ACC/AHA Clinical Performance Measures for Adults With ST-Elevation and Non-ST-Elevation Myocardial Infarction. A Report of the American College of Cardiology/American Heart Association Task Force on Performance Measures (Writing Committee to Develop Performance Measures on ST-Elevation and Non-ST-Elevation Myocardial Infarction)

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ACC/AHA Clinical Performance Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction

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PREAMBLE

Medicine is experiencing an unprecedented focus on quantifying and improving health care quality. The American College of Cardiology (ACC) and the American Heart Association (AHA) have developed a multi-faceted strategy to facilitate the process of improving clinical care. The initial phase of this effort was to create clinical practice guidelines that carefully review and synthesize available evidence to better guide patient care. Such guidelines are written in a spirit of suggesting diagnostic or therapeutic interventions for patients in *most* circumstances. Accordingly, significant judgment by clinicians is required to adapt these guidelines to the care of individual patients, and these guidelines can be generated with varying degrees of confidence based upon available evidence. Occasionally, the evidence supporting a particular structural aspect or process of care is so strong that failure to perform such actions reduces the likelihood that optimal patient outcomes will occur. Creating a mechanism for quantifying these opportunities to improve the outcomes of care is an important and pressing challenge.

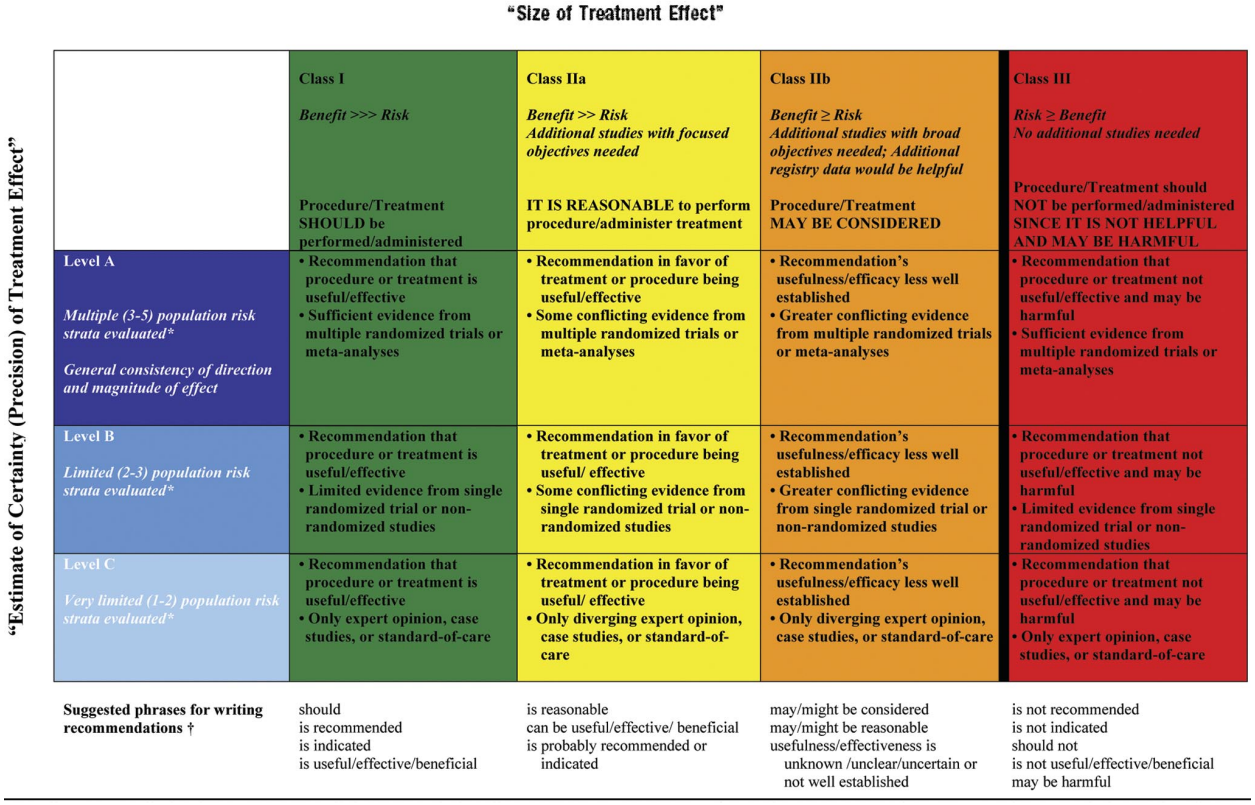
In the next phase of its quality improvement efforts, the ACC and the AHA created the ACC/AHA Task Force on Performance Measures in February 2000 to spearhead the development of performance measures that allow the quality of cardiovascular care to be assessed and improved. Three nominees from each organization were charged with the task of assembling teams of clinical and methodological experts, both from within the sponsoring organizations and from other organizations dedicated to the care of patients covered by the performance measurement set. These writing committees were given careful guidance with respect to the necessary attributes of good performance measures and the process of identifying, constructing, and refining these measures so that they can accurately achieve their desired goals (1).

The role of performance measurement writing committees is not to perform a primary evaluation of the medical literature; this is undertaken by ACC/AHA guidelines committees. However, performance measurement writing committees work collaboratively with guidelines committees so that the guideline recommendations are written with a degree of specificity that supports performance measurement and so that new knowledge can be rapidly incorporated into performance measurement. Development of ACC/AHA guidelines includes a detailed review of and ranking of the evidence available for the diagnosis and treatment of specific disease areas. Published guideline recommendations employ the ACC/AHA classification system I, IIa, IIb, and III (Fig. 1).

So as not to duplicate performance measure development efforts, writing committees were also instructed to evaluate existing nationally recognized performance measures using the ACC/AHA "attributes of good performance measures." The measure specifications were adopted for those performance measures that meet these criteria. Such measures have established validity, reliability, and feasibility and will form the foundation of the ACC/AHA measurement sets. Furthermore, writing committees are encouraged to identify additional performance measures that correspond to those key areas of quality proven to improve patient outcomes.

ACC/AHA Performance Measurement Sets are to be applied in either the inpatient and/or outpatient setting depending upon the topic. Although inpatient measures have traditionally been captured by retrospective data collection, the increased use of electronic medical records allows for prospective collection in the inpatient and outpatient settings. Prospective data collection is itself a continuous quality improvement process. The performance measures quantify explicit actions performed in carefully specified patients for whom adherence should be advocated in all but the most unusual circumstances. In addition, the measures are constructed with the intent to facilitate both retrospective and prospective data collection using explicit administrative and/or easily documented clinical criteria. Furthermore, the data elements required to construct the performance measures are identified and linked to existing ACC/AHA Clinical Data Standards to encourage the standardization of cardiovascular measurement.

While the focus of the performance measures writing committees is to develop measures for internal quality improvement, it is appreciated that other organizations may use these measures for external reporting of provider performance.



*Data available from clinical trials or registries about the usefulness/efficacy in different sub-populations, such as gender, age, history of diabetes, history of prior MI, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Even though randomized trials are not available, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

†In 2003, the ACC/AHA Task Force on Practice Guidelines developed a list of suggested phrases to use when writing recommendations. All recommendations in this guideline have been written in full sentences that express a complete thought, such that a recommendation, even if separated and presented apart from the rest of the document (including headings above sets of recommendations), would still convey the full intent of the recommendation. It is hoped that this will increase readers' comprehension of the guidelines and will allow queries at the individual recommendation level.

Figure 1. ACC/AHA classification of recommendations for practice guidelines.

Therefore, it is within the scope of the writing committee's task to comment on the strengths and limitations of externally reporting potential performance measures. Specifically, this was done in the inpatient measurement set, where a "Challenges to Implementation" section was included below the specification, when appropriate (see Appendix A).

All the measures contained in this set have limitations and challenges to implementation that could result in unintended consequences when used for accountability purposes. The implementation of these measures for purposes other than quality improvement (QI) require field testing to address issues related to, but not limited to, sample size, reasonable frequency of use for an intervention, comparability, and audit requirements. The way in which these issues are addressed will be highly dependent on the type of accountability system developed including data collection method, assignment of patients to physicians for measurement purposes, baseline measure setting, incentive system, and public reporting method among others. The ACC/AHA encourages those interested in working on implementation of these measures for purposes beyond QI to work with the ACC/AHA to understand these complex issues in pilot testing projects that can measure the impact of any limitations and provide guidance on possible refinements of the measures that would make them more suitable for additional purposes.

In the process of facilitating the measurement of cardiovascular health care quality, the ACC/AHA Performance Measurement Sets can serve as a vehicle for more rapidly translating the strongest clinical evidence into practice. These documents are intended to provide practitioners with "tools" for measuring the quality of care and for identifying opportunities to improve. Because the target audience and unit of analysis for these measures is the practitioner, they were constructed from the provider's perspective and were not intended to characterize "good" or "bad" practice but to be part of a system with which to assess and improve health care quality. It is our hope that an application of these performance measures within a system of QI will provide a mechanism through which the quality of medical care can be measured and improved.

Robert O. Bonow, MD, FACC, FAHA
Chair, ACC/AHA Task Force on Performance Measures

I. INTRODUCTION

The ACC/AHA ST-Elevation and Non–ST-Elevation Myocardial Infarction (STEMI/NSTEMI) Performance Measures Writing Committee was charged with the development of performance measures concerning the diagnosis and treatment of both ST-elevation myocardial infarction (STEMI) and non–ST-elevation myocardial infarction (NSTEMI) (see the Methodology section for detailed information on how the measures were constructed and selected.)

A. Scope of the Problem

Both STEMI and NSTEMI afflict an enormous number of people each year. The estimated incidence of myocardial infarction (MI) is 865 000 attacks annually. Twenty percent of men and 30% of women will die within 1 year after having an initial recognized MI. The risk of further cardiac disease complications, such as another heart attack, sudden death, angina pectoris, heart failure and stroke for those who survive an MI is substantial (2).

Over the past 30 years, advances in cardiovascular care have resulted in a dramatic decline in mortality and morbidity associated with STEMI and NSTEMI (3). However, there is strong evidence that the best treatments and strategies for these patients are not always pursued. As a result, the outcomes of STEMI and NSTEMI patients are not as good as they could be with better translation of the best scientific knowledge to the bedside.

B. Writing Committee Structure/Members

The members of the ACC/AHA STEMI/NSTEMI Performance Measures Writing Committee included senior clinicians, a content expert on STEMI and NSTEMI performance measurement, a methodologist, and a statistician. The Writing Committee also included members of the American College of Physicians (ACP), American Academy of Family Physicians (AAFP), and the American College of Emergency Physicians (ACEP).

C. Independence/Relationships With Industry Disclosure

The work of the Writing Committee was supported exclusively by the ACC and the AHA. Writing Committee members volunteered their time, and there was no commercial support. Meetings of the Writing Committee were confidential and attended only by committee members and staff. All Writing Committee members with relationships with industry relevant to this topic declared these in writing according to standard ACC and AHA reporting requirements; additionally, members verbally acknowledged these relationships to the Writing Committee. Please see Appendix C for relevant Writing Committee relationships with industry. In addition, Appendix D includes relevant relationships with industry information for all peer reviewers of this document.

D. Review/Endorsement

During the period August 13, 2004 to September 13, 2004, the ACC/AHA STEMI/NSTEMI Performance Measures document underwent a 30-day public comment period during which time ACC and AHA members, as well as other health professionals, had an opportunity to review and comment on the final draft document in advance of its final approval and publication. Over 40 responses were received.

The official peer and content review of the document was conducted simultaneously with the 30-day public comment period, with two peer reviewers nominated by the ACC and two reviewers nominated by the AHA. Additional comments were sought from clinical content experts and performance measurement experts.

The ACC/AHA Clinical Performance Measures for Adults with ST-Elevation and Non–ST-Elevation Myocardial Infarction was adopted by the respective Boards of the ACC and AHA on October, 2005. These measures will be reviewed for currency annually and will be updated as needed. They will be considered valid until they are updated or rescinded by the ACC/AHA Task Force on Performance Measures.

II. METHODOLOGY

The development of performance systems involves identification of a set of measures targeted toward a particular patient population, observed over a particular time period. To achieve this goal, the ACC/AHA Task Force on Performance Measures has outlined and published a methodology of sequential tasks that writing committees are required to complete (1). The following sections outline how these steps were applied by this Writing Committee.

A. Definition of STEMI/NSTEMI

The Writing Committee has incorporated the use of the terms STEMI and NSTEMI throughout this document along with the all-inclusive term acute myocardial infarction (AMI) based on the revision of the 1999 ACC/AHA Guideline for the Management of Patients with Acute Myocardial Infarction (4). This guideline update resulted in the topic of AMI being separated into two guidelines: the ACC/AHA 2002 Guideline Update for the Management of Patients With Unstable Angina and Non–ST-Segment Elevation Myocardial Infarction (5) and the 2004 ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (6). The Writing Committee has used the term AMI when the measure refers to both STEMI and NSTEMI patients, while the term STEMI was used in cases in which the clinical recommendation is specific to STEMI patients only. Measures specific to NSTEMI patients only are not contained in this set but may be considered in future updates.

Specific diagnosis codes, based on ICD-9-CM (Table 1), should be used to screen and select the inpatient target patient population. These codes correspond to the Joint

Table 1. Relevant ICD-9-CM Diagnosis Codes

ICD-9-CM	Description
410.01	Anterolateral wall, acute myocardial infarction-initial episode
410.11	Other anterior wall, acute myocardial infarction-initial episode
410.21	Inferolateral wall, acute myocardial infarction-initial episode
410.31	Inferoposterior wall, acute myocardial infarction-initial episode
410.41	Other inferior wall, acute myocardial infarction-initial episode
410.51	Other lateral wall, acute myocardial infarction-initial episode
410.61	True posterior wall, acute myocardial infarction-initial episode
410.71	Subendocardial, acute myocardial infarction-initial episode
410.81	Other specified sites, acute myocardial infarction-initial episode
410.91	Unspecified site, acute myocardial infarction-initial episode

Commission on Accreditation of Healthcare Organizations (JCAHO) and Centers for Medicare and Medicaid services (CMS) AMI cohort selection codes.

B. Dimensions of Care

Given the multiple domains of providing care that can be measured, the Writing Committee identified and explicitly articulated the relevant dimensions of care that should be evaluated. As part of the methodology, each potential performance measure was categorized into its relevant dimension of care. Classification into dimensions of care facilitated identification of areas where evidence was lacking as well as prevented duplication of measures within the set. Diagnostics, patient education (including prognosis and etiology), and treatment were selected as the relevant dimensions of care for the STEMI/NSTEMI performance measures. Self-management and monitoring of disease status will be evaluated in the future for the inpatient setting. The committee exclusively focused on processes and did not consider outcomes, because the purpose of the measures are to assist physicians in improving specific clinical care.

C. Literature Review

As the primary sources for deriving these measures, this Writing Committee reviewed the 1999 ACC/AHA Guidelines for the Management of Patients With Acute Myocardial Infarction (AMI Guideline) (4), the ACC/AHA 2002 Guideline Update for Management of Patients with Unstable Angina and Non–ST-Segment Elevation Myocardial Infarction (UA/NSTEMI guideline) (5), and the 2004 ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (STEMI guideline) (6). The Chair of this Writing Committee also participated on the Writing Committee of the latter guideline. As a participant on the guideline committee, the Chair was able to offer insights into measurement issues and provide suggestions for clarity and specificity of guideline recommendations. At the same time, the guideline contributed to the refinement of the measures developed by this Writing Committee.

In addition, existing measure sets, such as those developed by the JCAHO and CMS, were reviewed by the Writing Committee. See the Discussion section for details on our efforts to align our measures with CMS and JCAHO.

D. Definition and Selection of Measures

Explicit criteria exist for the development of performance measures so that they can accurately reflect the quality of care, including quantification of the numerator and denominators of potential measures and evaluating the interpretability, applicability, and feasibility of the proposed measure. To determine which measures would be considered for inclusion in the performance measurement set, the Writing Committee reviewed and prioritized the class I and class III recommendations as potential quality indicators from the AMI guideline, the UA/NSTEMI guideline, and the STEMI guideline (4–6).

From the analysis of these recommendations, the Writing Committee identified potential measures relevant to the treatment of STEMI and NSTEMI patients. Using the ACC/AHA performance measure rating form and guide (Appendix B), each Writing Committee member rated potential measures on 13 dimensions using a 5-point Likert scale (1 = lowest rating; 5 = highest rating) against the ACC/AHA attributes for good performance measures (Table 2).

The rating results of the final question on the rating form, "Overall Assessment," were used to make the final determination for inclusion of a potential measure in the measurement set. Any measure that received a full committee

Table 2. ACC/AHA Attributes for Satisfactory Performance Measures

ACC/AHA Attributes for Satisfactory Performance Measures
Useful in improving patient outcomes
1. Evidence-based
2. Interpretable
3. Actionable
Measure design
1. Denominator precisely defined
2. Numerator precisely defined
3. Validity
a. Face validity
b. Content validity
c. Construct validity
4. Reliability
Measure implementation
1. Feasibility
a. Reasonable effort
b. Reasonable cost
c. Reasonable time period for collection
Overall assessment

Table 3. ACC/AHA STEMI/NSTEMI Performance Measures: Inpatient Measure Descriptions

Performance Measure Name	Measure Description
1. Aspirin at Arrival	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival.
2. Aspirin Prescribed at Discharge	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients without aspirin contraindications who are prescribed aspirin at hospital discharge.
3. Beta-Blocker at Arrival	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients without beta-blocker contraindications who received a beta-blocker within 24 hours after hospital arrival.
4. Beta-Blockers Prescribed at Discharge	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients without beta-blocker contraindications who are prescribed a beta-blocker at hospital discharge.
5. LDL-Cholesterol Assessment	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients with documentation of low-density lipoprotein cholesterol (LDL-c) level in the hospital record or documentation that LDL-c testing was done during the hospital stay or is planned for after discharge.
6. Lipid-Lowering Therapy at Discharge	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients with elevated low-density lipoprotein cholesterol (LDL-c ≥100 mg/dl or narrative equivalent) who are prescribed a lipid-lowering medication at hospital discharge.
7. ACEI or ARB for LVSD at Discharge	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients with left ventricular systolic dysfunction (LVSD) and without both angiotensin-converting enzyme inhibitor (ACEI) and angiotensin receptor blocker (ARB) contraindications who are prescribed an ACEI or ARB at hospital discharge.
8. Time to Fibrinolytic Therapy	Median time from arrival to administration of fibrinolytic therapy in patients with ST-segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival time. Acute myocardial infarction (AMI-STEMI and LBBB only) patients receiving fibrinolytic therapy during the hospital stay and having a time from hospital arrival to fibrinolysis of 30 min or less.
9. Time to PCI	Median time from arrival to percutaneous coronary intervention (PCI) in patients with ST-segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to arrival time. Acute myocardial infarction (AMI-STEMI and LBBB only) patients receiving percutaneous coronary intervention (PCI) during the hospital stay with a time from hospital arrival to PCI of 90 min or less.
10. Reperfusion Therapy	Acute myocardial infarction (AMI-STEMI only) patients with ST-segment elevation on the electrocardiogram (ECG) performed closest to arrival who receive fibrinolytic therapy or primary percutaneous coronary intervention (PCI).
11. Adult Smoking Cessation Advice/Counseling	Acute myocardial infarction (AMI-STEMI and NSTEMI) patients with a history of smoking cigarettes who are given smoking cessation advice or counseling during hospital stay.

LDL-c = low-density lipoprotein cholesterol; NSTEMI = non–ST-elevation MI; STEMI = ST-elevation MI.

consensus rating of 3 or above in this area ("Overall Assessment") was advanced for full consideration by the Writing Committee.

In the case of the measure for angiotensin-converting enzyme inhibitor (ACEI), a Class IIa ACC/AHA STEMI guidelines recommendation for angiotensin receptor blockers (ARB) was considered and used as the basis for clarifying the measure constructed by the committee. Although class IIa recommendations are not considered for stand-alone measures, in some cases (such as this one) they provide additional information about valid alternative therapies that are considered by the committee for inclusion in a measure set.

III. STEMI/NSTEMI PERFORMANCE MEASURES

A. Inpatient Population and Care Period

The inpatient target population consists of patients aged 18 years or older with a principal discharge diagnosis of AMI (STEMI and NSTEMI) based on ICD-9-CM (Table 1). A set of inclusion and exclusion criteria specific to each inpatient measure was developed. The general period of assessment is the related inpatient hospitalization. The specific time period of interest for each measure is further defined in the full measure specifications (Appendix A).

B. Brief Summary of the Measurement Set

Table 3 shows the ACC/AHA STEMI/NSTEMI performance measurement set—those with the highest level of evidence and full-consensus support among the committee members. The measures include aspirin therapy at arrival and discharge, beta-blocker therapy at arrival and discharge, low-density lipoprotein cholesterol (LDL-c) assessment, lipid-lowering therapy at discharge, ACEI, and/or ARB therapy, time-to-fibrinolytic therapy, time-to-percutaneous coronary intervention (PCI), reperfusion therapy, and smoking cessation advice/counseling.

Appendix A provides the detailed specifications for each inpatient performance measure, including numerator, denominator, period of assessment, method of reporting, sources of data, rationale, corresponding guidelines, secondary measures to consider, and challenges to implementation.

Table 4. ACC/AHA STEMI/NSTEMI Performance Measurement Set: Dimensions of Care Inpatient Measures Matrix

Performance Measure	Diagnostics	Patient Education	Treatment	Self-Management*	Monitoring of Disease Status*
1. Aspirin at Arrival			✓		
2. Aspirin Prescribed at Discharge			✓		
3. Beta-Blocker at Arrival			✓		
4. Beta-Blockers Prescribed at Discharge			✓		
5. LDL-Cholesterol Assessment	✓				
6. Lipid-Lowering Therapy at Discharge			✓		
7. ACEI or ARB for LVSD			✓		
8. Time to Fibrinolytic Therapy			✓		
9. Time to PCI			✓		
10. Reperfusion Therapy			✓		
11. Adult Smoking Cessation Advice/Counseling		✓			

*Although no current measures exist for these dimensions of care for the inpatient setting, future measure development efforts will examine how to address this gap in the measurement set.

ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; LDL = low-density lipoprotein; LVSD = left ventricular systolic dysfunction.

C. Data Collection

To aid in the collection of hospital data, use of a data collection tool or flow sheet is recommended. The flow sheet may be developed at individual institutions to conform to local workflow issues and data collection practices. Examples of useful data collection tools are available from ACC's Guideline Applied in Practice (GAP) program Web site (http://www.acc.org/gap/mi/ami_downloadA.htm) and the AHA's Get With The Guidelines (GWTG) program web site (http://www.americanheart.org/presenter.jhtml?identifier=3003994). The tools can be modified for implementation at your institution in order to be used in practice.

To further the use of standardized terminology and data definitions in the field of cardiology, those collecting data on patients with STEMI or NSTEMI are referred to the ACC Key Data Elements and Definitions for Measuring the Clinical Management and Outcomes of Patients with Acute Coronary Syndromes (7).

IV. DISCUSSION

The ACC/AHA Clinical Performance Measures for Adults With ST-Elevation and Non–ST-Elevation MI addresses many of the same processes of care as earlier measurement sets published by other organizations. These measures were developed by employing the ACC/AHA methodology for developing performance measure sets (3). The Writing Committee has been cognizant of the previous efforts of other groups and sought to enhance and clarify measures in ways that reflect the advancement of the underlying science, the complexity of care, and the challenges of accurate and complete data collection. As such, the Writing Committee has made every attempt to align these measures with those promulgated by CMS and JCAHO.

This Writing Committee felt it was important to add exclusion criteria to the measures to recognize that there are justifiable medical and patient reasons for not meeting the performance measures. These reasons should be included in the "reasons documented by physician, nurse practitioner, or other health care provider for not. . ." Documentation of such factors should be encouraged and will provide valuable data for future research and conducting in-depth QI for situations where there seem to be outliers with respect to the number of patients with medical or patient-centered exclusions for the performance measures.

Challenges to implementation of measures are discussed, where applicable. In general, inadequate documentation is the initial challenge of any measurement effort. The fact that these challenges are discussed is not intended as an argument against measurement. Rather, they should be considered as cautionary notes that draw attention to areas where additional focus on research and improvement of the measures should be considered.

Four areas in this measurement set warrant further discussion: the addition of ARBs to the ACEI for left ventricular systolic dysfunction (LVSD) measure (#7), the use of "median" versus "mean" in the time-to-fibrinolytic measure (#8), the new standard for the time-to-PCI measure (#9), and the new reperfusion therapy (#10) measure.

A. Addition of ARBs to ACEI Measure

The measurement set includes ARBs along with ACEI prescription on discharge. Although Class IIa recommendations are not considered for stand-alone measures, in this case, the additional information provided about valid alternative therapies allowed it to be considered for inclusion in the measure. This change is made with

recognition that although the guidelines still recommend ACEI as first-line therapy, physicians should be given credit for prescribing or continuing ARB therapy. The support for the use of ARBs has evolved significantly in response to published clinical trials that have shown ARBs as an effective alternative therapy and is recommended in the 2004 ACC/AHA STEMI guidelines (6) as a reasonable alternative therapy.

B. Median—Time-to-Fibrinolytic Therapy and Time-to-Primary PCI Measures

Median better represents the typical time achieved than does *mean*. The mean time can be unduly skewed by outlier times, even as there are upper limits on the time. Thus, the committee favored reporting the median time. This is a contrast with the corresponding CMS/JCAHO measure, which reports the values in mean time. The CMS/JCAHO equivalent measures will report the median for discharges effective January 1, 2006. The information was released to the community in late August 2005.

C. New Standard for Time-to-Primary PCI Measure

This measurement set establishes the time-to-PCI standard at 90 min, which is different than the 120-min standard used in the current CMS and JCAHO measures. This change reflects the new recommendation from the 2004 ACC/AHA STEMI guidelines that, "delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min" (6).

D. New Reperfusion Therapy Measure

The new reperfusion therapy measure is meant to capture the percentage of patients eligible for reperfusion (either fibrinolytic therapy or PCI) who are reperfused. This measure is meant to assist facilities in assessing the appropriateness of their use of reperfusion therapy and detecting underutilization of reperfusion.

Although the Writing Committee considered a number of additional potential measures that focus on equally important aspects of care, either the evidence base or more significant challenges to measurement of these components of care across all patients undermined the benefits that might be gained. Of note, the committee discussed at length the possibility of including a clopidogrel measure and a measure for ACEI in patients with left ventricular ejection fraction (LVEF) greater than 0.40, but it felt that the evidence-base did not yet support their inclusion as a performance measure. The Writing Committee will monitor changes in the evidence in new clinical trials and will determine whether additional measures should be added in the future.

The ACC/AHA STEMI/NSTEMI performance measurement set should contribute to the evolution of reporting systems that allow physicians to improve care for a critical patient population. QI is a continuous process, and this document reflects the lessons the practicing community has learned to date in using existing measures and knowledge gained about how they might be improved. The clinical care team should collect data and review adherence to these measures on a routine basis, look for changes, and adjust practice patterns as necessary to improve performance.

APPENDIX A. ACC/AHA STEMI/NSTEMI Measurement Set Specifications

1. Aspirin at Arrival

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival.

Numerator	AMI patients who received aspirin within 24 hours before or after hospital arrival.
Denominator	AMI patients without aspirin contraindications. **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital on day of or day after arrival • Patients received in transfer from another acute care hospital, including another emergency department • Patients discharged on day of arrival • Patients who expired on day of or day after arrival • Patients who left against medical advice on day of or day after arrival • Patients with one or more of the following aspirin contraindications/reasons for not prescribing aspirin documented in the medical record: - Active bleeding on arrival or within 24 hours after arrival - Aspirin allergy - Coumadin/warfarin as pre-arrival medication - Other reasons documented by physician, nurse practitioner, or physician assistant for not giving aspirin within 24 hours before or after hospital arrival*
Period of assessment	Within 24 hours before or after hospital arrival.
Sources of data	Administrative data and medical records.

Rationale

The use of aspirin has been shown to reduce mortality with AMI.

Corresponding Guideline(s)

ACC/AHA STEMI Guidelines (6)

Class I

Aspirin should be chewed by patients who have not taken aspirin before presentation with STEMI. The initial dose should be 162 mg (Level of Evidence: A) to 325 mg (Level of Evidence: C). Although some trials have used enteric-coated aspirin for initial dosing, more rapid buccal absorption occurs with non–enteric-coated aspirin formulations.

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Antiplatelet therapy should be initiated promptly. Aspirin should be administered as soon as possible after presentation and continued indefinitely (Level of Evidence: A).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

*This also includes aspirin intolerance.

2. Aspirin Prescribed at Discharge	
Acute myocardial infarction (AMI–STEMI and NSTEMI) patients without aspirin contraindications who are prescribed aspirin at hospital discharge	
Numerator	AMI patients who are prescribed aspirin at hospital discharge.
Denominator	AMI patients without aspirin contraindications. **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice • Patients with one or more of the following aspirin contraindications/reasons for not prescribing aspirin documented in the medical record: - Aspirin allergy - Active bleeding on arrival or during hospital stay - Coumadin/warfarin prescribed at discharge - Other reasons documented by physician, nurse practitioner, or physician assistant for not prescribing aspirin at discharge*
Period of assessment	Hospital discharge.
Sources of data	Administrative data and medical records.
Rationale	
The use of aspirin has been shown to reduce recurrent MI and death in patients surviving an initial MI.	
Corresponding Guideline(s)	
ACC/AHA STEMI Guidelines (6) *Class I* A daily dose of aspirin (initial dose of 162 to 325 mg orally; maintenance dose of 75 to 162 mg) should be given indefinitely after STEMI to all patients without a true aspirin allergy (Level of Evidence: A). ACC/AHA UA/NSTEMI Guidelines (5) *Class I* Antiplatelet therapy should be initiated promptly. Aspirin should be administered as soon as possible after presentation and continued indefinitely (Level of Evidence: A).	
Method of Reporting	
Aggregate rate (standard error) generated from count data reported as a proportion.	

*This also includes aspirin intolerance.

3. Beta-Blocker at Arrival

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients without beta-blocker contraindications who received a beta-blocker within 24 hours after hospital arrival

Numerator	AMI patients who received a beta-blocker within 24 hours after hospital arrival.
Denominator	AMI patients without beta blocker contraindications. **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital on day of or day after arrival • Patients received in transfer from another acute care hospital, including another emergency department. • Patients discharged on day of arrival • Patients who expired on day of or day after arrival • Patients who left against medical advice on day of or day after arrival • Patients with one or more of the following beta-blocker contraindications/reasons for not prescribing beta-blocker documented in the medical record: - Beta-blocker allergy - Bradycardia (heart rate less than 60 beats/min) on arrival or within 24 hours after arrival while not on a beta-blocker - Heart failure on arrival or within 24 hours after arrival - Second- or third-degree heart block on ECG on arrival or within 24 hours after arrival and does not have a pacemaker - Shock on arrival or within 24 hours after arrival - Other reasons documented by a physician, nurse practitioner, or physician assistant for not giving a beta-blocker within 24 hours after hospital arrival*
Period of assessment	Within 24 hours after hospital arrival.
Sources of data	Administrative data and medical records.

Rationale

To reduce ventricular arrhythmias, recurrent ischemia, reinfarction, and if given early enough, infarct size and short-term mortality.

Corresponding Guideline(s)

ACC/AHA STEMI Guidelines (6)

Class I
Oral beta-blocker therapy should be administered promptly to those patients without a contraindication, irrespective of concomitant fibrinolytic therapy or performance of primary PCI (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I
A beta-blocker, with the first dose administered intravenously if there is ongoing chest pain, followed by oral administration, in the absence of contraindications (Level of Evidence: B).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

*This also includes beta-blocker intolerance.

4. Beta-Blocker Prescribed at Discharge	
Acute myocardial infarction (AMI–STEMI and NSTEMI) patients without beta-blocker contraindications who are prescribed a beta-blocker at hospital discharge	
Numerator	AMI patients who are prescribed a beta-blocker at hospital discharge.
Denominator	AMI patients without beta-blocker contraindications. **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice • Patients with one or more of the following beta-blocker contraindications/reasons for not prescribing a beta-blocker documented in the medical record: - Beta-blocker allergy - Bradycardia (heart rate less than 60 beats/min) on day of discharge or day prior to discharge while not on a beta-blocker - Second- or third-degree heart block on ECG on arrival or during hospital stay and does not have a pacemaker - Other reasons documented by a physician, nurse practitioner, or physician assistant for not prescribing a beta-blocker at discharge*
Period of assessment	Hospital discharge.
Source of data	Administrative data and medical records.
Rationale	
Reduction in recurring events and long-term mortality.	
Corresponding Guideline(s)	
ACC/AHA STEMI Guidelines (6) *Class I* All patients after STEMI except those at low risk (normal or near-normal ventricular function, successful reperfusion, absence of significant ventricular arrhythmias) and those with contraindications should receive beta-blocker therapy. Treatment should begin within a few days of the event, if not initiated acutely, and continue indefinitely (Level of Evidence: A). *Class IIa* It is reasonable to prescribe beta-blockers to low-risk patients after STEMI who have no contraindications to that class of medications (Level of Evidence: A). ACC/AHA UA/NSTEMI Guidelines (5) *Class I* Beta-blockers in the absence of contraindications (Level of Evidence: A).	
Method of Reporting	
Aggregate rate (standard error) generated from count data reported as a proportion.	

*This also includes beta-blocker intolerance.

5. LDL-Cholesterol Assessment

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients with documentation of low-density lipoprotein-cholesterol (LDL-c) level in the hospital record or documentation that LDL-c testing was done during the hospital stay or is planned for after discharge

Numerator	AMI patients with documentation of LDL-c level in the hospital record or documentation that LDL-c testing was done either during the hospital stay or is planned for after discharge.
Denominator	AMI patients. **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice • Lipid-lowering medication are pre-arrival medication • Patients with reason documented by a physician, nurse practitioner, or physician assistant for no LDL-c testing
Period of assessment	Inpatient admission.
Source of data	Administrative data and medical records.

Rationale

Measurement of lipid levels in patients with STEMI and NSTEMI is essential to gauging the need for lipid-lowering therapy and/or dietary modification and assessing the risk of subsequent coronary events.

Corresponding Guideline(s)

AHA/ACC Guidelines for Preventing Heart Attack and Death in Patients With Atherosclerotic Cardiovascular Disease: 2001 Update (8)
Assess fasting lipid profile in all patients, and within 24 hours of hospitalization for those with an acute event.

ACC/AHA STEMI Guidelines (6)

Class I
A lipid profile should be performed, or obtained from recent or past records, for all STEMI patients, preferably after they have fasted and within 24 hours of symptom onset (Level of Evidence: C).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

6. Lipid-Lowering Therapy at Discharge

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients with elevated low-density lipoprotein-cholesterol (LDL-c ≥100 mg/dl or narrative equivalent) who are prescribed a lipid-lowering medication at hospital discharge.

Numerator	AMI patients who are prescribed lipid-lowering medication at hospital discharge.
Denominator	AMI patients with elevated LDL-c. **Included populations:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • Patients with one or more of the following documented in the medical record: - LDL-c ≥100 mg/dl (or narrative equivalent) on test performed during hospital stay OR - If no in-hospital test result, LDL-c >100 mg/dl (or narrative equivalent) on test performed prior to arrival **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice • Patients who did not receive lipid-lowering medication and had a reason documented by a physician, nurse practitioner, or physician assistant for not prescribing lipid-lowering medication at discharge*
Period of assessment	Hospital discharge.
Sources of data	Administrative data and medical records.

Rationale

Multiple clinical trials have shown the benefit of lipid-lowering therapy for patients who have had an acute coronary event. Initiation of lipid-lowering therapy at discharge is preferred to enhance patient compliance with medication therapy.

Corresponding Guideline(s)

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Lipid-lowering agents and diet in post-acute coronary syndrome patients, including post-revascularization patients, with LDL-c greater than 130 mg/dl (Level of Evidence: A).

Lipid-lowering agents if LDL-c level after diet is greater than 100 mg/dl (Level of Evidence: B).

ACC/AHA STEMI Guidelines (6)

Class I

The target LDL-c level after STEMI should be substantially less than 100 mg/dl. Patients with LDL-c 100 mg/dl or above should be prescribed drug therapy on discharge, with preference given to statins (Level of Evidence: A).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

*This also includes intolerance to lipid-lowering medication.

7. ACEI or ARB for LVSD at Discharge

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients with left ventricular systolic dysfunction (LVSD) and without both angiotensin-converting enzyme inhibitor (ACEI) and angiotensin receptor blocker (ARB) contraindications who are prescribed an ACEI or ARB at hospital discharge.

(For purposes of this measure, LVSD is defined as chart documentation of a left ventricular ejection fraction [LVEF] less than 40% or a narrative description of left ventricular systolic [LVS] function consistent with moderate or severe systolic dysfunction.)

Numerator	AMI patients who are prescribed an ACEI or ARB at hospital discharge.
Denominator	AMI patients with LVSD and without both ACEI and ARB contraindications. **Included populations:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • Chart documentation of a LVEF less than 40% or a narrative description of LVS function consistent with moderate or severe systolic dysfunction. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice • Patients with BOTH a potential contraindication/reason for not prescribing an ACEI at discharge AND a potential contraindication/reason for not prescribing an ARB at discharge, as evidenced by one or more of the following: - ACEI or ARB allergy - Moderate or severe aortic stenosis - Physician, nurse practitioner, or physician assistant documentation of BOTH a reason for not prescribing an ACEI at discharge AND a reason for not prescribing an ARB at discharge* - Reason documented by physician, nurse practitioner, or physician assistant for not prescribing an ARB at discharge AND an ACEI allergy - Reason documented by physician, nurse practitioner, or physician assistant for not prescribing an ACEI at discharge AND an ARB allergy.*
Period of assessment	Hospital discharge.
Sources of data	Administrative data and medical records.

Rationale

ACEIs have been shown to reduce mortality rates for patients with AMI (or who recently had an MI) and have LVSD (9–13). Benefit has been greatest for those with anterior MI and those with greater LV dysfunction (LVEF <0.40). Benefit also has been shown in diabetic patients with LV dysfunction (14). Current guidelines (5,6) recommend (Class I designation) in-hospital initiation (within 24 hours) and outpatient continuation indefinitely.

The use of ARBs post-STEMI has not been as thoroughly explored as ACEIs in STEMI patients. The OPTIMAAL trial found no significant differences between losartan (target dose 50 mg once daily) and captopril (target dose 50 mg three times daily) in all-cause mortality (15); there was a trend toward better outcome with captopril. The VALIANT trial compared the effects of captopril (target dose 50 mg three times daily), valsartan (target dose 160 mg twice daily), and the combination (captopril target dose 50 mg three times daily; valsartan target dose 80 mg twice daily) on mortality in post-MI patients with LV dysfunction (16). During a median follow-up of 24.7 months, death occurred in 19.9% of the valsartan group, 19.5% of the captopril group, and 19.3% of the combined group. Accordingly, guidelines suggest that valsartan monotherapy (target dose 160 mg twice daily) should be administered to STEMI patients who are intolerant of ACEIs and have evidence of LV dysfunction. However, guidelines also state that valsartan monotherapy can be a useful alternative to ACEIs—the decision in individual patients may be influenced by physician and patient preference, cost, and anticipated side-effect profile (6).

Corresponding Guideline(s)

ACC/AHA STEMI Guidelines (6)

Class I

An ACEI should be administered orally within the first 24 hours of STEMI to patients with an anterior MI, pulmonary congestion, or LVEF less than 0.40, in the absence of hypotension (systolic blood pressure less than 100 mm Hg or less than 30 mm Hg below baseline) or known contraindications to that class of medications (Level of Evidence: A).

An ARB should be administered to STEMI patients who are intolerant of ACEIs and who have either clinical or radiological signs of heart failure or LVEF less than 0.40. Valsartan and candesartan have established efficacy for this recommendation (Level of Evidence: C).

An ACEI should be administered orally during convalescence from STEMI in patients who tolerate this class of medication, and it should be continued over the long term (Level of Evidence: A).

An ARB should be administered to STEMI patients who are intolerant of ACEIs and have either clinical or radiological signs of heart failure or LVEF less than 0.40. Valsartan and candesartan have demonstrated efficacy for this recommendation (Level of Evidence: B).

Class IIa

In STEMI patients who tolerate ACEIs, an ARB can be useful as an alternative to ACEIs provided there are either clinical or radiological signs of heart failure or LVEF is less than 0.40. Valsartan and candesartan have established efficacy for this recommendation (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Long-Term Medical Therapy

ACEIs for patients with CHF, LV dysfunction (LVEF less than 0.40), hypertension, or diabetes (Level of Evidence: A).

Method of Reporting
Aggregate rate (standard error) generated from count data reported as a proportion.

Challenges to Implementation
Determination of who has LVEF <0.40 is a potential challenge to implementation as well as how this can be reasonably, consistently, and reliably located in the patient record. Also, future updates may consider whether the determination of ACEI or ARB use is made only at discharge (discharge medication list) or whether additional credit should be provided for inhospital initiation and titration. Quality improvement efforts also should consider whether prescription of only specific agents or specific dose-ranges (based on clinical trial evidence) should be encouraged.

*This also includes ACEI or ARB intolerance.

8. Time to Fibrinolytic Therapy

Median time from arrival to administration of fibrinolytic agent in patients with ST-segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival time.
Acute myocardial infarction (AMI–STEMI and LBBB only) patients receiving fibrinolytic therapy during the hospital stay and having a time from hospital arrival to fibrinolysis of 30 min or less.

Numerator	AMI patients whose time from hospital arrival to fibrinolytic therapy is 30 min or less.
Denominator	AMI patients with ST-elevation or LBBB on ECG who received fibrinolytic therapy. **Included populations:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • ST-segment elevation or LBBB on the ECG performed closest to hospital arrival AND • Fibrinolytic therapy within 6 hours after hospital arrival AND • Fibrinolytic therapy is primary reperfusion therapy **Excluded populations:** • Patients less than 18 years of age • Patients received in transfer from another acute care hospital including another emergency department • Other reasons documented by physician, nurse practitioner, or physician assistant for delay in fibrinolytic therapy (e.g., social, religious, initial concern or refusal)
Period of assessment	Within 6 hours after hospital arrival.
Sources of data	Administrative data and medical records.

Rationale

There are a multitude of experimental and clinical studies that demonstrate that amount of myocardial salvage is directly related to time of fibrinolytic therapy administration. The earlier the treatment, the more myocardium is salvaged (i.e., "time is muscle"). Total time to fibrinolytic drug administration is dependent on a multitude of processes that begins on patient's arrival to the emergency department. The National Heart Attack Alert Program has chosen to focus on four D's of the overall process: Door, Data, Decision, and Delivery. The three easiest data points to measure on retrospective chart review are Door (arrival time), Data (ECG time), and Delivery (time of drug administration). Decision time can only be determined if the physician documents in the medical records the actual time that he/she gave the order for fibrinolytic drug administration. Data time only truly reflects actual data time if physician immediately reviews ECG results ("data not seen is data not done").

Corresponding Guideline(s)

Door-to-Data (ECG) Time
ACC/AHA STEMI Guidelines (6)

Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 min of emergency department arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of STEMI (Level of Evidence: C).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I
A 12-lead ECG should be obtained immediately (within 10 min) in patients with ongoing chest discomfort and as rapidly as possible in patients who have a history of chest discomfort consistent with acute coronary syndrome but whose discomfort has resolved by the time of evaluation (Level of Evidence: C).

Data-to-Decision Time
No ACC/AHA Guideline Recommendations

Decision-to-Delivery Time
No ACC/AHA Guideline Recommendations

Door-to-Delivery (fibrinolytic drug administration) Time
ACC/AHA STEMI Guidelines (6)

Class I
The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).
ACC/AHA Indications for Fibrinolytic Therapy–ST-Segment Elevation Cohort

ACC/AHA STEMI Guidelines (6)

Class I
All STEMI patients should undergo rapid evaluation for reperfusion therapy and have a reperfusion strategy implemented promptly after contact with the medical system (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Patients with definite acute coronary syndrome and ST-segment elevation should be evaluated for immediate reperfusion therapy (Level of Evidence: A).
ACC/AHA Indications for Fibrinolytic Therapy–LBBB Cohort

ACC/AHA STEMI Guidelines (6)

Class I

In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and new or presumably new LBBB (Level of Evidence: A).

Method of Reporting

Time: Aggregate measure of central tendency (median as calculated based on patients in the denominator within the period of assessment).
Per patient population: Aggregate rate (standard error) generated from count data reported as a proportion.

Secondary Measures to Consider

- Door-to-ECG
- ECG-to-decision
- Decision-to-fibrinolytic drug administration

Challenges to Implementation

No major challenges are anticipated for overall time to fibrinolytic therapy, as a version of this measure is among the core measures that CMS and JCAHO require and is one of the major measures in the NRMI dataset (as well as time to ECG). Also ECG time is easily measured but may not reflect actual time if processes are not in place to ensure immediate physician interpretation. The major challenge would be to implement a measure of the decision time, as this would require a strong presence of emergency department directors in insisting upon better documentation.

9. Time to Primary Percutaneous Coronary Intervention (PCI)

Median time from arrival to percutaneous coronary intervention (PCI) in patients with ST-segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to arrival time.
Acute myocardial infarction (AMI–STEMI and LBBB only) patients receiving PCI during the hospital stay with a time from hospital arrival to PCI of 90 min or less.

Numerator	AMI patients whose time from hospital arrival to PCI is 90 min or less.
Denominator	AMI patients with ST-segment elevation or LBBB on ECG who received PCI. **Included populations:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • PCI (ICD-9-CM Principal or Other Procedure Codes for PCI) AND • ST-segment elevation or LBBB on the ECG performed closest to hospital arrival AND • PCI performed within 24 hours after hospital arrival **Excluded populations:** • Patients less than 18 years of age • Patients received in transfer from another acute care hospital including another emergency department • Patients administered fibrinolytic agent prior to PCI • MD/NP/PA described the PCI as non-primary • Other reasons documented by physician, nurse practitioner, or physician assistant for delay in PCI (e.g., social, religious, initial concern or refusal)
Period of assessment	Within 24 hours after hospital arrival.
Sources of data	Administrative data and medical records.

Rationale

The role of primary angioplasty in STEMI patients presenting to the emergency department with contraindications to fibrinolytic therapy is clear. Likewise, it is well-established that emergency PCI is more effective than fibrinolytic therapy in centers in which PCI can be performed by experienced personnel in a timely fashion. What is debatable is the utility of primary angioplasty in the typical community hospital. Since fibrinolytic therapy can be administered in most centers within 30 to 60 min of arrival, and since fibrinolytic therapy usually opens the occluded artery within 60 to 90 min, this equates to reperfused artery in 90 to 150 min after emergency department arrival in patients with STEMI treated with fibrinolytic therapy. Since "time is muscle," there obviously has to be a time from arrival until balloon insufflation in which the benefits of PCI are lost due to excess myocardial death that would have been spared had fibrinolytic therapy been administered. Thus, it is imperative to continually strive to improve door-to-balloon times such that the benefits of PCI are not lost from the excess cell death due to delays in opening occluded vessel.

Corresponding Guideline(s)

Door-to-Data (ECG) Time
ACC/AHA STEMI Guidelines (6)

Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 min of emergency department arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of STEMI (Level of Evidence: C).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I
A 12-lead ECG should be obtained immediately (within 10 min) in patients with ongoing chest discomfort and as rapidly as possible in patients who have a history of chest discomfort consistent with acute coronary syndrome but whose discomfort has resolved by the time of evaluation (Level of Evidence: C).

Data-to-Decision Time
No ACC/AHA Guideline Recommendations

Decision-to-Delivery Time
No ACC/AHA Guideline Recommendations

Door-to-Delivery Time (primary PCI)
ACC/AHA STEMI Guidelines (6)

Class I

The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).

ACC/AHA Indications for Primary PCI
ACC/AHA STEMI Guidelines (6)

Class I
All STEMI patients should undergo rapid evaluation for reperfusion therapy and have a reperfusion strategy implemented promptly after contact with the medical system (Level of Evidence: A).

The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Patients with definite acute coronary syndrome and ST-segment elevation should be evaluated for immediate reperfusion therapy (Level of Evidence: A).

LBBB Cohort

ACC/AHA STEMI Guidelines (6)

Class I

If immediately available, primary PCI should be performed in patients with STEMI (including true posterior MI) or MI with new or presumably new LBBB who can undergo PCI of the infarct artery within 12 hours of symptom onset, if performed in a timely fashion (balloon inflation within 90 min of presentation) by persons skilled in the procedure (individuals who perform more than 75 PCI procedures per year). The procedure should be supported by experienced personnel in an appropriate laboratory environment (performs more than 200 PCI procedures per year, of which at least 36 are primary PCI for STEMI, and has cardiac surgery capability) (Level of Evidence: A).

Method of Reporting

Time: Aggregate measure of central tendency (median as calculated based on patients in the denominator within the period of assessment).
Per patient population: Aggregate rate (standard error) generated from count data reported as a proportion.

Secondary Measures to Consider

- Door-to-ECG
- ECG-to-decision
- Decision-to-cath lab arrival
- Cath lab arrival-to-balloon time

Challenges to Implementation

No major challenges are anticipated as a version of this measure is already a core measure of CMS and JCAHO and is one of the major measures in the NRMI dataset. The biggest difficulty in measuring the time period is typically due to poor documentation in the cath lab. Measurement efforts must also be specific and consistent in defining the time of angioplasty (assumed to be time of first balloon insufflation).

10. Reperfusion Therapy

Acute myocardial infarction (AMI–STEMI only) patients with ST-segment elevation on the electrocardiogram (ECG) performed closest to arrival, who receive fibrinolytic therapy or primary percutaneous coronary intervention (PCI)

Numerator	AMI patients who receive fibrinolytic therapy or primary PCI.
Denominator	AMI patients with ST-segment elevation on ECG who received fibrinolytic therapy or primary PCI. **Included populations:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • ST-segment elevation on the ECG performed closest to hospital arrival AND • Patients presenting within 12 hours of symptom onset. **Excluded populations:** • Patients less than 18 years of age • Patient refusal of reperfusion therapy • Other reasons documented by a physician, nurse practitioner, or physician assistant for not doing reperfusion therapy
Period of assessment	Within 12 hours of symptom onset.
Sources of data	Administrative data and medical records.

Rationale

Evidence exists that expeditious restoration of flow in the obstructed infarct artery after the onset of symptoms in STEMI patients is a key determinant of short- and long-term outcomes regardless of whether reperfusion is accomplished by fibrinolysis or PCI. Despite such strong evidence, studies continue to indicate that reperfusion therapy is underutilized and often not administered soon after presentation. Indecision about the choice of reperfusion therapy should not deter physicians from using these strategies or delay them in administering therapy.

Corresponding Guideline(s)

ACC/AHA Indications for Fibrinolytic Therapy–ST-Segment Elevation Cohort
ACC/AHA STEMI Guidelines (6)

Class I
All STEMI patients should undergo rapid evaluation for reperfusion therapy and have a reperfusion strategy implemented promptly after contact with the medical system (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I
Patients with definite acute coronary syndrome and ST-segment elevation should be evaluated for immediate reperfusion therapy (Level of Evidence: A).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

11. Adult Smoking Cessation Advice/Counseling

Acute myocardial infarction (AMI–STEMI and NSTEMI) patients with a history of smoking cigarettes, who are given smoking cessation advice or counseling during hospital stay.
(For the purposes of this measure, a smoker is defined as someone who has smoked cigarettes anytime during the year prior to hospital arrival.)

Numerator	AMI patients (cigarette smokers) who receive smoking cessation advice or counseling during the hospital stay
Denominator	AMI patients with a history of smoking cigarettes anytime during the year prior to hospital arrival. **Included population:** Discharges with: • An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 2 AND • A history of smoking cigarettes anytime during the year prior to hospital arrival. **Excluded populations:** • Patients less than 18 years of age • Patients transferred to another acute care hospital or federal hospital • Patients who expired • Patients who left against medical advice • Patients discharged to hospice
Period of assessment	Hospital discharge.
Sources of data	Administrative data and medical records.

Rationale

In patients who have undergone an acute coronary event, smoking cessation is essential to their recovery, long-term health, and the prevention of subsequent reinfarction. All STEMI and NSTEMI patients with a history of smoking should be advised to quit and offered smoking cessation resources including nicotine replacement therapy, pharmacological therapy (i.e., bupropion), and referral to behavioral counseling or support group.

Corresponding Guideline(s)

ACC/AHA STEMI Guidelines (6)

Class I

Patient counseling to maximize adherence to evidence-based post-STEMI treatments (e.g., compliance with taking medication, exercise prescription, and smoking cessation) should begin during the early phase of hospitalization, occur intensively at discharge, and continue at follow-up visits with providers and through cardiac rehabilitation programs and community support groups, as appropriate (Level of Evidence: C).

Patients recovering from STEMI who have a history of cigarette smoking should be strongly encouraged to stop smoking and to avoid secondhand smoke. Counseling should be provided to the patient and family, along with pharmacological therapy (including nicotine replacement and bupropion) and formal smoking cessation programs as appropriate (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

Class I

Specific instructions should be given on the following: smoking cessation and achievement or maintenance of optimal weight, daily exercise, and diet (Level of Evidence: B).

Consider the referral of patients who are smokers to a smoking cessation program or clinic and/or an outpatient cardiac rehabilitation program (Level of Evidence: A).

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion.

APPENDIX B. Sample Rating Form and Rating Form Guide

Name of Measure:
Clinical Rationale:
Numerator:
Denominator:
Measure:

	Disagree	Moderate Agreement			Agree
Rate this measure on the following criteria.	**1**	**2**	**3**	**4**	**5**
Useful in Improving Patient Outcomes					
1. Evidence-based: The scientific basis of the measure is well established.	**1**	**2**	**3**	**4**	**5**
2. Interpretable: The results of the measure are interpretable by practitioners.	**1**	**2**	**3**	**4**	**5**
3. Actionable: The measure addresses an area that is under the practitioner's control.	**1**	**2**	**3**	**4**	**5**
Measure Design					
1. Denominator: The patient group to whom this measure applies (denominator) is clinically meaningful.	**1**	**2**	**3**	**4**	**5**
2. Numerator: The definition of conformance for this measure is clinically meaningful.	**1**	**2**	**3**	**4**	**5**
3. Validity:					
a. The measure appears to measure what it is intended to (face validity).	**1**	**2**	**3**	**4**	**5**
b. The measure captures most meaningful aspects of care (content validity).	**1**	**2**	**3**	**4**	**5**
c. The measure correlates well with other measures of the same aspect of care (construct validity).	**1**	**2**	**3**	**4**	**5**
4. Reliability: The measure is likely to be reproducible across organizations and delivery settings.	**1**	**2**	**3**	**4**	**5**
Measure Implementation					
1. Feasibility:					
a. The data required for the measure is likely to be obtained with reasonable effort.	**1**	**2**	**3**	**4**	**5**
b. The data required for the measure is likely to be obtained at reasonable cost.	**1**	**2**	**3**	**4**	**5**
c. The data required for the measure is likely to be obtained within the period allowed for data collection.	**1**	**2**	**3**	**4**	**5**
Overall Assessment	**Do Not Include**	**Could Include**			**Must Include**
Considering your assessment of this measure on all dimensions above, rate this measure overall for inclusion into the ACC/AHA STEMI/NSTEMI Performance Measurement Set.	**1**	**2**	**3**	**4**	**5**

Rating Form Guide	
Attribute of Performance	**Considerations**
Useful in Improving Patient Outcomes	
1. Evidence-based: The scientific basis of the measure is well established.	This can be confirmed by explicit reference to a published clinical practice guideline.
2. Interpretable: The results of the measure are interpretable by practitioners.	This is your assessment of the degree with which a provider can clearly understand what the results mean and can take action if necessary.
3. Actionable: The measure addresses an area that is under the practitioner's control.	This is your assessment of the degree with which a provider is empowered and can influence the activities of the health care system toward improvement.
Measure Design	
1. Denominator: The patient group to whom this measure applies (denominator) is clinically meaningful.	Depending upon intended use of the measure, the data source, any inclusion or exclusion criteria, and sampling frames are explicit. These criteria used must be clinically meaningful. An algorithm for determining the denominator may be present.
2. Numerator: The definition of conformance for this measure is clinically meaningful.	The numerator may be specified using either explicit or implicit criteria. These criteria used must be clinically meaningful. An algorithm for determining the numerator may be present.
3. Validity: a. The measure appears to measure what it is intended to (face validity). b. The measure captures most meaningful aspects of care (content validity). c. The measure correlates well with other measures of the same aspect of care (construct validity).	This can be confirmed by your judgment of the clarity and comprehensiveness of the measure. For those measures that have been actually tested for validity, you may see indications of specific testing such as comparisons with the results of other methods, criterion or gold standard validity testing, and criterion validity testing. There may also be documentation that the health care construct underlying the measure is associated with important health care processes/outcomes.
4. Reliability: The measure is likely to be reproducible across organizations and delivery settings.	This can be confirmed by specific tests undertaken by the measure developers. For those measures that have been actually tested for reliability, you may see indications of types of reliability testing such as test-retest reliability, inter-rater reliability, data accuracy checks, and internal consistency analyses. If the measure has not been used in practice, indicate the degree of likelihood that it is reproducible.
Measure Implementation	
1. Feasibility: a. The data required for the measure is likely to be obtained with reasonable effort. b. The data required for the measure is likely to be obtained at reasonable cost. c. The data required for the measure is likely to be obtained within the period allowed for data collection.	From your perspective, the required data can be typically abstracted from patient charts or there are national registries, databases readily available. For those measures actually being used, there is information on the data collection approach and the system required to support the measure.
Overall Assessment	
Considering your assessment of this measure on all dimensions above, rate this measure inclusion in the ACC/AHA STEMI/NSTEMI Performance Measurement Set.	Consider a balance in the continuum of care. Consider overall purpose of the measurement set and the intended user.

APPENDIX C. Relationships With Industry—ACC/AHA Writing Committee to Develop Performance Measures on ST-Elevation MI/Non–ST-Elevation MI

Name	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/ Advisory Board
Dr. Harlan M. Krumholz	• Parkes-Davis/Pfizer • Genentech • Biogen	None	None	• Astra Zeneca • BMS/Sanofi • CVT
Dr. Jeffrey L. Anderson	• Merck • Pharmacia (Pfizer) • Wyeth	• Berlex • Merck • Pfizer	None	• Aventis • Berlex • Merck • Wyeth
Dr. Neil H. Brooks	None	None	None	• Lilly
Dr. Francis M. Fesmire	• Agilent Technologies • Cor Therapeutics • DuPont Radiotherapeutics • Genentech	• Dade-Behring	None	None
Dr. Costas T. Lambrew	None	None	None	None
Dr. Mary Beth Landrum	• Merck	None	None	None
Dr. W. Douglas Weaver	None	None	None	None
Dr. John Whyte	None	None	None	None

This table represents the actual or potential relationships of committee members with industry that were reported orally at the initial committee meeting and updated in conjunction with all meetings and conference calls of the writing committee. It does not reflect any actual or potential relationships at the time of publication.

APPENDIX D. Relationships With Industry–External Peer Reviewers for the ACC/AHA Clinical Performance Measures for Adults With ST-Elevation MI/Non–ST-Elevation MI*

Reviewer Name†	Representation	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/ Advisory Board
Dr. Elliott Antman	• Official Reviewer–Chair, ACC/AHA Task Force on Practice Guidelines Chair, ACC/AHA STEMI Guideline Writing Committee	• Aventis • Bayer • Biosite • Boehringer Mannheim • Bristol-Myers Squibb • British Biotech • Centor • Cor/Millennium • Corvas • Dade • Genentech • Lilly • Merck • Pfizer • Sunol	None	None	• Aventis
Dr. Robert Califf	• Official Reviewer–ACCF Board of Trustees	• Accumetrics • Actelion • Ajinomoto • Alsius • Amgen • Astra Hassle • Aventis • Biomarin • Biosite • Boston Scientific • Bracco • Bristol-Myers Squibb • Cambridge Heart • Cardiodynamics • Centocor • Chase Medical • Chiron • Coagulation Diagnostics • Corcept • Corgentech • Critline • Dade Behring • Daiichi • Datascope • Devco • Elan Pharmaceuticals • Enzon • Esai • Geneceutics • Genentech • GlaxoSmithKline • Guidant • Guilford • Pharmaceuticals • Harvard Health Care • Hemosol • InfraReDx • Intracel • IOMED • Lincare	• Aventis • Bristol-Myers Squibb • Conceptis • GlaxoSmithKline • Merck • Millennium • Novartis • Ortho Biotech • Paraxel • Pennside • Partners • Pfizer • Pharmacia/Upjohn • Pharsight • Schering Plough • Wyeth Ayerst	None	• GlaxoSmithKline • Pfizer

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This table represents the relationships of peer reviewers with industry that were disclosed at the time of peer review of this guideline. It does not necessarily reflect relationships with industry at the time of publication. *Participation in the peer-review process does not imply endorsement of the document. †Names are listed in alphabetical order within each category of review.

APPENDIX D Continued

Reviewer Name†	Representation	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/ Advisory Board
Dr. Robert Califf (continued)		• Medicure • Medivance • Medtronic Foundation • Merck • Millennium • NABI • Novartis • Ortho Biotech • Otsuka • Parke Davis • Pfizer • Pharmacia/Upjohn • Pheromone Science • Proctor and Gamble • Promethesus • Quanam • Salix • Sanofi • Spectranetics • St. Jude Medical • Synaptic • The Medicines Company • Theravance • Vesicor • Vicuron • Wyeth Ayerst • Yamanouchi			
Dr. Barbara Drew	• Official Reviewer–American Heart Association	None	• Phillips • Inovise Medical • Medtronic GE	None	None
Dr. Kim A. Eagle	• Official Reviewer–Lead Reviewer, ACC/AHA Task Force on Performance Measures	None	None	None	None
Dr. Gregg Fonarow	• Official Reviewer–American Heart Association	• GSK • Pfizer	None	None	• GlaxoSmithKline • Merck-Shering Plough • Pfizer • Bristol-Myers Squibb/Sanofi Partnership
Dr. George McKendall	• Official Reviewer–ACCF Board of Governors	None	None	None	None
Ms. Janet Leiker	• Organizational Reviewer–American Academy of Family Physicians	None	None	None	None
Dr. Martha Radford	• Content Reviewer–Chair, ACC/AHA Task Force on Clinical Data Standards	None	None	None	None
Dr. Rita F. Redberg	• Content Reviewer–ACC/AHA Task Force on Clinical Data Standards	None	None	None	None

APPENDIX D Continued

Reviewer Name†	Representation	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/ Advisory Board
Dr. Judith Hochman	• Content Reviewer–ACC/AHA STEMI Guideline Writing Committee	• Arginox Pharmaceutical • Aventis • Cor/Millennium • Guidant • Lilly • Merck			• Daichii • Proctor & Gamble
Dr. Frederick Kushner	• Content Reviewer–ACC/AHA STEMI Guideline Writing Committee	• Aginamoto Co. • Andrx Labs • Atherogenics, Inc. • Boehringer-Ingelheim • Medtronic • Novartis • Rorer • Schering-Plough	• Bristol-Myers Squibb • Merck • Pfizer • Reliant	• Abbott Labs • Baxter • Guidant • Medtronic • Merck • Pfizer	• Millennium, Inc.
Dr. Joseph Ornato	• Content Reviewer–ACC/AHA STEMI Guideline Writing Committee	• Genentech • Meridian Medical Corp. • Wyeth	None	None	• Bristol-Myers-Squibb • Genentech • HP/Agilent • Medtronic • Meridian • Medical Corp. • Philips • PhysioControl • Scios • Revivant Corp. • Wyeth
Dr. Eugene Braunwald	• Content Reviewer–Chair, ACC/AHA UA/NSTEMI Guideline Writing Committee	None	None	None	None
Dr. Thomas Levin	• Content Reviewer–ACC/AHA UA/NSTEMI Guideline Writing Committee	None	None	None	None
Dr. Earl Smith III	• Content Reviewer–ACC/AHA UA/NSTEMI Guideline Writing Committee	None	None	None	None
Dr. Pierre Theroux	• Content Reviewer–ACC/AHA UA/NSTEMI Guideline Writing Committee	None	None	• Astra Zeneca • Aventis • Proctor & Gamble	None
Dr. Rohit Arora	• Content Reviewer–ACCF Cardiac Catheterization and Intervention Committee	None	• Aventis	None	None
Dr. Carlos Ruiz	• Content Reviewer–ACCF Cardiac Catheterization and Intervention Committee	• Cook Cardiology	None	None	None

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APPENDIX D Continued

Reviewer Name†	Representation	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/ Advisory Board
Dr. Karl B. Kern	• Content Reviewer–ACCF Emergency Cardiac Care Committee	None	None	None	• ERS • Medtronic • Revivant Corp.
Dr. Mary Ann Peberdy	• Content Reviewer–ACCF Emergency Cardiac Care Committee	None	None	None	None
Dr. Michael Rosenberg	• Content Reviewer–ACCF Emergency Cardiac Care Committee	None	None	None	None
Dr. David Faxon	• Content Reviewer–AHA Quality of Care and Outcomes Steering Committee	None	None	None	None
Dr. William Weintraub	• Content Reviewer–AHA Quality of Care and Outcomes Steering Committee	None	None	None	None
Dr. Bojan Cercek	• Content Reviewer–AHA Committee on Acute Cardiac Care	None	None	None	None
Dr. James De Lemos	• Content Reviewer–AHA Committee on Acute Cardiac Care	• Aventis • BMS/Sanofi • Merck	None	None	None
Dr. Jose Lopez-Sendon	• Content Reviewer–AHA Committee on Acute Cardiac Care	• Aventis • BMS • TIMI	None	None	None

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Correction

In the article, "ACC/AHA Clinical Performance Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction: A Report of the American College of Cardiology/American Heart Association Task Force on Performance Measures (Writing Committee to Develop Performance Measures on ST-Elevation and Non–ST-Elevation Myocardial Infarction)," by Krumholz et al, which published online before print on January 3, 2006 (DOI: 10.1161/CIRCULATIONAHA.106.172860) and appeared in the February 7, 2006, issue of the journal (*Circulation*. 2006;113:732–761), the following corrections are needed:

1. Appendix A, Part 10 ("Reperfusion Therapy"; p 752): In the entry for "Denominator," the phrase "who received fibrinolytic therapy or primary percutaneous intervention (PCI)" should be deleted so that it reads "AMI patients with ST-segment elevation on ECG."
2. In Appendix D (p 759), the relationships with industry information for Dr Eugene Braunwald is as follows:

APPENDIX D. Relationships With Industry—External Peer Reviewers for the ACC/AHA Clinical Performance Measures for Adults With ST-Elevation MI/Non–ST-Elevation MI*

Reviewer Name†	Representation	Research Grant	Speakers' Bureau/Honoraria	Stock Ownership	Consultant/Advisory Board
Dr Eugene Braunwald	• Content Reviewer—ACC/AHA UA/NSTEMI Guideline Writing Committee Chair	• AstraZeneca • Sanofi-Aventis • CV Therapeutics • Eli Lilly • Millennium • Schering-Plough • Nuvelo • Pfizer • Inotek • Merck • Bristol-Myers Squibb	• AstraZeneca • Sanofi-Aventis • CV Therapeutics • Eli Lilly • Millennium • Schering-Plough • Nuvelo • Pfizer • Inotek • Merck • Bristol-Myers Squibb	None	• Momenta • Scios • Biopure • Sanofi/Synthelabo • Schering-Plough • Bristol-Myers Squibb • Pfizer • Interleuken Genetics • Protein Design Labs • Bayer, Ag

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*Participation in the peer-review process does not imply endorsement of the document.

†Names are listed in alphabetical order within each category of review.

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