

Development and Validation of a Functional Morbidity Index to Predict Mortality in Community-dwelling Elders

Elise C. Carey, MD, Louise C. Walter, MD, Karla Lindquist, MS, Kenneth E. Covinsky, MD, MPH

OBJECTIVE: Functional measures have a great appeal for prognostic instruments because they are associated with mortality, they represent the end-impact of disease on the patient, and information about them can be obtained directly from the patient. However, there are no prognostic indices that have been developed for community-dwelling elders based primarily on functional measures. Our objective in this study was to develop and validate a prognostic index for 2-year mortality in community-dwelling elders, based on self-reported functional status, age, and gender.

DESIGN: Population-based cohort study from 1993 to 1995.

SETTING: Community-dwelling elders within the United States.

PARTICIPANTS: Subjects, age ≥ 70 ($N = 7,393$), from the Asset and Health Dynamics Among the Oldest Old study. We developed the index in 4,516 participants (mean age 78, 84% white, 61% female), and validated it in 2,877 different participants (mean age 78, 73% white, 61% female).

MAIN OUTCOME MEASURES: Prediction of 2-year mortality using risk factors such as activities of daily living, instrumental activities of daily living, additional measures of physical function, age, and gender.

RESULTS: Overall mortality was 10% in the development cohort and 12% in the validation cohort. In the development cohort, 6 independent predictors of mortality were identified and weighted, using logistic regression models, to create a point scale: male gender, 2 points; age (76 to 80, 1 point; >80 , 2 points); dependence in bathing, 1 point; dependence in shopping, 2 points; difficulty walking several blocks, 2 points; and difficulty pulling or pushing heavy objects, 1 point. We calculated risk scores for each patient by adding the points of each independent risk factor present. In the development cohort, 2-year mortality was 3% in the lowest risk group (0 to 2 points), 11% in the middle risk group (3 to 6 points), and 34% in the highest risk group (>7 points). In the validation cohort, 2-year mortality was 5% in the lowest risk group, 12% in the middle risk group, and 36% in the highest risk group. The c-statistics for the point system were 0.76 and 0.74 in the development and validation cohorts, respectively.

CONCLUSIONS: This prognostic index, which relies solely on self-reported functional status, age, and gender, provides a simple and accurate method of stratifying community-dwelling elders into groups at varying risk of mortality.

KEY WORDS: activities of daily living; prognosis; survival; mortality.

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Prognosis, like diagnosis and treatment, is one of the major responsibilities and challenges of physicians.¹ Prognosis can inform treatment decisions, identify high-risk patients for intervention, and provide a foundation for discussions of goals of care with patients. It also is the basis for risk adjustment, which is essential for evaluating medical effectiveness and quality of care and for informing health policy decisions.² Assessment of prognosis is particularly important to individualizing care in the elderly population, which has a great diversity of chronic conditions, functional limitations, and social challenges that impact health, quality of life, and the benefits and risks of medical interventions.³

Despite the importance of prognosis, very few mortality prediction indices exist for community-dwelling elders. Most existing indices that have been developed for use in older persons are intended for use in hospitalized elders,⁴⁻⁶ and all of them rely heavily on specific diagnoses and physiologic measures, such as laboratory studies.⁴⁻⁷ In addition, while there are a number of prognostic indices that include functional status among their risk factors, there are, to our knowledge, no predictive indices for community-dwelling elders based primarily on functional status.

Using functional status as the basis for a prognostic index in older persons has great appeal for a number of reasons. First, functional status is a key quality of life indicator. Second, worse functional status is associated with a number of negative health outcomes, including hospital readmission, higher health care costs, nursing home admission, and death.⁸⁻¹⁰ Third, instead of considering specific diseases and physiologic parameters, functional status provides a measure of the end-effect of an illness or group of illnesses on a given patient. Fourth, information about functional status can be obtained directly from the patient, without need of a medical chart, laboratory data, or other special testing. Finally, several studies looking at multiple domains of risk, including other prognostic indices, have found functional impairment to be strongly predictive of death.^{4,5,7}

The goal of this study was to develop and validate a prognostic index for 2-year mortality for community-dwelling elders based solely on self-reported functional status, age, and gender. In an effort to create a tool that is easy to use, we chose measures that could be obtained by patient interview alone. We hypothesized that such an index would be able to discriminate effectively between older people at varying risks of death.

Received from the Division of Geriatrics (ECC, LCW, KL, KEC), University of California San Francisco; and San Francisco VA Medical Center (LCW, KEC), San Francisco, Calif.

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Address correspondence and requests for reprints to Dr. Carey: Division of Geriatrics, VA Medical Center (181G), 4150 Clement Street, San Francisco, CA 94121 (e-mail: ecarson@medicine.ucsf.edu).

METHODS

Participants

We studied 7,447 patients interviewed in 1993 as part of the Asset and Health Dynamics Among the Oldest Old (AHEAD) study. The AHEAD study is a national prospective study that sampled community-dwelling U.S. elders age 70 and older.¹¹ A full description of the sampling and weighting procedures has been described elsewhere.¹² Data were collected through interviews with the participant or his/her proxy at baseline and 2-year follow-up. Proxy respondents were used when, in the interviewer's judgment, the subject was too ill or cognitively impaired to be interviewed or when the subject refused direct interview but agreed to a proxy interview. Most respondents age 70 to 79 were interviewed by telephone, while most respondents age 80 and over were interviewed in person. The overall survey response rate was 80%. There was no significant difference in the response rate of those interviewed by phone as compared to those interviewed in person.¹³

We developed our predictive index in subjects from the eastern, western, and central regions of the country ($N = 4,546$), and we validated it in subjects from the southern region of the country ($N = 2,901$). We excluded 54 subjects (0.7%) who were missing major predictive variables, including 30 (0.7%) from the development cohort and 24 (0.8%) from the validation cohort. This left a final analytic cohort of 7,393:4,516 for the development cohort and 2,877 for the validation cohort. Proxy respondents were used at similar rates in both cohorts (10% and 11% of interviews in the development and validation cohorts, respectively).

Measures

Predictors of Mortality. The potential predictors of mortality included age, gender, and functional status measures assessed in the baseline interview. Age was coded into 5-year intervals up to age 85. The functional status measures included 6 activities of daily living (ADL), 5 instrumental activities of daily living (IADL), and 5 additional measures of physical function.

The 6 ADLs assessed included eating, toileting, bathing, dressing, transferring, and walking across a room. For each ADL, subjects were asked whether they needed the help of another person to complete the task. Subjects reporting they needed help were classified as dependent, while subjects not needing help were classified as independent.

The 5 IADLs assessed included grocery shopping, preparing meals, using the telephone, managing medications, and managing finances. Dependence was defined as requiring the assistance of another person in order to complete the task, and participants were categorized as either independent or dependent. In the case of IADLs, it is often the case that a given task is done by one family member and not another, due to convenience and habit but unrelated to impairment. To accommodate this, participants

were given the option to answer that they did not perform the task. If participants said that they did not perform the task due to health reasons, they were classified as dependent. If the reason for not doing a task was unrelated to their health, they were classified as independent.

We considered 5 additional measures of physical function for our index. These included walking several blocks, climbing one flight of stairs without resting, pushing or pulling a heavy object (like a living room chair), lifting or carrying objects weighing 10 or more pounds, and picking up a dime from a table. For each of these activities, participants were categorized as having difficulty or not.

Definition of Outcome. The outcome of interest was death within 2 years of the initial interview date. We assessed mortality using AHEAD survey follow-up procedures¹⁴ and the U.S. National Death Index.¹⁵

Statistical Analyses: Development and Validation of the Model

We looked at mortality as both a dichotomous and a continuous outcome. For the dichotomous outcome, subjects were categorized depending on whether or not they survived 2 years from their initial interview date. For the continuous outcome, survival time was defined as the number of months between the baseline interview and the date of death. All surviving participants were censored at the 25th month or on December 31, 1995, whichever was earlier.

In developing the index, we first measured the bivariable relationship between each risk factor and 2-year mortality in the development cohort, using logistic regression models containing only the risk factor of interest. We then performed multivariable analyses, including as candidate variables all the risk factors associated with 2-year mortality ($P < .05$). The multivariable modeling was done in several stages. First, we divided all the functional status variables into 3 separate groups: ADLs, IADLs, and additional measures of physical function. Within each group, the variables were then entered into a stepwise multivariable logistic regression model ($P < .05$ to enter, $P < .05$ to stay) in which the outcome was 2-year mortality. The variables from each of the 3 initial models that remained significant after stepwise elimination were then placed into a final stepwise multivariable model along with age and gender. The remaining variables were then used to create our prognostic index. At all stages, forward stepwise elimination, backward stepwise elimination, and backward elimination yielded the same results. Cox regression models, in which the outcome was time to death, also resulted in the same selection of variables.

After developing the final model, we constructed a point scoring system, in which we assigned points to each risk factor by using the β -coefficients from the logistic regression model. We divided the β -coefficient for each risk factor by the lowest β -coefficient (bathing) and rounded to

the nearest integer.^{4,16} We assigned a risk score to each participant by adding the points for each risk factor present. We created risk groups based on the distribution of risk scores within the development cohort, and subjects were divided into risk groups based on their risk score.

To validate the index, we applied the point scoring system created in the development cohort to the validation cohort, thereby determining risk scores for each participant in the validation cohort. We determined the calibration of the index by comparing the predicted mortality from the development cohort to the observed mortality in the validation cohort. We evaluated the discrimination of the index by calculating the c-statistic for the final model in both the development and validation cohorts. We chose to validate our predictive index in a different region of the country from where it was developed in order to test geographic transportability as well as diagnostic accuracy.¹⁷

To assess the contributions of the different components of our final model to the model's overall discrimination, we calculated separate c-statistics in the development cohort for age and gender combined and for the functional measures. In addition, to assess the extent to which adding the comorbidities to the model would have added to the discrimination of the index, we calculated two additional c-statistics in the development cohort. We first calculated a c-statistic for the comorbidities listed in Table 1 alone, and then we calculated a c-statistic for the final functional morbidity index with the comorbidities added.

The Human Subjects Committee of the University of California, San Francisco and the San Francisco Veterans Affairs Research and Development committee approved this study. All statistics were performed using Intercooled Stata software (version 8.0; Stata Corporation, College Station, Tex).

RESULTS

Characteristics of Participants

The mean (standard deviation [SD]) age of participants in the development cohort was 78 (6) years. Sixty-one percent were women, and 84% were white. Thirteen percent were dependent in 1 or more ADL, 27% were dependent in 1 or more IADL, and 58% had difficulty with 1 or more additional measure of physical function (Table 1). The overall 2-year mortality in the development cohort was 10%.

The mean (SD) age of participants in the validation cohort was 78 (6) years. Sixty-one percent were women, and 73% were white. Seventeen percent were dependent in 1 or more ADL, 31% were dependent in 1 or more IADL, and 64% had difficulty with 1 or more additional measure of physical function (Table 1). The overall 2-year mortality in the validation cohort was 12%.

Risk Factors

Risk factors associated with 2-year mortality in bivariable analyses ($P < .05$) included male gender; age over

Table 1. Characteristics of Patients in the Development and Validation Cohorts

Characteristic	Development (N = 4,516)	Validation (N = 2,877)
Demographics		
Age, y (%)		
≤75	2,034 (45)	1,230 (43)
76–80	1,187 (26)	760 (26)
81–85	809 (18)	545 (19)
>85	486 (11)	342 (12)
Female (%)	2,734 (61)	1,754 (61)
Ethnicity (%)		
White	3,777 (84)	2,090 (73)
Hispanic	165 (4)	251 (9)
Black	509 (11)	504 (18)
Other	65 (1)	32 (1)
Education (%)		
Less than high school	1,815 (40)	1,524 (53)
High school graduate	1,482 (33)	664 (23)
Postsecondary education	1,219 (27)	689 (24)
Net worth, \$ (%)		
≤50,000	1,539 (34)	1,281 (45)
50,001–162,000	1,498 (33)	893 (31)
>162,000	1,479 (33)	703 (24)
Comorbidities (%)		
Hypertension	2,259 (50)	1,436 (50)
Diabetes	582 (13)	409 (14)
Cancer	644 (14)	371 (13)
Chronic lung disease	513 (11)	329 (11)
Heart disease	1,412 (31)	922 (32)
Stroke/TIA	465 (10)	323 (11)
Functional measures		
Activities of daily living:		
dependence (%)		
Eating	190 (4)	158 (5)
Toileting	96 (2)	99 (3)
Bathing	371 (8)	310 (11)
Dressing	330 (7)	286 (10)
Transferring	137 (3)	143 (5)
Walking	253 (6)	231 (8)
Instrumental activities of daily living: dependence (%)		
Shopping	795 (18)	596 (21)
Preparing meals	388 (9)	348 (12)
Using the telephone	204 (5)	214 (7)
Managing medications	210 (5)	176 (6)
Managing finances	785 (17)	578 (20)
Other measures of physical functioning: difficulty		
Walking several blocks	1,770 (39)	1,277 (44)
Climbing stairs	1,268 (28)	1,174 (41)
Pushing/pulling heavy objects	1,708 (38)	1,241 (43)
Lifting 10 lbs	1,587 (35)	1,100 (38)
Picking up a dime	386 (9)	284 (10)

TIA, transient ischemic attack.

75; dependency in eating, toileting, bathing, dressing, transferring, and walking across a room; dependency in grocery shopping, preparing meals, telephoning, managing medications, and managing finances; and difficulty with walking several blocks, climbing stairs, pushing/pulling a heavy object, lifting a 10-pound object, and picking up a dime (Table 2).

Table 2. Bivariable Associations of Risk Factors and 2-Year Mortality in the Development Cohort

Risk Factor	% Mortality	Odds Ratio (95% CI)
Gender		
Female	8	1.0
Male	13	1.7 (1.4 to 2.1)
Age, y		
<75	6	1.0
76–80	10	1.9 (1.5 to 2.5)
81–85	15	2.8 (2.1 to 3.6)
>85	21	4.4 (3.3 to 5.9)
Activities of daily living		
Eating		
Independent	9	1.0
Dependent	34	5.1 (3.7 to 7.0)
Toileting		
Independent	10	1.0
Dependent	35	5.1 (3.3 to 7.8)
Bathing		
Independent	8	1.0
Dependent	31	4.8 (3.8 to 6.2)
Dressing		
Independent	9	1.0
Dependent	29	4.3 (3.3 to 5.5)
Transferring		
Independent	10	1.0
Dependent	35	5.1 (3.6 to 7.4)
Walking		
Independent	9	1.0
Dependent	31	4.6 (3.4 to 6.1)
Instrumental activities of daily living		
Shopping		
Independent	7	1.0
Dependent	25	4.4 (3.6 to 5.3)
Preparing meals		
Independent	8	1.0
Dependent	30	4.6 (3.6 to 5.8)
Using the telephone		
Independent	10	1.0
Dependent	25	3.2 (2.3 to 4.5)
Managing medications		
Independent	9	1.0
Dependent	28	3.8 (2.7 to 5.2)
Managing finances		
Independent	8	1.0
Dependent	20	2.8 (2.2 to 3.4)
Other measures of physical functioning		
Walking several blocks		
No difficulty	5	1.0
Difficulty	18	4.2 (3.4 to 5.2)
Climbing stairs		
No difficulty	7	1.0
Difficulty	19	3.2 (2.6 to 3.9)
Push/pull heavy object		
No difficulty	6	1.0
Difficulty	17	3.1 (2.5 to 3.8)
Lifting 10-lb object		
No difficulty	7	1.0
Difficulty	17	2.7 (2.2 to 3.2)
Picking up a dime		
No difficulty	10	1.0
Difficulty	17	1.9 (1.4 to 2.5)

CI, confidence interval.

Table 3. Risk Factors Associated with 2-Year Mortality in the Development Cohort in Multivariable Analyses

Risk Factor	Adjusted OR (95% CI)	Points
Male gender	2.8 (2.3 to 3.5)	2
Age, y		
76–80	1.7 (1.3 to 2.2)	1
81–85	2.1 (1.5 to 2.7)	2
>85	2.5 (1.8 to 3.4)	2
Dependence in bathing	1.6 (1.1 to 2.1)	1
Dependence in shopping	1.9 (1.5 to 2.5)	2
Difficulty walking several blocks	2.3 (1.7 to 3.0)	2
Difficulty pulling/pushing heavy objects	1.7 (1.3 to 2.2)	1

CI, confidence interval.

Six of these 18 risk factors were independently associated with 2-year mortality after multivariable analyses, including male gender, age over 75, dependence in bathing, dependence in shopping for groceries, difficulty walking several blocks, and difficulty pushing or pulling a heavy object (Table 3).

Point Scoring System

The points assigned to each of the final 6 risk factors are listed in Table 3. A risk score was assigned to each participant by adding the points for each risk factor present (see Appendix online at www.jgim.com). For example, an 80-year-old (1 point) woman (0 points) who has difficulty pushing or pulling her living room chair (1 point), but who is able to walk several blocks without difficulty (0 points) and who has no ADL or IADL dependencies (0 points), has a risk score on our index of 2 points, which puts her in the lowest risk group. Risk scores in the development cohort ranged from 0 to 10 points (mean [SD], 3 [2]).

Patients were divided into 3 risk groups by point score. In the development cohort, mortality ranged from 3% in the lowest risk group (0 to 2 points) to 34% in the highest risk group (7 to 10 points). Within those groups, participants with 0 points had a 3% mortality (15/595) and those with >9 points had a 54% mortality (45/83). The results were similar in the validation cohort: the lowest risk group (0 to 2 points) had 5% mortality and the highest risk group (7 to 10 points) had 36% mortality (Table 4). The point scoring system had a slightly better discrimination in the development cohort than the validation cohort, with c-statistics of 0.76 and 0.74, respectively. Kaplan-Meier survival curves of the 3 risk groups demonstrate that the 3 groups have distinct survival trajectories and that survival differences persist over the 2 years of follow-up (Fig. 1).

To address the extent to which functional measures added to the discrimination of the index, over and above what was gained from age and gender alone, we calculated additional c-statistics looking at these groups of variables separately. In the development cohort, using age and gender alone as predictors of death resulted in a c-statistic of

Table 4. Two-Year Mortality Rates by Risk Score

Risk Score	Development Cohort	Validation Cohort
0 to 2 points (%)	72/2,080 (3)	60/1,183 (5)
3 to 6 points (%)	215/1,909 (11)	159/1,303 (12)
7 to 10 points (%)	177/527 (34)	139/391 (36)
C-statistic (ROC curve area)	0.76	0.74

ROC, receiver operating characteristic.

0.67, whereas using only the functional measures from the final index to predict death resulted in a c-statistic of 0.72. In addition, using the comorbidities from Table 1 alone as predictors of death resulted in a c-statistic of 0.64. All of these c-statistics are lower than the 0.76 value of the entire model. Adding the comorbidities from Table 1 to the final model only marginally increased the overall c-statistic to 0.77.

DISCUSSION

We developed and validated a prognostic index using age, gender, and self-reported functional status that effectively stratifies community-dwelling elders into groups at varying risk of 2-year mortality. Our index includes risk factors from each of the 3 groups of functional variables evaluated: dependence in ADL (bathing), dependence in IADL (shopping for groceries), and difficulty with additional measures of physical function (walking several blocks and pushing/pulling heavy objects). Our index was well calibrated, based on the similarity between mortality rates in the development and validation cohorts. Our index also showed good discrimination, with a c-statistic of 0.76 in the development cohort and 0.74 in the validation cohort. The discrimination of our index was comparable to prognostic indices that consider multiple domains of risk, including medical diagnoses and biochemical markers of disease.^{4,6,10}

In the bivariable analyses, every functional variable we measured was associated with a 2-fold or greater increase in mortality. The functional variables that remained independently predictive of mortality in the final multivariable model were those that evaluated multiple areas of function simultaneously. Grocery shopping, for example, requires intact cognitive function to identify a need, get to the store, and manage money for payment, as well as intact physical functioning to ambulate, push a cart, reach for items, lift, and carry. Bathing is a similarly complex task; it requires upper and lower extremity dexterity, the ability to transfer safely, and the ability to dress and undress oneself. Bathing is typically the ADL with the highest prevalence of disability, and it is commonly the first ADL in which independence is lost.^{18,19}

Previous studies have demonstrated the prognostic value of functional status by showing that functional

impairment was independently predictive of mortality when used alongside other, more conventional predictors such as disease status.^{4,7} Inouye et al. developed a 3-item functional index that, when added to commonly used burden of illness scores, such as the Charlson index, substantially improved their ability to predict 90-day and 2-year mortality in hospitalized patients.⁵ However, our study is the first to demonstrate that simple self-reported measures of function, along with age and gender, can be used together to stratify community-dwelling elders into groups at variable risk for mortality. In particular, we identified groups at low (5%) and high (36%) risk of mortality in 2 years. According to the U.S. life tables for the year 2000, an 80-year-old has a 2-year mortality of 12%,²⁰ which was the average mortality of our entire cohort and the mortality of our middle-risk group. According to our index, however, a fully functional 80-year-old woman has a mortality of less than half that, whereas an 80-year-old woman who is dependent in all of the functional measures of our index has a mortality that is 3 times higher than that.

We used a population-based cohort representative of community-dwelling elders in the United States. Although 95% of elders live in the community and are outpatients,¹⁹ most prognostic indices have been developed for use in hospitalized elders, who are sicker and have higher mortality rates. Many of these indices specifically attempt to identify patients at high risk of immediate death, with the goal of identifying patients in whom transition to palliative care is appropriate. In community-dwelling elders, however, short-term mortality is much lower, such that the expected mortality rate for an 80-year-old over 2 years is only 12%.²⁰ In our study, we were able to identify a large group of extremely well elders, whose mortality rate was less than half that (5%), and a smaller group of sick elders with a mortality rate 3 times as high (36%), such that there was a 7-fold difference in mortality rates among these elders overall. There is tremendous value in identifying elders at either extreme. In our study, we identified a large group of extremely well elders, with much longer than average life

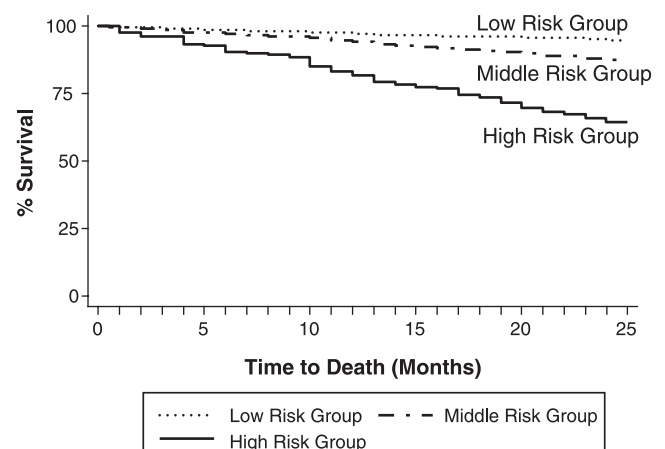


FIGURE 1. Two-year survival by risk group in the validation cohort.

expectancies. Indeed, our lowest risk group was the largest group we identified, including 46% of the development cohort and 41% of the validation cohort. Identifying elders at significantly lower risk of death than average can help health care providers appropriately target interventions, such as cancer screening tests, many of which have a lag time to benefit of 5 to 10 years.²¹ These extremely well elders, with greater than average life expectancies, are in the best position to benefit from preventive interventions and health care maintenance efforts, with the goals of maintaining and even improving their health. There is also, however, a great need to identify those elders who are approaching the end of their lives but not imminently at risk of death. In our study, our highest risk group, which accounted for approximately 12% of the development cohort and 14% of the validation cohort, had a mortality rate of 36%, which is lower than is seen in mortality indices developed in sicker patients. However, we sampled well, community-dwelling elders for whom a 36% mortality rate over 2 years represents a 3-fold increase over expected mortality. Identifying elders at considerably higher risk for death than average can help identify patients in whom discussions about goals of care, treatment preferences, and advance directives may be particularly appropriate. Such discussions are best held with patients long before the time of death, while patients are still competent to state their own preferences. The tremendous heterogeneity of the growing elderly population demands that we improve our ability to prognosticate so that we can provide each person with the best individualized care. Without improving prognostication strategies for elders, we will continue to make important errors of undertreatment and overtreatment.

Our study, in highlighting the prognostic impact of functional status, provides further evidence for the importance of assessing functional status. Functional status reflects the end-impact of illnesses and psychosocial factors on a given patient, and it is likely that this explains its prognostic value. The value of functional status, however, extends far beyond prognosis. Knowing a patient's function helps to provide high-quality care: functional status assessment is vital to determining a patient's long-term care needs, to providing patients with appropriate therapies, and to assessing a caregiver's needs. Functional dependency is a risk factor not only for mortality, but also for nursing home placement and elder mistreatment.^{10,19,22} With the investment of just a few minutes of time, one can gain rich clinical and prognostic information about a patient through assessing functional status. Yet, despite its importance and the ease of obtaining this information, physicians often fail to recognize functional disability in their patients.²³

Our prognostic index provides a simple and effective means of estimating mortality that can be used in a variety of settings. It applies an easy-to-use point scoring system, and all the necessary variables can be obtained through patient interview alone. In addition to clinical uses, our

index also may have important research and health policy uses, in that it could provide a simple means of risk stratifying patients to account for unmeasured differences in illness severity. For example, using our index to risk adjust for mortality in different settings may facilitate quality of care comparisons and evaluations of medical effectiveness. Our index could also be helpful in observational studies, in which subtle baseline differences in functional status are important aspects of health outcomes. In addition, using our index as a tool to account for baseline illness severity in different settings, such as Medicare HMOs, may be beneficial in setting reimbursement rates that more accurately reflect the illness severity of the population.

While a strength of our study was our use of a large sample of community-dwelling elders that is representative of the U.S. population, there are several methodological considerations that should be taken into account in evaluating the generalizability of our results. First, our sample was generally healthy, with only 13% of the development cohort being dependent in 1 or more ADL. However, approximately 60% of each cohort had difficulty with 1 or more of the additional measures of physical function, such as walking several blocks. As a result, the additional measures of physical function better differentiated outcomes than ADL dependence. In a more severely ill population, it is likely that ADL impairment would have better distinguished between patients at variable risk for death. Second, we only considered 2-year mortality for our index. It is likely that we may have found different predictors of mortality had we used a different time frame as our endpoint. Third, there are many methods of asking about functional status, and the prognostic value of functional measures may differ depending on how the measure is assessed. For example, asking about ADL and IADL difficulty instead of dependence would likely have resulted in greater levels of impairment but perhaps a smaller association with mortality. In addition, while we assessed dependence for ADLs and IADLs, we only asked about difficulty for the additional measures of physical function because walking several blocks and pushing furniture are not tasks essential for daily functioning and independent living. Finally, all of our functional data relied on patient or proxy report. While it may be the case that clinical evaluation and observation provide a more reliable measure of function, this is often less practical. A patient's gait can be tested in the office hallway, but it is not so simple to test a patient's ability to grocery shop or bathe. In addition, there is evidence that patient and proxy reports provide valid measures of function.²⁴ Future research should assess whether performance-based or patient-reported functional measures have a better prognostic performance.

In summary, we developed and validated a prognostic index using a few simple measures of functional status, along with age and gender. Our index employs a simple point-scoring system, using measures that can be obtained by patient interview alone, without need for a medical chart

or laboratory data. It effectively stratifies elders into groups at varying risks of death, and it can be used in a variety of different settings. Our findings provide further evidence of the prognostic importance of functional status, demonstrating that evaluating function has important clinical, policy, and research uses.

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APPENDIX

Appendix: Disability Questions for Use With Index

Does anyone ever help you bathe or shower? Yes = Dependent
No = Independent

Are you able to shop for groceries without help?[†] Yes = Independent
No = Dependent

Do you have difficulty walking several blocks?[†] Yes = Difficulty
Do you have difficulty pulling or pushing large objects No = Independent
like a living room chair?[†]

[†]If the patient does not perform these tasks, assess whether or not failure to perform them is due to a health reason. If it is not due to a health reason, but instead is due to personal preference or convenience, then consider them independent.