Quality of Care Is Associated with Survival in Vulnerable Older Patients

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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.**

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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 ≥ 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.

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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%) 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.

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

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 ($<$85 years of age) versus older ($\geq$85 years of age) patients and between healthier (VES-13 score $<$ 7) versus sicker (VES-13 score $\geq$ 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).

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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

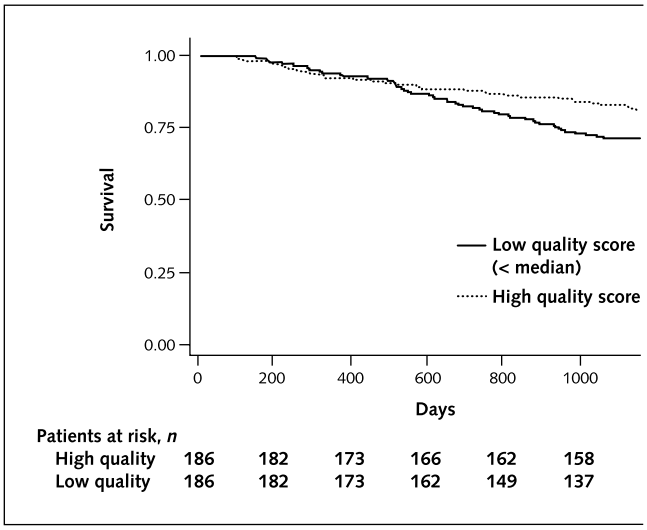
When we split the sample in half on the basis of quality score, participants in the upper half received a mean quality score of 62%, SD 7% (range, 52% to 88%) and participants in the lower half had a mean quality score of 44%, SD 6% (range, 22% to 52%). **Figure 1** shows the Kaplan–Meier survival curves 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

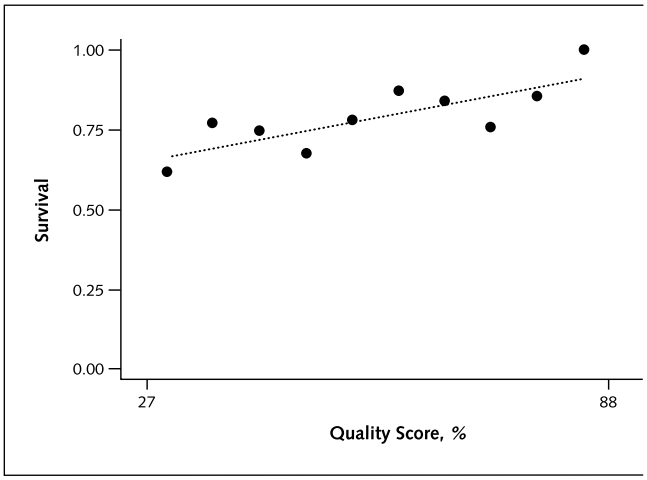
Nine quality indicators had at least 50 patients who passed and 50 patients who failed. For 8 of these 9 quality indicators, patients who received recommended care were less likely to die than those who did not receive such care (**Table 2**). The National Death Index included the cause of death for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

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

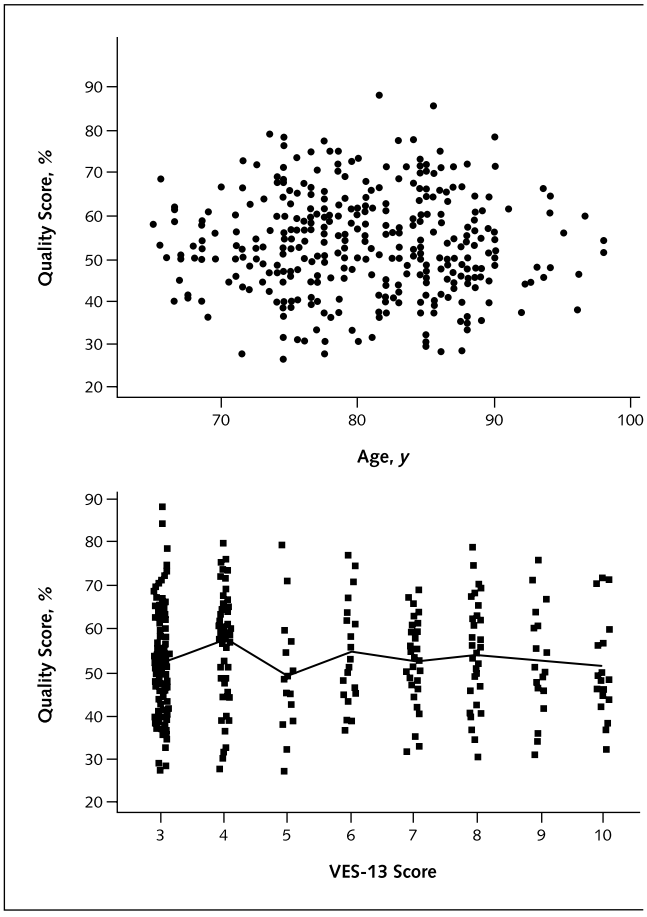


Table 3. **Correlation of the Potential Omitted Confounder with Death and Quality That Would Be Required To Eliminate the Observed Quality–Survival Relationship**

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.

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 association 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.

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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 ≥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., ≤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 ≤ 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 ≤ 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 ≤ 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

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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.