.53)	1.48 (0.93–2.36)
Chronic Conditions				
Hypertension				1.11 (0.80–1.53)
Heart disease				1.60 (1.08–2.39)
Cancer				3.37 (2.14–5.30)
Diabetes				1.80 (1.29–2.52)
Hip fracture				1.35 (0.73–2.48)
Stroke				0.82 (0.49–1.38)

Notes: Values represent odds ratios and 95% confidence intervals. ADL = activity of daily living.

tion (model 4), for the short walk we again obtained ORs almost identical to those obtained for the summary measure and reported in Table 2. Similarly, with the scores on the short walk and medical conditions entered into the equation, the self-reported ADL measure was not a significant predictor of mortality.

Thus it appears that the short walk is as predictive of 2-year mortality as the summary measure. When we repeated the analyses for chair stands and balance (results not shown), our findings were considerably weaker and less consistent than those for the summary score or the short walk (results available from the authors).

DISCUSSION

As found in previous research, a simple three-task battery of lower body function was a significant predictor of short-term mortality in Mexican American elderly persons. In addition, the short walk alone was as predictive as the summary measure and more predictive than the balance and chair stand tasks. The predictive ability of both the summary measure and short walk were reduced only minimally by the addition of a self-reported lower body ADL measure and by the addition of life-threatening medical conditions. Finally, the self-reported ADL measure was no longer a significant predictor of mortality when the summary performance measure and life-threatening medical conditions were entered into the equation, as well as when the short walk and life-threatening medical conditions were entered into the equation.

Our findings are consistent with previous literature showing that simple physical performance tests of lower body function are strong predictors of mortality (2,23). It also supports the finding that lower body function may be a better predictor of mortality than self-reported ADL function (6). Although previous research has found that both performance and ADL measures are significant independent predictors of mortality (5,6,23), we found that the predictive power of self-reported ADL lower body function becomes insignificant when performance measures and medical conditions are entered into the equation.

Why are performance measures so much more predictive than self-report measures in our analysis? Performance measures are fairly objective indicators of actual ability and probably are an extreme manifestation of the disablement process (24) when individuals reach the point when they are unable to do a task. ADL measures are more subtle, but more complex, and probably reflect individuals' adaptation to physical decline. Why ADLs appear to perform less well in this sample of Mexican American elderly persons than previously reported with other groups is not clear. Perhaps they are subject to more error in this population, although they correlate at similar levels with performance measures as in the general population (22).

An important contribution of this study was the continued strong influence of performance measures on mortality even after controlling for life-threatening medical conditions. Moreover, their influence on mortality was stronger than that of any disease, including cancer, at least for the extreme end of the distribution, which included those unable to perform a task. Clearly, performance measures of function are useful for identifying high-risk persons in the elderly population, which is better than simply relying on disease profiles. Identifying high-risk persons using objective standardized tests will assist in providing them with better medical care and preventive interventions.

Additional research is needed to help us better understand why poor physical function is so highly related to death. Except for fatal falls and accidents, poor physical function does not kill people. Obviously, it is a marker for poor health and the adverse consequences of chronic disease. Although the association between chronic disease and physical function in the elderly is an area of extensive research, our understanding of this relationship remains limited, especially among Mexican Americans and other minority populations (13).

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