



JENNIE CHIN HANSEN
Chief Executive Officer

Comments Submitted Electronically to OPH@cdc.gov

January 3, 2011

Office of Prevention Through Healthcare
Office of the Associate Director for Policy
Centers for Disease Control and Prevention
1600 Clifton Road, NE
Mailstop D-28
Atlanta, GA 30333

Attn: Health Risk Assessment Guidance

Dear Sir or Madam:

The American Geriatrics Society (AGS) greatly appreciates the opportunity to provide the following comments to assist in the development of guidance concerning Health Risk Assessments (HRAs) pursuant to Section 4103 of the Affordable Care Act (ACA), which requires the inclusion of an HRA in the new Medicare annual wellness visit benefit that was authorized by the ACA.

The AGS is a not-for-profit organization comprised of more than 6,000 health professionals who are devoted to improving the health, independence and quality of life of all older people. The Society provides leadership to healthcare professionals, policy makers and the public by implementing and advocating for programs in patient care, research, professional and public education and public policy. As a specialty society, our mission is to promote high quality of care and quality improvement.

Our comments are divided into two parts. First, we provide overall comments and pose several questions regarding the intent of an HRA as envisioned by the Centers for Disease Control and Prevention (CDC) and the Centers for Medicare & Medicaid Services (CMS). Second, we respond to a number of the specific areas of emphasis outlined by the CDC in its Request for Information.

I. Overall Comments

The AGS believes that it is first necessary to define the purpose of the HRA. For example, would an HRA be used as a predictive tool to identify patients who are at high risk of developing specific diseases or conditions, or of being subject to undesirable outcomes, such as hospitalization or nursing home admission? Or would the HRA be viewed as the basis for a plan of care?

An assessment of health risk should facilitate data gathering that enables physicians and other practitioners to provide the best possible care, but should not add a layer of work that could be viewed by clinicians as burdensome because it does not facilitate or promote better care.

The statute requires the new Medicare Annual Wellness Visit to include a health risk assessment. The Annual Wellness Visit contains the following elements:

- Establishment of a beneficiary's medical/family history.
- Establishment of a list of current providers and suppliers that are regularly involved in providing medical care to the beneficiary.
- Measurement of an individual's height, weight, BMI (or waist circumference, if appropriate), blood pressure, and other routine measurements as appropriate, based on the beneficiary's medical/family history.
- Detection of any cognitive impairment that the individual may have as defined in this section.
- Review of the individual's potential (risk factors) for depression, including current or past experiences with depression or other mood disorders, based on the use of an appropriate screening instrument for persons without a current diagnosis of depression, which the health professional may select from various available standardized screening tests designed for this purpose and recognized by national medical professional organizations.
- Review of the individual's functional ability and level of safety based on direct observation, or the use of appropriate screening questions or a screening questionnaire, which the health professional may select from various available screening questions or standardized questionnaires designed for this purpose and recognized by national professional medical organizations.
- Establishment of a written screening schedule for the individual, such as a checklist for the next 5 to 10 years, as appropriate, based on recommendations of the United States Preventive Services Task Force (USPSTF) and the Advisory Committee on Immunization Practices (ACIP), as well as the individual's health status, screening history, and age-appropriate preventive services covered by Medicare.
- Establishment of a list of risk factors and conditions for which primary, secondary, or tertiary interventions are recommended or are underway for the individual, including any mental health conditions or any such risk factors or conditions that have been identified through an IPPE, and a list of treatment options and their associated risks and benefits.
- Furnishing of personalized health advice to the individual and a referral, as appropriate, to health education or preventive counseling services or programs aimed at reducing identified risk factors and improving self-management, or community-based lifestyle interventions to reduce health risks and promote self-management and wellness, including weight loss, physical activity, smoking cessation, fall prevention, and nutrition.
- Voluntary advance care planning (as defined in this section) upon agreement with the individual.

We point out that some of these elements, which are required by statute, are clearly exam items. But many could potentially be assisted by an HRA that the patient and physician/clinician could discuss, in order to determine health risk and to help clinicians and patients work together and to contribute to shared decision-making.

The HRA would also help to identify those patients who are in need of relatively intensive interventions immediately. For geriatric patients, an HRA could help to identify individuals who need care coordination for multiple chronic conditions.

II. Comments on Specific Areas of Emphasis

A. Content and Design

- Risk assessment domains—what are generic elements of any HRA and what elements must be tailored to specific populations, particularly those stratified by age?
- How should literacy and other cultural appropriateness factors be factored into the design?
- How should the HRA instrument support shared decision-making by provider and patient?

Response:

A health risk assessment tool should be relatively simple and easy to administer in the physician's office. The tool should not be complex or time-consuming, but should contribute to the practical care of the primary care patient (see Section C below for a brief discussion of an HRA of which we are aware -- the VES-13 -- to assess health risk and functional capacity in the vulnerable elderly).

As discussed above, the health risk assessment should at least conform to the required elements of the Annual Wellness Visit. Certain elements of the HRA should be tailored, for example, for the older Medicare population, who are often more frail and suffer from multiple chronic conditions requiring greater coordination amongst a team of providers. In older adults, sensory alterations are often overlooked or ignored, yet such alterations can significantly influence multiple domains of function. Questions regarding sensory function should be considered for inclusion in a HRA.

Ideally, a health risk assessment should support shared decision-making by the health care provider and the patient by first helping the provider to gather important information about the patient, and then facilitating communication between the provider and the patient as to the best approach to the patient's care, in terms of both short term needs and in planning for the future.

B. Mode of Administration

- How will individuals access the HRA (*e.g.*, via kiosk or some other means in the physician's office, Internet, mail-in paper form, other nontraditional healthcare locations, such as, kiosk in a pharmacy)?
- What are the cultural appropriateness factors in patient HRA access?

Response:

At least initially, we would not envision the use of kiosks, or similar self-administered technology in physicians' offices. Such technology would be expensive and impractical for use by most small primary care practices, particularly with geriatric patients, who are often very sick, frail and may suffer from multiple illness or conditions, including dementia. We would envision the use of a paper format that is not overly complex, that a patient could complete in the physician's office. The form could potentially be made available online, so that the patient or the patient's family member or caregiver could access it and complete it prior to coming in to the office.

With respect to cultural sensitivity, the assessment tool should be easily translatable into Spanish and/or other languages that are common in different parts of the country. The Department of Health and Human Services has experience with rules that promote cultural sensitivity, particularly where individuals may have limited proficiency with English, or come from diverse cultural and ethnic backgrounds.

C. Primary Care Office Capacity

- What primary care office capacity (personnel, Information Technology (IT), etc.) is required to utilize HRA data effectively in support of personalized prevention planning?
- Are training and technical assistance necessary for effective practice utilization of an HRA? What entity should provide this technical assistance?
- What are potential or demonstrated community care transition linkages— follow-up outside the office by other providers—that help patients and providers manage priority risks identified by the HRA?
- What is the current practice of HRA in medical practices of various sizes, particularly those with five or fewer physicians?

Response:

Utilization of a HRA in the primary care office setting in support of personalized prevention planning will involve time and training in order to effectively integrate its use into the work flow of the practice. The type of training or technical assistance may depend upon the length, content and format of the tool. Certainly the adoption of an electronic tool may require additional technical assistance. Some practices are moving ahead with the adoption of sophisticated health information technology systems and electronic medical records, which may have the capacity to include an HRA, however time and resources will still be required to administer the instrument, and to either enter or summarize the information provided by the patient, and to then review the information with the patient.

Many primary care practices do not tend to utilize an HRA at this time. Currently providers do not have great incentive to utilize an HRA, particularly in small or solo physician practices which constitute the bulk of physician practices today. Reimbursement for the initial and subsequent annual wellness visits under Medicare begins in 2011, and these visits have been valued at the same rate as an office visit, which does not currently include the additional work associated with the administration of an HRA.

We are aware of an HRA that has been validated in a number of clinical settings. The Vulnerable Elders Survey-13 (VES-13) is a self-administered survey that consists of one item for age and an additional 12 items that assess self-related health, functional capacity, and physical performance.¹ This survey identifies a population subset that is at high risk for functional decline and high medical cost. Additionally, the work of ACOVE (Assessing Care of the Vulnerable Elderly) is a widely recognized quality improvement initiative that starts with the use of this instrument. Care that is more consistent with ACOVE standards has been correlated with reduced mortality.² We note, however,

¹ Saliba D., Elliott M., Rubenstein LZ, et al. *The Vulnerable Elders Survey: a tool for identifying vulnerable older people in the community.* *J Am Geriatr Soc.* 2001; 49:1691-1699.

² Takahiro Higashi, MD, PhD; Paul G. Shekelle, MD, PhD; et al.; *Quality of Care is Associated with Survival in Vulnerable Older Patients,* *Ann Intern Med.* 2005; 143:274-281.

that any HRA is only as useful as it was intended to be. That is, if identification of being vulnerable is useful in a given practice's population, then the VES-13 is useful, but it may not be the appropriate tool for all practices or populations.

D. Consumer/Patient Perspective

- How could HRA data be shared with the patients for their feedback and follow up in the primary care practice?
- What role, if any, do incentives play in motivating patients to take the HRA and/or participate in follow-up interventions?

Response:

Initially, we view the HRA as a simple tool that patients could complete to provide information to their primary care practitioner either in the physician's office or prior to an office visit, in order to allow the physician/clinician to identify risks and health care needs, and to generate discussion with respect to a care plan. The HRA could provide the basis for future preventive care planning.

As discussed above, many physicians are not currently incentivized to utilize an HRA in their practice as a means of improving communication with their patients and with other providers. There may be concern that the time burden associated with the use of an HRA may only add a layer of administrative burden, without actually improving communication or outcomes. Many physicians would prefer to see improved reimbursement for the annual wellness visit that captures the work involved in administering an HRA, but more importantly, physicians and other clinicians want to ensure that the work involved will actually improve patient care, and not increase the time and administrative burden that already faces most primary care physicians.

It is unclear what type of beneficiary incentives would be either adequate or appropriate to encourage beneficiaries to complete an HRA or participate in follow-up care. If the purpose of the HRA is to encourage the sharing of information in order to identify health risks and to be able to develop a personalized plan for preventing future health issues, then improved quality of care and the potential for improved health outcomes may provide the added incentive for beneficiaries to complete a HRA.

E. Data

- With respect to Information Technology (IT), how could HRA data entered in any form populate electronic health records, and what special challenges and solutions occur if the data are entered in a non-electronic form?
- Are there standardized and certified tools available to support this data migration from multiple data entry sources?

Response:

We are not aware of standardized tools or certified tools available to support HRA data entered in a way to populate EMRs.

F. Certification

- What certification tools and processes should complement the HRA guidance and how should they be made available to support primary care office selection of an HRA instrument?

Response:

We view the HRA as a simple, paper tool, at least initially. We do not believe primary care practices should be required to select only certified HRAs. We do not support this added layer of oversight, for a tool that may or may not assist them in practice. We acknowledge that certification, if not a requirement, could guide clinicians to better HRA's. Certification could also assist CMS in evaluation of the utility of the HRA.

G. Evaluation and Quality Assurance

- How should the HRA guidance be evaluated and updated with respect to individual and population level (practice-based panel management) health outcomes?

Response:

While it is appropriate to evaluate the HRA utility and cost, it is difficult to suggest an evaluation method until such time as the goals of the HRA are better established. Whether or not the HRA helps achieve the intended goals would be the fundamental evaluation task. We would hope that evaluations and updates would be conducted in an open process with ample opportunity for comment.

The American Geriatrics Society greatly appreciates the opportunity to provide comments on the development of guidance regarding health risk assessments. We were supportive of the provision in the ACA establishing an annual wellness visit benefit for Medicare beneficiaries and we look forward to working with the CDC and with CMS as the provision is implemented in 2011, along with the appropriate and practical use of a health risk assessment.

Please feel free to contact Susie Sherman, Coordinator Public Affairs & Advocacy at 212-308-1414/sshorman@americangeriatrics.org if you have any questions or if you would like any additional information.

Sincerely,



Sharon A. Brangman, MD
President



Jennie Chin Hansen, RN, MS, FAAN
Chief Executive Officer

The Vulnerable Elders Survey: A Tool for Identifying Vulnerable Older People in the Community

Debra Saliba, MD,*[‡] Marc Elliott, PhD,* Laurence Z. Rubenstein, MD,*[‡]
David H. Solomon, MD,*[‡] Roy T. Young, MD,*[‡] Caren J. Kamberg, MSPH,*
Carol Roth RN, MPH,* Catherine H. MacLean, MD,*[‡] Paul G. Shekelle, MD,*[‡]
Elizabeth M. Sloss, PhD,* and Neil S. Wenger, MD*[‡]

OBJECTIVES: To develop a simple method for identifying community-dwelling vulnerable older people, defined as persons age 65 and older at increased risk of death or functional decline. To assess whether self-reported diagnoses and conditions add predictive ability to a function-based survey.

DESIGN: Analysis of longitudinal survey data.

SETTING: A nationally representative community-based survey.

PARTICIPANTS: Six thousand two hundred five Medicare beneficiaries age 65 and older.

MEASUREMENTS: Bivariate and multivariate analyses of the Medicare Current Beneficiary Survey; development and comparison of scoring systems that use age, function, and self-reported diagnoses to predict future death and functional decline.

RESULTS: A multivariate model using function, self-rated health, and age to predict death or functional decline was only slightly improved when self-reported diagnoses and conditions were included as predictors and was significantly better than a model using age plus self-reported diagnoses alone. These analyses provide the basis for a 13-item function-based scoring system that considers age, self-rated health, limitation in physical function, and functional disabilities. A score of ≥ 3 targeted 32% of this nationally representative sample as vulnerable. This targeted group had 4.2

times the risk of death or functional decline over a 2-year period compared with those with scores < 3 . The receiver operating characteristics curve had an area of .78. An alternative scoring system that included self-reported diagnoses did not substantially improve predictive ability when compared with a function-based scoring system.

CONCLUSIONS: A function-based targeting system effectively and efficiently identifies older people at risk of functional decline and death. Self-reported diagnoses and conditions, when added to the system, do not enhance predictive ability. The function-based targeting system relies on self-report and is easily transported across care settings. *J Am Geriatr Soc* 49:1691–1699, 2001.

Key words: function; mortality; frail; risk; survey

Older persons at increased risk of health deterioration are an important target for medical intervention.^{1,2} Accurately identifying this vulnerable group is a critical step in focusing interventions^{3,4} and implementing quality improvement efforts. If the method of identification can be applied across systems of care, healthcare providers and policy makers can compare and monitor plan enrollment and performance more effectively.^{5,6} The goal of our study was to develop a simple tool for screening community-dwelling populations to identify older persons at risk for health deterioration.

We define vulnerable older people as persons age 65 and older who are at increased risk of functional decline or death over 2 years. This definition anchors vulnerability to two health outcomes (death or functional decline), rather than to disease or future resource use (e.g., future hospitalization or medical expenditures). The definition captures persons typically labeled “frail” (older people at highest risk of decline or death) and older people at moderately high risk.

Providers and policy makers do not have a straightforward tool that can be used to identify this important group. Although many risk factors for decline and death

From the *RAND, Santa Monica, California; †the Greater Los Angeles System Veterans Administration Medical Center, Sepulveda Geriatric Research Education and Clinical Center, Los Angeles, California; and ‡the UCLA School of Medicine, Department of Medicine, Los Angeles, California.

Supported by a contract from Pfizer Pharmaceuticals, Inc. Global Outcomes Research.

Dr. Saliba is a Pfizer/FHA postdoctoral fellow and recipient of a Claude Pepper OAIC Award AG10415.

This study was presented at the American Geriatrics Society Annual Meeting, Nashville, TN, May 2000, and received the American Geriatrics Society 2000 Presidential Poster Award for Health Services Research.

Address correspondence to Debra Saliba, MD, MPH, RAND, 1700 Main Street, Santa Monica, CA 90401.

have been identified, the complex interaction of aging, decreased functional reserve, and ongoing pathology poses a unique challenge in selecting a subset of these risk factors to include in a simple identification system. In various analyses, age,⁷⁻¹⁵ function,^{9-12,16} health behaviors,^{9,12,17} income,^{9,13,14} and/or diseases and conditions^{9-15,17-19} have all emerged as predictors of decline and death.

As part of the Assessing Care of Vulnerable Elders project—an initiative to develop tools for measuring quality of care for older people at increased risk of health decline²⁰—an expert clinical panel considered alternative approaches to identifying vulnerable older people and reviewed candidate predictors to be included. The panel recommended that (1) a survey be developed to make the identification scheme easily transportable across organizations; (2) the survey not be dependent on prior utilization as a predictor; (3) the ability to perform instrumental activities of daily living (IADLs) be considered as a predictor; and (4) the survey use an abbreviated list of items with simple scoring rules to minimize respondent burden and enhance provider willingness to adopt the identification strategy. We followed the panel's recommendations.

In developing a survey system, we focused on the 20% to 40% of community-dwelling older people who are most at risk of death or decline in IADLs or activities of daily living (ADLs) over 2 years. Based on our literature review, we hypothesized that a survey system that relied on baseline function and age could identify these vulnerable older people as effectively as could a system that relied on conditions and medical diagnosis. To test this hypothesis and to develop a survey tool, we analyzed information from a large national probability interview, focusing on risk factors that could be elicited through a brief survey and translated into a simple score for identifying vulnerable older people.

METHODS

We translated our definition of vulnerable older people into specific candidate predictors and outcomes; developed and tested prediction models for functional decline, death, and functional decline or death; identified concise models that maximized prediction strength; translated selected prediction models into scoring systems; and measured and compared the predictive ability of the scoring systems.

Study Sample

We used the 1993 and 1995 Medicare Current Beneficiary Survey (MCBS) public-use files for analyses. The MCBS annually surveys a representative sample of Medicare enrollees; a random sample of respondents is selected for follow-up in a longitudinal component. We restricted our analysis to the community-dwelling respondents who were age 65 or older in 1993 and who were surveyed in the 1995 follow-up survey or had died. Because we wanted to identify all at-risk community-dwelling older people, we included the 10% of the 1993 respondents who were proxy respondents. To include mortality as an outcome, we obtained a separate list of all 1993 respondents who had died by the end of 1995.

Outcomes

We examined IADL²¹/ADL²² decline and death as the outcomes of interest. We focused on the following IADL and

ADL items in the MCBS: shopping, performing light housework, managing finances, preparing meals, using the telephone, bathing, dressing, transferring, toileting, walking across the room, and eating. We defined IADL/ADL disability as self-reported receipt of human assistance or non-performance for a health-related reason. We defined functional decline as a change from no IADL or ADL disability to any IADL or ADL disability, an increase of two or more in the total count of IADL or ADL disabilities, or new admission to a nursing home.

Because the available MCBS longitudinal weights did not account for the possibility of death, we developed weights that allow consideration of death or functional decline as an outcome. Specifically, the MCBS longitudinal weights were designed to reproduce the 1993 population from 1995 respondents. They were not appropriate for joint consideration of death and decline outcomes. For our purpose, it was necessary to develop new longitudinal weights. The probability of inclusion in the 1995 sample for those who died was assumed to be 1, because information about death was available for all members of the 1993 sample. The non-random loss to follow-up of surviving members of the 1993 sample was modeled in a multiple logistic regression with variables in the 1993 MCBS file used as predictors. (By design, the 1995 MCBS identified a random set of 1993 respondents who would not be included in follow-up.) After accounting for the 30% random retirement of these non-lost survivors, we computed longitudinal weights as the inverse of the estimated probabilities of inclusion in the 1995 sample for all 1995 respondents and 1993–1995 deaths.

Predictors

We identified predictor variables in the 1993 MCBS data set. We examined two types of functional status items: limitations in physical function (self/proxy-reported difficulty with stooping/bending, lifting 10 pounds, reaching, writing, walking, heavy housework)^{8,12,23-25} and IADL/ADL disability.^{7,9-11,16,26-28} We selected five IADL/ADL items (receive help with shopping, light housework, finances, walking across room, and bathing) as predictors, using item response theory to demonstrate consistent item performance across population subgroups (men age ≥ 65 , women age ≥ 65 , and persons age ≥ 85) and best subsets analysis to identify a most efficient set. A positive response to any of these five items identified 93% of persons receiving help with any of 11 IADL/ADL items.²⁹

The other examined predictors were age,^{7-15,30} self-rated health (SRH),^{9-13,19,30} and self/proxy-reported history of selected medical conditions or behaviors—dementia;^{26,31,32} diabetes mellitus;^{11,12,14,15,19,33,34} stroke;^{11,13,14,19,33} psychiatric diagnosis;^{17,35} myocardial infarction (MI) or angina;^{13,28} valvular heart disease,^{9,36} heart failure,^{9,37} or other heart conditions;¹⁹ current tobacco use;^{9,12} limited vision;^{15,34} limited hearing;^{15,38} limited vision or hearing;⁸ hip fracture;³⁹ cancer;^{14,15} and arthritis.^{14,15,18,34} For all of these predictors, the MCBS employed brief survey items to elicit self-report.

Analyses

We performed bivariate and multivariate analyses as intermediate steps in developing a scoring system. We assessed whether functional decline or death could be combined as a single outcome in a logistic regression model or would

need to be maintained as separate outcomes in a trinomial model. Because contrary effects on death and decline would suggest the need for a trinomial model, we assessed whether each variable was either protective for both outcomes or a risk factor for both outcomes (i.e., the predictor's effect on the two outcomes was in the same direction). We examined bivariate relationships and developed logistic regression models for three outcomes: death, functional decline, and functional decline or death.

We developed four types of models. (1) *Function models* considered age, function, and SRH. (2) *Function + conditions models* added medical conditions and health behaviors that, in the literature and our exploratory models, most consistently predicted decline or death. (3) *Function + expanded conditions models* considered additional conditions that less strongly predicted decline or death in the literature and in our exploratory analyses. We analyzed the latter two types of models to determine whether adding self-reported diagnoses/conditions improved the prediction strength of a function-based model enough to justify developing a longer questionnaire. (4) The fourth type of model excluded function and included only age, SRH, and self-reported diagnoses/conditions. We empirically tested and compared the prediction strength of models that measure function or conditions through simple counts with models that assigned differential weights within a category. Within each type of model, we also empirically determined ordinal categories for continuous and count variables that captured large increases in risk in bivariate associations between the ordinal variable and the outcomes.

After selecting the variables and their functional forms, we developed three types of scoring systems to target community-dwelling vulnerable older people. Integer point values were assigned to each level of the variables in such a way as to maximize the receiver operating characteristics (ROC) value for the model. This maximization took place in a multivariate context, using fully interacted multiple logistic regression models. The resulting scoring systems assigned points to each respondent based on the presence of identified predictors. To compare the scoring systems' performance, we examined the odds of functional decline or death for groups identified by the various scores and determined the sensitivity and specificity of the scoring systems at each potential cutpoint. These cutpoints were used to generate a ROC curve for each scoring system and the area under the curve (AUC) was determined. An AUC of 0.5 represents a predictive ability no better than chance, whereas 1.0 indicates perfect predictive ability.

RESULTS

Study Sample and Outcomes

In the 1993 MCBS, 9,865 community-dwelling respondents were age 65 and older. Of these, 1,110 had died and 1,025 were lost to follow-up by the end of 1995. (Those lost to follow-up were disproportionately older, less likely to be married, and less likely to be African American.) As part of the MCBS follow-up design, 2,635 older people were randomly retired from survey follow-up. These excluded respondents were selected from the 7,730 survivors not lost to follow-up. The 5,095 respondents who were followed up and the 1,110 who died constituted our matched

sample of 6,205 older people. After applying longitudinal weights, we found that 24% of the matched respondents experienced either decline in IADL/ADL ($n = 876$, 14%) or death ($n = 615$, 10%) over the 2-year period.

Bivariate and Multivariate Analyses

Of the 12 self-reported diagnoses/conditions examined in bivariate and multivariate analyses, seven predicted increased risk of the combined outcome of functional decline or death. These seven were stroke, dementia, diabetes mellitus, psychiatric diagnosis, cancer, limited vision, and current tobacco use. Of these seven, four (stroke, dementia, diabetes mellitus, psychiatric diagnosis) exhibited statistically significant multivariate associations in the same direction for both the death outcome and the decline outcome. Two predictors, tobacco use and cancer, revealed trends in the same direction, and only one, vision, had contrary effects for death and decline. We therefore concluded that the combined outcome of death and decline could be employed in a logistic regression. Five variables, MI or angina, other heart conditions, arthritis, hip fracture, and limited hearing, consistently failed to show statistically significant increased risk of decline or death.

In the four types of models, other analytic findings contributed to the development of our scoring systems. (1) Age, SRH, and function (functional limitations, IADL/ADL disability) had strong and consistent effects on death and decline in bivariate analysis and in all models tested. (2) A multivariate model that used function, SRH, and age to predict death or functional decline was only slightly improved when self-reported diagnoses were included as predictors (Somers's $D = .572$ vs $.592$). (3) A model that included only age and self-reported diagnoses/conditions was significantly less predictive than the function + age model (Somers's $D = .457$ vs $.572$). We therefore did not develop a scoring system for the age + self-reported diagnoses/conditions model. (4) A simple count of self-reported diagnoses/conditions was as predictive as a more complex scheme wherein conditions were differentially weighted based on the literature and bivariate chi-square values.

Scoring Systems

We selected the *function-based* model, the *function + diagnosis-based* model, and the *function + expanded diagnosis-based* model that maximized simplicity and prediction strength.

We translated the three selected models into scoring systems. Because we wanted a simple scoring system that could be calculated during brief interviews and because condition counts were as predictive as differential weights, we assigned whole number values to each included variable. The *function-based scoring system* considers age, SRH, six physical function limitations, and five IADL/ADL items. The resulting survey and approach to scoring are shown in Appendix 1 (Vulnerable Elders Survey (VES-13)). The *function + diagnosis-based scoring system* adds to the function-based score one point for each of four self-reported diagnoses: stroke history, diabetes mellitus, psychiatric history, and dementia diagnosis. The *function + expanded diagnosis-based scoring system* adds one point to

Table 1. Prevalence of Baseline Score and Incidence of 2-Year Decline or Death

Score	Percentage of Population with Score	Percentage with Score who Decline or Die
Function-based scoring system		
0	33.6	6.1
1	23.7	14.2
2	10.5	24.3
3	9.2	36.9
4+	23.1	54.9
Function + expanded diagnosis scoring system		
0	17.6	4.7
1	22.3	9.5
2	17.1	13.8
3	10.8	23.5
4	7.5	36.5
5	4.2	45.3
6–9	13.9	51.4
10+	6.5	67.2

the latter model for each of three items: limited vision, tobacco use, and cancer history.

Table 1 indicates the percentage of the total population assigned each score and the percentage of persons with each score who declined or died for the *function-based scoring system* and the *function + expanded diagnosis-based scoring system*. Tables 2 and 3 show, the performance at various scores or “cutpoints” of the *function-based scoring system* and the *function + expanded diagnosis-based scoring system*, respectively, for predicting functional decline or death. For our desired target group, the 20% to 40% of older people at increased risk, the two scoring systems are approximately equivalent. The *function + diagnosis-based scoring system* also demonstrated equivalent performance and therefore is not shown. Using the *function-based scoring system*, a risk score of 3 or higher identifies 32% of the sample as vulnerable. This targeted group has 4.2 times the risk of death or functional decline over a 2-year period.

Figure 1 shows the ROC curves and the AUC for the *function-based scoring system* and the *function + expanded diagnosis-based scoring system*. The AUC for the *function-based scoring system* is 0.78, whereas that for the *function + expanded diagnosis-based scoring system* is 0.79. Focusing on the section of the curve that targets the 25% to 33% at highest risk, the curves essentially overlap. The ROC curve

for the *function + diagnosis-based model*, not shown, had an AUC of 0.79 and overlapped the ROC curve for the *function + expanded diagnosis-based scoring system*.

DISCUSSION

A simple function-based screen effectively and efficiently identifies older people at risk of functional decline or death over a 2-year period. The one-third of the Medicare population identified as vulnerable with this screen has 4.2 times the risk of functional decline or death over 2 years, compared with the remaining two-thirds of the population. This targeting system relies on patient self-report, is easily transportable across settings, and will remain relevant as care systems evolve. It applies across care systems regardless of the quality of administrative data, does not require direct observations or laboratory data, and avoids reliance on utilization patterns or on the quality of condition detection within each system. This simple scoring system forms the basis of the 13-item VES-13 shown in Appendix 1. In pilot tests with seniors, nonclinicians were able to administer and score the VES-13 in an average of less than 5 minutes on the telephone.

This function-based screen is consistent with widely accepted health models that emphasize the functioning of individuals within their environment.^{23,40,41} IADL or ADL disability is one of many recognized predictors of mortality, hospitalization, and institutionalization.^{7,9–11,16,26–28} In addition, physical function limitations have been shown to predict decline and death.^{8,12,23–25} Function clarifies and integrates severity and impact of medical conditions and psychosocial factors.^{22,42} For example, difficulty stooping associated with arthritis provides more information than a simple diagnosis of arthritis. Our analysis revealed that self-reported diagnosis adds little predictive ability to the function score for identifying the subset of seniors at increased risk of functional decline or death over 2 years. This underscores the importance and potential efficiency of considering function in risk-identification systems that might otherwise rely solely on self-reported diagnoses.^{26,43,44}

The VES-13 also includes age and SRH. Age describes unmeasured risk and is an important independent predictor of functional recovery,⁴⁵ decline, and death, even when considering multiple other risk factors.^{7–15} Individuals' global rating of their own health as “fair” or “poor” is also a strong and consistent predictor of functional decline or death,^{9–13,19,30} perhaps because it integrates an individual's subjective and objective health experience and function.⁴⁶

The VES-13 identifies older people at increased risk of decline or death over 2 years. We did not test whether indi-

Table 2. Performance of Function-Based Scoring System

Cutpoint	Scores Grouped by Cutpoint	Percentage of Population in Score Group	Percentage in Group who Decline or Die	Relative Risk for Group with High Score	Sensitivity at Cutpoint	Specificity at Cutpoint
3	0–2	67.8	11.8			
	3+	32.3	49.8	4.2	0.67	0.79
4	0–3	77	14.8			
	4+	23.1	54.9	3.7	0.53	0.86

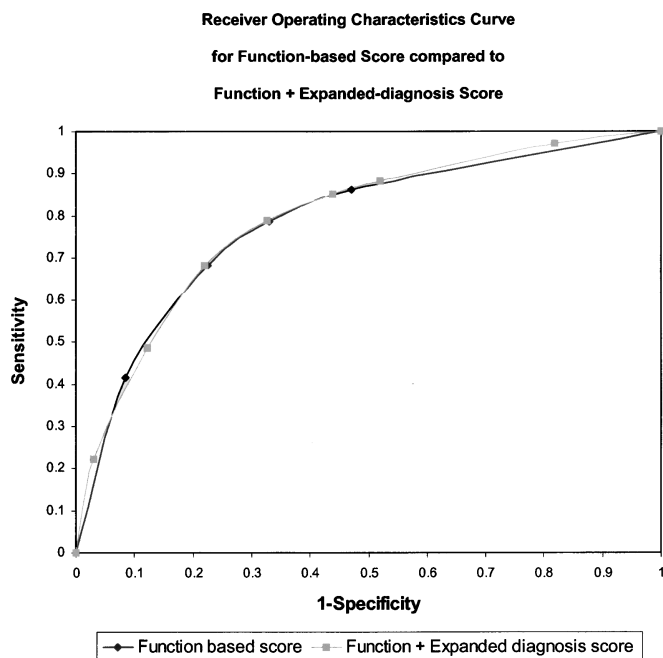


Figure 1. Receiver operating characteristics curve for function-based score compared with function + expanded-diagnosis score.

vidual items or overall score related to future health expenditures or resource use. Disability and impending mortality are associated with increased Medicare expenditures.⁴⁷ However, this is a complex relationship that varies by the mix of services/payors (i.e., Medicare, Medicaid, out-of-pocket) considered and may vary inversely by age category.⁴⁸ It cannot be assumed that the VES-13 will predict future costs.

Limitations

The self-report format of the MCBS may underestimate the prevalence of underdiagnosed conditions. In addition, self-reported conditions might include persons with minimal disease burden, remote events, or incorrect diagnoses.⁹ Specifically, the MCBS did not include formal depression or mental status screens, objective measures of disease, or validated angina and heart failure classification schemes. Under- and overreporting of conditions potentially influenced the final selection of predictors. However, the self-report format was most compatible with our desire to develop a concise and simple screening system, and the final

items selected for the VES-13 are reliably reported by individual respondents.^{49,50}

Some might question a system that uses existing function to predict functional decline. However, IADL/ADL disability strongly predicts death.^{9,11,16,26–28} In addition, the survey predicts decline, not merely continued disability. We used a conservative definition of decline (change from none to one or more disabilities, an increase in disability count by two or more, or new residence in a nursing home).

Although the predictive ability of our scoring system compares favorably with other published approaches for identifying at-risk older people,^{51–53} the predictive ability of the scoring system was determined in the derivation sample. It is likely that our decision to proceed without split-sample validation resulted in some degree of overestimation of predictive performance of the scoring system. Because the sample size was relatively large compared with the number of predictors considered, the degree of this overestimation is likely to be quite small. It should be noted that this bias will affect competing models equally and therefore will not affect comparisons between models. The VES-13 has not been tested independent of the MCBS survey. However, the MCBS is a nationally representative sample, and the number of observations minimizes the possibility that the conclusions drawn would be unique to this data set. In addition, as outlined above, the variables included in the scoring system have been consistent predictors of decline and death across studies.

A function-based identification system requires a survey of older people. Although surveys are increasingly used to evaluate older people,^{49,52,54,55} they can be time consuming and costly to administer and may be plagued by nonresponse.^{49,56} For some organizations with well-structured administrative data, it may be more efficient to employ an administrative screen to identify at-risk populations. However, administrative data have well-recognized limitations for monitoring risks in populations⁵⁷ and the quality and content of administrative data vary across organizations.^{5,44,56}

CONCLUSIONS

The VES-13 provides a simple, function-based screen that is clinically relevant and can help healthcare organizations, policy makers, and researchers to identify a group of older people with increased vulnerability. The screen facilitates comparison of enrollment across organizations and may identify older persons with the least reserve for tolerating poor medical care. Organizations interested in focusing on

Table 3. Performance of Function + Expanded Diagnosis Based Scoring System

Cutpoints	Scores Grouped by Cutpoint	Percentage of Population in Score Group	Percentage in Group who Decline or Die	Relative Risk for Group with High Score	Sensitivity at Cutpoint	Specificity at Cutpoint
4	0–3	67.8	11.6			
	4+	32.2	50.3	4.3	0.67	0.79
5	0–4	75.3	14.1			
	5+	24.7	54.5	3.9	0.56	0.85
6	0–5	79.6	15.7			
	6+	20.4	56.4	3.6	0.48	0.88

particular conditions may add conditions to the selection criteria as needed, but additional questions are not necessary for identifying the one-fourth to one-third most vulnerable older people. The impact of other predictors, such as socioeconomic status, on the VES-13 score should be assessed. The feasibility of using the VES-13 needs to be evaluated, and future studies should compare the performance of administrative-based screens to that of the VES-13, both within and across organizations.

ACKNOWLEDGMENTS

In addition to the members of the Assessing Care of Vulnerable Elders Clinical Committee and Policy Advisory Committee, we thank the following people for their assistance in developing this work: Robert Brook for advice and guidance with the conceptual framework; Patty Smith for assistance with manuscript preparation; Lisa Schmidt and Kevin Heslin for assistance with literature review; David Reuben, Teresa Seeman, Jack Guralnik, and Susan Adler for assistance in initiating analysis; Kathleen Brody and Eric Coleman for sharing unpublished details of their work; Frank Eppig and Gerald Adler for assistance with obtaining MCBS data and for reviewing longitudinal weights.

Clinical Committee Members: Alan Adelman, MD, Milton S. Hershey Medical Center; Richard Besdine, MD, Brown University Center for Gerontology and Health Care Research; Dan Blazer, MD, Duke Univ. Medical Center; Christine Cassel, MD, Mt. Sinai Medical Center; Jeffrey Cummings, MD, UCLA Alzheimers Disease Center; Paul Katz, MD, Monroe Community Hospital; Dalane Kitzman, MD, Wake Forest University School of Medicine; Risa Lavizzo-Mourey, MD, University of Pennsylvania Institute on Aging; Linda Mondoux, MSRN, Strategies for Long Term Care; Rose Popovich, MSW, Society for Social Work Leadership in Health Care; Walter Pories, MD, East Carolina University School of Medicine; Nanette Wenger, MD, Emory University.

REFERENCES

1. Rubenstein LV, Calkins DR, Greenfield S et al. Health status assessment for elderly patients. Report of the Society of General Internal Medicine Task Force on Health Assessment. *J Am Geriatr Soc* 1989;37:562-569.
2. Rubenstein LZ, Goodwin M, Hadley E et al. Working group recommendations: Targeting criteria for geriatric evaluation and management research. *J Am Geriatr Soc* 1991;39(9 Pt 2):375-415.
3. Reuben DB, Wolde-Tsadik G, Pardamean B et al. The use of targeting criteria in hospitalized HMO patients: Results from the demonstration phase of the Hospitalized Older Persons Evaluation (HOPE) Study. *J Am Geriatr Soc* 1992;40:482-488.
4. Winograd CH. Targeting strategies: An overview of criteria and outcomes. *J Am Geriatr Soc* 1991;39:255-355.
5. Bradley EH, Besdine R. Outcomes-based quality improvement: Reducing the data collection burden. *J Am Geriatr Soc* 1998;46:534-535.
6. Siu AL, Brook RH, Rubenstein LZ. Medicare capitation and quality of care for the frail elderly. *Health Care Financ Rev* 1986;(Special No.):57-63.
7. Palmore EB, Nowlin JB, Wang HS. Predictors of function among the old-old: A 10-year follow-up. *J Gerontol* 1985;40:244-250.
8. Crimmins EM, Saito Y. Getting better and getting worse. *J Aging Health* 1993;5:3-36.
9. Fried LP, Kronmal RA, Newman AB et al. Risk factors for 5-year mortality in older adults: The Cardiovascular Health Study. *JAMA* 1998;279:585-592.
10. Mor V, Wilcox V, Rakowski W et al. Functional transitions among the elderly: Patterns, predictors, and related hospital use. *Am J Public Health* 1994;84:1274-1280.
11. Goldman N, Korenman S, Weinstein R. Martial status and health among the elderly. *Soc Sci Med* 1995;40:1717-1730.
12. Idler EL, Kasl SV, Lemke JH. Self-evaluated health and mortality among the

- elderly in New Haven, Connecticut and Iowa and Washington counties, Iowa, 1982-1986. *Am J Epidemiol* 1990;131:91-103.
13. Kaplan GA, Strawbridge WJ, Camacho T et al. Factors associated with change in physical functioning in the elderly: A six-year prospective study. *J Aging Health* 1993;5:140-153.
14. Boulton C, Altman M, Gilbertson D et al. Decreasing disability in the 21 century: The future effects of controlling six fatal and nonfatal conditions. *Am J Public Health* 1996;86:1388-1393.
15. Seeman TE, Charpentier PA, Berkman LF et al. Predicting changes in physical performance in a high-functioning elderly cohort: MacArthur studies of successful aging. *J Gerontol A Biol Sci Med Sci* 1994;49A:M97-M108.
16. Guralnik JM, LaCroix AZ, Branch LG et al. Morbidity and disability in older persons in the years prior to death. *Am J Public Health* 1991;81:443-447.
17. Cho CY, Alessi CA, Cho M et al. The association between chronic illness and functional change among participants in a comprehensive geriatric assessment program. *J Am Geriatr Soc* 1998;46:1-6.
18. Coroni-Huntley JC, Foley DJ, Guralnik JM. Co-morbidity analysis: A strategy for understanding mortality, disability and use of health care facilities of older people. *Int J Epidemiol* 1991;20(Suppl. 1):S8-S17.
19. Furner SE, Rudberg MA, Cassel CK. Medical conditions differentially affect the development of IADL disability: Implications for medical care and research. *Gerontologist* 1995;35:444-450.
20. Sloss E, Solomon D, Shekelle P et al. Selecting target conditions for quality of care improvement in vulnerable older adults. *J Am Geriatr Soc* 2000;48:363-369.
21. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist* 1969;9:179-186.
22. Katz S, Ford AB, Moskowitz RW et al. Studies of illness in the aged, the index of ADL: A standardized measure of biological and psychosocial function. *JAMA* 1963;185:914-919.
23. Nagi SZ. Some conceptual issues in disability and rehabilitation. In: Sussman MB, ed. *Sociology and Rehabilitation*. Washington, DC: American Sociological Association, 1965, pp 100-113.
24. Rosow I, Breslow N. A Guttman health scale for the aged. *J Gerontol* 1966;21:556-559.
25. Harris T, Kovar MG, Suzman R et al. Longitudinal study of physical ability in the oldest-old. *Am J Public Health* 1989;79:698-702.
26. Inouye SK, Peduzzi PN, Robison JT et al. Importance of functional measures in predicting mortality among older hospitalized patients. *JAMA* 1998;279:1187-1193.
27. Reuben DB, Rubenstein LV, Hirsch SH et al. Value of functional status as a predictor of mortality: Results of a prospective study. *Am J Med* 1992;93:663-669.
28. Corti MC, Guralnik JM, Salive ME et al. Serum albumin level and physical disability as predictors of mortality in older persons. *JAMA* 1994;272:1036-1042.
29. Saliba D, Orlando M, Wenger N et al. Identifying a short functional disability screen for older persons. *J Gerontol A Biol Sci Med Sci* 2000;55A:M750-M756.
30. Bernard SL, Kincade JE, Konrad TR et al. Predicting mortality from community surveys of older adults: The importance of self-rated functional ability. *J Gerontol B Psychol Sci Soc Sci* 1997;52B:S155-S163.
31. Agüero-Torres H, Fratiglioni L et al. Dementia is the major cause of functional dependence in the elderly: 3-year follow-up data from a population-based study. *Am J Public Health* 1998;88:1452-1456.
32. Gill TM, Williams CS, Richardson ED et al. Impairments in physical performance and cognitive status as predisposing factors for functional dependence among nondisabled older persons. *J Gerontol A Biol Sci Med Sci* 1996;51A:M283-M288.
33. Boulton C, Kane RL, Louis TA et al. Chronic conditions that lead to functional limitation in the elderly. *J Gerontol A Biol Sci Med Sci* 1994;49A:M28-M36.
34. Mor V, Murphy J, Masterson-Allen S et al. Risk of functional decline among well elders. *J Clin Epidemiol* 1989;42:895-904.
35. Bruce ML, Seeman TE, Merrill SS et al. The impact of depressive symptomatology on physical disability: MacArthur Studies of Successful Aging. *Am J Pub Health* 1994;84:1796-1799.
36. Otto CM, Lind BK, Kitzman DW et al. Association of aortic-valve sclerosis with cardiovascular mortality and morbidity in the elderly. *N Engl J Med* 1999;341:142-147.
37. Dargie HJ, McMurray JJ, McDonagh TA. Heart failure—implications of the true size of the problem. *J Intern Med* 1996;239:309-315.
38. Strawbridge WJ, Wallhagen MI, Shema SJ et al. Negative consequences of hearing impairment in old age: A longitudinal analysis. *Gerontologist* 2000;40:320-326.
39. Wolinsky FD, Fitzgerald JF, Stump TE. The effect of hip fracture on mortality, hospitalization, and functional status: A prospective study. *Am J Public Health* 1997;87:398-403.
40. Nagi SZ. Disability concepts revisited: Implications for prevention. In: Pope AM, Tarlov AR, eds. *Disability in America: Toward a National Agenda for Prevention*. Washington, DC: National Academy Press, 1991, pp 35-51.

41. Verbrugge L, Jette A. The disablement process. *Soc Sci Med* 1994;38:1–14.
42. Sullivan M, LaCroix A, Baum C et al. Coronary disease severity and functional impairment: How strong is the relation? *J Am Geriatr Soc* 1996;44:1461–1465.
43. Iezzoni LI, Ayanian JZ, Bates DW et al. Paying more fairly for Medicare capitated care. *N Engl J Med* 1998;339:1933–1938.
44. Riley G, Tudor C, Chiang YP et al. Health status of Medicare enrollees in HMOs and fee-for-service in 1994. *Health Care Finance Rev* 1996;17:65–76.
45. Gill TM, Robison JT, Tinetti ME. Predictors of recovery in activities of daily living among disabled older persons living in the community. *J Gen Intern Med* 1997;12:757–762.
46. Brook RH, Ware JE Jr, Davies-Avery A et al. Overview of adult health measures fielded in Rand's health insurance study. *Med Care* 1979;17(7 Suppl):iii–x,1–131.
47. Jette AM, Davies AR, Cleary PD et al. The Functional Status Questionnaire: Reliability and validity when used in primary care. *J Gen Intern Med* 1986;1:143–149.
48. Gruenberg L, Tompkins C, Porell F. The health status of utilization patterns of the elderly: Implications for setting Medicare payments to HMOs. *Adv Health Econ Health Serv Res* 1989;10:41–73.
49. Skitovsky AA. "The high cost of dying" revisited. *Milbank Q* 1994;72:561–591.
50. McBean AM, Turner CF, Fitterman LK et al. Monitoring the health status and impact of treatment on Americans: The Medicare beneficiary health status registry. *Med Care* 1999;37:189–203.
51. Coleman EA, Wagner EH, Grothaus LC et al. Predicting hospitalization and functional decline in older health plan enrollees: Are administrative data as accurate as self-report? *J Am Geriatric Soc* 1998;46:419–425.
52. Brody KK, Johnson RE, Ried LD. Evaluation of a self-report screening instrument to predict frailty outcomes in aging populations. *Gerontologist* 1997;37:182–191.
53. Pacala JT, Boulton C, Reed RL et al. Predictive validity of the P_{ra} instrument among older recipients of managed care. *J Am Geriatr Soc* 1997;45:614–617.
54. Schnaier JA, Sweeny SF, Williams VS et al. Special issues addressed in the CAHPS survey of Medicare managed care beneficiaries. *Consumer Assessment of Health Plans Study*. *Med Care* 1999;37(3 Suppl):MS69–MS78.
55. National Committee for Quality Assurance. HEDIS 2000, Vol. 6: Specifications for the Medicare Health Outcomes Survey. Washington, DC: National Committee for Quality Assurance, 2000.
56. National Research Council. Health Performance Measurement in the Public Sector: Principles and Policies for Implementing an Information Network. Perrin EB, ed., Washington, DC: National Academy Press, 1999.
57. Iezzoni LI. The risks of risk adjustment. *JAMA* 1997;278:1600–1607.

Appendix 1

VES-13

1. Age _____

**SCORE: 1 POINT FOR AGE 75-84
3 POINTS FOR AGE ≥ 85**

2. In general, compared to other people your age, would you say that your health is:

- Poor,* (1 POINT)
- Fair,* (1 POINT)
- Good,
- Very good, or
- Excellent

SCORE: 1 POINT FOR FAIR or POOR

3. How difficult, on average, do you have with the following physical activities:

	<u>No</u> <u>Difficulty</u>	<u>A little</u> <u>Difficulty</u>	<u>Some</u> <u>Difficulty</u>	<u>A Lot of</u> <u>Difficulty</u>	<u>Unable</u> <u>to do</u>
a. stooping, crouching or kneeling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *
b. lifting, or carrying objects as heavy as 10 pounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *
c. reaching or extending arms above shoulder level?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *
d. writing, or handling and grasping small objects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *
e. walking a quarter of a mile?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *
f. heavy housework such as scrubbing floors or washing windows?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> *	<input type="checkbox"/> *

SCORE: 1 POINT FOR EACH * RESPONSE IN Q3a THROUGH f . MAXIMUM OF 2 POINTS.

4. Because of your health or a physical condition, do you have any difficulty:

a. shopping for personal items (like toilet items or medicines)?

- YES → Do you get help with shopping? YES * NO
- NO
- DON'T DO → Is that because of your health? YES * NO

b. managing money (like keeping track of expenses or paying bills)?

- YES → Do you get help with managing money? YES * NO

- NO
- DON'T DO → Is that because of your health? YES * NO

.....

Continued

c. walking across the room? USE OF CANE OR WALKER IS OK.

- YES → Do you get help with walking? YES * NO
- NO
- DON'T DO → Is that because of your health? YES * NO

d. doing light housework (like washing dishes, straightening up, or light cleaning)?

- YES → Do you get help with light housework? YES * NO
- NO
- DON'T DO → Is that because of your health? YES * NO

e. bathing or showering?

- YES → Do you get help with bathing or showering? YES * NO
- NO
- DON'T DO → Is that because of your health? YES * NO

**SCORE: 4 POINTS FOR ONE OR MORE *
RESPONSES IN Q4a THROUGH Q4e**

Quality of Care Is Associated with Survival in Vulnerable Older Patients

Takahiro Higashi, MD, PhD; Paul G. Shekelle, MD, PhD; John L. Adams, PhD; Caren J. Kamberg, MSPH; Carol P. Roth, RN, MPH; David H. Solomon, MD; David B. Reuben, MD; Lillian Chiang, MD; Catherine H. MacLean, MD, PhD; John T. Chang, MD, MPH; Roy T. Young, MD; Debra M. Saliba, MD, MPH; and Neil S. Wenger, MD, MPH

Background: Although assessment of the quality of medical care often relies on measures of process of care, the linkage between performance of these process measures during usual clinical care and subsequent patient outcomes is unclear.

Objective: To examine the link between the quality of care that patients received and their survival.

Design: Observational cohort study.

Setting: Two managed care organizations.

Patients: Community-dwelling high-risk patients 65 years of age or older who were continuously enrolled in the managed care organizations from 1 July 1998 to 31 July 1999.

Measurements: Quality of care received by patients (as measured by a set of quality indicators covering 22 clinical conditions) and their survival over the following 3 years.

Results: The 372 vulnerable older patients were eligible for a mean of 21 quality indicators (range, 8 to 54) and received, on

average, 53% of the care processes prescribed in quality indicators (range, 27% to 88%). Eighty-six (23%) persons died during the 3-year follow-up. There was a graded positive relationship between quality score and 3-year survival. After adjustment for sex, health status, and health service use, quality score was not associated with mortality for the first 500 days, but a higher quality score was associated with lower mortality after 500 days (hazard ratio, 0.64 [95% CI, 0.49 to 0.84] for a 10% higher quality score).

Limitations: The observational design limits causal inference regarding the effect of quality of care on survival.

Conclusions: Better performance on process quality measures is strongly associated with better survival among community-dwelling vulnerable older adults.

Ann Intern Med. 2005;143:274-281.

For author affiliations, see end of text.

www.annals.org

As clinicians, the public, and health systems become more aware that many Americans do not receive necessary care, the importance of measuring and improving quality of care has gained increasing attention (1–3). Although quality of care can theoretically be measured by outcomes (what happens to patients), process (what providers do) is often preferred (3–5) because process is under relatively greater control of providers, needs a shorter time frame, can directly inform improvement, and may not require statistical adjustment for severity of illness (6, 7). Typically, process measures evaluate the proportion of eligible patients who receive care as recommended (for example, the proportion of patients \geq 65 years of age receiving pneumococcal vaccine).

To be a meaningful measure of quality, a process of care must be related to improved patient outcomes. For many quality indicators, this relationship is based on evidence of efficacy from randomized, controlled trials, usually among a select patient population. However, the relationship between performance on process of care quality indicators and better health outcomes remains a largely untested assumption for general populations of patients receiving care in community settings. The lack of a demonstrated relationship between performance on process quality measures and outcome advantage in a cohort of

patients has hindered the acceptance of quality indicators as a way to measure and improve health outcomes (8).

The Assessing Care of Vulnerable Elders (ACOVE) project developed a set of process quality criteria that were judged by clinical experts to improve patient outcomes on the basis of clinical evidence and professional opinion (9–11). Combined with mortality information available through the National Death Index, our study evaluated the process–outcome relationship. While the development method conferred content validity on the process measures, we aimed to assess the predictive validity of the quality measurement system by examining the relationship between the quality of care received by sampled participants and their subsequent survival.

See also:

Print

Editors' Notes	275
Editorial comment	305
Summary for Patients	I-33

Web-Only

Appendix Table
Conversion of figures and tables into slides

METHODS

The ACOVE Project

The ACOVE project developed and implemented a set of quality indicators that focuses on process of care for clinical conditions important in the care of vulnerable older patients. Details of the methods of selecting conditions and developing quality indicators have been described in previous reports (9, 10, 12). We selected quality indicators by using systematic reviews of the medical literature followed by deliberations by several panels of clinical experts using formal consensus methods to assess the validity of quality indicators. This process resulted in 236 quality indicators covering 22 clinical areas (continuity of care, dementia, depression, diabetes mellitus, end-of-life care, falls and mobility problems, hearing loss, heart failure, hospital care, hypertension, ischemic heart disease, malnutrition, medication management, osteoarthritis, osteoporosis, pain management, pneumonia, pressure ulcer, screening and prevention, stroke and atrial fibrillation, urinary incontinence, and vision care) across the continuum of care, including prevention, diagnosis, treatment, and follow-up. Each quality indicator contains an “if” clause that defines the patient who is eligible to receive it and a “then” clause that describes what care is recommended (for example: “If a vulnerable elder has had a myocardial infarction, then he or she should be offered a β -blocker”). If the medical record describes a contraindication to the recommended care, the patient is not eligible for the quality indicator. Furthermore, we explicitly defined certain indicators as being not applicable, and therefore not included, when assessing the care of patients with advanced dementia or poor prognosis (13).

We applied the ACOVE quality indicators to a sample of vulnerable older patients in 2 large managed care organizations, 1 in the northeastern United States and the other in the southwestern United States (11). Each managed care plan had more than 20 000 senior members and contracted with a network of providers for delivery of care. Eligibility criteria included continuous enrollment in the managed care organization with no out-of-network care during the 13-month study period and no active treatment for malignant conditions except for nonmelanoma skin cancer. We identified vulnerable older persons by telephone interview using the Vulnerable Elders Survey-13 (VES-13) (14). The VES-13 is a 13-item questionnaire that produces a vulnerability score ranging from 0 to 10 based on age, self-reported health, and function. Patients with scores of 3 or higher are at 4 times the risk for death or functional decline over the next 2 years and are therefore defined as vulnerable. We excluded non-English-language speakers because interviews were available only in English. Among 3207 community-dwelling patients 65 years of age and older who were randomly selected from the 2 managed care plans, we conducted screening interviews with 2278 patients (9% through proxies) and identified 475 (21%)

Context

Quality-of-care evaluation often focuses on how often patients receive certain tests or treatments. Theoretically, the content of care should predict patient survival, but the evidence is inconclusive.

Contribution

This study used 207 criteria to assess good care in 372 vulnerable elderly patients. When care did not meet these standards, patients were more likely to die during the 3 years of follow-up.

Implications

In vulnerable older patients, the content of care is associated with mortality. This finding supports the use of process measures in the evaluation of quality of care and shows that good care may prolong life.

—The Editors

patients as vulnerable. Among them, 420 (88%) patients consented to participate in the study and 372 (78%) patients had medical records for the 13-month period from 1 July 1998 to 31 July 1999 that were able to be abstracted.

We collected all participants' medical records, including those for inpatient care, outpatient care, nursing home care, home care, and mental health care. Trained nurses abstracted charts to apply quality indicators. A senior nurse reviewer assessed completed abstractions, and physician overreaders reviewed them for clinical assessment. We evaluated inter-rater reliability by reabstraction of 10% of the medical records, which contained 698 quality indicators. Agreement was 97% for quality indicator eligibility and 95% for overall quality score. We collected patient characteristics, including age, sex, cognitive function measured by the Blessed Orientation–Memory–Concentration test (15), and mental health score derived from Medical Outcomes Study Short Form-36 items (16), at the time of the recruitment telephone interview. The RAND institutional review board approved the study protocol.

Among the 236 ACOVE quality indicators, 207 could be implemented in the field trial either by medical record (183 indicators) or patient interview (24 indicators). Because some patients died before the interview was conducted, we used only quality indicators for which information was available in medical records. Among these, 160 quality indicators had at least 1 eligible patient; 43 focused on prevention, 42 on diagnosis, 47 on treatment, and 28 on follow-up care. These 160 quality indicators covered all 22 conditions. The **Appendix Table** (available at www.annals.org) contains the list of quality indicators used in our report, the number of eligible patients, and the pass rate for each indicator.

Statistical Analysis

We calculated quality scores for each patient on the basis of the percentage of ACOVE quality indicators for

which an eligible patient received recommended care. We obtained death, date, and cause-of-death data for ACOVE participants from the National Death Index during 3 years after the quality measurement period (from August 1999 to September 2002).

We used both unadjusted and adjusted analyses to examine the link between patient survival and quality score. For the unadjusted analysis, we first divided the sample in half on the basis of quality score (that is, \geq median and $<$ median) and examined the difference in survival curves between patients with higher quality and patients with lower quality by using the log-rank test. Second, we calculated survival for 10 equal intervals of quality score from the lowest quality score to the highest quality score in the sample and graphically assessed the graded relationship between quality score and survival.

We used the Cox proportional hazards survival model in adjusted analyses. Because the proportional hazards assumption for the multivariate survival analysis did not hold for the entire observation period, we used a piecewise model that allowed the coefficients for quality to vary between 500 days or less and more than 500 days, as suggested by the Kaplan–Meier survival curve in the unadjusted analysis. Covariates included sex, VES-13 score (including age), mental health, number of hospitalizations and office visits during the quality measurement period, and number of conditions that patients had during the quality measurement period among 13 comorbid conditions (dementia, depression, diabetes mellitus, heart failure, hypertension, ischemic heart disease, osteoarthritis, osteoporosis, pressure ulcer, atrial fibrillation, urinary incontinence, chronic obstructive pulmonary disease, and chronic renal failure). The mental health score ranged from 1 to 6, and we created 3 categories on the basis of the score (<2 , very good; 2 to 3, good; and >3 , fair). An indicator variable designated patients who were not interviewed for mental health items because of cognitive impairment.

To further examine a plausible mechanism for the quality–survival link, we examined the relationship between survival and high-prevalence individual quality indicators. For the individual quality indicators, we calculated the relative risk for death over the 3 years for patients who were eligible and received recommended care (that is, pass) in comparison with patients who were eligible but did not receive the recommended care (that is, fail). Because quality indicators with few eligible patients cannot produce reliable estimates of this ratio, we evaluated only those quality indicators for which at least 50 patients received the recommended care and at least 50 patients did not receive the care. In addition, we compared cause of death between patients who received high-quality care and those who received low-quality care.

We also performed analyses to evaluate whether patients who were sicker received lower-quality care, perhaps because they were perceived to be on an immutable trajectory toward death, by studying the relationship between

quality score and patient sickness level, represented by patient age and VES-13 score. For this examination, we used correlation coefficients, as well as a comparison of mean quality scores between younger (<85 years of age) versus older (≥ 85 years of age) patients and between healthier (VES-13 score < 7) versus sicker (VES-13 score ≥ 7) patients. Furthermore, we compared quality for the 39 patients identified as having advanced dementia, documented poor prognosis, or preferences not to receive aggressive care (13) versus the remaining 333 patients in the sample.

Sensitivity Analyses

Since the main analysis defined quality score as a simple percentage of the recommended care received, we conducted 2 sensitivity analyses. The first sensitivity analysis repeated the main analysis by using weights proportionate to the number of quality indicators for which patients were eligible. These weights reflect the stability of quality scores by placing greater emphasis on scores calculated from more care processes and reducing the effect of unstable quality scores, making it less likely to find a relationship by chance. The second sensitivity analysis aimed to adjust for differences in the level of difficulty satisfying individual quality indicators by creating an alternative quality score by subtracting from each person's score the population mean score for the set of quality indicators for which the patient was eligible. This alternative score represents the quality above or below the average score of the population eligible for the set of quality indicators for which the patient was eligible.

Role of a Potential Omitted Confounder

We performed an additional sensitivity analysis by using a simulation technique to assess the potential effects of an omitted confounder variable. We assumed the omitted variable to be binary and generated it to correlate with both death and quality of care (similar results are obtained for positive correlations with death and negative correlations with quality). We selected values to illustrate the magnitude of the correlations required to eliminate the quality effect on survival. We conducted statistical analyses by using Stata, version 8.2 (Stata Corp., College Station, Texas).

Role of the Funding Source

This study was supported by a contract with Pfizer Inc. The funding source had no role in the design, analysis, or interpretation of the study or in the decision to submit the manuscript for publication.

RESULTS

Sample Characteristics

Among 420 vulnerable older patients who consented to participate in the study, 372 had available medical records for quality-of-care measurement (11). They had a mean age of 81 years; 64% were women, and the mean vulnerability score was 5.3. During the 3-year period from

Table 1. Description of the Study Sample (n = 372)*

Characteristic	Value
Demographic	
Mean age, y	80.6, SD 6.8
Women, %	64
High school graduate, %	59
Clinical	
Mean VES-13 score	5.3, SD 2.3
Mean self-reported health (5-point scale)	2.6
Mean activities of daily living disabilities (6-point scale)	0.49
Mean instrumental activities of daily living disabilities (6-point scale)	1.2
Mental health, %†	
Very good	77
Good	16
Fair	7
Cognitive impairment, %‡	37
Mean hospitalizations, n§	0.28, SD 0.72
Mean office visits, n§	8.7, SD 5.7
Comorbid conditions, %	
Dementia	8
Depression	16
Diabetes mellitus	24
Heart failure	15
Hypertension	61
Ischemic heart disease	31
Osteoarthritis	24
Osteoporosis	12
Pressure ulcer	2
Atrial fibrillation	13
Urinary incontinence	9
COPD or related disorders	25
Chronic renal failure	7

* COPD = chronic obstructive pulmonary disease; VES-13 = Vulnerable Elders Survey-13.

† Information was available for 285 patients. Mental health score on a scale of 1 to 6 points: very good, <2 points; good, 2–3 points; or fair, >3 points. For 87 patients, this information was not available because proxies answered the screening interview questions.

‡ Cognitive impairment was defined as either proxy respondent needed for interview or patient scored 17 points or less on the Blessed Orientation–Memory–Concentration test.

§ During 13-mo quality measurement period.

August 1999 to September 2002, 86 (23%) patients died. Overall, the 372 participants had a mean quality score of 53%, SD 11% (range, 22% to 88%), indicating that they received, on average, 53% of the care recommended in the ACOVE quality indicators. Each participant was, on average, eligible for 21 quality indicators (9 prevention, 3 diagnosis, 6 treatment, and 2 follow-up [values do not add up to 21 because of rounding]). Table 1 summarizes other patient characteristics.

Among 48 participants for whom medical records could not be used for quality-of-care evaluation, 28 participants received no care during the 13-month observation period and 20 patients had incomplete or illegible medical records. Overall, the 3-year mortality rate for these 48 participants was 23%.

Quality–Survival Association

When we split the sample in half on the basis of quality score, participants in the upper half received a mean

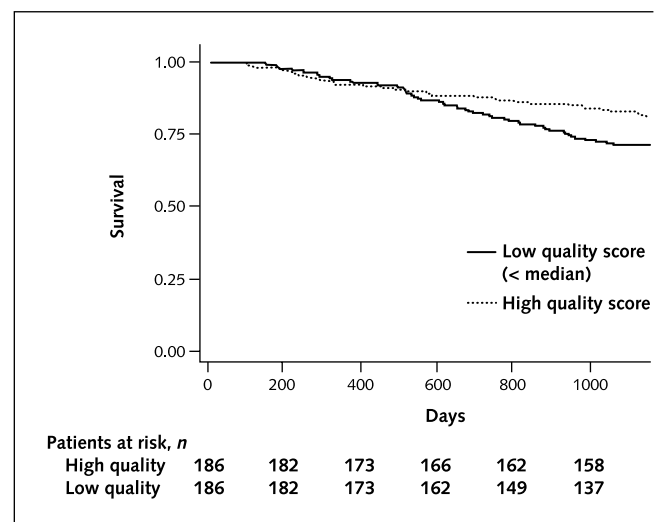
quality score of 62%, SD 7% (range, 52% to 88%) and participants in the lower half had a mean quality score of 44%, SD 6% (range, 22% to 52%). Figure 1 shows the Kaplan–Meier survival curves for the upper and lower quality half samples. Participants receiving higher-quality care had significantly lower mortality (18%) than patients receiving lower-quality care (28%) (log-rank test; $P = 0.02$). Furthermore, when patients were grouped into 10 equal intervals of quality score, there was a graded relationship between quality score and 3-year survival (Figure 2). The unadjusted piecewise Cox model showed that the hazard ratio associated with a 10% quality score increase was 1.16 (95% CI, 0.86 to 1.56) for up to 500 days and 0.68 (CI, 0.54 to 0.87) after 500 days.

After adjustment for sex, vulnerability score (including age and functional status), mental health, number of hospitalizations and outpatient visits, and number of conditions by using the piecewise Cox proportional hazards model, higher quality was not associated with mortality within 500 days after the quality measurement period (hazard ratio, 1.19 [CI, 0.86 to 1.64] for a 10% higher quality score) but was significantly associated with lower mortality after 500 days (hazard ratio, 0.64 [CI, 0.49 to 0.84] for a 10% higher quality score).

Analyses of Possible Mechanisms of the Quality–Survival Association

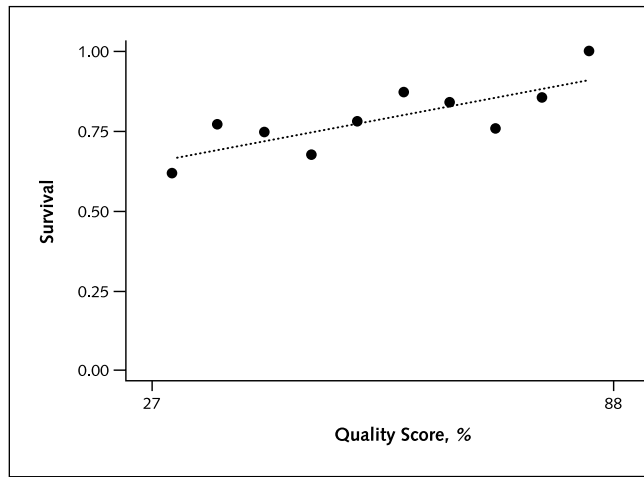
Nine quality indicators had at least 50 patients who passed and 50 patients who failed. For 8 of these 9 quality indicators, patients who received recommended care were less likely to die than those who did not receive such care (Table 2). The National Death Index included the cause of death for 78 patients. Twenty-one (27%) patients died of

Figure 1. Kaplan–Meier survival curves for patients grouped into the upper and lower half of quality.



Patients in the upper half of quality received a mean quality score of 62%, and patients in the lower half had a mean quality score of 44%. Survival curves differed by the log-rank test ($P = 0.02$).

Figure 2. Three-year survival for 10 equal intervals of quality score.



Relationship of survival to quality captured in 10 equal intervals ($r = 0.77$).

cardiovascular diseases; 16 (21%) died of respiratory diseases; 9 (12%) died of malignant neoplasms; and 9 (12%) died of neurologic disorders, including dementia. The cause of death did not differ between patients in the upper half of quality of care and those in the lower half.

Sensitivity Analyses

Both sensitivity analyses produced results similar to the main analysis. The analysis using weights to reduce the effect of unstable quality scores yielded a hazard ratio of 1.15 (CI, 0.79 to 1.68) within 500 days and 0.61 (CI, 0.45 to 0.81) after 500 days for a 10% increase in quality score. The analysis in which quality scores were adjusted for the difficulty of passing each patient’s set of quality indicators provided a hazard ratio of 1.23 (CI, 0.85 to 1.76) within 500 days and 0.64 (CI, 0.49 to 0.84) after 500 days.

Role of a Potential Omitted Confounder

Table 3 presents the revised estimates and 95% CIs for the effect of quality on survival more than 500 days after the observation period when we incorporated a hypothetical confounder into the proportional hazards model. We selected these particular values to illustrate the magnitude of the correlations that would be required to eliminate the quality effect. Substantial correlations of a potential confounder with quality of care and mortality would be required to eliminate the finding of a reduction in mortality associated with quality of care.

Assessment of Alternative Hypothesis

We recognized that the relationship between higher quality score and survival could be explained by an alternative hypothesis: Physicians provide sicker patients with less care because they presume that such patients are likely to die anyway. This would result in lower-quality care being related to higher mortality. To investigate this possibility, we studied the relationship between quality score and patient sickness level, represented by patient age and VES-13 score, which was significantly related to death over 3 years in the multivariate analysis (relative risk for death for each point of the scale was 1.18; $P < 0.001$). We found no relationship between quality score and patient age or VES-13 score: Pearson correlation coefficients were -0.03 and -0.01 , respectively, and graphical assessment showed no relationship (Figure 3). The mean quality score did not significantly differ between older participants and younger participants (54% for those 65 to 84 years of age vs. 53% for those ≥ 85 years of age; $P > 0.2$) or between healthier patients and sicker patients (that is, 54% for those with a VES-13 score < 7 vs. 53% for those with a VES-13 score > 7 ; $P > 0.2$). Mean quality score for the 39 patients who had advanced dementia or poor prognosis or who declined aggressive care was similar to that for the remaining 333 patients (55% vs. 53%, respectively; $P > 0.2$).

Table 2. Relative Risk for Death When Receiving Recommended Care versus Not Receiving Recommended Care by Individual Quality Indicators

Quality Indicator Care Process	Eligible Patients, n	Mortality if Received Recommended Care, %	Mortality if Did Not Receive Recommended Care, %	Relative Risk for Death Pass/Fail (95% CI)*
Influenza vaccine	372	21	27	0.78 (0.54–1.14)
Ask about falls annually	372	26	22	1.18 (0.78–1.77)
Pneumococcal vaccine	370	12	27	0.46 (0.26–0.79)
Annual evaluation of urinary incontinence	363	21	25	0.87 (0.57–1.31)
Weight measurement at every visit	355	19	25	0.74 (0.49–1.11)
Follow-up of medications in outpatient setting	189	23	26	0.89 (0.53–1.50)
Document response to drug therapy	180	20	32	0.62 (0.37–1.04)
Cognitive screen at new evaluation	130	24	31	0.77 (0.43–1.35)
Targeted physical examination for pain	123	16	18	0.87 (0.40–1.90)

* If providing recommended care is associated with reduced mortality, relative risk is < 1.0 .

DISCUSSION

We found that better quality of care provided to community-dwelling vulnerable older persons was associated with higher 3-year survival. The relationship between quality of care and survival was robust to analysis in several different ways. The process–outcome link remained after weighting for quality score stability and after adjustment for quality indicator difficulty. The alternative explanation, that physicians elect to provide less care to persons on a downward trajectory, is less likely because we did not observe a relationship between care quality and sickness or age. Although our study is observational, our results satisfy most of the factors explicated by Hill (17) for making causal inference in observational studies, the most important of which are strength of association, temporality of the cause and effect, the presence of a dose–response gradient, plausibility of causal mechanisms, coherence with current knowledge, consistency with other studies, and specificity of the association. Our finding of a moderately strong association between process and outcome has no temporal ambiguity between process and outcome, with evidence of a dose–response relationship, and a plausible mechanism of

Figure 3. Relationship between quality score and age (*top*) and relationship between quality score and Vulnerable Elders Survey-13 (VES-13) score (*bottom*).

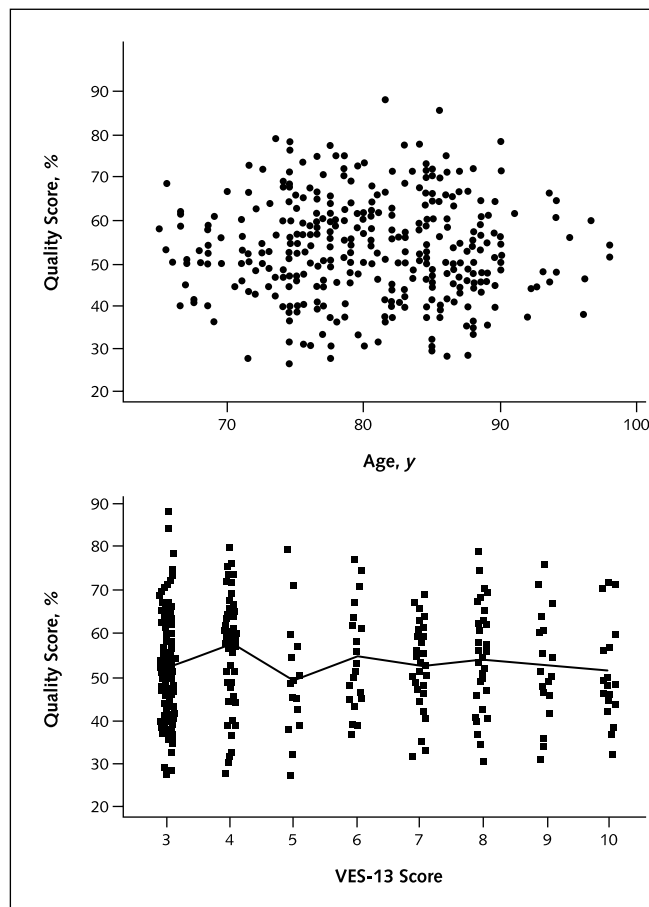


Table 3. Correlation of the Potential Omitted Confounder with Death and Quality That Would Be Required To Eliminate the Observed Quality–Survival Relationship

Correlation of Omitted Variable with Death	Correlation of Omitted Variable with Quality	Hazard Ratio for Death (95% CI)*
–0.8	0.2	0.99 (0.74–1.33)
–0.8	0.3	1.13 (0.81–1.57)
–0.6	0.2	0.82 (0.61–1.11)
–0.6	0.3	1.11 (0.82–1.51)
–0.4	0.4	0.89 (0.67–1.20)
–0.4	0.5	1.00 (0.74–1.36)
–0.2	0.6	0.82 (0.60–1.13)

* Estimated hazard ratios are associated with a 10% higher quality score for the period of 500 d after the quality measurement period.

effect that is consistent with current knowledge. Only consistency and specificity of the association are not satisfied by our results. Consistency cannot be tested by only 1 study, and specificity cannot be tested because our only outcome measure is mortality. Furthermore, the formal sensitivity analysis for a potential unmeasured omitted confounder revealed that this confounder must be very strongly related to both quality and survival to explain the quality–survival relationship beyond the adjustment for other covariates. Therefore, we believe that the most plausible interpretation of our results is that the receipt of better-quality care was causally linked with improvement in 3-year mortality in our sample of community-dwelling vulnerable older adults.

Although many studies have measured process quality on the basis of indicators that have content validity derived from their link to outcomes in the medical literature, our study is, to our knowledge, the first to show the predictive validity of a broad-based, process-of-care quality measurement system using patient survival among community-dwelling older persons. Previous evaluation of the process–outcome link has focused on a narrower range of conditions and care domains. In 1 study, Kahn and colleagues (18) used explicit criteria to examine the quality of care for older patients hospitalized with congestive heart failure, myocardial infarction, pneumonia, cerebrovascular accident, and hip fracture. Better processes of care in 4 of these 5 conditions were related to lower 30-day mortality. In another study (19), the quality of medication prescribing was statistically significantly related to preserved basic self-care function, although not survival, among community-dwelling older persons. Several other studies (20–22) investigated the process–outcome link to examine the validity of annual hospital mortality statistics released by the Health Care Financing Administration (now the Centers for Medicare & Medicaid Services) (23). These studies found a weak relationship or no relationship between process quality and hospital mortality. We speculate that our study could detect an association between process quality and mortality because ACOVE quality measurement was both broad in coverage and specifically constructed to as-

sess those aspects of health care judged most likely to prevent death and loss of function. Furthermore, we assessed care in a particularly vulnerable patient population with 23% mortality over 3 years, which enabled us to detect this association even in a relatively small group over a relatively short time period. Among the frequently occurring indicators that were commonly both passed and failed, receiving recommended care was associated with improved survival. Some of these indicators have randomized, controlled trial evidence of a direct relationship with reduced mortality (for example, influenza vaccine). Others may begin a pathway to processes that may reduce mortality (such as the regular measurement of weight), and still others may not lead directly or indirectly to reduced mortality but may be markers for careful medical care (which is then related to reduced mortality).

Our findings show that performance on a comprehensive measure of process of care is linked to survival. This should motivate policies that promote such measurement for older patients. Process-of-care measurement is valuable in many ways: The results identify targets for improvement; it does not require complicated case-mix adjustment; and the effect of a quality intervention can be measured in a more timely manner compared with most outcome measures. Yet process measures have disadvantages as well, such as the need to frequently update quality criteria to keep up with advances in medical knowledge and technology, lack of face validity for patients, and the cost of measurement. The cost of medical record abstraction can be particularly high when evaluating a broad range of care. Recent advances in information technology, however, will increase the practicality of process-of-care measurement (1). Our study supports the investment of resources to expedite implementation of broad measurement strategies integrated into routine clinical documentation (for example, through electronic medical records) as a critical step toward improving outcomes for vulnerable populations.

Our study has several limitations. First, as mentioned earlier, this is an observational study, meaning that causal inference is guarded because the possibility of confounding by unmeasured variables cannot be ruled out. However, observational studies will probably be the predominant study design to assess the relationship between quality and survival, since it would be unethical to deliberately randomly assign persons to lower-quality care. Furthermore, our results meet most of the factors proposed by Hill (17) when considering causation from observational studies. The most important unmet factor is consistency. Our study needs replication in other populations. Second, this study focused only on survival. Functional capability and quality of life are important to vulnerable older patients and should be additional targets in future studies. Third, in calculation of the quality score, we treated individual quality indicators as equal. Providing recommended care for some quality indicators undoubtedly has a greater effect on survival than others. This makes our estimates of associa-

tion between quality and survival more conservative because the assumption of equal weights biases the results toward the null value. Fourth, we calculated quality scores on the basis of individual sets of quality indicators because individuals are eligible for different care processes. Therefore, the same quality score can signify different care across patients. We tried to adjust for patient sickness with general measures, such as the VES-13, the number of comorbid conditions, and health service use, and these analyses upheld our main result. Finally, our study has limited generalizability because our sample comes from noninstitutionalized members of 2 managed care organizations. Replications in a fee-for-service Medicare population and other patient groups are needed.

In conclusion, our study reports that better quality of care, as measured by a broad set of quality indicators, is associated with better survival among community-dwelling vulnerable older persons. Although resource requirements may pose an obstacle to implementing such a broad-based quality measurement system, advances in information technology may substantially ameliorate the data collection burden in the near future. Since only about half of recommended care was received, poor care may be responsible for unnecessary deaths among vulnerable older patients. The process measures in ACOVE can be implemented by health care providers. An important next step is to evaluate whether interventions can be implemented that improve the delivery of these processes to vulnerable older patients and whether these improvements lead, as our results suggest, to improvement in mortality.

From RAND Health, Santa Monica, California, and Washington, DC, and the University of California, Los Angeles, and the Greater Los Angeles Veterans Affairs Healthcare System, Los Angeles, California.

Acknowledgments: The authors thank Robert Brook, MD, ScD, for inspiration and guidance; Robin P. Hertz, PhD, senior director of outcomes research and population studies at Pfizer Inc, for providing valuable support; and Patricia Smith and Victor Gonzalez for their technical assistance.

Grant Support: Supported by a contract from Pfizer Inc. Dr. Higashi is supported by a St. Luke's Life Science Institute Fellowship Award. Dr. Shekelle was a Senior Research Associate of the Veterans Affairs Health Services Research & Development Service. Dr. Chiang is supported by a Bureau of Health Professionals Geriatrics Research Faculty Training Program. Drs. MacLean and Saliba are Research Associates of the Veterans Affairs Health Services Research & Development Service. Dr. Chang is supported by a National Research Service Award (PE-19001) and the University of California, Los Angeles, Specialty Training and Advanced Research (STAR) Program.

Potential Financial Conflicts of Interest: *Stock ownership or options (other than mutual funds):* R.T. Young (Pfizer Inc).

Requests for Single Reprints: Neil S. Wenger, MD, MPH, RAND, 1700 Main Street, Santa Monica, CA 90407.

Current author addresses are available at www.annals.org.

References

1. **Institute of Medicine.** Crossing the Quality Chasm. Washington DC: National Acad Pr; 2001.
2. **Schuster MA, McGlynn EA, Brook RH.** How good is the quality of health care in the United States? *Milbank Q.* 1998;76:517-63, 509. [PMID: 9879302]
3. **McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, et al.** The quality of health care delivered to adults in the United States. *N Engl J Med.* 2003;348:2635-45. [PMID: 12826639]
4. **National Committee on Quality Assurance.** HEDIS 2004 Summary Table of Measures and Product Lines. Washington, DC: National Committee on Quality Assurance; 2004. Accessed at www.ncqa.org/Programs/HEDIS/Hedis%202004%20Summary%20Table.pdf on 22 June 2004.
5. **Jencks SF, Cuerdon T, Burwen DR, Fleming B, Houck PM, Kussmaul AE, et al.** Quality of medical care delivered to Medicare beneficiaries: a profile at state and national levels. *JAMA.* 2000;284:1670-6. [PMID: 11015797]
6. **Lilford R, Mohammed MA, Spiegelhalter D, Thomson R.** Use and misuse of process and outcome data in managing performance of acute medical care: avoiding institutional stigma. *Lancet.* 2004;363:1147-54. [PMID: 15064036]
7. **Mant J, Hicks N.** Detecting differences in quality of care: the sensitivity of measures of process and outcome in treating acute myocardial infarction. *BMJ.* 1995;311:793-6. [PMID: 7580444]
8. **Brook RH, McGlynn EA, Cleary PD.** Quality of health care. Part 2: measuring quality of care [Editorial]. *N Engl J Med.* 1996;335:966-70. [PMID: 8782507]
9. **Wenger NS, Shekelle PG.** Assessing care of vulnerable elders: ACOVE project overview. *Ann Intern Med.* 2001;135:642-6. [PMID: 11601946]
10. **Shekelle PG, MacLean CH, Morton SC, Wenger NS.** ACOVE quality indicators. *Ann Intern Med.* 2001;135:653-67. [PMID: 11601948]
11. **Wenger NS, Solomon DH, Roth CP, MacLean CH, Saliba D, Kamberg CJ, et al.** The quality of medical care provided to vulnerable community-dwelling older patients. *Ann Intern Med.* 2003;139:740-7. [PMID: 14597458]
12. **Sloss EM, Solomon DH, Shekelle PG, Young RT, Saliba D, MacLean CH, et al.** Selecting target conditions for quality of care improvement in vulnerable older adults. *J Am Geriatr Soc.* 2000;48:363-9. [PMID: 10798460]
13. **Solomon DH, Wenger NS, Saliba D, Young RT, Adelman AM, Besdine RK, et al.** Appropriateness of quality indicators for older patients with advanced dementia and poor prognosis. *J Am Geriatr Soc.* 2003;51:902-7. [PMID: 12834508]
14. **Saliba D, Elliott M, Rubenstein LZ, Solomon DH, Young RT, Kamberg CJ, et al.** The Vulnerable Elders Survey: a tool for identifying vulnerable older people in the community. *J Am Geriatr Soc.* 2001;49:1691-9. [PMID: 11844005]
15. **Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H.** Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *Am J Psychiatry.* 1983;140:734-9. [PMID: 6846631]
16. **McHorney CA, Ware JE Jr, Lu JF, Sherbourne CD.** The MOS 36-item Short-Form Health Survey (SF-36): III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Med Care.* 1994;32:40-66. [PMID: 8277801]
17. **Hill AB.** The environment and disease: association or causation? *Proc R Soc Med.* 1965;58:295-300. [PMID: 14283879]
18. **Kahn KL, Rubenstein LV, Draper D, Kosecoff J, Rogers WH, Keeler EB, et al.** The effects of the DRG-based prospective payment system on quality of care for hospitalized Medicare patients. An introduction to the series. *JAMA.* 1990;264:1953-5. [PMID: 2120473]
19. **Hanlon JT, Fillenbaum GG, Kuchibhatla M, Artz MB, Boulton C, Gross CR, et al.** Impact of inappropriate drug use on mortality and functional status in representative community dwelling elders. *Med Care.* 2002;40:166-76. [PMID: 11802089]
20. **Thomas JW, Holloway JJ, Guire KE.** Validating risk-adjusted mortality as an indicator for quality of care. *Inquiry.* 1993;30:6-22. [PMID: 8454316]
21. **Jencks SF, Daley J, Draper D, Thomas N, Lenhart G, Walker J.** Interpreting hospital mortality data. The role of clinical risk adjustment. *JAMA.* 1988;260:3611-6. [PMID: 3057250]
22. **Park RE, Brook RH, Kosecoff J, Keesey J, Rubenstein L, Keeler E, et al.** Explaining variations in hospital death rates. Randomness, severity of illness, quality of care. *JAMA.* 1990;264:484-90. [PMID: 2195173]
23. **Health Care Financing Administration.** Medicare Hospital Mortality Information, 1986. HCFA publication 01-002. Washington, DC: U.S. Department of Health and Human Services; 1987.

Current Author Addresses: Dr. Higashi: Department of Epidemiology and Healthcare Research, Kyoto University, Yoshida-konoe-cho, Sakyo-ku, Kyoto 606-8501, Japan.

Dr. Chang: Division of General Internal Medicine, University of California, Los Angeles, 911 Broxton Plaza, Los Angeles, CA 90095-1736.

Drs. Shekelle, MacLean, and Saliba: Greater Los Angeles Veterans Affairs Healthcare System, 11301 Wilshire Boulevard, Los Angeles, CA 90073.

Drs. Solomon, Adams, and Wenger and Ms. Roth: RAND, 1700 Main Street, M-26, Santa Monica, CA 90407-2138.

Ms. Kamberg: RAND, 1200 South Hayes Street, Arlington, VA 22202.

Dr. Young: Division of General Internal Medicine, University of California, Los Angeles, 200 Medical Plaza, Los Angeles, CA 90095-1736.

Drs. Reuben and Chiang: Division of Geriatrics, University of California, Los Angeles, 200 Medical Plaza, Los Angeles, CA 90095-1736.

Appendix Table. Quality Indicators Using Medical Records as the Information Source, Eligible Patients, and Pass Rates*

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
Continuity and coordination of care		
IF an outpatient vulnerable elder is started on a new prescription medication, and he or she has a follow-up visit with the prescribing physician, THEN the medical record at the follow-up visit should document 1 of the following: 1) The medication is being taken, 2) the physician asked about the medication (e.g., side effects or adherence or availability), or 3) the medication was not started because it was not needed or because it was changed.	189	66
IF a vulnerable elder is discharged from a hospital to home or to a nursing home, and the hospital medical record specifies a follow-up appointment for a physician visit or a treatment (e.g., physical therapy or radiation oncology), THEN the medical record should document that the visit or treatment took place or that it was postponed or was not needed.	62	90
IF a vulnerable elder is discharged from a hospital to home or to a nursing home, THEN there should be a discharge summary in the outpatient physician or nursing home medical record within 6 weeks.	52	41
IF a vulnerable elder is discharged from a hospital to home or to a nursing home, and the transfer form or discharge summary indicates that a test result is pending, THEN the outpatient or nursing home medical record should include the test result within 6 weeks of hospital discharge.	14	71
IF a vulnerable elder is discharged from a hospital to home, and he or she received a new prescription medication or a change in medication before discharge, THEN the outpatient medical record should document or acknowledge the medication change within 6 weeks of discharge.	11	55
IF a vulnerable elder is under the outpatient care of ≥ 2 physicians, and 1 physician prescribed a new prescription medication or a change in medication, THEN subsequent medical record entries by the nonprescribing physician should acknowledge the medication change.	6	42
Dementia		
IF a vulnerable elder is admitted to a hospital or is new to a physician practice, THEN there should be documentation of a multidimensional assessment of cognitive ability.	130	52
IF a vulnerable elder is admitted to a hospital or is new to a physician practice, THEN there should be an assessment of functional status.	130	18
IF a vulnerable elder with dementia has a caregiver (and, if capable, the patient assents), THEN the physician should discuss or refer the patient and caregiver for discussion about patient safety, provide education on how to deal with conflicts at home, and inform them about community resources for dementia.	28	26
IF a vulnerable elder receives a new diagnosis of dementia, THEN the diagnosing physician should advise the patient not to drive a motor vehicle, request that the Department of Motor Vehicles (or equivalent) retests the patient's ability to drive, or refer the patient to a drivers' safety or education course that includes assessment of driving ability consistent with state laws.	6	50
IF a vulnerable elder has dementia, THEN he or she should be screened for depression during the initial evaluation period.	5	60
IF a vulnerable elder receives a new diagnosis of dementia, THEN a serum vitamin B ₁₂ and TSH test should be performed.	5	20
IF a vulnerable elder with dementia has cerebrovascular disease, THEN he or she should be offered appropriate stroke prophylaxis.	2	100
Depression		
IF a vulnerable elder presents with new onset of 1 of the following symptoms: sad mood, feeling down, insomnia or difficulties with sleep, apathy or loss of interest in pleasurable activities, reports of memory loss, unexplained weight loss greater than 5% in the past month or 10% over 1 year, or unexplained fatigue or low energy; THEN the patient should be asked about or treated for depression or should be referred to a mental health professional within 2 weeks of presentation.	34	26
IF a vulnerable elder receives a diagnosis of a new depression episode, THEN the medical record should document at least 3 of the 9 DSM-IV target symptoms for major depression within the first month of diagnosis.	13	0
IF a vulnerable elder receives a diagnosis of a new depression episode, THEN the medical record should document on the day of diagnosis the presence or absence of suicidal ideation and psychosis (consisting of, at a minimum, auditory hallucinations or delusions).	13	0

Continued on following page

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
IF a vulnerable elder receives a diagnosis of depression, THEN antidepressant treatment, psychotherapy, or electroconvulsive therapy should be offered within 2 weeks after diagnosis unless there is documentation within that period that the patient has improved or unless the patient has substance abuse or dependence, in which case treatment may wait until 8 weeks after the patient is in a drug- or alcohol-free state.	13	69
IF a vulnerable elder is started on an antidepressant medication, THEN the following medications should not be used as first- or second-line therapy: tertiary amine tricyclics (amitriptyline, imipramine, doxepin, clomipramine, or trimipramine), monoamine oxidase inhibitors (unless atypical depression is present), benzodiazepines, or stimulants (except methylphenidate).	10	90
IF a vulnerable elder has no meaningful symptom response after 6 weeks of treatment, THEN 1 of the following treatment options should be initiated by the 8th week of treatment: Medication dose should be optimized or the patient should be referred to a psychiatrist (if initial treatment was medication) or medication should be initiated or referral to a psychiatrist should be offered (if initial treatment was psychotherapy alone).	9	22
IF a vulnerable elder responds only partially after 12 weeks of treatment, THEN 1 of the following treatment options should be instituted by the 16th week of treatment: Switch to a different medication class or add a second medication to the first (if initial treatment includes medication), add psychotherapy (if the initial treatment was medication), try medication (if initial treatment was psychotherapy without medication), consider electroconvulsive therapy, or refer to a psychiatrist.	8	25
IF a vulnerable elder with a history of cardiac disease is started on a tricyclic antidepressant, THEN baseline electrocardiography should be performed before initiation of or within 3 months before treatment.	1	0
Diabetes mellitus		
IF a vulnerable elder has diabetes, THEN his or her blood pressure should be checked at each outpatient visit.	85	59
IF a vulnerable elder has diabetes, THEN his or her glycated hemoglobin level should be measured at least every 12 months.	84	80
IF a diabetic vulnerable elder is not blind, THEN he or she should receive an annual dilated eye examination performed by an ophthalmologist, optometrist, or diabetes specialist.	84	48
ALL diabetic vulnerable elders should be offered daily aspirin therapy.	59	41
IF a diabetic vulnerable elder has elevated blood pressure, THEN he or she should be offered a therapeutic intervention to lower blood pressure within 3 months if blood pressure is 150–160/90–100 mm Hg and within 1 month if blood pressure is greater than 160/100 mm Hg.	44	79
IF a diabetic vulnerable elder does not have established renal disease and is not receiving an ACE inhibitor or ACE receptor blocker, THEN he or she should receive an annual test for proteinuria.	43	19
IF a diabetic vulnerable elder has a fasting total cholesterol level ≥ 6.2 mmol/L (≥ 240 g/dL), THEN he or she should be offered an intervention to lower cholesterol.	12	92
IF a vulnerable elder has an elevated glycated hemoglobin level, THEN he or she should be offered a therapeutic intervention aimed at improving glycemic control within 3 months if the glycated hemoglobin level is 9.0% to 10.9%, and within 1 month if the glycated hemoglobin level is $\geq 11\%$.	9	61
IF a diabetic vulnerable elder has proteinuria, THEN he or she should be offered therapy with an ACE inhibitor or ACE receptor blocker.	5	20
End-of-life care		
ALL vulnerable elders should have in their outpatient charts 1) an advance directive indicating the patient's surrogate decision maker, or 2) documentation of a discussion about who would be a surrogate decision maker or a search for a surrogate, or 3) indication that there is no identified surrogate.	370	4
IF a vulnerable elder with dementia, coma, or altered mental status is admitted to the hospital, THEN within 48 hours of admission, the medical record should 1) contain an advance directive indicating the patient's surrogate decision maker, 2) document a discussion about who would be a surrogate decision maker or a search for a surrogate, or 3) indicate that there is no identified surrogate.	20	25

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
IF a vulnerable elder with decision-making capacity has orders written in the hospital or the nursing home to withhold or withdraw a particular treatment modality (e.g., DNR order or an order not to initiate dialysis), THEN the medical record should document 1) patient participation in the decision or 2) why the patient chose not to participate in the decision.	10	70
IF a vulnerable elder has an advance directive in the outpatient, inpatient, or nursing home medical record or the patient reports the existence of an advance directive in an interview, and the patient receives care in a second venue, THEN 1) the advance directive should be present in the medical record at the second venue or 2) documentation should acknowledge its existence, its contents, and the reason that it is not in the medical record.	8	25
IF a vulnerable elder is admitted directly to the intensive care unit (from the outpatient setting or emergency department) and survives 48 hours, THEN within 48 hours of admission, the medical record should document consideration of the patient's preferences for care or that these could not be elicited or are unknown.	6	17
IF a vulnerable elder carries a diagnosis of severe dementia, is admitted to the hospital, and survives 48 hours, THEN within 48 hours of admission, the medical record should document consideration of the patient's previous preferences for care or that these could not be elicited or are unknown.	2	100
IF a vulnerable elder requires mechanical ventilation during a hospitalization (except short-term and postoperative mechanical ventilation), THEN the medical record should document within 48 hours of the initiation of mechanical ventilation the goals of care and the patient's preference for mechanical ventilation or why this information is unavailable.	2	100
Fall or illness problem		
ALL vulnerable elders should have documentation that they were asked at least annually about the occurrence of recent falls.	372	25
IF a vulnerable elder reported ≥ 2 falls in the past year or 1 fall with injury requiring treatment, THEN there should be documentation of a basic fall history.	57	49
IF a vulnerable elder reported ≥ 2 falls in the past year or 1 fall with injury requiring treatment, THEN there should be documentation of a basic fall examination.	57	3
IF a vulnerable elder reported ≥ 2 falls in the past year or 1 fall with injury requiring treatment, THEN there should be an examination with documented recommendations.	57	30
IF a vulnerable elder reports or is found to have new or worsening difficulty with ambulation, balance, and/or mobility, THEN there should be documentation that a basic gait, mobility, and balance evaluation was performed within 6 months that resulted in specific diagnostic and therapeutic recommendations.	22	23
IF a vulnerable elder is found to have problems with gait, strength (e.g., $\leq 4/5$ on manual muscle testing or needs arms to rise from a chair), or endurance (e.g., dyspnea on mild exertion), THEN an exercise program should be offered.	14	71
IF a vulnerable elder demonstrates decreased balance or proprioception or increased postural sway, THEN an appropriate exercise program should be offered and an evaluation for an assistive device performed.	13	62
Hearing loss		
IF a vulnerable elder fails a hearing screening, THEN he or she should be offered a formal audiologic evaluation within 3 months.	18	94
IF a vulnerable elder has a hearing problem or fails an audiologic screening, THEN he or she should have an ear examination within 3 months.	15	83
ALL vulnerable elders should have a hearing screening examination as part of the initial evaluation.	4	0
IF a vulnerable elder is a hearing aid candidate, THEN he or she should be offered hearing rehabilitation.	4	50
Heart failure		
IF a vulnerable elder has heart failure and LV ejection fraction ≤ 0.4 (or unknown), THEN he or she should be offered an ACE inhibitor or receptor blocker.	23	65

Continued on following page

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
IF a vulnerable elder has heart failure, has LV ejection fraction \leq 0.4, and is NYHA class I–III, THEN he or she should be offered a β -blocker unless a contraindication (e.g, uncompensated heart failure) has been documented.	21	48
IF a vulnerable elder has heart failure, has LV ejection fraction \leq 0.4, and does not have AF, THEN from among the 3 generations of calcium-channel blocker medications, he or she should not be treated with a first- or second-generation calcium-channel blocker.	9	100
IF a vulnerable elder is hospitalized with heart failure, THEN he or she should have serum electrolytes, creatinine, and blood urea nitrogen levels measured within 1 day of hospitalization.	8	100
IF a vulnerable elder has heart failure and AF, THEN he or she should be offered anticoagulation to achieve an INR of 2.0 to 3.0.	7	71
IF a vulnerable elder receives a new diagnosis of heart failure, THEN he or she should have a history taken at the time of diagnosis and hospitalization that documents the presence or absence of previous MI, documented coronary artery disease, revascularization, current symptoms of chest pain or angina, history of hypertension, history of diabetes, history of hypercholesterolemia, history of valvular heart disease, history of thyroid disease, smoking, current medications, and a description of functional capacity (e.g., NYHA functional status).	6	83
IF a vulnerable elder receives a new diagnosis of heart failure, THEN he or she should be offered an evaluation of LV ejection fraction within 1 month.	6	67
IF a vulnerable elder receives a new diagnosis of heart failure, THEN he or she should have the following elements of the physical examination documented at the time of presentation: weight, blood pressure and heart rate, lung examination, cardiac examination, and abdominal or lower-extremity examination.	6	100
IF a vulnerable elder receives a new diagnosis of heart failure, THEN he or she should undergo the following studies within 1 month of the diagnosis (unless they have already been performed within the previous 3 months): chest radiography, electrocardiography, CBC, serum sodium and potassium levels, serum creatinine level, and TSH level in patients with AF or heart failure with no obvious cause.	6	67
IF a vulnerable elder has heart failure and AF and he or she has documented contraindications to anticoagulation, THEN he or she should be offered aspirin.	3	33
IF a vulnerable elder has heart failure and LV ejection fraction \leq 0.4, THEN he or she should not be treated with a type I antiarrhythmic agent unless an implantable cardioverter defibrillator is in place.	1	100
Hospital care		
IF a vulnerable elder is admitted to the hospital for any acute or chronic illness or any surgical procedure, THEN the evaluation should include within 24 hours: 1) diagnoses and 2) prehospital and current medications.	57	97
IF a vulnerable elder is admitted to the hospital for any acute or chronic illness or any surgical procedure, THEN documentation of cognitive status should be performed within 24 hours.	57	20
IF a vulnerable elder enters the hospital, THEN discharge planning should begin within 48 hours.	57	67
IF a hospitalized vulnerable elder has peptic stress ulcer risk factors, THEN the patient should receive prophylaxis with either an H ₂ -blocker, sucralfate, or a proton-pump inhibitor.	10	45
IF a hospitalized vulnerable elder has a definite or suspected diagnosis of delirium, THEN an evaluation for potentially precipitating factors must be undertaken and identified causes treated.	10	60
IF a hospitalized vulnerable elder has a definite or suspected diagnosis of delirium, THEN identified potential causes should be treated.	9	44
IF a hospitalized vulnerable elder is at very high risk for venous thrombosis, THEN the patient should have venous thromboembolism prophylaxis.	4	100
Hypertension		
IF a vulnerable elder requires pharmacotherapy for treatment of hypertension in the outpatient setting, THEN a once- or twice-daily medication should be used unless there is documentation about the need for agents that require more frequent dosing.	59	93

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
IF a vulnerable elder has hypertension and has renal parenchymal disease with a serum creatinine level >133 μmol/L (>1.5 mg/dL) or > 1 g of protein/24 hours of collected urine, THEN therapy with an ACE inhibitor should be offered.	19	63
IF a vulnerable elder has hypertension and asthma, THEN β-blocker therapy for hypertension should not be used.	15	100
IF a vulnerable elder remains hypertensive after nonpharmacologic intervention, THEN pharmacologic antihypertensive treatment should be initiated.	11	64
IF a vulnerable elder receives a new diagnosis of hypertension, THEN within 4 weeks of the diagnosis, electrocardiography should be performed.	6	33
IF a vulnerable elder receives a new diagnosis of hypertension, THEN there should be documentation about the presence or absence of other cardiovascular risk factors.	6	33
IF a vulnerable elder receives a new diagnosis of hypertension, THEN nonpharmacologic therapy with lifestyle modification for treatment of hypertension should be recommended, including dietary sodium restriction and weight loss if patient is > 10% more than ideal body weight.	6	33
IF a vulnerable elder receives a new diagnosis of hypertension and the blood pressure is below 170/90 mm Hg, THEN there should be evidence that 3 or more blood pressure measures ≥ 140/90 mm Hg were obtained before the diagnosis.	3	33
Ischemic heart disease		
IF a vulnerable elder has established CHD and is not receiving warfarin, THEN he or she should be offered antiplatelet therapy.	73	66
IF a vulnerable elder has had a MI, THEN he or she should be offered a β-blocker.	53	53
IF a vulnerable elder has established CHD and LDL cholesterol level >3.36 mmol/L (> 130 mg/dL) and a trial of step II diet therapy was not offered or was ineffective, THEN he or she should be offered cholesterol-lowering medication.	16	47
IF a vulnerable elder with established CHD smokes, THEN he or she should be offered counseling for smoking cessation at least annually and have this documented in the medical record.	8	50
IF a vulnerable elder has established CAD and his or her cholesterol level is not known, THEN he or she should undergo a fasting cholesterol evaluation, including total LDL and HDL cholesterol.	3	33
IF a vulnerable elder has an acute MI or unstable angina, did not undergo angiography, and does not have contraindications to revascularization, THEN he or she should be offered noninvasive stress testing 4–21 days after the infarction or anginal event.	3	0
IF a vulnerable elder is hospitalized with an acute MI, THEN he or she should be offered assessment of LV function before discharge or within 3 days after hospital discharge.	2	50
IF a vulnerable elder has an acute MI or unstable angina, THEN he or she should be given aspirin therapy within 1 hour of presentation.	2	0
IF a vulnerable elder has unstable angina or an acute MI, THEN he or she should be offered β-blocker therapy within 12 hours of presentation.	2	50
IF a vulnerable elder has had a recent MI or recent coronary bypass graft surgery, THEN he or she should be offered cardiac rehabilitation.	2	0
IF a vulnerable elder has clinically significant left main or clinically significant 3-vessel coronary artery disease with LV ejection fraction < 0.5, THEN he or she should be offered coronary artery bypass graft surgery.	1	0
Malnutrition		
ALL vulnerable elders should be weighed at each physician office visit and these weights should be documented in the medical record.	355	42
IF a vulnerable elder is hospitalized, THEN his or her nutritional status should be documented during the hospitalization by evaluation of oral intake or serum biochemical testing (e.g., albumin, prealbumin, or cholesterol levels).	57	47
IF a vulnerable elder has documented involuntary weight loss or hypoalbuminemia (<35 g/L), THEN she or he should receive an evaluation for potentially reversible causes of poor nutritional intake.	33	52

Continued on following page

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
IF a vulnerable elder has documented involuntary weight loss or hypoalbuminemia (<35 g/L), THEN he or she should receive an evaluation for potentially relevant comorbid conditions, including medications that might be associated with decreased appetite (e.g., digoxin, fluoxetine, anticholinergics), depressive symptoms, and cognitive impairment.	33	76
IF a vulnerable elder has involuntary weight loss > 10% of body weight over ≤1 year, THEN weight loss (or a related disorder) should be documented in the medical record as an indication that the physician recognized malnutrition as a potential problem.	13	77
Medication use		
IF a vulnerable elder does not need control of seizures, THEN barbiturates should not be used.	372	99
IF a vulnerable elder requires analgesia, THEN meperidine should not be used.	369	99
ALL vulnerable elders should not be prescribed a medication with strong anticholinergic effects if alternatives are available.	366	98
IF a vulnerable elder is prescribed a new drug, THEN the patient (or, if incapable, a caregiver) should receive education about the purpose of the drug, how to take it, and expected side effects or important adverse reactions.	259	18
IF a vulnerable elder is prescribed a new drug, THEN the prescribed drug should have a clearly defined indication documented in the record.	258	98
EVERY new drug that is prescribed to a vulnerable elder on an ongoing basis for a chronic medical condition should have a documentation of response to therapy within 6 months.	180	65
IF a vulnerable elder is prescribed a thiazide or loop diuretic, THEN he or she should have electrolyte levels checked at least yearly.	127	80
IF a vulnerable elder is prescribed an oral hypoglycemic drug, THEN chlorpropamide should not be used.	89	99
IF a vulnerable elder is prescribed warfarin, THEN an INR should be determined at least every 6 weeks.	44	53
IF a vulnerable elder is newly started on a diuretic, THEN serum potassium and creatinine levels should be checked within 1 month of the initiation of therapy.	25	34
IF a vulnerable elder is newly started on an ACE inhibitor, THEN serum potassium and creatinine levels should be checked within 1 month of the initiation of therapy.	23	37
IF a vulnerable elder is prescribed warfarin, THEN an INR should be determined within 4 days after initiation of therapy and at least every 6 weeks.	11	45
Osteoarthritis		
IF a vulnerable elder is treated with COX-2 nonselective NSAIDs, THEN there should be evidence that the patient was advised of the risks associated with these drugs.	50	4
IF a vulnerable elder is older than 75 years of age and/or has a history of peptic ulcer disease, gastrointestinal bleeding, or current warfarin use and the patient is being treated with a COX-2 nonselective NSAID, THEN he or she should be offered concomitant treatment with either misoprostol or a proton-pump inhibitor.	38	11
IF oral pharmacologic therapy is initiated to treat osteoarthritis, THEN acetaminophen should be the first drug used, unless there is a documented contraindication to use.	37	43
IF an ambulatory vulnerable elder receives a new diagnosis of symptomatic osteoarthritis of the knee and has no contraindications to exercise and is physically and mentally able to exercise, THEN a directed or supervised strengthening or aerobic exercise program should be prescribed within 3 months of diagnosis.	19	16
IF a vulnerable elder with severe symptomatic osteoarthritis of the knee or hip has not responded to nonpharmacologic and pharmacologic therapy, THEN the patient should be offered referral to an orthopedic surgeon to be evaluated for total joint replacement within 6 months unless a contraindication to surgery is documented.	10	90
IF oral pharmacologic therapy for osteoarthritis is changed from acetaminophen to a different oral agent, THEN there should be evidence that the patient has had a trial of maximum-dose acetaminophen (suitable for age and comorbid conditions).	3	33

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
Osteoporosis		
ALL female vulnerable elders who smoke should be counseled annually about smoking cessation.	25	48
IF a vulnerable elder has a new diagnosis of osteoporosis, THEN during the initial evaluation period, an underlying cause of osteoporosis should be sought by checking medication use and current alcohol use.	12	42
IF a female vulnerable elder receives a new diagnosis of osteoporosis, THEN the patient should be offered treatment with hormone replacement therapy or bisphosphonates or calcitonin within 3 months of diagnosis.	10	60
IF a vulnerable elder is taking corticosteroids for more than 1 month, THEN the patient should be offered calcium and vitamin D.	7	71
IF an ambulatory vulnerable elder has an osteoporotic fracture diagnosed, THEN physical therapy or an exercise program should be offered within 3 months.	7	0
Pain management		
IF a vulnerable elder has a newly reported, chronic painful condition, THEN a targeted history should be performed within 1 month.	123	40
IF a vulnerable elder has a newly reported, chronic painful condition, THEN a physical examination should be performed within 1 month.	123	58
IF a vulnerable elder has a newly reported, chronic painful condition, THEN treatment should be offered.	121	86
IF a vulnerable elder is treated for a chronic painful condition, THEN he or she should be assessed for a response within 6 months.	70	66
IF a vulnerable elder has been prescribed a COX-2 nonselective NSAID for the treatment of chronic pain, THEN the medical record should indicate whether he or she has a history of peptic ulcer disease and, if a history is present, justification of NSAID use should be documented.	50	10
IF a vulnerable elder with chronic pain is treated with opioids, THEN he or she should be offered a bowel regimen or the medical record should document the potential for constipation or explain why bowel treatment is not needed.	46	0
Pneumonia		
IF a vulnerable elder with no history of allergy to the pneumococcal vaccine is not known to have already received a pneumococcal vaccine or if the patient received it more than 5 years ago (if before age 65 years), THEN a pneumococcal vaccine should be offered.	372	29
IF a vulnerable elder has no history of anaphylactic hypersensitivity to eggs or to other components of the influenza vaccine, THEN the patient should be offered an annual influenza vaccination.	372	66
IF a vulnerable elder is admitted to the hospital with pneumonia, THEN antibiotics should be administered within 8 hours of hospital arrival.	8	88
IF a vulnerable elder is admitted to the hospital with community-acquired pneumonia with hypoxia, THEN the patient should receive oxygen therapy.	7	100
IF a vulnerable elder with community-acquired pneumonia is to be discharged home, THEN the patient should not be unstable on the day before or the day of discharge.	7	100
IF a smoker develops pneumonia, THEN the smoker should be advised to quit smoking.	3	33
Prevention and screening		
ALL vulnerable elders newly admitted to a physician practice should receive within 6 months the elements of a comprehensive geriatric assessment.	4	14
ALL vulnerable elders newly admitted to a physician practice should receive within 6 months recommendations from the comprehensive geriatric assessment.	3	44
IF the elements of a comprehensive geriatric assessment are performed, THEN follow-up should assure the implementation of recommendations.	2	100
IF a vulnerable elder has valvular or congenital heart disease, intracardiac valvular prosthesis, hypertrophic cardiomyopathy, mitral valve prolapse with regurgitation, or previous episode of endocarditis and a high-risk procedure is planned, THEN endocarditis prophylaxis should be given.	1	100

Continued on following page

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %‡
Pressure ulcer		
IF a vulnerable elder is admitted to an intensive care unit or a medical or surgical unit of a hospital and cannot reposition himself or herself or has limited ability to do so, THEN risk assessment for pressure ulcers should be performed on admission.	11	59
IF a vulnerable elder is identified as at risk for pressure ulcer development or a pressure ulcer risk assessment score indicates that the person is at risk, THEN preventive intervention must be instituted within 12 hours, addressing repositioning needs and pressure reduction (or management of tissue loads).	9	0
IF a vulnerable elder presents with a pressure ulcer, THEN the pressure ulcer should be assessed for 1) location, 2) depth and stage, 3) size, and 4) presence of necrotic tissue.	9	33
IF a vulnerable elder is identified as at risk for pressure ulcer development and has malnutrition (involuntary weight loss > 10% over 1 year or low albumin or prealbumin levels), THEN nutritional intervention or dietary consultation should be instituted.	6	83
IF a vulnerable elder presents with a clean full-thickness pressure ulcer and has no improvement at 4 weeks post-treatment, THEN 1) the appropriateness of the treatment plan and 2) the presence of cellulitis or osteomyelitis should be assessed.	2	50
IF a vulnerable elder with a full-thickness pressure ulcer presents with systemic signs and symptoms of infection, such as elevated temperature, leukocytosis, confusion, and agitation, and these signs and symptoms are not due to another identified cause, THEN the ulcer should be debrided of necrotic tissue within 12 hours.	1	0
IF a vulnerable elder presents with a partial-thickness pressure ulcer and has no improvement at 2 weeks post-treatment, THEN the appropriateness of the treatment plan should be assessed.	1	33
Stroke and AF		
IF a vulnerable elder has AF for > 48-hour duration and has any high-risk condition (impaired LV function; women age > 75 years; hypertension or systolic blood pressure > 160 mm Hg; or previous ischemic stroke, TIA, or systemic embolism), THEN he or she should be offered oral anticoagulation, or antiplatelet therapy if the medical record documents a reason not to give anticoagulant therapy.	18	94
IF a vulnerable elder has a TIA or stroke, THEN the medical record should document that smoking status was assessed and that smokers were counseled to stop smoking.	6	100
IF a male vulnerable elder has carotid artery symptoms and receives a diagnosis of TIA or nondisabling stroke, and the medical record does not document that the patient is not a candidate for carotid surgery, THEN a carotid artery imaging study should be performed within 4 weeks.	3	100
IF a vulnerable elder has a presumed stroke, THEN a CT or an MRI of the head should be obtained before initiation or continuation of thrombolytic treatment, anticoagulant therapy, or antiplatelet therapy.	2	100
IF a vulnerable elder receives a diagnosis of acute atherothrombotic ischemic stroke or TIA, THEN antiplatelet treatment should be offered within 48 hours after the stroke or TIA, unless the patient is already receiving anticoagulant treatment.	2	100
IF a vulnerable elder is admitted to the hospital with a diagnosis of acute ischemic or hemorrhagic stroke, THEN he or she should be admitted to a specialized acute or combined acute and rehabilitative stroke unit or transferred to a specialized stroke unit if such a unit is available in the hospital.	2	50
Urinary incontinence		
ALL vulnerable elders should annually have documentation of the presence or absence of urinary incontinence.	363	31
IF a vulnerable elder has new urinary incontinence that persists for more than 1 month or urinary incontinence at the time of a new evaluation, THEN a targeted physical examination should be performed that documents 1) a rectal examination and 2) a genital system examination (including a pelvic examination for women).	32	22
IF a vulnerable elder has new urinary incontinence that persists for more than 1 month or urinary incontinence at the time of a new evaluation, THEN a dipstick urinalysis and postvoid residual should be obtained.	32	13

Appendix Table—Continued

Text of Quality Indicators	Patients Triggered, n†	Pass Rates, %†
IF a vulnerable elder has new urinary incontinence or urinary incontinence at the time of a new evaluation, THEN treatment options should be discussed.	32	59
IF a vulnerable elder has new urinary incontinence that persists for more than 1 month or urinary incontinence at the time of a new evaluation, THEN a targeted history should be obtained that documents each of the following: 1) characteristics of voiding, 2) ability to get to the toilet, 3) previous treatment for urinary incontinence, 4) importance of the problem to the patient, and 5) mental status.	32	19
IF a cognitively intact vulnerable elder who is capable of independent toileting has documented stress, urge, or mixed incontinence without evidence of hematuria or high postvoid residual, THEN behavioral treatment should be offered.	31	13
ALL vulnerable elders should have documentation of the presence or absence of urinary incontinence during the initial evaluation.	4	50
IF a female vulnerable elder has documented stress urinary incontinence caused by isolated ISD or ISD with coexistent hypermobility and she undergoes surgical correction, THEN a sling or artificial sphincter procedure should be used.	1	100
IF a vulnerable elder undergoes surgery or periurethral injections for urinary incontinence, THEN subtracted cystometry should be performed before the procedure.	1	0
Vision care		
IF a vulnerable elder receives a diagnosis of a cataract, THEN assessment of visual function with respect to his or her ability to carry out needed or desired activities should be performed every 12 months.	102	31
IF a vulnerable elder with diabetes has a retinal examination, THEN the presence or degree of diabetic retinopathy should be documented.	43	88
IF a vulnerable elder receives a diagnosis of a cataract that limits the patient's ability to carry out needed or desired activities, THEN cataract extraction should be offered.	22	86
IF a vulnerable elder undergoes cataract surgery, THEN a follow-up ocular examination should occur within 48 hours and reexamination should occur within 3 months.	18	100
IF a vulnerable elder has sudden-onset visual changes, eye pain, corneal opacity, or severe purulent discharge, THEN the patient should be examined within 72 hours by an ophthalmologist.	10	80
IF a vulnerable elder who has been prescribed an ocular therapeutic regimen becomes hospitalized, THEN the regimen should be administered in the hospital unless discontinued by an ophthalmologic consultant.	6	83
IF a vulnerable elder develops progression of a chronic visual deficit that now interferes with his or her ability to perform needed or desired activities, THEN he or she should have an ophthalmic examination performed by a person skilled at ophthalmic examination within 2 months.	5	100
IF a vulnerable elder has a new diagnosis of primary open-angle glaucoma, THEN the initial evaluation of each eye should include the essential components of a comprehensive eye examination and documentation of the optic nerve appearance, visual field testing, and determination of an initial target pressure.	3	0
IF a vulnerable elder with diabetes receives a diagnosis of macular edema, THEN a dilated eye examination should be performed at least every 6 months.	2	100

* ACE = angiotensin-converting enzyme; AF = atrial fibrillation; CAD = coronary artery disease; CBC = complete blood count; CHD = coronary heart disease; COX-2 = cyclooxygenase-2; CT = computed tomography; DNR = do not resuscitate; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; HDL = high-density lipoprotein; INR = international normalized ratio; ISD = intrinsic sphincter deficiency; LDL = low-density lipoprotein; LV = left ventricular; MI = myocardial infarction; MRI = magnetic resonance imaging; NSAID = nonsteroidal anti-inflammatory drug; NYHA = New York Heart Association; TIA = transient ischemic attack; TSH = thyroid-stimulating hormone.

† Number of eligible patients × pass rate may not be an integer because partial score was awarded if a patient triggered a quality indicator more than once and received recommended care only some of the time.