Measuring Quality of Care With Explicit Process Criteria Before and After Implementation of the DRG-Based Prospective Payment System

Katherine L. Kahn, MD; William H. Rogers, PhD; Lisa V. Rubenstein, MD, MSPH; Marjorie J. Sherwood, MD; Ellen J. Reinisch, MS; Emmett B. Keeler, PhD; David Draper, PhD; Jacqueline Kosecoff, PhD; Robert H. Brook, MD, ScD

We developed explicit process criteria and scales for Medicare patients hospitalized with congestive heart failure, myocardial infarction, pneumonia, cerebrovascular accident, and hip fracture. We applied the process scales to a nationally representative sample of 14012 patients hospitalized before and after the implementation of the diagnosis related group–based prospective payment system. For the four medical diseases, a better process of care resulted in lower mortality rates 30 days after admission. Patients in the upper quartile of process scores had a 30-day mortality rate 5% lower than that of patients in the lower quartile. The process of care improved after the introduction of the prospective payment system; eg, better nursing care after the introduction of the prospective payment system was associated with an expected decrease in 30-day mortality rates in pneumonia patients of 0.8 percentage points, and better physician cognitive performance was associated with an expected decrease in 30-day mortality rates of 0.4 percentage points. Overall, process improvements across all four medical conditions were associated with a 1 percentage point reduction in 30-day mortality rates after the introduction of the prospective payment system.

(*JAMA*. 1990;264:1969-1973)

PROCESSES of care—what we do to patients—have been considered an essential component of quality of care measurement for over 50 years.[1-6] Even if outcomes of care—what happens to patients—are the most meaningful measures of quality to the patient, we will be unable to develop clinical methods to improve outcomes unless we understand how processes and outcomes are related. Assessing quality of care by process also provides some measurement advantages over studying outcomes, because not all patients who experience a poor process of care suffer a poor outcome.

The purpose of this article is twofold. First, we report on the development of a set of validated process criteria for elderly patients admitted to the hospital with one of five conditions. By validated we mean that process predicts outcome. Second, we apply the validated process criteria to patients treated before and after the implementation of the prospective payment system (PPS) to determine whether the PPS has been associated with changes in the processes of care.

METHODS

We based our analysis on the sample described in more detail elsewhere in this series.[7]

Developing Process Criteria

We used literature review and consultation with experts to develop a set of process measures for which better process was likely to make a difference in patient outcome. These measures were then presented to disease-specific panels consisting of five to 12 physicians, who were selected by our collaborators, the professional review organizations. Each panel reviewed the suggested criteria to decide whether they believed that data to assess these criteria were reliably recorded in the medical record and whether the criteria made clinical sense. Process criteria based on data whose recording was likely to vary by year, state, or hospital type were excluded. We developed disease-specific abstraction forms[8-12] to collect data on approximately 100 process criteria for each disease.

Scoring Process Criteria

In scoring process criteria, we first applied the criteria only to patients who were likely to benefit from their use. Using this kind of conditional logic, many criteria were applicable to all patients, some to just a few. For example, *if* a patient with congestive heart failure was considered to be severely ill, *then* the intensive care unit should be used. Second, we used clinical judgment to assign scores (points) to each process criterion based on how likely a patient was to benefit from it. For example, use of the intensive care unit for very sick patients was assigned seven points, whereas use of the intensive care unit for moderately sick patients was assigned three points. Third, the process

From the Health Program of the RAND Corp, Santa Monica, Calif (Drs Kahn, Rogers, Rubenstein, Sherwood, Keeler, Draper, and Brook and Ms Reinisch); the Departments of Medicine (Drs Kahn, Rubenstein, Kosecoff, and Brook) and Health Services (Drs Kosecoff and Brook), UCLA; and Value Health Sciences Inc, Santa Monica (Dr Kosecoff).

The opinions, conclusions, and proposals in the text are those of the authors alone and do not necessarily represent the views of the RAND Corp or UCLA.

Reprint requests to the RAND Corp, 1700 Main St, PO Box 2138, Santa Monica, CA 90406-2138 (Dr Kahn).

Table 1.—Examples of Process Criteria and Performance Levels Before and After Introduction of the PPS*

		Patients to Whom Criteria Were Applicable, %		Patients to Whom Criteria Were Applicable Who Met Process Criteria, %	
Criteria	Disease	Before PPS	After PPS	Before PPS	After PPS
Physician Cognitive Scale					
Within the initial 2 days of hospitalization the physician should document each of the following in the medical record as noted or not noted					
Past surgery	Congestive heart failure	100	100	61	66†
Lung examination on day 2	Congestive heart failure	100	100	58	71†
Alcoholism or smoking habits	Acute myocardial infarction	100	100	61	64
Jugular veins	Acute myocardial infarction	100	100	61	68†
Tobacco use or nonuse	Pneumonia	100	100	47	52†
Lower-extremity edema	Pneumonia	100	100	68	75†
Previous cerebrovascular accident	Cerebrovascular accident	100	100	48	53†
Gag reflex	Cerebrovascular accident	100	100	35	38
Mental status	Hip fracture	100	100	68	70
Pedal or leg pulse	Hip fracture	100	100	62	67†
Nurse Cognitive Scale					
On day 2 of the hospitalization at least three blood pressure readings should be noted					
>3 blood pressure readings noted	Congestive heart failure	100	100	78	84†
>3 blood pressure readings noted	Pneumonia	100	100	69	79†
>3 blood pressure readings noted	Cerebrovascular accident	100	100	79	86†
Technical Diagnostic Scale					
Within the initial 2 days of hospitalization an electrocardiogram should be obtained					
Electrocardiogram obtained	Congestive heart failure	100	100	87	91†
Electrocardiogram obtained	Cerebrovascular accident	100	100	82	86†
Electrocardiogram obtained	Hip fracture	100	100	90	93†
Within the initial 2 days of hospitalization a serum potassium determination should be performed					
Serum potassium level determined	Congestive heart failure	100	100	93	97†
Serum potassium level determined	Cerebrovascular accident	100	100	88	94†
Serum potassium level determined	Hip fracture	100	100	89	94†
Technical Therapeutic Scale					
If po_2<60 mm Hg, use oxygen therapy or intubate					
Oxygen therapy or intubation done	Congestive heart failure	16	20	87	93†
Oxygen therapy or intubation done	Pneumonia	23	31	83	90†
Begin antibiotic therapy for patients with pneumonia in a timely manner					
Within 4 hours of admission for nonimmunocompromised patients	Pneumonia	91	88	28	32†
Within 2 hours of admission for nonimmunocompromised patients	Pneumonia	9	12	3	4
Monitoring With Intensive Care and Telemetry Scale					
For patients who are moderately sick‡ use the intensive care unit; telemetry is not sufficient but is preferable to no cardiac monitoring					
Used intensive care unit on day 1	Congestive heart failure	16	16	43	46
Used telemetry on day 1	Congestive heart failure	16	16	8	24†
Used intensive care unit on day 2	Congestive heart failure	6	7	49	41
Used telemetry on day 2	Congestive heart failure	6	7	13	31†
Used intensive care unit on day 1	Pneumonia	17	19	7	9
Used telemetry on day 1	Pneumonia	17	19	4	10†
Used intensive care unit on day 2	Pneumonia	8	8	31	35
Used telemetry on day 2	Pneumonia	8	8	4	12†
For patients who are very sick‡ use the intensive care unit; telemetry is not sufficient but is preferable to no cardiac monitoring					
Used intensive care unit on day 1	Congestive heart failure	5	6	61	71
Used telemetry on day 1	Congestive heart failure	5	6	12	17
Used intensive care unit on day 2	Pneumonia	9	11	42	50
Used telemetry on day 2	Pneumonia	9	11	5	7

*PPS indicates prospective payment system.

†P<.05 compared with before PPS.

‡Moderately sick was defined as a score of 5 or 6 and very sick as a score ≥7 on each hospital day, with points assigned as follows: chest pain, 1 point; shortness of breath, 1 point; confusion, 2 points; heart rate ≥130 beats per minute, 2 points; respiratory rate ≥30/min, 2 points; and diastolic blood pressure ≥105 mm Hg and systolic blood pressure <90 mm Hg, 3 points.

scores accounted for the use of different interventions. Very sick patients received seven of seven points for use of the intensive care unit, three of seven points for use of telemetry, and no points for no cardiac monitoring.

Process Scales

Using clinical judgment we grouped process criteria according to what concept we thought they measured and then tested our groupings by comparing them with those suggested by a Likert scaling model.[13] Use of these methods yielded five process subscales and one overall process scale: physician cognitive, nurse cognitive, technical diagnostic, technical therapeutic, monitoring with intensive care or telemetry, and overall process.

The physician diagnostic cognitive scale measures the physician's performance as a gatherer of data about the patient's medical history and current symptoms and the performance of physical examinations during the hospital stay. The nurse diagnostic cognitive scale measures the nurse's performance as a gatherer of data about the patient's functional status, current symptoms, and vital signs. The technical diagnostic process scale measures use of diagnostic tests (eg, venous laboratory studies, arterial blood gas tests, roentgenograms, and electrocardiograms) that are indicated given the patient's daily burden of illness. The technical therapeutic process scale measures use of treatments (eg, medication, surgery, and physical therapy) that are indicated given the patient's daily sickness level. The intensive care or telemetry monitoring scale evaluates the monitoring of patients as a function of their level of illness. Whereas both the physician and nurse cognitive scales are somewhat dependent on styles of documentation in the medical record, the technical diagnostic, technical therapeutic, and intensive care or telemetry monitoring scales are much less dependent on styles of documentation.

To produce these scales, we combined some process measures applicable to all patients with those applicable to subsets of patients. Sicker patients and those with longer hospital stays had a greater number of applicable process criteria than did less-sick patients. In general, compliance with criteria that were applicable only to sicker patients was lower than compliance with criteria that were applicable to all patients. To avoid a bias when combining criteria to form scales, we standardized all process criteria to have a mean of 0 and an SD of 1. The overall process scale represents an average of the five subscales. A patient who underwent an average process of care has an expected process score of 0 and an SD of 1.

To validate our process scales we used logistic regression to examine the relationship between in-hospital process scale scores and mortality 30 and 180 days after admission after adjusting for disease-specific sickness at admission.[14] Linear regression was also used to determine the association of the PPS with change in process.

Table 2.—Relationships Between Mortality Rates After Admission Adjusted for Sickness at Admission and Overall Process Scale for Five Diseases

Disease	Mortality Rates 30 Days After Admission, Adjusted for Sickness at Admission,[14] by Overall Process Scale Score Category, %*			P†	Relative Risk of Adjusted 30-Day Death for Poor Compared With Good Care Process‡
	Good	Medium	Poor		
Congestive heart failure	10.7	12.9	18.6	<.01	1.74 (0.23)
Acute myocardial infarction	23.9	22.0	30.1	<.01	1.26 (0.11)
Pneumonia	14.8	15.2	20.2	<.01	1.36 (0.16)
Cerebrovascular accident	18.7	20.3	25.5	<.01	1.36 (0.14)
Hip fracture	5.1	5.2	4.6	>.05	0.90 (0.22)

*Patients were rank-ordered according to process scale scores. Patients with process scale scores in the highest 25% were considered to have experienced good process, those with scores in the lowest 25% poor process, and the remainder medium process.

†From tests of the significance of the process coefficients in the logistic regressions of mortality on process and sickness at admission.

‡Values in parentheses are approximate SEs.

RESULTS

Reliability and Validity of Measures

Compliance was high for most of the explicitly stated process criteria (Table 1). However, for 21% of our patients with congestive heart failure, 16% of our patients with acute myocardial infarction, and 24% of our patients with pneumonia, the presence or absence of a heart murmur was not noted in the medical record. For 19% of the patients with congestive heart failure, 26% of the patients with pneumonia, and 17% of the patients with cerebrovascular accidents, fewer than three blood pressure readings were taken on day 2 of the hospitalization. Five percent of the patients with congestive heart failure, 6% of the patients with acute myocardial infarction, 9% of the patients with cerebrovascular accidents, 10% of the patients with pneumonia, and 10% of the patients with hip fractures did not have a serum potassium study done on day 1 or 2 of the hospital stay. One fourth of the patients sick enough to be hospitalized for congestive heart failure did not have a serum creatinine study done in the first 2 days, while one third of the patients with congestive heart failure admitted in a moderately sick or very sick condition did not have any creatinine phosphokinase enzyme studies done on day 1 or 2 of the hospitalization to rule out an acute myocardial infarction.

For patients hospitalized with congestive heart failure, acute myocardial infarction, pneumonia, or cerebrovascular accident, better process is significantly associated with a lower 30-day mortality rate. For patients with congestive heart failure, the mortality rate 30 days after admission, adjusted for sickness at admission, was 11% for patients who experienced good process of care, 13% for those who experienced medium process, and 19% for those who

Table 3.—Relationships Between Mortality Rates 30 Days After Admission Adjusted for Sickness at Admission and Process Scales for Five Diseases

Process Subscale	Congestive Heart Failure: Good Process	Congestive Heart Failure: Poor Process	Acute Myocardial Infarction: Good Process	Acute Myocardial Infarction: Poor Process	Pneumonia: Good Process	Pneumonia: Poor Process	Cerebrovascular Accident: Good Process	Cerebrovascular Accident: Poor Process	Hip Fracture: Good Process	Hip Fracture: Poor Process
	Mortality Rates 30 Days After Admission, Adjusted for Sickness at Admission,[14] by Process Scale Score Category, %*									
Physician cognitive	12	16†	23	28†	15	19†	18	24†	6	5
Nurse cognitive	11	17†	24	27†	15	19†	19	24†	4	6
Technical diagnostic	11	16†	24	29†	14	19†	19	25†	4	5
Technical therapeutic	11	21†	29	21‡	15	21†	§	§	5	5
Monitoring with intensive care and telemetry	18	13	21	28†	19	15	23	21	10	5‡
Overall	11	19†	24	30†	15	20†	19	26†	5	5

*Patients were rank-ordered according to process scale scores. Patients with process scale scores in the highest 25% were considered to have experienced good process, and those with scores in the lowest 25% poor process.

†$P<.05$ using logistic regression of mortality, adjusted for sickness at admission, on process.

‡Paradoxical $P<.05$—a better process was associated with a worse outcome.

§The technical therapeutic scale was not measured for cerebrovascular accident.

Table 4.—Process Scores Before and After Introduction of the PPS*

	Congestive Heart Failure			Acute Myocardial Infarction			Pneumonia		
	Change in Process Score After PPS†	Expected Change in Mortality Rates After PPS, Percentage Points‡		Change in Process Score After PPS†	Expected Change in Mortality Rates After PPS, Percentage Points‡		Change in Process Score After PPS†	Expected Change in Mortality Rates After PPS, Percentage Points‡	
Process Subscale		30-Day	180-Day		30-Day	180-Day		30-Day	180-Day
Physician cognitive	+0.31§	−0.5	−0.7	+0.24§	−0.7	−0.7	+0.24§	−0.4	−0.5
Nurse cognitive	+0.36§	−0.8	−0.6	+0.22§	−0.6	−0.5	+0.42§	−0.8	−1.3
Technical diagnostic	+0.26§	−0.4	−0.0	+0.21§	−0.6	−0.5	+0.23§	−0.4	−0.5
Technical therapeutic	+0.09§	−0.2	−0.1	+0.16§	+0.2¶	+0.3¶	+0.15§	−0.3	−0.4
Monitoring with intensive care and telemetry	+0.21§	−0.2‖	−0.9‖	+0.05	−0.1	−0.1	+0.08	+0.1‖	−0.0‖
Overall process	+0.42§	−1.2	−1.0	+0.27§	−0.8	−0.7	+0.43§	−1.0	−1.6

*PPS indicates prospective payment system.
†Scores are rated on a scale with a mean of 0 and an SD of 1.
‡Mortality rates are adjusted for sickness at admission.
§$P<.05$ for change in process score after the introduction of the PPS.
‖This expected change in mortality rate is included for completeness; however, the process-outcome link was not sufficiently strong for this process scale to accurately predict a change in the mortality rate from the change in the process score.
¶Paradoxical $P<.05$ for the process-outcome relationship—a better process was associated with a worse outcome.
#The technical therapeutic scale was not measured for cerebrovascular accident.

experienced poor process ($P=.0002$). The relative risk of adjusted 30-day death as process changed from good to poor ranged from 1.74 for congestive heart failure to 1.26 for acute myocardial infarction ($P<.05$, Table 2). We were unable to demonstrate a process-outcome link for patients with hip fractures, partly because 5% of patients with hip fractures died, and this low death rate limited our power to detect a process-outcome relationship.

In addition, a significant process-outcome relationship existed for four of the five process subscales for congestive heart failure, acute myocardial infarction, and pneumonia and for three of the four process subscales for cerebrovascular accidents (Table 3). We found a clinically sensible process-outcome link for the monitoring with intensive care and/or telemetry subscale only for patients with acute myocardial infarction; we defined the need for such monitoring more precisely for acute myocardial infarction than we did for the other diseases.

Process of Care Before and After Introduction of the PPS

For each process scale, for all five diseases, we found better process of care after the introduction of the PPS (Table 4). In all instances the improvement was significant ($P<.05$), except for monitoring with intensive care and/or telemetry, for which the process changed significantly ($P<.05$) only for congestive heart failure and hip fracture. The improvements in process after the introduction of the PPS were apparent both for process measures that could have been influenced by changes in documentation in the medical record (eg, the physician and nurse cognitive scales) and for process measures that were unlikely to be affected by such potential biases (eg, the technical diagnostic and technical therapeutic scales).

We used the previously demonstrated process-outcome link to translate the better process of care after the introduction of the PPS into mortality reductions. For example, for patients with congestive heart failure, the improvement in the process of care of 0.31 SD on the physician cognitive process scale was associated with an expected 0.5 percentage point reduction in the 30-day postadmission mortality rate and an expected 0.7 percentage point reduction in the 180-day postadmission mortality rate. Similar improvements in process on the nurse cognitive scale were associated with expected decreases in mortality of 0.8 and 0.6 percentage points at 30 and 180 days, respectively. Except for hip fracture, the improvements in the overall process scale after the introduction of the PPS were associated with an expected reduction of 0.1 to 1.4 percentage points in the 30-day mortality rate and an expected reduction of 0.4 to 1.6 percentage points in the 180-day mortality rate. Aggregating across our four medical diseases, process improvements after the introduction of the PPS were associated with a 1.0 percentage point reduction in the expected 30-day mortality rate (95% confidence limits, 0.6 to 1.4 percentage points). Given that the observed raw 30-day mortality rate for our four medical diseases was 18.7%, the 1.0 percentage point change represents a 5.3% decline in expected mortality associated with the improvements in process.

The improvements in process scale scores paralleled those found in individual items (Table 1). For example, 58% of patients with congestive heart failure had documentation of a day 2 lung examination before the introduction of the PPS compared with 71% after the introduction of the PPS. Nurses documented at least three blood pressure readings on day 2 for 78% of patients with congestive heart failure before the introduction of the PPS compared with 84% after the introduction of the PPS. The use of oxygen (or intubation) on day 1 for hypoxic patients (ie, pO_2 <60 mm Hg) improved from 87% before the introduction of the PPS to 93% after the introduction of the PPS.

COMMENT

We have demonstrated the validity of our process scales by establishing process-outcome links. If our process scores only reflected recording rather than what happened to patients, we would have been unable to find a statistically significant relationship between better processes of care and lower mortality. In addition, if we were measuring only improvements in recording after the introduction of the PPS vs before the PPS, we would have found improvements in process after the introduction of the PPS only for those process measures that depend heavily on recording (eg, physician and nurse process). However, we have demonstrated a significant process-outcome relationship consistently across diseases and across types (ie, recording-sensitive and -insensitive) of process measures. We found the process of care to be better after the introduction of the PPS.

The lack of a consistent process-outcome relationship for scales based on intensive care and telemetry monitoring was disappointing. We believe the

Cerebrovascular Accident			Hip Fracture		
Change in Process Score After PPS†	Expected Change in Mortality Rates After PPS, Percentage Points‡		Change in Process Score After PPS†	Expected Change in Mortality Rates After PPS, Percentage Points‡	
	30-Day	180-Day		30-Day	180-Day
+0.36§	−0.8	−0.4	+0.16§	+0.1‖	−0.0‖
+0.46§	−0.8	−0.5	+0.31§	−0.1‖	−0.3‖
+0.25§	−0.6	−0.4	+0.22§	−0.0‖	−0.2‖
#	#	#	+0.29§	−0.1‖	−0.2‖
+0.08	−0.2‖	−0.2‖	−0.04§	−0.1¶	−0.2¶
+0.49§	−1.4	−1.0	+0.41§	−0.0‖	−0.4

problem lies in our imperfect measurement of the *if* in the if-then process statements. We need to better understand how to identify the group of patients for whom use of intensive care and telemetry monitoring makes a difference.[15]

It is notable that we found a significant process-outcome relationship for patients with all four of the medical diseases but not for patients with hip fractures. This may be because short-term mortality occurs less often for patients with hip fractures than for those with medical diseases. Alternatively, mortality may not be the best outcome to study for patients with hip fractures. Another possibility is that the medical record does not provide an adequate data source for evaluating surgical, particularly intraoperative, processes. Methods for better evaluating surgical processes of care are needed.

Our consistent findings across process subscales and diseases suggest that the process of care has improved from 1981 to 1986. The implementation of the PPS was not associated with a deterioration in care, even in those areas that were most sensitive to the financial incentives provided by prospective payment to decrease the level of services, such as nursing activities and the use of intensive care units. This is an encouraging finding and indicates that the 24% decrease in length of stay after the introduction of the PPS was not associated with a deterioration in the process of in-hospital care. If anything, improvements in the process of care after the introduction of the PPS should lead to about a 1 percentage point reduction in the 30-day mortality rate. This effect was produced by improvements in both physician and nursing care.

Our other notable result was the large difference in mortality, adjusted for admission sickness, between patients at the top and bottom ends of our overall process scale. For the four medical conditions combined, the adjusted mortality rate went from 17.0% to 23.6% as the process went from the highest to the lowest quartile, an effect more than six times greater than the effect on expected mortality of process improvements after the introduction of the PPS. Further analyses may identify which types of patients and hospitals tend to fall in the lower or upper process quartiles. With this information an ongoing clinical system for improving care can be developed through which professionals can improve the care they give and thereby improve the health of the American people.

This study was supported by cooperative agreement 18-C-98853/9-03 issued by the Health Care Financing Administration of the US Department of Health and Human Services. The entire costs to the RAND Corp for this project ($3.9 million) were funded with federal money.

We gratefully acknowledge the collaborative effort of the five professional review organizations that enabled this work to be completed. Participants from the professional review organizations included medical directors, physician-consultants and -reviewers, project directors, and review coordinators from each of the five study states. In particular, we appreciate the keen clinical insight of the specialist physicians from the professional review organizations with whom we consulted throughout this study. We also acknowledge the many contributions of Harry Savitt, PhD, project officer from the Office of Research and Demonstrations of the Health Care Financing Administration of the US Department of Health and Human Services, whose administrative skills, astute commentary, and continuing support helped us immeasurably. Stanley S. Bentow, MS; Maureen Carney, MS; Patricia A. Damiano; Carole Chew, RRA, MPH; Linda Ferguson; Caren Kamberg, MSPH; Nancy J. Palmer; and Carol Roth, RN, MPH, were key contributors to project development and implementation. Andrea Steiner, MS, gave valuable editorial advice. Our policy advisory board (John C. Beck, MD; Barbara J. Burns, PhD; Monroe T. Gilmour, MD; Paul F. Griner, MD; Charlene Harrington, RN, PhD; T. Reginald Harris, MD; Rosalie Kane, DSW; Shirley Kellie, MD; Judith R. Lave, PhD; Charles E. Lewis, MD; Joseph Martin; Francis D. Moore, Jr, MD; Richard N. Pierson, Jr, MD; and James F. Rodgers, PhD) provided astute advice and guidance. We acknowledge the important contributions of the 297 hospitals whose medical records we reviewed. Without the efforts of these individuals and institutions, this evaluation could not have been successfully completed. Finally, we thank Florence McGinty, without whose secretarial skills this article would not have been produced.

References

1. Donabedian A. Evaluating the quality of medical care. *Milbank Q.* 1966;44:166-203.
2. Brook RH, Appel RA. Quality of care assessment: choosing a method for peer review. *N Engl J Med.* 1973;288:1323-1329.
3. Wyszewianski L. Quality of care: past achievements and future challenges. *Inquiry.* 1988;25:13-22.
4. McAuliffe WE. Studies of process-outcome correlations in medical audits: a critique. *Med Care.* 1978;16:907-930.
5. Rubenstein LV, Mates S, Sidel VW. Quality of care assessment by process and outcome scoring. *Ann Intern Med.* 1977;86:617-625.
6. Greenfield S, Cretin S, Worthman L. Comparison of criteria maps to a criteria list in quality of care assessment for patients with chest pain: the relation of each to outcome. *Med Care.* 1981;19:255-272.
7. Draper D, Kahn KL, Reinisch EJ, et al. Studying the effects of the DRG-based prospective payment system on quality of care: design, sampling, and fieldwork. *JAMA.* 1990;264:1956-1961.
8. Kahn KL, Chassin MR, Rubenstein LV, et al. *Medical Record Abstraction Form and Guidelines for Assessing Quality of Care for Hospitalized Patients With Congestive Heart Failure.* Santa Monica, Calif: RAND Corp; 1988. N-2798-HCFA.
9. Rubenstein LV, Kosecoff J, Kahn KL, et al. *Medical Record Abstraction Form and Guidelines for Assessing Quality of Care for Hospitalized Patients With Cerebrovascular Accident.* Santa Monica, Calif: RAND Corp; 1988. N-2802-HCFA.
10. Kosecoff J, Rubenstein LV, Kahn KL, et al. *Medical Record Abstraction Form and Guidelines for Assessing Quality of Care for Hospitalized Patients With Acute Myocardial Infarction.* Santa Monica, Calif: RAND Corp; 1988. N-2799-HCFA.
11. Sherwood MJ, Kahn KL, Kosecoff J, et al. *Medical Record Abstraction Form and Guidelines for Assessing Quality of Care for Hospitalized Patients With Hip Fracture.* Santa Monica, Calif: RAND Corp; 1988. N-2800-HCFA.
12. Roth CP, Kahn KL, Sherwood MJ, et al. *Medical Record Abstraction Form and Guidelines for Assessing Quality of Care for Hospitalized Patients With Pneumonia.* Santa Monica, Calif: RAND Corp; 1988. N-2801-HCFA.
13. Nunnally JC. Assessment of reliability. In: Nunnally JC, ed. *Psychometric Theory.* New York, NY: McGraw-Hill International Book Co; 1978:193-197.
14. Keeler EB, Kahn KL, Draper D, et al. Changes in sickness at admission following the introduction of the prospective payment system. *JAMA.* 1990; 264:1962-1968.
15. Griner PF. Medical intensive care in the teaching hospital: costs versus benefits: the need for an assessment. *Ann Intern Med.* 1973;78:581-585.