

*Quality of Health Care***PART 2: MEASURING QUALITY OF CARE**

UNTIL recently, we relied primarily on professional judgment to ensure that patients received high-quality medical care. Hospitals routinely monitored poor outcomes, such as deaths or infections, to identify ways to improve the quality of care. In rare cases, medical societies reviewed the performance of physicians. However, monitoring of and improvement in quality were generally left to individual clinicians.

This situation has changed dramatically. We have learned that practice patterns and the quality of medical care vary much more than many people had realized, our ability to measure the quality of care has advanced considerably, and clinicians are increasingly interested in having objective information about their practices. Furthermore, patients and purchasers want to know more about the quality of care available to them.

Rudimentary methods of monitoring care, such as utilization review and profiling, are now widely used by insurers and managed-care companies to improve the efficiency of services. Because these approaches are often described as measuring quality, many physicians assume they are the best we can do, even though they are based largely on administrative or billing data and lack clinical details. Fortunately, this assumption is wrong. We now have sophisticated and efficient methods of measuring quality that can help clinicians and institutions improve the quality of the medical care they provide. In this article, we review various approaches to the assessment of quality and describe some of their advantages and disadvantages.

Two important caveats should be kept in mind. First, it will never be possible to produce an error-free measure of the quality of care. Because poor measures of quality can unfairly harm institutions and physicians, every effort should be made to use state-of-the-art measures, even if their use requires additional expenditures. Second, the quality of care can be assessed at several levels, from the care provided by individual health care professionals (e.g., nurses or physicians) to the care provided by a health plan. The measurement issues we discuss are relevant to all these levels, although we emphasize assessment at the level of the health plan.

STRUCTURE, PROCESS, AND OUTCOME

Quality of care can be evaluated on the basis of structure, process, or outcome.¹⁻⁶ Structural data are

characteristics of physicians and hospitals (e.g., a physician's specialty or the ownership of a hospital).⁷ Process data are the components of the encounter between a physician or another health care professional and a patient (e.g., tests ordered). Outcome data refer to the patient's subsequent health status (e.g., an improvement in symptoms or mobility).

If quality-of-care criteria based on structural or process data are to be credible, it must be demonstrated that variations in the attribute they measure lead to differences in outcome. If outcome criteria are to be credible, it must be demonstrated that differences in outcome will result if the processes of care under the control of health professionals are altered.

People who criticize the use of process data to measure the quality of care worry that these measures may not be important predictors of outcomes. These critics argue that if resources were directed toward improving the processes of care represented by these measures, the cost of medical care might increase without producing any corresponding improvement in health.⁸

People who criticize the use of outcome measures believe that most differences in outcomes among patients receiving the same treatment are the result of factors not under the control of health care providers, such as differences in patients' characteristics. Thus, they argue that conclusions about quality that are based on outcome measures may be invalid.

When used appropriately, however, both process and outcome measures can provide valid information about the quality of care. Process data are usually more sensitive measures of quality than outcome data, because a poor outcome does not occur every time there is an error in the provision of care.

METHODS OF QUALITY ASSESSMENT

There are five methods by which quality can be assessed on the basis of process data, outcome data, or both.⁹ The first three methods are implicit — that is, there are no prior standards or agreements about what reflects good or poor quality. With each of these methods, a health care professional (usually a physician) reviews a data source (usually a medical record, after care has been provided) and answers one of the following questions: Was the process of care adequate (first method)? Could better care have improved the outcome (second method)? Considering both the process and outcome of care, was the overall quality of care acceptable (third method)?

The fourth method evaluates the provision of care with the use of explicit process criteria.¹⁰ For example, if we were examining the quality of care received by a patient with diabetes, we might ask the following questions: Did the patient undergo an annual funduscopic examination by an ophthalmologist? Were the patient's feet professionally examined an-

nually? A nurse or medical-record technician trained in quality assessment would then compare what was done to what should have been done, and the result would be expressed as the proportion of criteria that were met.

The fifth method uses explicit a priori criteria to determine whether the observed results of care are consistent with the outcome predicted by a model that has been validated on the basis of scientific evidence and clinical judgment. For example, we might ask the following question: In a population of patients with type II diabetes and specific clinical characteristics, what are the expected outcomes at one year as a result of excellent, average, or poor care? We might predict that with excellent care, 95 percent of the patients will have normal glycosylated hemoglobin levels and 80 percent will be within 20 percent of their normal body weight; with average care, these proportions will be 75 and 50 percent, respectively. These explicit expectations are then compared with the actual outcomes.

The results of the assessment will vary according to the method used. The explicit process method is the most strict, the implicit outcome method the least strict. Consider a group of patients who are admitted to the hospital with heart attacks. If we provide no care for them, most will survive and have a good outcome. On the other hand, if we provide everything we can for them, from thrombolytic therapy to appropriate monitoring, a few more patients will live, and a few others will have a better functional status. An explicit process assessment would indicate that everyone received poor care in the first case and excellent care in the second case. However, the differences would be much smaller if an implicit outcome assessment were used to measure the quality of care.

In one study, the explicit process method indicated that 2 percent of patients received adequate care, whereas the implicit outcome method indicated that 63 percent received adequate care.⁹ There are good reasons for thinking that the 2 percent figure is correct. If the process criteria are specified correctly, on the basis of rigorous clinical data and expert clinical judgment, they will reflect the potential benefit of excellent care for the other 61 percent of the patients. As we have observed, however, many patients get better even when they do not receive all the care that they need. For many chronic conditions, the time between the performance of the key processes of care and the outcome of that care may be quite long. A patient with diabetes and poorly controlled blood sugar may not have retinopathy or require amputation of a leg for 10 or 20 years. But we can determine whether the patient is receiving the necessary annual monitoring. More important, routine monitoring should increase the likelihood that action will be taken to improve the odds of achieving

a positive outcome earlier (i.e., before an adverse outcome occurs). It is therefore not surprising that when physicians are asked to describe what they mean by quality of care, they define it in terms of process rather than outcome (i.e., they would find it unacceptable if patients who were ideal candidates for thrombolytic therapy but did not receive it were considered to have received good care because they were lucky enough to live).¹¹

For all these reasons, the assessment of quality should depend much more on process data than on outcome data, especially when those systems are used to compare health plans or physicians. There are, of course, exceptions to the rule — for example, the method used to compare differences in outcome after coronary-artery bypass surgery.¹²⁻¹⁵ There has been extensive research on the best way to adjust statistically for case-mix differences when assessing the outcome of such surgery, there is strong evidence of the link between the quality of care and survival, death after coronary-artery bypass is common enough to be used as a measure of differences in the quality of care, and differences in mortality among institutions or among groups of patients receiving coronary-artery bypass surgery can be assessed relatively soon after the surgery. Furthermore, because numerous aspects of the care that are also difficult to measure influence postsurgical mortality (e.g., the physician's skill in the operating room), differences in survival may reflect differences in quality not revealed by a limited number of process assessments. Alternatively, we might prefer to use adjusted outcomes to evaluate the potential effect of a change in policy designed to reduce health care expenditures. For example, adjusted mortality rates were used in a quasi-experimental design to determine whether the prospective-payment system had a positive or negative effect on quality.

SELECTING SOURCES OF DATA

After deciding what method of quality assessment should be used, the next step is to determine the appropriate source of data. Data used in quality assessment are obtained from diverse sources, such as records maintained by insurance companies to reimburse physicians, clinical records maintained by health care professionals, survey data collected for quality-assessment purposes, and direct observations of the physician-patient encounter. Each source of data produces a different view of the quality of care.¹⁶ For example, suppose we asked a patient who had been told she had breast cancer whether the doctor had discussed options for removing the cancer. Because of the emotional impact of the news, the patient might not remember whether the doctor had discussed therapeutic options. The doctor might not have recorded that discussion in the patient's medical record, but an audiotape would have cap-

tured the entire conversation. Which data source will result in the most valid assessment of quality? The answer depends on the purpose of the assessment. If the purpose is to determine whether the patient comprehended the relevant information, then survey data are most appropriate.¹⁷⁻¹⁹ If one wants to determine whether the physician informed the patient of her options, then the audiotape is the best source of information. Finally, if one wants to determine whether one doctor recorded enough information to allow another physician caring for the patient to know what had been done, then the medical record would be the best source of data. Thus, the appropriate source of data for quality assessment depends on the purpose for which the information will be used.

SUCCESSFUL EXAMPLES OF DEVELOPING MEASURES OF QUALITY

It is important for clinicians to understand that the information they see on physician profiles or utilization-review reports almost never reflects the knowledge we have accumulated in the past few years about how best to measure quality. It would be regrettable to lose support and momentum in the area of quality monitoring because of bad experiences with these management tools. Although it is impossible to provide a comprehensive or even representative review of assessment techniques here, several examples will illustrate their potential.

The Agency for Health Care Policy and Research has used both literature reviews and expert opinion to establish guidelines for care and quality-of-care criteria.²⁰⁻³⁰ The scientific literature has also been used to develop evidence-based practice guidelines³¹⁻³⁴ and to evaluate both the appropriateness of use³⁵⁻⁴¹ of procedures and the quality of inpatient care received by patients with heart failure, pneumonia, or stroke.⁴² In the United Kingdom, the Cochrane Centre conducts similar reviews.⁴³ In addition, the Agency for Health Care Policy and Research has recently funded a project, Consumer Assessments of Health Plans, to advance the state of the art in asking patients about the quality of their health care.

After the scientific literature has been reviewed, specific criteria of the quality of care are enumerated and categorized by the level of evidence (randomized controlled trials, observational studies, or expert opinion) supporting them. To be useful, these criteria must be as clinically detailed as possible and must cover diverse topics, such as what drugs were used in a patient with asthma, whether smoking cessation was recommended for smokers with stable angina, or whether the appropriate candidates were offered coronary-artery bypass surgery. Once the criteria have been developed, data sources for evaluating compliance with them need to be identified.

To perform an explicit outcome assessment, such

as comparing mortality at 30 days among patients undergoing coronary-artery bypass surgery at various hospitals or assessing differences in symptoms, functioning, and survival among patients receiving different types of treatment,⁴⁴ all the above steps must be taken, with special attention to adjustments for differences in case mix. Such adjustments require a conceptual model that links variables such as age, coexisting conditions, clinical signs, and symptoms to the outcomes being assessed.⁴⁵ All these variables must be measured and appropriate statistical tests used to adjust for differences in them when comparing performance with an explicit standard. Appropriate use of the explicit outcome method virtually always requires detailed clinical data.⁴⁶⁻⁵⁴

CONGRUITY OF ASSESSMENT MEASURES

If performed well, the various methods for assessing the quality of care will produce congruent, albeit different, results. For example, in a national study of the influence of prospective payment on the quality of hospital care, data were obtained from the medical records of 11,250 patients presenting to a random sample of 297 hospitals with heart attack, pneumonia, stroke, or congestive heart failure. The quality of care was assessed by three of the above methods: the implicit process method, the explicit process method with branching criteria (e.g., if blood pressure is x , then y should be done), and the explicit outcome method, which looked at 30-day mortality after adjustment for the severity of illness at the time of hospitalization.⁴²

With the explicit process method, hospitals in the lowest quartile of quality had about 5 to 6 more deaths per 100 people admitted than hospitals in the top quartile of the distribution, after adjustment for patients' characteristics at the time of admission.⁵⁵ Similarly, in a study of the quality of care provided by teaching hospitals, other urban hospitals, and rural hospitals, all three measures of quality — explicit process, implicit process, and explicit outcome (adjusted death rate) — showed that teaching hospitals provided higher-quality care than other urban hospitals, and rural hospitals provided lower-quality care than urban hospitals. Thus, the results of the methods were congruent.⁵⁶

COMPREHENSIVENESS OF QUALITY-OF-CARE MEASURES

There is scant evidence that one can generalize from the quality of care for one set of symptoms or diseases to the quality of care for another set of symptoms or diseases. For example, in the prospective-payment study, hospitals that provided a higher quality of care for patients with heart attacks also provided a higher quality of care for patients who had heart failure or pneumonia, but the correlations, although significant, were weak. Likewise, a study of

the process of prenatal care in several health maintenance organizations demonstrated that performance on one set of measures that involved screening was not closely correlated with performance on measures that involved follow-up of abnormalities found on screening.⁵⁷ A study of six medical and surgical interventions at six teaching hospitals showed that the rank ordering of the hospitals' performance in terms of both process and outcome measures differed depending on the intervention.⁵⁸ Although there is some evidence supporting the concept of high-quality performance by a physician or hospital, that evidence is not sufficient to allow one to generalize about quality on the basis of a few conditions, diagnoses, or symptoms. Such generalizations are especially problematic when different types of medical functions are evaluated, such as screening, prevention, diagnosis, and treatment. Thus, a sound measure of the quality of care must include separate measures for these functions.

It takes skill, time, and money to evaluate the scientific literature, update criteria as science changes, develop and administer valid data-collection instruments, and analyze the results with appropriate methods. It is therefore not surprising that the most widely used system for measuring the performance of health plans, the Health Plan Employer Data and Information Set (HEDIS) 2.5, is based mostly on readily available administrative data.⁵⁹ The system contains nine indicators of quality, seven of which are process indicators; five of these process indicators are related to prevention. We do not know whether plans that perform well on the basis of these preventive measures are likely to perform well in the diagnosis and treatment of serious acute and chronic illnesses. The developers of HEDIS understand this problem and recently issued a call for measures that will expand the system's coverage beyond preventive care. Some of these new measures will require data sources other than traditional administrative records; more detailed clinical data will be needed, as well as the patient's perspective on the quality of care received. A new version of HEDIS that assesses the quality of care for chronic conditions will be much more expensive to use than is HEDIS 2.5. We need to educate the public and other purchasers about the value of using more sophisticated and clinically meaningful measurement techniques.

CONCLUSIONS

Tools are now available to measure quality efficiently.⁶⁰ Our goal should be to ensure that all patients receive care considered to be high in quality on the basis of scientific data and expert judgment. To meet this goal will require an assessment of quality that is based largely on process criteria; we believe this orientation toward process will prove fruitful in preventing a deterioration in the quality of

care in the long run. In this endeavor, however, we must use only process measures for which we have sound scientific evidence or a formal consensus of experts that the criteria we are using do indeed, when applied, lead to an improvement in health. We can thus ensure that the quality of care remains on the political agenda as we try to improve the health of our patients.

ROBERT H. BROOK, M.D., Sc.D.
ELIZABETH A. MCGLYNN, Ph.D.

RAND
Santa Monica, CA 90407

PAUL D. CLEARY, Ph.D.
Harvard Medical School
Boston, MA 02115

Address reprint requests to Dr. Brook at RAND, 1700 Main St., Santa Monica, CA 90407.

We are indebted to the Commonwealth Fund for the discussions that led to the ideas presented in this article.

REFERENCES

1. Donabedian A. Explorations in quality assessment and monitoring. Vol. 1. The definition of quality and approaches to its assessment. Ann Arbor, Mich.: Health Administration Press, 1980.
2. *Idem*. Explorations in quality assessment and monitoring. Vol. 2. The criteria and standards of quality. Ann Arbor, Mich.: Health Administration Press, 1982.
3. *Idem*. Explorations in quality assessment and monitoring. Vol. 3. The methods and findings of quality assessment and monitoring: an illustrated analysis. Ann Arbor, Mich.: Health Administration Press, 1985.
4. Brook RH, Davies-Avery A, Greenfield S, et al. Assessing the quality of medical care using outcome measures: an overview of the method. *Med Care* 1977;15:Suppl.
5. Brook RH, Ware JE Jr, Davies-Avery A, et al. Overview of adult health measures fielded in RAND's Health Insurance Study. *Med Care* 1979;17: Suppl.
6. Lohr KN, Brook RH, Kamberg CJ, et al. Use of medical care in the RAND Health Insurance Experiment: diagnosis- and service-specific analyses in a randomized controlled trial. *Med Care* 1986;24:Suppl:S1-S87.
7. Brennan TA, Hebert LE, Laird NM, et al. Hospital characteristics associated with adverse events and substandard care. *JAMA* 1991;265:3265-9.
8. Ellwood PM. Outcomes management: a technology of patient experience. *N Engl J Med* 1988;318:1549-56.
9. Brook RH, Appel FA. Quality-of-care assessment: choosing a method for peer review. *N Engl J Med* 1973;288:1323-9.
10. Ashton CM, Kuykendall DH, Johnson ML, et al. A method of developing and weighting explicit process of care criteria for quality assessment. *Med Care* 1994;32:755-70.
11. Doorey AJ, Michelson EL, Topol EJ. Thrombolytic therapy of acute myocardial infarction: keeping the unfulfilled promises. *JAMA* 1992;268: 3108-14.
12. O'Connor GT, Plume SK, Olmstead EM, et al. A regional intervention to improve the hospital mortality associated with coronary artery bypass graft surgery. *JAMA* 1996;275:841-6.
13. Hannan EL, Kilburn H Jr, O'Donnell JF, Lukacik G, Shields EP. Adult open heart surgery in New York State: an analysis of risk factors and hospital mortality rates. *JAMA* 1990;264:2768-74.
14. Parsonnet V, Dean D, Bernstein AD. A method for uniform stratification of risk for evaluating the results of surgery in acquired adult heart disease. *Circulation* 1989;79:Suppl I:I-3-I-12. [Erratum, *Circulation* 1990; 82:1078.]
15. Report of the Ad Hoc Committee on Risk Factors for Coronary Artery Bypass Surgery. *Ann Thorac Surg* 1988;45:348-9.
16. Wilson A, McDonald P. Comparison of patient questionnaire, medical record, and audio tape in assessment of health promotion in general practice consultations. *BMJ* 1994;309:1483-5.

17. Cleary PD, McNeil BJ. Patient satisfaction as an indicator of quality care. *Inquiry* 1988;25:25-36.
18. Meterko M, Nelson EC, Rubin HR, eds. Patient judgments of hospital quality: report of a pilot study. *Med Care* 1990;28(9):Suppl 9.
19. Davies AR, Ware JE Jr. Involving consumers in quality of care assessment. *Health Aff (Millwood)* 1988;7(1):33-48.
20. Cataract Management Guideline Panel. Cataract in adults: management of functional impairment. Clinical practice guideline. No. 4. Rockville, Md.: Department of Health and Human Services, 1993. (AHCPR publication no. 93-0542.)
21. Depression Guideline Panel. Depression in primary care. Vol. 1. Detection and diagnosis. Clinical practice guideline, No. 5. Rockville, Md.: Department of Health and Human Services, 1993. (AHCPR publication no. 93-0550.)
22. Sickle Cell Disease Guideline Panel. Sickle cell disease: screening, diagnosis, management, and counseling in newborns and infants. Clinical practice guideline. No. 6. Rockville, Md.: Department of Health and Human Services, 1993. (AHCPR publication no. 93-0562.)
23. El-Sadr W, Oleske JM, Agins BD, et al. Evaluation and management of early HIV infection. Clinical practice guideline. No. 7. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 94-0572.)
24. McConnell JD, Barry MJ, Bruskewitz RC, et al. Benign prostatic hyperplasia: diagnosis and treatment. Clinical practice guideline. No. 8. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 94-0582.)
25. Konstam MA, Dracup K, Baker DW, et al. Heart failure: evaluation and care of patients with left-ventricular systolic dysfunction. Clinical practice guideline. No. 11. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 94-0612.)
26. Stool SE, Berg AO, Berman S, et al. Otitis media with effusion in young children. Clinical practice guideline. No. 12. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 94-0622.)
27. Bassett LW, Hendrick RE, Bassford TL, et al. Quality determinants of mammography. Clinical practice guideline. No. 13. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 95-0632.)
28. Bigos S, Bowyer O, Braen G, et al. Acute low back problems in adults. Clinical practice guideline. No. 14. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 95-0642.)
29. Bergstrom N, Allman RM, Alvarez OM, et al. Treatment of pressure ulcers. Clinical practice guideline. No. 15. Rockville, Md.: Department of Health and Human Services, 1994. (AHCPR publication no. 95-0652.)
30. Wenger NK, Froelicher ES, Smith LK, et al. Cardiac rehabilitation. Clinical practice guideline. No. 17. Rockville, Md.: Department of Health and Human Services, 1995. (AHCPR publication no. 96-0672.)
31. Chalmers I, Enkin M, Keirse MJN, eds. Effective care in pregnancy and childbirth. Vol. 1. Pregnancy. Oxford, England: Oxford University Press, 1989.
32. Eccles M, Clapp Z, Grimshaw J, et al. North of England Evidence Based Guidelines Development Project: methods of guideline development. *BMJ* 1996;312:760-2.
33. North of England Asthma Guideline Development Group. North of England Evidence Based Guidelines Development Project: summary version of evidence based guideline for the primary care management of asthma in adults. *BMJ* 1996;312:762-6.
34. North of England Stable Angina Guideline Development Group. North of England Evidence Based Guidelines Development Project: summary version of evidence based guideline for the primary care management of stable angina. *BMJ* 1996;312:827-32.
35. Shekelle PG, Adams AH, Chassin MR, et al. The appropriateness of spinal manipulation of low-back pain: indications and ratings by a multidisciplinary expert panel. Santa Monica, Calif.: RAND, 1991. (Publication R-4025/2-CCR/FCER.)
36. Hilborne LH, Leape LL, Kahan JP, Park RE, Kamberg CJ, Brook RH. Percutaneous transluminal coronary angioplasty: a literature review and ratings of appropriateness and necessity. Santa Monica, Calif.: RAND, 1991. (Publication JRA-01-CWF/HF.)
37. Leape LL, Hilborne LH, Kahan JP, et al. Coronary artery bypass graft: a literature review and ratings of appropriateness and necessity. Santa Monica, Calif.: RAND, 1991. (Publication JRA-02-CWF/HF.)
38. Bernstein SJ, Laouri M, Hilborne LH, et al. Coronary angiography: a literature review and ratings of appropriateness and necessity. Santa Monica, Calif.: RAND, 1992. (Publication JRA-03-CWF/HF.)
39. Ballard DJ, Etchason JA, Hilborne LH, et al. Abdominal aortic aneurysm surgery: a literature review and ratings of appropriateness and necessity. Santa Monica, Calif.: RAND, 1992. (Publication JRA-04-CWF/HF.)
40. Matchar DB, Goldstein LB, McCrory DC, et al. Carotid endarterectomy: a literature review and ratings of appropriateness and necessity. Santa Monica, Calif.: RAND, 1992. (Publication JRA-05-CWF/HF.)
41. Bernstein SJ, McGlynn EA, Kamberg CJ, et al. Hysterectomy: a literature review and ratings of appropriateness. Santa Monica, Calif.: RAND, 1992. (Publication JR-04.)
42. Kahn KL, Draper D, Keeler EB, et al. A summary of the effects of DRG-based prospective payment system on quality of care for hospitalized Medicare patients. Santa Monica, Calif.: RAND, 1990. (Publication N-3132-HCEFA.)
43. Chalmers I, Enkin M, Keirse MJ. Preparing and updating systematic reviews of randomized controlled trials of health care. *Milbank Q* 1993;71:411-37.
44. Guadagnoli E, Hauptman PJ, Ayanian JZ, Pashos CL, McNeil BJ, Cleary PD. Variation in the use of cardiac procedures after acute myocardial infarction. *N Engl J Med* 1995;333:573-8.
45. Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life: a conceptual model of patient outcomes. *JAMA* 1995;273:59-65.
46. Green J, Wintfeld N. Report cards on cardiac surgeons — assessing New York State's approach. *N Engl J Med* 1995;332:1229-32.
47. Green J, Wintfeld N, Sharkey P, Passman LJ. The importance of severity of illness in assessing hospital mortality. *JAMA* 1990;263:241-6.
48. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. An evaluation of outcome from intensive care in major medical centers. *Ann Intern Med* 1986;104:410-8.
49. Hannan EL, Kilburn H Jr, Bernard H, O'Donnell JF, Lukacik G, Shields EP. Coronary artery bypass surgery: the relationship between in-hospital mortality rate and surgical volume after controlling for clinical risk factors. *Med Care* 1991;29:1094-107.
50. Hannan EL, Kilburn H Jr, O'Donnell JF, Lukacik G, Shields EP. Intra-aortic access to selected cardiac procedures for patients hospitalized with coronary artery disease in New York State. *Med Care* 1991;29:430-41.
51. Iezzoni LI. Monitoring quality of care: what do we need to know? *Inquiry* 1993;30:112-4.
52. Iezzoni LI, Foley SM, Daley J, Hughes J, Fisher ES, Heeren T. Comorbidities, complications, and coding bias: does the number of diagnosis codes matter in predicting in-hospital mortality? *JAMA* 1992;267:2197-203.
53. Iezzoni LI, Restuccia JD, Shwartz M, et al. The utility of severity of illness information in assessing the quality of hospital care: the role of the clinical trajectory. *Med Care* 1992;30:428-44.
54. Iezzoni LI, Shwartz M, Moskowitz MA, Ash AS, Sawitz E, Burnside S. Illness severity and costs of admissions at teaching and nonteaching hospitals. *JAMA* 1990;264:1426-31.
55. Kahn KL, Rogers WH, Rubenstein LV, et al. Measuring quality of care with explicit process criteria before and after implementation of the DRG-based prospective payment system. *JAMA* 1990;264:1969-73.
56. Keeler EB, Rubenstein LV, Kahn KL, et al. Hospital characteristics and quality of care. *JAMA* 1992;268:1709-14.
57. Murata PJ, McGlynn EA, Siu AL, et al. Quality measures for prenatal care: a comparison of care in six health care plans. *Arch Fam Med* 1994;3:41-9.
58. Cleary PD, Greenfield S, Mulley AG, et al. Variations in length of stay and outcomes for six medical and surgical conditions in Massachusetts and California. *JAMA* 1991;266:73-9.
59. Key findings and lessons learned: 21 plans' performance profiles. NCQA Technical Report. Washington, D.C.: Report Card Pilot Project, 1993.
60. Brook RH. Quality of care: do we care? *Ann Intern Med* 1991;115:486-90.

©1996, Massachusetts Medical Society.