

Measuring and Improving Quality of Care A Report From the American Heart Association/American College of Cardiology First Scientific Forum on Assessment of Healthcare Quality in Cardiovascular Disease and Stroke

Quality of Care and Outcomes Research in CVD and Stroke Working Groups*

Quantifying and improving the quality of health care is an increasingly important goal in American medicine. To address this need, the First Scientific Forum on Assessment of Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke was held May 24 to May 26, 1999. This conference brought together providers, researchers, payers (eg, the Health Care Financing Administration [HCFA] and the US Department of Veterans Affairs [VA]), managed care, industry, and assessors of healthcare quality (eg, the Joint Commission on Accreditation of Healthcare Organizations [JCAHO], National Committee for Quality Assurance [NCQA], and Foundation in Accountability [FACCT]) to discuss the current state of quality assessment in cardiovascular disease and stroke. An important aspect of the forum was the 4 working groups that were formed to focus on acute myocardial infarction (AMI), heart failure, stroke, and methods of quality assessment and improvement. Members of the working groups are listed in the Appendix. The discussion and lectures that took place at the conference illuminated several important methodological challenges inherent in judging the quality of health care and evaluating changes in it over time. This summary highlights several of the most important topics in quality measurement. It also includes summary reports on quality measurement provided by conference working groups on AMI, heart failure, and stroke.

Topics in Quality Measurement

Involvement of Healthcare Providers

The importance of measuring and monitoring healthcare quality is no longer in doubt. Yet quantifying healthcare quality is a complex and challenging process for which public and payer demands clearly exceed current capabilities. The conference presenters and participants articulated the view that healthcare professionals need to engage in efforts to evaluate quality of care to ensure its relevance and validity.

From selecting patient cohorts to guiding analyses and interpretation, the entire process of quality assessment requires judgment and choices that should be influenced by the clinical realities of medical care, a perspective that clinicians uniquely possess. Accordingly, it is considered essential that healthcare providers acquire the knowledge to participate actively in the assessment of healthcare quality.

Guidelines Are Not Performance Measures

Assessing quality requires the development and application of performance measures. Performance measures are explicit standards of care against which actual clinical care is judged. Given the availability of evidenced-based guidelines for the management of patients with cardiovascular and neurological disease, there is a natural inclination to use these consensus statements as a basis for developing performance measures for the evaluation of healthcare quality. However, guidelines are not performance measures. Guidelines are written to suggest diagnostic or therapeutic interventions for most patients in most circumstances. The use of guideline recommendations in diagnosing and treating individual patients is left to the discretion of the physician. In contrast, performance measures are standards of care that imply that physicians are in error if they do not care for patients according to these standards. Therefore, in addition to stating an explicit diagnostic or therapeutic action to be performed, performance measures must also define how to practically identify those patients for whom a specific action should be taken.

Conference participants identified a need to link development of guidelines with development of performance measures or quality indicators. Both are dependent on the same body of scientific evidence. A coordinated process would leverage the clinical expertise of the guideline panels to identify areas in which data and professional consensus could support performance measures. Performance measures should

*For a complete list of authors, please see the Appendix.

"Measuring and Improving Quality of Care: A Report From the American Heart Association/American College of Cardiology First Scientific Forum on Assessment of Healthcare Quality in Cardiovascular Disease and Stroke" is an American Heart Association/American College of Cardiology Conference Proceedings statement. The recommendations set forth in this report are those of the conference authors and do not necessarily reflect the official position of the American Heart Association, the American College of Cardiology, or other organizations represented at the conference.

This article is being published simultaneously in the April 2000 issue of *Stroke*.

A companion article, "Evaluating Quality of Care for Patients With Heart Failure," appears in the March 28, 2000, online edition of *Circulation*.

A single reprint of this article is available by calling 800-242-8721 (US only) or writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0184.

(*Circulation*. 2000;101:1483-1493.)

© 2000 American Heart Association, Inc.

Circulation is available at <http://www.circulationaha.org>

be explicit actions, performed for carefully specified, easily identified (using clear administrative and/or easily documented clinical criteria) patients for whom adherence should be advocated in all but the most unusual circumstances. Performance measures can be a powerful addition to the guideline process. Not only will such a process allow experts to suggest measures for quality-assessment efforts that reflect the realities of clinical care, but these indicators may also become a vehicle for more rapid translation of strong new evidence into clinical practice.

Methodological Challenges in Quantifying Healthcare Quality

Overview

Conducting analyses to evaluate performance may have profound consequences on the groups being evaluated. Obviously, such analyses are predicated on having accurate data. Yet obtaining such data can be difficult and expensive, and errors can occur at several levels. The steps for collecting data for healthcare-quality assessment include identifying patients with the specified disease, evaluating the severity of their condition to determine whether they are appropriate candidates for the performance measure, and collecting data on the process of care to compare with the performance standard. If outcomes are assessed as well, accurate collection and risk adjustment of outcomes to ensure that differences are attributable to quality of care and not underlying patient characteristics present additional challenges.

Challenges to Data Quality

Identifying appropriate patients in whom to apply performance measures is complicated by limitations in current information technologies. Patients with conditions for which hospitalization is usually required (eg, AMI) can be found in hospital administrative records. However, administrative sources of data lack important clinical elements and can be inaccurate with respect to the principal diagnosis for which a patient was treated. In a patient for whom quality of care will be judged, the latter problem may require confirmation of the diagnosis through additional parameters. The limitations of administrative records exist because the original collection of data was for a purpose other than assessment of healthcare quality.

Retrospective chart abstraction can often further clarify important patient characteristics, but the recording of such data by healthcare providers may be incomplete. Even when the data are available, inaccuracies can occur in documentation or abstraction.

Prospective data collection has the potential to provide the most useful information when the data are specifically defined and collected for quality-assessment purposes. Prospective data collection also permits acquisition of data directly from patients or physicians and allows assessment of variables such as health status. Unfortunately, in the absence of electronic medical records, prospective data collection is expensive and requires substantial organization to be incorporated into routine patient care.

Collection of outcome data adds another level of complexity and expense. Although deaths can be tracked through

administrative sources such as the National Death Index (there is a substantial time lag), most other outcomes require the tracking of individual patients over time. Some patients will be lost to follow-up, and their characteristics and outcomes may differ substantially from those for whom data are available. Many desired outcomes, such as health status and readmission, require collection of data directly from patients, and inaccurate telephone numbers, addresses, and lack of patient cooperation with follow-up efforts may limit efforts to collect this information.

Time Frame Considerations in Tracking Outcomes

For acute, catastrophic conditions such as AMI and stroke, in-hospital treatment is followed by transition to long-term care for a chronic condition. When judging the quality of care provided by an individual or institution, should the outcomes assessment be restricted to the initial hospitalization only or should longer-term assessments be included as well? The topic was controversial, but many conference participants thought that the impact of medical care should be assessed for both the acute and postdischarge phases of care. Two rationales support the need for longer-term assessments. First, although certain interventions (eg, thrombolysis for AMI) can positively influence short-term survival (eg, 30 days), the full impact of these and other interventions (such as revascularization) are manifest only months or years after discharge. Second, patient care does not end with the patient's discharge from the hospital. Rather, a smooth transition with the outpatient primary care clinician is an essential component of high-quality care. In addition, secondary prevention (eg, lipid management, smoking cessation, or cardiac rehabilitation) is as important as many acute therapeutic decisions. Although a longer-term time horizon places significant importance on outpatient treatment decisions that may not be under the direct control of the acute healthcare provider, the initial in-hospital provider assumes a responsibility for appropriate communication with the patient's primary care physician. If a hospital is identified as having poor long-term patient outcomes, an internal review can help determine whether this is due to inpatient or outpatient care processes. Ultimately, this effort will lead to quality-improvement processes that can generate better patient outcomes for that institution in the future.

Risk Adjustment

The importance of risk adjustment is that it allows interpretation of outcomes data among groups with different types of patients. Knowing the outcome rate of a provider or hospital is not sufficient for judging quality. The outcome rate may be more attributable to patient characteristics rather than quality of care delivered. Although a range of sophisticated biostatistical techniques is available to account for variability due to patient factors, much variability remains unexplained, even in the best models. Also, there are few risk-stratification models for health status and other outcomes.

Finally, even excellent risk-adjustment models are not sufficient for accurately ranking providers on the basis of patient outcomes with sample sizes that are common for many conditions. This limitation is particularly important

when public disclosure is likely, because there is a substantial possibility of misinterpretation. Consequently, in most cases, outcomes measurement is considered more appropriate for internal quality-improvement purposes.

Current Report Cards

Despite the limitations in ranking quality measures, providers, and institutions, many organizations publish report cards that purport to rank the quality of healthcare systems and providers. The growth of the Internet has fostered an even greater range of rankings, many of which may provide contradictory assessments of any given hospital. This growing trend is disconcerting. As evidenced by the methodological challenges described above, the ranking of hospitals, organizations, and providers is difficult. To date, these challenges have not been addressed, and assessments are often based on administrative claims data. Although many organizations do not provide an explanation of their ranking methods, those that do often place a strong emphasis on financial performance instead of the elements of health care that are of most concern to providers and patients. The sentiment was strong among conference participants that any entity ranking provider performance should make a thorough disclosure of its methods and should address the limitations of its approach in a manner that can be clearly understood by the intended audience.

Conceptual Framework for Evaluating Healthcare Quality

Obviously, obtaining accurate insight into healthcare quality is difficult, yet important. Consequently, there is a great need for a framework of organizing and presenting data—its meaning and limitations—to providers, payers, and the public. Some organizations are working to resolve this problem, but more research is needed to learn how to summarize and display the results and uncertainties of healthcare-quality assessment.

Beginning with the seminal work of Donabedian,¹ healthcare quality has been separated into 3 components: structure, process, and outcomes. Structure refers to the components of the healthcare system: personnel training and skills, adequacy of equipment resources (both diagnostic and therapeutic), and organizational systems to efficiently mobilize these resources for optimal patient care. Process refers to the use of appropriate diagnostic and therapeutic modalities for individual patients. To facilitate the interpretability of process assessments, “ideal” patient subsets—those without contraindications for therapy—are often used as the denominator, and those who received appropriate treatments are reported as the numerator. The term “outcomes” refers to the consequences of treatment and can represent markers of disease progression (mortality, readmission, etc), health status (symptoms, functioning, and quality of life), and/or cost. Each conference working group organized its report by using this framework.

Principles of Selection of Performance Measures

Performance measures are the discrete parameters for structure, process, or outcomes used to define good care. Although new knowledge will necessitate changing specific perfor-

mance measures, conference participants believed that certain principles could be embraced that would allow rational analysis of potential performance measures and dictate whether or not to adopt these measures as markers of healthcare quality. The basic principles for selecting performance measures are as follows:

1. The performance measure must be meaningful. Any potential performance measure must be either a meaningful outcome to patients and society or be closely linked to such an outcome.
2. The measure must be valid and reliable. To serve as a useful marker of healthcare quality, it must be possible to measure the structure, process, or outcome of interest.
3. The measure can be adjusted for patient variability. Interpretation of quality assessments necessitates that the observed outcomes/rates of process adherence be adjusted so that observed differences between healthcare systems are due to the performance of those systems and not patient characteristics.
4. The measure can be modified by improvements in the processes of care. To be a useful measure of quality, there must be an opportunity for motivated providers to improve their performance. This requires that the measure have variability after risk adjustment among providers. In addition, evidence should be available that suggests that alterations in the process of care can favorably influence this measure.
5. It is feasible to measure the performance of healthcare providers. Quantifying healthcare quality is a complex and costly undertaking. Although certain performance measures, such as health status, may fulfill all other criteria, the expense of collecting baseline and follow-up health status may be too great for a healthcare system to perform on a routine basis. Sensitivity to the fiscal implications of assessing certain performance measures may require limited sampling or avoidance altogether of certain potential measures of healthcare quality.

In light of these challenges and principles, the conference working groups have summarized insights from the conference that pertain to assessing the quality of care for AMI, heart failure, and stroke.

Summary of the Working Group on AMI

AMI is a catastrophic manifestation of coronary artery disease that strikes >1 100 000 Americans each year; of these, roughly 350 000 will die.² In the last 30 years, the evidence base for treatment of AMI has increased dramatically. The combined results of laboratory and clinical research have identified specific clinical strategies that are beneficial for initial treatment and secondary prevention. These interventions can substantially reduce the morbidity and mortality associated with this condition. In addition, the American College of Cardiology (ACC) and the American Heart Association (AHA) have synthesized this evidence into clinical practice guidelines that identify interventions for which there is evidence and/or general agreement that such interventions are “beneficial, useful, and effective.”³ The strength of this evidence as well as the prevalence of the condition have made AMI the focus of many quality-

improvement initiatives throughout the country. Hence, the process of measuring quality of care for AMI is probably more established than that for other diseases.

Because of its high prevalence, morbidity, and mortality, as well as the availability of substantial efficacy data, numerous quality-of-care initiatives in the treatment of AMI are ongoing. Those of national scope include the HCFA Cooperative Cardiovascular Project (CCP), which focuses on quality of care in elderly Americans; the VA External Peer Review Program, which evaluates quality in both inpatient and follow-up care of veterans; the NCQA, which focuses on managed-care plans; JCAHO, which evaluates hospitals; and the National Registry of Myocardial Infarction (NRMI), an industry-sponsored registry that includes nearly 1500 hospitals (see www.ncqa.org, www.hcfa.org, www.jcaho.org, or va.gov/resdev/queri.htm for detailed descriptions). Although targeted to different patient groups, each effort focuses on similar process and outcomes assessments and attempts to benchmark individual hospitals or health plans against "best practices."

Structural Measures

Enhanced 911 systems and trained emergency medical services personnel can improve emergency response times and prehospital survival. Emergency department protocols can reduce time to reperfusion. Medical personnel with special expertise are more likely to provide the correct treatments, producing better patient outcomes. Improved organizational systems can reduce errors, and disease-management programs hold the promise of reducing hospitalization costs while maintaining or improving quality of care.

Despite the evidence of an association between key structural measures and improved outcome, the working group was unable to identify any structural measures of AMI care that fulfilled all 5 criteria described in the section "Principles of Selection of Performance Measures." Little experience exists in implementing these measures of structures and systems.

There is an urgent need to develop measurement tools for the structure of AMI care, describe the reliability and validity of these tools, and link the results of these measurements to clinically relevant outcomes. The need to develop and test good structural measures is particularly acute in small to mid-sized hospitals, in which the number of AMI patients is too small to obtain stable estimates of process and outcome measures.

Until valid, well-tested structural measures are developed, the working group recommends that institutions assess the following domains of care:

- Prehospital evaluation, triage, and treatment.
- Access to invasive and noninvasive cardiac tests and procedures, including transfer protocols to appropriate facilities when the necessary equipment or personnel are not available.
- Appropriately trained staff with access to cardiovascular specialists for management of AMI patients with complications.

- Protocols or other management programs that ensure timely delivery of required therapies.
- Systems to ensure patient education, rehabilitation, and follow-up.
- Quality-improvement programs that provide for collection and review of data on AMI care and that can be used to identify areas for improvement.

Process Measures

At the national level, quality-performance measures for AMI have been more fully developed and used longer than for any other medical condition. In contrast to structural measures, many process measures in the care of patients with AMI match the selection criteria for performance measures.

The working group reviewed the following current and proposed process-of-care quality-performance measures:

- Use of β -blockers at discharge and during admission. Of the process-of-care measures in use, prescription of β -blockers at discharge has demonstrated the strongest "performance" as a quality-performance measure. This is because considerable underutilization, unexplained variability, and opportunity for improvement remain.^{4,5} Evidence of efficacy and effectiveness, including an unequivocal link between the process of care and outcome (decreased mortality), is strong and strengthening for every important population sector. The only drawback to the β -blocker at discharge measure is that the list of possible relative contraindications to this therapy is long (although most patients are candidates). This means that the ideal subgroup can be small⁶ and therefore statistically unstable, especially for small hospitals. Although experience with β -blockers during admission as a quality-performance measure is less extensive, it is likely that similar observations will hold.⁷
- Use of aspirin at discharge and during admission. Aspirin administration also has strong clinical scientific support^{8,9} but ranks second to β -blockers because relatively high rates of administration leave less opportunity for improvement. Because it is unusual for patients not to be candidates for aspirin therapy, these measures are broadly applicable and statistically stable, even for small cohorts.
- Timely and appropriate acute reperfusion (thrombolysis or primary angioplasty). This family of measures has captured the attention of providers as an important—and improvable—aspect of quality care for AMI.¹⁰ From the point of view of quality-performance measures, these measures are limited by the fact that a minority of patients with AMI are candidates for reperfusion, and thus the potential denominator for measures may be small. In addition, the reliability of ECG criteria for acute reperfusion, as indicated by medical records, is lower than that for other elements of record abstraction in which current techniques are used.¹¹
- The use of angiotensin-converting enzyme (ACE) inhibitors for patients with depressed left ventricular systolic function. Similarly, a minority of patients with AMI are potential candidates for this care process, limiting its applicability to smaller cohorts. Incorporation of the frequency of measurement of left ventricular ejection fraction

may be useful to illuminate the interdependencies of care decisions.^{6,12,13}

- Risk-factor assessment and lifestyle counseling. The proportion of patients eligible for smoking-cessation counseling is relatively small, and ascertainment can be difficult, given the variability in documentation as well as practice. Diet and exercise counseling are broadly applicable but have not been adequately tested as quality-performance measures; there are similar concerns about ascertainment of these important but variably documented processes of care.
- Cholesterol status assessment and management. There is good reason to believe that assessment and management of cholesterol status will become successful quality measures. The challenges for these measures include developing a professional consensus about when to assess cholesterol status and ascertainment of outpatient patterns of care for this medical decision, which may be made in either inpatient or outpatient care venues.

Outcome Measures

The quality of care for AMI potentially affects a broad range of patient outcomes, including not only death and reinfarction but also patients' health status (symptoms, functional status, quality of life), perceptions of care (satisfaction), and physiological targets for modifying their future cardiovascular risk.

Although some outcomes, such as survival and health status, are meaningful to patients and physicians, the relevance of physiological targets to patients and/or physicians is less clear. Furthermore, although reliable and valid outcome measurements for coronary disease are available, they can be expensive to collect, especially those that rely on survey techniques (eg, health status) or physiological measurements (eg, cholesterol levels 1 year after AMI).

Although major predictors for mortality have been described,^{14–16} risk-adjustment techniques for outcomes such as health status are less developed. For example, if a patient's functional status or achievement of cholesterol targets is to be used as a quality-performance measure for AMI care, then the physician must be able to adjust for baseline functional status, its modulators, and factors that influence compliance with medical therapy.

The lack of ability to risk-adjust outcomes suggests that although changes in outcomes can be tracked, the relationship of these changes to quality of care is uncertain, except perhaps at a large population level. The rudimentary state of risk adjustment and the expense of determining some of these outcomes mean that their feasibility as quality-performance measures has not been explored.

The working group reviewed the status of the following outcome measures:

- Death. Death is relatively easy to ascertain and has been advocated as a quality measure. However, risk-adjustment limitations, random variation, and the statistical instability of small samples limit the ability to use death rates for interhospital comparisons. Having to choose between short- and long-term mortality as a quality measure underscores the importance of strengthening understanding of

the link between processes and outcomes. However, the working group believes that providers should internally track their institution's mortality trends as a local quality-assurance marker.

- Readmission. Administrative databases permit ascertainment of readmission events but may not contain sufficient detail to indicate whether readmission was planned as part of the course of care, was related to the patient's disease, or occurred as a result of suboptimal care.
- Physiological end points. Achievement of risk-factor modification targets (cholesterol status at 1 year, smoking rates, blood pressure control, etc) is appealing as a quality-performance measure because ascertainment of such targets is part of good-quality care. These assessments blur the distinction between process and outcome in that the primary benefit of optimizing these measures is prevention of more clinically significant outcomes. Understanding patient factors that modulate these outcomes as well as issues of ascertainment feasibility and expense are areas of active research and development.
- Patient health status. This includes symptoms, functional status, and quality of life. Measurement of symptoms, functioning, and quality of life is principally accomplished by surveys.^{17,18} This information is not routinely gathered in clinical care, making it difficult to track outside prospective longitudinal studies. Because these outcomes are particularly meaningful to patients, the working group recommends continued exploration of these potential quality measures.
- Patient satisfaction. Although widely measured by hospitals, the association between patient satisfaction and quality of care is not clear.

Research Priorities

Although the science of quality-of-care measurement may be most advanced for patients with AMI, substantial unanswered questions remain for consideration as research priorities. These include the following:

1. Development of reliable and valid measurement tools for evaluating and using structural measures in assessment of quality of care.
2. Development of minimum structural standards that can be applied to a range of more or less sophisticated hospitals and systems.
3. Improvement of the method of determining appropriateness of post-MI cardiac procedures.
4. Development of appropriate interventions to address deficiencies in performance measures.
5. Broadening of the scope of AMI-care performance measurement and improvement to include long-term care, primary care, and secondary prevention, eg, the development of new process measures such as lipid testing and post-MI lipid-lowering therapy.
6. Development of a minimal data set that allows collection of performance data with appropriate risk adjustment.
7. Enhanced understanding of the best practices with respect to AMI care, eg, determining institution-specific maximum attainable performance on process measures such as use of discharge medications.

8. Development of risk-adjustment methods for outcomes such as anginal frequency and symptom severity.
9. Incorporation of nonmortality outcomes into accepted performance measures, including functional status and physiological measurement.

Summary of the Working Group on Heart Failure

Heart failure is an increasingly common condition that results in substantial morbidity, mortality, and consumption of medical resources, particularly among older Americans.¹ National efforts are under way by HCFA and the VA to assess and improve the quality of care and outcomes of patients with heart failure. Furthermore, other organizations, such as the American Medical Association, JCAHO, and the NCQA, have a strong interest in incorporating heart failure measures into their assessments of care.

Despite the importance of heart failure and the extensive medical literature on the subject,¹⁹ relatively few quality measures are endorsed as legitimate measures of quality of care. This report reveals that operational issues (eg, feasibility and cost of data collection) and the absence of evidence on the efficacy of many diagnostic and therapeutic modalities for specific subgroups of patients hamper efforts to define a set of quality measures for patients with heart failure. The purpose of this report is not to be prescriptive about current efforts but to emphasize issues that need to be addressed, ongoing initiatives, and areas of research that are essential to enhance understanding of the process and achieve better outcomes.

Structural Measures

Although many structural measures can be proposed as indicators of quality care, few have been formally evaluated with regard to their relationship with outcomes. Measures that may be self-evident to specialty groups (eg, the need for specialty training) may be controversial to generalists and perceived as self-serving by others. Consequently, it is difficult to mandate specific training, personnel, or facilities as quality indicators.

Nevertheless, the working group has endorsed 4 specific structural measures for consideration as quality indicators. First, clinicians at the care facility should have clear, evidence-based guidelines for the care of patients with heart failure. These guidelines may take the form of either pathways or recommendations, but the facility should have a document that describes or endorses the best practice for its patients and that aligns with existing medical evidence. Second, clinicians at the care facility should have a mechanism to systematically monitor patient care and outcomes. The domains of care to be evaluated should align with the guideline recommendations endorsed by the clinicians. The clinical staff should review this information periodically (ie, at least annually). Third, the clinicians and care facility staff should recognize that patients may require different levels of care and that there must be an organizational structure to move patients to the appropriate level of care. For example, access to an advanced heart failure facility should be available to patients who need assistance to establish diagnosis, enhance medical therapy, or make a decision about surgery,

including cardiac transplantation. Finally, the working group believes that clinicians and care facilities could benefit patients by having specific programs to address the end-of-life needs of many patients with heart failure.

Process Measures

The working group considered process measures an important area for quality assessment. Limitations of these measures were reviewed, and several were emphasized. First, heart failure is predominantly a condition of older patients, who commonly have many other coexistent diseases, and yet randomized trials have generally evaluated the efficacy of therapies in younger patients with less comorbidity. The value of guideline-based therapies for older patients is not definitively known. Second, heart failure tends to be a chronic condition for which care is delivered across many venues over time. Therapies may be initiated, modified, or terminated at any point in the patient's care. The assessment of quality of care in 1 setting (eg, the hospital) may be misleading if changes are made in the outpatient venue. For example, β -blockers are now considered a useful medication for patients with heart failure and systolic dysfunction.²⁰ However, they should be initiated when the patient's condition is stable. Consequently, a hospital assessment may suggest underutilization when many physicians are legitimately waiting several weeks after discharge to start patients' medications.

Nevertheless, after a thorough review of the literature, this expert group endorsed 4 items as quality measures. First, the medical record of patients with heart failure should have clear documentation of left ventricular systolic function. This measure has implications for both therapy and prognosis, and studies suggest that many patients do not have this assessment.^{21,22} Second, patients with heart failure, left ventricular systolic dysfunction, and no contraindications to ACE inhibitors should be prescribed ACE inhibitors.²³ Given the current evidence, the working group did not believe that angiotensin-receptor blockers or a hydralazine-nitrate combination should be substituted for ACE inhibitors in patients who tolerate ACE inhibitors. The group also did not believe that the evidence about dosing was strong enough to warrant its inclusion as a quality indicator. Third, patients hospitalized with heart failure and left ventricular systolic dysfunction should be treated with digoxin. Fourth, patients with NYHA class II and III heart failure, left ventricular systolic dysfunction, and no contraindication to β -blockers should be prescribed β -blockers. However, this assessment is most appropriately applied to outpatients because this medication should be initiated when the patient's condition is stable, and some physicians may reasonably choose not to initiate this therapy during hospitalization.

The working group considered several other indicators important. In particular, group members wanted to emphasize the importance of the appropriate diagnosis of heart failure by skilled clinicians; proper titration of diuretic therapy; effective education of patients about heart failure, self-care and preventive strategies, and proper length of stay; and compassionate counseling of patients about their care and prognosis. The reluctance of the group to recommend these domains as

indicators derived from the difficulty of measuring the domains validly and reliably. Also, these domains raised difficult issues regarding optimal timing for obtaining these measures. Nevertheless, group members urged efforts to capture this information accurately and to develop approaches to transform it into useful quality indicators.

Group members also emphasized the importance of several general medical interventions as quality indicators for these patients. They recommended that patients receive vaccinations against influenza and pneumonia. In addition, anticoagulation for atrial fibrillation, evaluation of ischemia, and treatment of hyperlipidemia for coronary artery disease were also thought to be important indicators of quality of care.

Outcomes Measures

The working group considered outcomes to be an important measure of the success of patient care. These measures could include mortality, readmission, resource consumption, health status, and satisfaction with care. The most pressing limitation to use of outcomes as markers of quality is the absence of adequate risk-stratification models.

However, the working group had strong beliefs about the appropriate use of outcome measures. The group did not believe that these measures should inform consumer choice because of the numerous limitations in risk-adjustment methodologies and the lack of standards for minimum sample sizes and acceptable random variation. The group also acknowledged the logistic challenges of collecting this information. However, group members strongly believed that outcome measures should be collected by clinicians and used for internal quality-improvement activities. Results over time should be used to identify potential opportunities to improve care.

The working group also acknowledges that mortality is not always an indication of poor-quality care in heart failure and may be the inevitable consequence of a long illness for which the patient may have received excellent care. Suffering associated with this condition may be substantial, and health-status measures may be as important as survival rates.

Research Priorities

In the course of developing these recommendations, the working group identified some important areas of further research. The group believes that the science of assessing and improving the care of patients with heart failure will depend on the success of research efforts to add to knowledge in the following areas:

1. Development and testing of new quality-of-care indicators for patients with heart failure, particularly in the outpatient venue or with the perspective of the continuum of care.
2. Development of risk-adjustment models and methods for measuring various outcomes of patients with heart failure.
3. Development of improved, easy-to-use, disease-specific instruments to evaluate functional status and quality-of-life domains for patients with heart failure.
4. Determination of the association of specific structural characteristics with outcomes of patients with heart

failure and definition of the essential features of disease-management programs.

5. Determination of quality-improvement strategies that result in the most rapid adoption of new, proven diagnostic and therapeutic modalities.
6. Definition of the best clinical strategies for older patients, particularly the elderly, who are unlikely to be enrolled in clinical trials. The use of carefully collected registries may be the best approach in the heterogeneous older group of patients.
7. Definition of the critical elements of high-quality, end-of-life care and development of quality indicators in this area.
8. Evaluation of the value of various new technical and organizational interventions to improve the care of patients with heart failure.
9. Development of methods to efficiently capture information, including information technology solutions, which can be used to assess quality of care for patients with heart failure.

Summary of the Working Group on Stroke

Cerebrovascular disease is a major medical problem. It is the third leading cause of death, and one of the leading causes of serious disability in the United States. Stroke is also one of the most common and expensive diseases. Major efforts are under way by HCFA, the VA, the American Academy of Neurology, and other national groups to examine stroke-management processes, define strategies to enhance quality of care, and ultimately improve the outcome of patients with cerebrovascular disease.

Despite concerns about the quality of stroke care, few quality measures have been formally evaluated. Those reported to date have a narrow focus, and critical aspects of care are often neglected. However, there are convincing data that an organized approach to stroke care reduces mortality, shortens length of stay, and improves functional outcome.²⁴ The specific factors responsible for this improvement and their relative impact on the quality of stroke-related care remain to be determined.

Sufficient data are not yet available to support the use of specific indicators for comparing the overall quality of stroke care between institutions. However, the working group thought that there was sufficient evidence to support a specific set of clinical practices as an indication of quality care within institutions. The goal of the working group was to define major aspects of stroke care and specific indicators that could be used to support current stroke quality initiatives in individual organizations.

Good performance can be evaluated in several domains.²⁵ For the purpose of defining quality-improvement measures, 6 domains were identified, each representing an essential goal of ischemic stroke care: (1) coordination of care; (2) diagnosis; (3) preservation of neural tissue; (4) prevention of complications; (5) initiation of secondary prevention; and (6) restoration of function.

For each domain of stroke care, the working group has proposed a set of structure, process, and outcome indicators. Although these indicators are not measures, they outline the areas in which current care, as well as research efforts to develop measures, should be directed. The goal of the

working group was to propose standards that could be applied across all acute care settings, regardless of the level of care available locally. The domains of care, associated indicators, and outcomes are outlined below and will be described in detail in future statements by the working group.

Structural Measures

Given the frequency of stroke and its impact on those affected, it was thought that all hospitals should have systems and procedures to evaluate care for stroke patients. In the absence of proven or evidence-based structural measures to improve stroke outcomes, the working group sought to identify minimum standards that have strong preliminary evidence and high face validity that would be acceptable to a wide range of stroke care providers and that could be measured in a variety of practice settings. The working group endorsed 5 measures:

- Quality-improvement effort. There should be a mechanism to monitor the processes of stroke care and associated outcomes. Not all items need be measured continuously or concurrently. It is most important that hospitals be able to ensure that local practices align with current guideline recommendations. This information should be periodically reviewed to assess how care has been delivered as part of an ongoing effort to achieve optimal compliance with treatment guidelines.
- Local competence. Clinicians who care for stroke patients should have a basic core knowledge of stroke and its management. Minimum standards should include the stroke component of advanced cardiac life support training (or its equivalent).²⁶
- Stroke plan. All institutions should have a plan in place for the care of patients with acute ischemic stroke. This plan could be in the form of critical pathways or treatment recommendations. The plan should include, as a minimum, information about coordination of care and a statement on the use of thrombolytic therapy. Although thrombolytic therapy may not be appropriate for all institutional settings (see below), each hospital should develop a policy for use of thrombolytics. For hospitals that offer this therapy, a prespecified protocol is essential to ensure that patients are treated appropriately within the very narrow therapeutic window. In these hospitals, adherence to thrombolytic guidelines should be monitored.
- Brain imaging. An accurate diagnosis by skilled clinicians is essential for management of patients with acute neurological syndromes.²⁷ Because a clinical evaluation cannot exclude structural diseases that may mimic a stroke or differentiate between a hemorrhagic and ischemic stroke, brain imaging is central to the diagnostic evaluation. Therefore, brain imaging with CT scan or MRI should be available for all patients who present with an acute stroke syndrome.²⁸ Ideally, but not necessarily, this technology should be available on-site.
- Access to neurological/neurosurgical expertise. All levels of care will not be available at all institutions; however, the organizational structure must allow movement of patients to the level of care that they require. Patients who have a stroke for which a neurosurgical intervention is indicated (eg, subarachnoid hemorrhage or acute subdural hematoma) should have access to neurosurgical care. This care

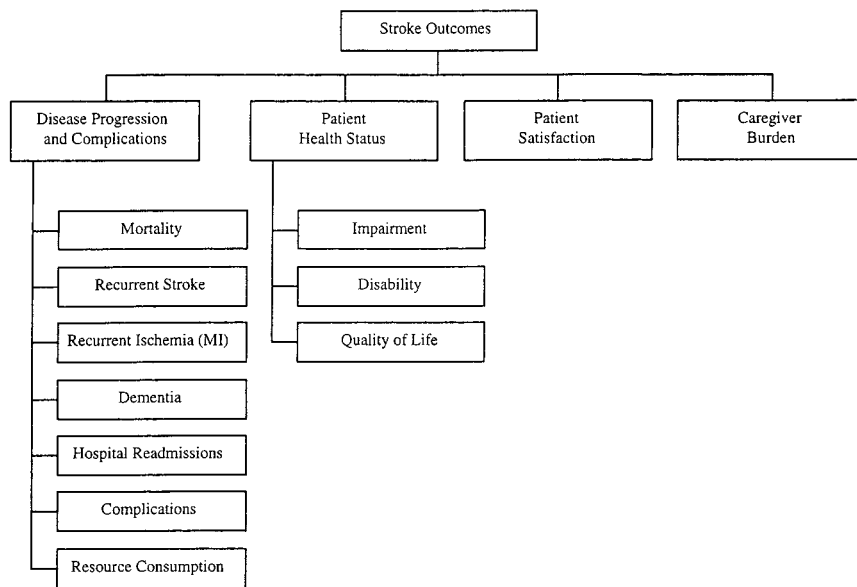
should be available locally or through transfer to another institution. Transfer arrangements, if necessary, should be made as a matter of policy.

Process Measures

Process measures are the current focus of most quality-improvement efforts for stroke. The working group proposed the following:

- Documented patient care plan. A treatment plan should be documented in the medical record.
- Initial evaluation. A central part of the evaluation is to ensure an accurate diagnosis and address comorbid conditions that would require a change in therapy.^{28,29} Three measures were selected: (a). Performance of a brain imaging study (usually either CT or MRI). (b). ECG to evaluate for atrial fibrillation or myocardial ischemia. (c). Glucose measurement (because hypoglycemia may mimic a stroke syndrome and requires urgent treatment).
- Acute therapy. Although few therapies exist for directly decreasing damage to neural tissue,^{30–32} much can be done to improve (or worsen) outcomes among stroke patients.^{33,34} Thrombolytic therapy is currently used in and is applicable for only a small minority of patients, and it may not be appropriate in all care settings. When recombinant tissue plasminogen activator is used, thrombolysis guidelines (such as those from the AHA or American Academy of Neurology) that adhere to the NIH protocol should be followed and outcomes systematically monitored.

Three measures were selected for acute stroke therapy: (1) use of aspirin within 48 hours of admission (aspirin improves outcome in the setting of acute ischemic stroke and if used acutely may enhance its continued use for secondary prevention)³⁰; (2) not using sublingual nifedipine (precipitous drops in blood pressure may place ischemic but noninfarcted brain tissue at risk for further damage)^{35,36}; and (3) treatment of fever >100.5°F (38.0°C). Extensive experimental studies and observation studies in humans show that even mild hyperthermia worsens ischemic neurological damage.³⁷
- Preventive therapy. Two areas were recommended as indicators within the domain of initiating secondary prevention.^{27,38} First, patients with ischemic stroke and no contraindications should be discharged on some form of antithrombotic therapy (either an antiplatelet agent or anticoagulation). Except in the case of warfarin use in patients with atrial fibrillation and no contraindications to anticoagulation, the working group did not choose to specify the specific agent because there is some controversy about its relative efficacy. Second, although educational efforts remain understudied, the working group thought that education should be undertaken with a focus on (1) enhancing secondary prevention and (2) recognizing the symptoms and response to recurrent stroke. Other aspects of secondary prevention of stroke (or cardiovascular disease) should also be undertaken and may be appropriate for quality indicators, including the identification and treatment of carotid stenosis, as well as general medical interventions such as vaccinations for influenza and pneumonia.
- Functional assessment/rehabilitation plan. The medical record should include documentation of the neurological



Stroke outcome categories and clinical measures.

deficits and functional status associated with a stroke and consideration of the need for rehabilitation consultation and services (including occupational, physical, or speech therapy) among patients with deficits.³⁹

Outcomes Measures

Outcomes are the measure of success of patient care. It is important, especially with diseases such as stroke, to remember not to abandon what is meaningful for what is measurable. Stroke may have a larger number of outcome categories and clinical measures compared with other forms of vascular disease (see Figure).^{40–42} This is related to the central role of the brain in human activities (both cognitive and physical) and the extensive range of syndromes associated with stroke. Minor neuronal injuries may be associated with devastating functional deficits, which further complicate outcome assessment.

The selection of outcomes should fit into the overall goal of the quality-improvement measures selected and the specific domains of care, such as preservation of neural tissue (disability and mortality), prevention of complications (pneumonia, infection, deep-vein thrombosis, mortality), secondary prevention (recurrent stroke, MI, vascular death), and restoration of function (disability and quality of life).

In measuring outcome, not only is it important to identify appropriate types of measures but also the timing of measurement. Most stroke recovery occurs within 1 to 3 months. Additional recovery, albeit modest, may continue well beyond 1 year. For quality improvements directed at acute stroke care, the working group agreed that end points should be focused on 1 month after discharge. The reason for this decision is that clinical status beyond this time, however important, is more difficult to measure and will be influenced by factors beyond acute stroke care, such as rehabilitation, management of depression, and recurrent ischemic events.^{43,44} A future statement will address the strengths and limitations of specific outcome categories and measures as indicators of quality stroke care.

Research Priorities

In reviewing the existing literature, the working group identified important directions for future research. Many of the

general challenges of quality and outcome measures (such as risk-adjustment models) are listed in other sections of this report. The working group hopes that these listed priorities will help further the cause of developing and evaluating structure, process, and outcome measures that have been specifically examined in the setting of acute ischemic stroke.

1. Development and testing of new quality-of-care indicators for patients with acute ischemic stroke. These should take a global approach to cerebrovascular disease, including short- and long-term care, and should address the global nature of vascular disease.
2. Development and testing of outcome measures appropriate for evaluating specific domains of care as well as a global assessment. Measures should be able to account for the interests of patients, family, caregivers, hospitals, payers, and society.
3. Comparison of outcome measures across different symptoms and severity of presentation. An identical stroke that occurs a few millimeters away in the brain can result in dramatically different clinical status.
4. Assessment of which patient-level measures are meaningful, valid, and sensitive to differences in quality of care for ischemic stroke.
5. Assessment of which aspects of stroke care contribute to improved outcomes in the setting of a “stroke unit” or other organized systems for the delivery of stroke-related care.
6. Development of the concept of a center of excellence and definition of its role in stroke care locally and regionally.
7. Improvement of techniques for capturing, analyzing, and presenting quality data and outcome measures.

Appendix

Quality of Care and Outcomes Research Forum Executive Committee and Working Group Members

Steering Committee: Harlan M. Krumholz, Chair; Lawrence M. Brass, Cochair; Nathan R. Every, Cochair; John A. Spertus, Cochair;

Terry Bazzarre, David J. Cohen, Mark A. Hlatky, Eric D. Peterson, Martha J. Radford, William S. Weintraub.

Acute Myocardial Infarction Working Group: Nathan R. Every, Chair; Christopher P. Cannon, Edward F. Ellerbeck, Barbara J. McNeil, Eric D. Peterson, Martha J. Radford, Thomas J. Ryan, Sidney C. Smith, Jr, John A. Spertus.

Congestive Heart Failure Working Group: Harlan M. Krumholz, Chair; David W. Baker, Cochair; Carol M. Ashton, Sandra B. Dunbar, Gottlieb C. Friesinger, Edward P. Havranek, Mark A. Hlatky, Marvin Konstam, Diana L. Ordin, Ileana L. Pina, Bertram Pitt, John A. Spertus.

Methods Working Group: John A. Spertus, Chair; Elizabeth R. DeLong, Kim A. Eagle, Sharon-Lise Normand, Daniel B. Mark, Ben D. McAllister, J. William Thomas, William S. Weintraub.

Stroke Working Group: Lawrence M. Brass, Chair; Pamela W. Duncan, Larry B. Goldstein, Philip B. Gorelick, Judith A. Hinchey, David B. Matchar, David Nilasena, David Wennberg, Linda S. Williams, Philip A. Wolf.

Acknowledgments

The Steering Committee gratefully acknowledges the generous support for this conference provided by the American Heart Association, the American College of Cardiology, the Veterans Affairs Health System, the Robert Wood Johnson Foundation, the American Heart Association Councils on Clinical Cardiology and Cardiothoracic and Vascular Surgery, and Bristol-Myers Squibb.

References

- Donabedian A. The quality of care: how can it be assessed? *JAMA*. 1988;260:1743-1748.
- American Heart Association. 1999 *Heart and Stroke Statistical Update*. Dallas, Tex. Available at: <http://www.americanheart.org/statistics/index.html>.
- Ryan TJ, Antman EM, Brooks NH, Califf RM, Hillis LD, Hiratzka LF, Rapaport E, Riegel B, Russell RO, Smith EE III, Weaver WD, Gibbons RJ, Alpert JS, Eagle KA, Gardner TJ, Garson A Jr, Gregoratos G, Smith SC Jr. 1999 update: ACC/AHA guidelines for the management of patients with acute myocardial infarction: executive summary and recommendations: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). *Circulation*. 1999;100:1016-1030.
- Krumholz HM, Radford MJ, Wang Y, Chen J, Heiat A, Marciniak TA. National use and effectiveness of beta-blockers for the treatment of elderly patients after acute myocardial infarction: National Cooperative Cardiovascular Project. *JAMA*. 1998;280:623-629.
- O'Connor GT, Quinton HB, Traven ND, Ramunno LD, Dodds TA, Marciniak TA, Wennberg JE. Geographic variation in the treatment of acute myocardial infarction: the Cooperative Cardiovascular Project. *JAMA*. 1999;281:627-633.
- Marciniak TA, Ellerbeck EF, Radford MJ, Kresowik TF, Gold JA, Krumholz HM, Kiefe CI, Allman RM, Vogel RA, Jencks SF. Improving the quality of care for Medicare patients with acute myocardial infarction: results from the Cooperative Cardiovascular Project. *JAMA*. 1998;279:1351-1357.
- Krumholz HM, Radford MJ, Wang Y, Chen J, Marciniak TA. Early beta-blocker therapy for acute myocardial infarction in elderly patients. *Ann Intern Med*. 1999;131:648-654.
- Collaborative overview of randomised trials of antiplatelet therapy, I: prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. Antiplatelet Trialists' Collaboration. *BMJ*. 1994;308:81-106.
- Krumholz HM, Radford MJ, Ellerbeck EF, Hennen J, Meehan TP, Petrillo M, Wang Y, Jencks SF. Aspirin for secondary prevention after acute myocardial infarction in the elderly: prescribed use and outcomes. *Ann Intern Med*. 1996;124:292-298.
- Krumholz HM, Murillo JE, Chen J, Vaccarino V, Radford MJ, Ellerbeck EF, Wang Y. Thrombolytic therapy for eligible elderly patients with acute myocardial infarction. *JAMA*. 1997;277:1683-1688.
- Huff ED. Comprehensive reliability assessment and comparison of quality indicators and their components. *J Clin Epidemiol*. 1997;50:1395-1404.
- Ellerbeck EF, Jencks SF, Radford MJ, Kresowik TF, Craig AS, Gold JA, Krumholz HM, Vogel RA. Quality of care for Medicare patients with acute myocardial infarction: a four-state pilot study from the Cooperative Cardiovascular Project. *JAMA*. 1995;273:1509-1514.
- Krumholz HM, Vaccarino V, Ellerbeck EF, Kiefe C, Hennen J, Kresowik TF, Gold JA, Jencks SF, Radford MJ. Determinants of appropriate use of angiotensin-converting enzyme inhibitors after acute myocardial infarction in persons ≥ 65 years of age. *Am J Cardiol*. 1997;79:581-586.
- Lee KL, Woodlief LH, Topol EJ, Weaver WD, Betriu A, Col J, Simoons M, Aylward P, Van de Werf F, Califf RM. Predictors of 30-day mortality in the era of reperfusion for acute myocardial infarction: results from an international trial of 41 021 patients: GUSTO-I Investigators. *Circulation*. 1995;91:1659-1668.
- Krumholz HM, Chen J, Wang Y, Radford MJ, Chen YT, Marciniak TA. Comparing AMI mortality among hospitals in patients 65 years of age and older: evaluating methods of risk adjustment. *Circulation*. 1999;99:2986-2992.
- Normand ST, Glickman ME, Sharma RG, McNeil BJ. Using admission characteristics to predict short-term mortality from myocardial infarction in elderly patients: results from the Cooperative Cardiovascular Project. *JAMA*. 1996;275:1322-1328.
- Spertus JA, Winder JA, Dewhurst TA, Deyo RA, Prodzinski J, McDonnell M, Fihn SD. Development and evaluation of the Seattle Angina Questionnaire: a new functional status measure for coronary artery disease. *J Am Coll Cardiol*. 1995;25:333-341.
- McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993;31:247-263.
- Konstam MA, Dracup K, Baker DW, Bortoff MB, Brooks NH, Dacey RA, Dunbar SB, Jackson AB, Jessup M, Johnson JC, Jones RH, Luchi RJ, Massie BM, Pitt B, Rose EA, Rubin LJ, Wright RF, Hadorn DC. *Heart Failure: Evaluation and Care of Patients With Left Ventricular Systolic Dysfunction. Clinical Practice Guideline No. 11*. Rockville, Md: Agency for Health Care Policy and Research, Public Health Service, US Department of Health and Human Services; 1994. Publication No. 94-0612.
- Krumholz HM. Beta-blockers for mild to moderate heart failure. *Lancet*. 1999;353:2-3.
- Krumholz HM, Wang Y, Parent EM, Mockalis J, Petrillo M, Radford MJ. Quality of care for elderly patients hospitalized with heart failure. *Arch Intern Med*. 1997;157:2242-2247.
- Havranek EP, Abrams F, Stevens E, Parker K. Determinants of mortality in elderly patients with heart failure: the role of angiotensin-converting enzyme inhibitors. *Arch Intern Med*. 1998;158:2024-2028.
- Baker DW, Konstam MA, Bortoff M, Pitt B. Management of heart failure, I: pharmacologic treatment. *JAMA*. 1994;272:1361-1366.
- Indredavik B, Bakke F, Slørdahl SA, Rokseth R, Håheim LL. Stroke unit treatment improves long-term quality of life: a randomized controlled trial. *Stroke*. 1998;29:895-899.
- Oddone EZ, Kaplan L, QUERI Stroke Executive Committee. Quality Enhancement Research Initiative (QUERI) for Stroke Toolbox. 1999. Available at: <http://hsrd.durham.med.va.gov/queri/default.htm>.
- Kothari R, Atkinson RP, Furlan AJ, Gallagher EJ, Hazinski MF, Koroshetz WJ, Sanders AB, Stapleton ER. Acute stroke. In: *Advanced Cardiac Life Support*. Dallas, Tex: American Heart Association; 1998:10-1-10-28.
- Helgason CM, Wolf PA. American Heart Association Prevention Conference IV: prevention and rehabilitation of stroke: executive summary. *Circulation*. 1997;96:701-707.
- Culebras A, Kase CS, Masdeu JC, Fox AJ, Bryan RN, Grossman CB, Lee DH, Adams HP, Thies W. Practice guidelines for the use of imaging in transient ischemic attacks and acute stroke: a report of the Stroke Council, American Heart Association. *Stroke*. 1997;28:1480-1497.
- Mohr JP, Albers GW, Amarenco P, Babikian VL, Biller J, Brey RL, Coull B, Easton JD, Gomez CR, Helgason CM, Kase CS, Pullicino PM, Turpie AG. American Heart Association Prevention Conference IV: prevention and rehabilitation of stroke: etiology of stroke. *Stroke*. 1997;28:1501-1506.
- Bednar MM, Gross CE. Antiplatelet therapy in acute cerebral ischemia. *Stroke*. 1999;30:887-893.
- Adams HP Jr, Brott TG, Furlan AJ, Gomez CR, Grotta J, Helgason CM, Kwiatkowski T, Lyden PD, Marler JR, Torner J, Feinberg W,

- Mayberg M, Thies W. Guidelines for thrombolytic therapy for acute stroke: a supplement to the guidelines for the management of patients with acute ischemic stroke: a statement for healthcare professionals from a Special Writing Group of the Stroke Council, American Heart Association. *Circulation*. 1996;94:1167-1174.
32. Adams HP Jr, Brott TG, Crowell RM, Furlan AJ, Gomez CR, Grotta J, Helgason CM, Marler JR, Woolson RF, Zivin JA, Feinberg WM, Mayberg M. Guidelines for the management of patients with acute ischemic stroke: a statement for healthcare professionals from a Special Writing Group of the Stroke Council, American Heart Association. *Stroke*. 1994;25:1901-1914.
33. Davenport RJ, Dennis MS, Wellwood I, Warlow CP. Complications after acute stroke. *Stroke*. 1996;27:415-420.
34. Alberts MJ, Brass LM. Assessment of early deterioration. *J Stroke Cerebrovasc Dis*. 1999;8:171-175.
35. Grossman E, Messerli FH, Grodzicki T, Kowey P. Should a moratorium be placed on sublingual nifedipine capsules given for hypertensive emergencies and pseudoemergencies? *JAMA*. 1996;276:1328-1331.
36. Powers WJ. Acute hypertension after stroke: the scientific basis for treatment decisions. *Neurology*. 1993;43:461-467.
37. Castillo J, Dávalos A, Noya M. Aggravation of acute ischemic stroke by hyperthermia is related to an excitotoxic mechanism. *Cerebrovasc Dis*. 1999;9:22-27.
38. Wolf PA, Clagett GP, Easton JD, Goldstein LB, Gorelick PB, Kelly-Hayes M, Sacco RL, Whisnant JP. Preventing ischemic stroke in patients with prior stroke and transient ischemic attack: a statement for healthcare professionals from the Stroke Council of the American Heart Association. *Stroke*. 1999;30:1991-1994.
39. Greshman GE, Alexander D, Bishop DS, Giuliani C, Goldberg G, Holland A, Kelly-Hayes M, Linn RT, Roth EJ, Stason WB, Trombly CA. American Heart Association Prevention Conference IV: prevention and rehabilitation of stroke: rehabilitation. *Stroke*. 1997;28:1522-1526.
40. Duncan PW, Samsa GP, Weinberger M, Goldstein LB, Bonito A, Witter DM, Enarson C, Matchar D. Health status of individuals with mild stroke. *Stroke*. 1997;28:740-745.
41. Williams LS. Health-related quality of life outcomes in stroke. *Neuroepidemiology*. 1998;17:116-120.
42. Pound P, Tilling K, Rudd AG, Wolfe CD. Does patient satisfaction reflect differences in care received after stroke? *Stroke*. 1999;30:49-55.
43. Bounds JV, Wiebers DO, Whisnant JP, Okazaki H. Mechanisms and timing of deaths from cerebral infarction. *Stroke*. 1981;12:474-477.
44. Silver FL, Norris JW, Lewis AJ, Hachinski VC. Early mortality following stroke: a prospective review. *Stroke*. 1984;15:492-496.

KEY WORDS: AHA/ACC Conference Proceedings ■ heart failure ■ stroke ■ cardiovascular disease ■ acute myocardial infarction