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ACC/AHA 2008 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 for ST-Elevation and Non–ST-Elevation Myocardial Infarction): Developed in Collaboration With the American Academy of Family Physicians and the American College of Emergency Physicians: Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, Society for Cardiovascular Angiography and Interventions, and Society of Hospital Medicine

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Developed in Collaboration With the American Academy of Family Physicians and the American College of Emergency Physicians

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, Society for Cardiovascular Angiography and Interventions, and Society of Hospital Medicine

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Preamble

Over the past decade, there has been an increasing awareness that the quality of medical care delivered in the United States is inadequate. In its seminal document dedicated to characterizing deficiencies in delivering effective, timely, safe, equitable, efficient, and patient-centered medical care, the Institute of Medicine described a quality "chasm."[1] The recognition of the magnitude of the gap between the care that is delivered and the care that ought to be provided has stimulated interest in the development of measures of quality of care and the use of such measures for the purposes of quality improvement and accountability.

Table 1. ACC/AHA Performance Measure Sets

Topic	Original Publication Date	Partnering Organizations
Chronic heart failure[2]	2005	ACC/AHA: inpatient measures; ACC/AHA/PCPI: outpatient measures
Chronic stable coronary artery disease[3]	2005	ACC/AHA/PCPI
Hypertension[4]	2005	ACC/AHA/PCPI
STEMI and NSTEMI[5]	2006	ACC/AHA
Cardiac rehabilitation[6]	2007	AACVPR/ACC/AHA
Atrial fibrillation[7]	2008	ACC/AHA/PCPI
Primary prevention of cardiovascular disease	Pending	ACC/AHA
Peripheral arterial disease	Pending	ACC/AHA/ACR/SCAI/SIR/SVM/SVN/SVS

PCPI indicates American Medical Association–Physician Consortium for Performance Improvement; AACVPR, American Association of Cardiovascular and Pulmonary Rehabilitation; ACR, American College of Radiology; SCAI, Society for Cardiac Angiography and Interventions; SIR, Society for Interventional Radiology; SVM, Society for Vascular Medicine; SVN, Society for Vascular Nursing; and SVS, Society for Vascular Surgery.

Consistent with this national focus on healthcare quality, the American College of Cardiology (ACC) and the American Heart Association (AHA) have taken a leadership role in developing measures of the quality of care for cardiovascular disease in several clinical areas (Table 1). The ACC/AHA Task Force on Performance Measures was formed in February 2000 and was charged with identifying the clinical topics appropriate for the development of performance measures and assembling writing committees comprising clinical and methodological experts. When appropriate, these committees have included representation from other organizations involved in the care of patients with the condition of focus. The committees are informed about the methodology of performance measure development and are instructed to construct measures for use both prospectively and retrospectively that rely on easily documented clinical criteria and, when appropriate, incorporate administrative data. The data elements required for the performance measures are linked to existing ACC/AHA clinical data standards to encourage uniform measurements of cardiovascular care. The writing committees also are instructed to evaluate the extent to which existing nationally recognized performance measures conform to the attributes of performance measures described by the ACC/AHA and to strive to create measures aligned with acceptable existing measures when this is feasible.

The initial measure sets published by the ACC/AHA focused primarily on processes of medical care, or actions

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Table 2. Applying Classification of Recommendations and Level of Evidence

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	SIZE OF TREATMENT EFFECT →			
	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/administered	**CLASS IIa** *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	**CLASS IIb** *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	**CLASS III** *Risk ≥ Benefit* Procedure/Treatment should **NOT** be performed/administered **SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL**
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations†	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	is not recommended is not indicated should not is not useful/effective/beneficial may be harmful

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, 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 guideline recommendations 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.

taken by healthcare providers, such as the prescription of a medication for a condition. These process measures are founded on the strongest recommendations contained in the ACC/AHA clinical practice guidelines, delineating actions taken by clinicians in the care of patients. Specifically, the writing committees consider as candidates for measures those processes of care that are recommended by the guidelines as either Class I, which identify procedures/treatments that should be administered, or Class III, which identify procedures/treatments that should not be administered (Table 2). Class II recommendations are not considered candidates for performance measures. The methodology guiding the translation of guideline recommendations into process measures has been delineated explicitly by the ACC/AHA, providing guidance to the writing committees.[8]

Although possessing several strengths, processes of care are limited as the sole measures of quality. Thus, current ACC/AHA performance measures writing committees are instructed to consider measures of structures of care, outcomes, and efficiency as complements to process measures. In developing such measures, the committees are guided by methodology established by the ACC/AHA.[9] Although the implementation of measures of outcomes and efficiency is currently not as well established as that of process measures, it is expected that such measures will become more pervasive over time.

Although the focus of the performance measures writing committees is on measures intended for quality improvement efforts, other organizations may use these measures for external review or public reporting of provider performance. Therefore, it is within the scope of the writing committee's task to comment, when appropriate, on the strengths and limitations of such external reporting for a particular cardiovascular disease state or patient population. Thus, the metrics

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contained within this document are categorized as either performance measures or test measures. Performance measures are those metrics that the committee designates appropriate for use for both quality improvement and external reporting. In contrast, test measures are those appropriate for the purposes of quality improvement but not for external reporting until further validation and testing are performed.

All measures have limitations and pose challenges to implementation that could result in unintended consequences when used for accountability. The implementation of measures for purposes other than quality improvement requires field testing to address issues related but not limited to sample size, frequency of use of an intervention, comparability, and audit requirements. The manner in which these issues are addressed is dependent on several factors, including the method of data collection, performance attribution, baseline performance rates, incentives, and public reporting methods. The ACC/AHA encourages those interested in implementing these measures for purposes beyond quality improvement to work with the ACC/AHA to consider these complex issues in pilot implementation projects, to assess limitations and confounding factors, and to guide refinements of the measures to enhance their utility for these additional purposes.

By facilitating measurements of cardiovascular healthcare quality, ACC/AHA performance measurement sets may serve as vehicles to accelerate appropriate translation of scientific evidence into clinical practice. These documents are intended to provide practitioners and institutions that deliver care with tools to measure the quality of their care and to identify opportunities for improvement. It is our hope that application of these performance measures will provide a mechanism through which the quality of medical care can be measured and improved.

Frederick A. Masoudi, MD, MSPH, FACC
Chair, ACC/AHA Task Force on Performance Measures

1. Introduction

The ACC/AHA ST-Elevation and Non–ST-Elevation Myocardial Infarction (STEMI/NSTEMI) Performance Measures Writing Committee (the writing committee) was charged with the development of performance measures concerning the diagnosis, treatment, and outcomes of both STEMI and NSTEMI. The purpose of the effort is to develop measures that can be used to improve care for patients with an acute myocardial infarction (AMI). Recognizing that each measure may impose a burden, the writing committee sought to focus on those areas with the most potential for impact, where there was the strongest consensus about the best practice, and where the likelihood for unintended harm was lowest. Moreover, the group sought to keep the measures as straightforward as possible, as aligned with existing measures as possible (when appropriate), and as clinically sensible as possible, giving the clinician the opportunity for judgment about the appropriateness of an intervention to the extent possible. The focus is on in-hospital care, with attention to outpatient care being deferred at this time (even as the importance of the episode of care is acknowledged by the writing committee). Many processes recommended by the guidelines were not translated into measures. The decisions were based on many factors, and common considerations were the complexity of the recommendations (making translation difficult) and the timing of the decision relative to other processes (eg, whether the process was better considered as an outpatient measure). This document is intended to supersede the prior publication of AMI performance measures.[5] We present a refinement in 9 measures, the deletion of a measure (early beta-blocker therapy), 4 new performance measures, and 9 test measures (Table 3). The test measures are understood as areas worthy of measurement, but, for reasons related to the strength of evidence, the feasibility of the measure, or other considerations, are not considered to be suitable for accountability or public reporting.

1.1. Scope of the Problem

The estimated annual incidence of MI in the United States (including both STEMI and NSTEMI) is 600 000 new and 320 000 recurrent attacks. In 2004, AMI resulted in 695 000 hospital stays and $31 billion in hospital charges.[10] The risk of further cardiovascular complications, including recurrent MI, sudden cardiac death, heart failure, stroke, and angina pectoris, for those who survive AMI is substantial.[11]

Over the past 30 years, advances in cardiovascular care have resulted in a dramatic decline in mortality and morbidity associated with STEMI and NSTEMI.[12] However, there remain gaps in the application of the best treatments and strategies for these patients.[13,14] As a result, the outcomes of STEMI and NSTEMI patients are not as good as they could be with more effective and widespread application of the best scientific knowledge to their care.

1.2. Writing Committee Structure/Members

The members of the ACC/AHA STEMI/NSTEMI Performance Measures Writing Committee included clinicians specializing in cardiology, internal medicine, family medicine, and emergency medicine and individuals with expertise in performance measurement. Moreover, the writing committee included representatives of the American College of Physicians (ACP), American Academy of Family Physicians (AAFP), and the American College of Emergency Physicians (ACEP).

1.3. Independence/Relationships With Industry Disclosure

The work of the writing committee was supported exclusively by the ACC and AHA without direct commercial support. Writing committee members volunteered their time to this effort. Meetings of the writing committee were confidential and attended only by committee members, invited observers from the Centers for Medicare and Medicaid Services (CMS) to promote alignment as described further below, and staff from the ACC and AHA. Writing committee members declared all relationships with industry relevant to this topic in writing and at each meeting according to standard reporting requirements of the ACC and AHA. Committee members with relevant relationships to a specific measure did not participate in the voting regarding that measure but were allowed to participate in the discussion after disclosing the

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Table 3. Comparison of 2006 and 2008 Measures

2006 Measure	2008 Measure	Change	Rationale
1. Aspirin at arrival	1. Aspirin at arrival	Minor revisions to denominator exclusions	Align with CMS/TJC
2. Aspirin prescribed at discharge	2. Aspirin prescribed at discharge	Minor revisions to denominator exclusions	Align with CMS/TJC
3. Beta-blocker at arrival		Deleted performance measure	Increased complexity of decision making and controversy about the magnitude of net benefit
4. Beta-blockers prescribed at discharge	3. Beta-blockers prescribed at discharge	Minor revisions to denominator exclusions	Align with CMS/TJC
6. Lipid-lowering therapy at discharge	4. Statin at discharge	Changed to specify statins only and deleted denominator requirement that LDL-C is greater than 100 mg/dL	Most recent Class I guideline recommendations support use of statins in the absence of contraindications, regardless of baseline LDL-C and diet modification
	5. Evaluation of LVSF	New performance measure	Determines prognosis and drives treatment decisions
7. ACEI or ARB for LVSD	6. ACEI or ARB for LVSD	Revised denominator exclusions	Align with CMS/TJC
8. Time to fibrinolytic therapy	7. Time to fibrinolytic therapy	Revised denominator exclusions	Align with CMS/TJC
9. Time to PCI	8. Time to PCI	Revised denominator exclusions	Align with CMS/TJC
10. Reperfusion therapy	9. Reperfusion therapy	Corrected denominator statement (added LBBB; omitted "who received fibrinolytic therapy or primary PCI")	Incorporates published errata
	10. Time from ED arrival at STEMI referral facility to ED discharge from STEMI referral facility in patients transferred for PCI	New performance measure	Positive impact of timely reperfusion on clinical outcomes and continuing gaps in the delivery of this effective therapy
	11. Time from ED arrival at STEMI referral facility to PCI at STEMI receiving facility among transferred patients	New performance measure	Positive impact of timely reperfusion on clinical outcomes and continuing gaps in the delivery of this effective therapy
11. Adult smoking cessation advice/counseling	12. Adult smoking cessation advice/counseling	Minor revisions to denominator exclusions	Align with CMS/TJC
	13. Cardiac rehabilitation patient referral from an inpatient setting	New performance measure (adapted from Reference 6)	Current guidelines recommend cardiac rehabilitation/secondary prevention programs for patients with AMI
5. LDL-C assessment	T-1. LDL-C assessment	Changed to test measure	Although current STEMI and UA/NSTEMI guidelines recommend LDL assessment within 24 h for all patients, they also recommend statin regardless of baseline LDL; measurement of LDL is accounted for in the statin at discharge performance measure (measure 4 above)

(*Continued*)

relationship. Please see Appendix A for relevant writing committee relationships with industry. In addition, Appendix B includes relevant relationships with industry information for all peer reviewers of this document.

1.4. Review/Endorsement

Between June 23 and July 22, 2008, the ACC/AHA STEMI/NSTEMI Performance Measures document underwent a 30-day public comment period during which time ACC and

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Table 3. Continued

2006 Measure	2008 Measure	Change	Rationale
	T-2. Excessive initial heparin dose	New test measure	Recommended doses are well established; however, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is common
	T-3. Excessive initial enoxaparin dose	New test measure	As above
	T-4. Excessive initial abciximab dose	New test measure	As above
	T-5. Excessive initial eptifibatide dose	New test measure	As above
	T-6. Excessive initial tirofiban dose	New test measure	As above
	T-7. Anticoagulant dosing protocol (structural measure)	New test measure	As above
	T-8. Anticoagulant error tracking system (structural measure)	New test measure	As above
	T-9. Clopidogrel at discharge	New test measure	Recent national registry data demonstrate significant variability in the prescription of clopidogrel at hospital discharge; because rates are already very high among those undergoing PCI and stent placement, this test measure was restricted to medically managed patients

LDL-C indicates LDL cholesterol; LBBB, left bundle-branch block; and ED, emergency department.

AHA members, as well as other health professionals and members of the general public, had an opportunity to review and comment on the draft document in advance of its final approval and publication. A number of medical specialty societies with an interest in this topic, including the AAFP, ACEP, Society of Hospital Medicine (SHM), and other organizations that develop or implement performance measures, participated in the public comment period.

Official peer and content review of the document was conducted simultaneously with the 30-day public comment period, with 2 peer reviewers nominated by the ACC and 2 reviewers nominated by the AHA. Additional comments were sought from numerous clinical content experts and performance measurement experts.

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 in September 2008 and AHA in October 2008 and are endorsed by AAFP, ACEP, American Association of Cardiovascular and Pulmonary Rehabilitation, SHM, and Society for Cardiovascular Angiography and Interventions. These measures will be reviewed for the need for update or revision annually or as needed by modifications in relevant practice guidelines. They will be considered valid until they are updated or rescinded by the ACC/AHA Task Force on Performance Measures.

2. 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 required for the development of process of care measures and for outcomes measures suitable for public reporting.[8,9] The following sections outline how these steps were applied by this writing committee.

2.1. Definition of STEMI/NSTEMI

The writing committee has incorporated the terms STEMI and NSTEMI throughout this document, along with the all-inclusive term AMI. The writing committee has used the term AMI when the measure refers to both STEMI and NSTEMI patients, whereas the term STEMI was used in cases when the measure is specific to STEMI patients only. In all cases, the measures pertain to patients with an AMI, as defined by the recent statements.[15,16] Unstable angina (UA) is not considered in this document, in part because of the difficulty in defining the population with certainty and concern about the accuracy of the administrative codes for use in the retrospective ascertainment of patients. The measures also are intended for patients admitted to the hospital with an AMI as opposed to patients who have an AMI during the hospitalization as part of another illness. This choice was

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Table 4. Relevant ICD-9-CM Diagnosis Codes*

ICD-9-CM	Description
410.00	Anterolateral wall, AMI—episode of care unspecified
410.01	Anterolateral wall, AMI—initial episode
410.10	Other anterior wall, AMI—episode of care unspecified
410.11	Other anterior wall, AMI—initial episode
410.20	Inferolateral wall, AMI—episode of care unspecified
410.21	Inferolateral wall, AMI—initial episode
410.30	Inferoposterior wall, AMI—episode of care unspecified
410.31	Inferoposterior wall, AMI—initial episode
410.40	Other inferior wall, AMI—episode of care unspecified
410.41	Other inferior wall, AMI—initial episode
410.50	Other lateral wall, AMI—episode of care unspecified
410.51	Other lateral wall, AMI—initial episode
410.60	True posterior wall, AMI—episode of care unspecified
410.61	True posterior wall, AMI—initial episode
410.70	Subendocardial, AMI—episode of care unspecified (NSTEMI)
410.71	Subendocardial, AMI—initial episode (NSTEMI)
410.80	Other specified sites, AMI—episode of care unspecified
410.81	Other specified sites, AMI—initial episode
410.90	Unspecified site, AMI—episode of care unspecified
410.91	Unspecified site, AMI—initial episode

*All 410.XX *International Classification of Diseases*, ninth revision, clinical modifications (ICD-9-CM) codes are designated as variants of STEMI, with the exception of the 410.7X, or subendocardial infarctions, which are designated as NSTEMI. In practice, this coding may not be applied consistently and may not allow a distinction of STEMI or NSTEMI based on the codes alone.[18]

made because patients with a secondary diagnosis of AMI tend to be complex and are not addressed well by the literature or the guidelines.

The writing committee recognizes that in some cases there will be interest in prospective assessment of performance on quality measures for AMI, but these measures are constructed to permit the retrospective assessment of performance, consistent with contemporary performance measure implementation. For possible use in retrospective analysis of performance, it was thought useful to identify administrative codes that could be used to screen for eligible patients, providing guidance in standardizing case ascertainment. This approach should not preclude modifications of assessments in real time for the purpose of quality improvement, although it should be recognized that differences in case ascertainment may affect the results of the measurements.

For retrospective identification of patients, specific diagnosis codes, based on *International Classification of Diseases*, 9th revision, clinical modification (Table 4), are recommended in the screening and selection of an inpatient target patient population. These codes correspond to those used by CMS and The Joint Commission (TJC) for the identification of patients with AMI.[17] These measures are constructed to include only those patients with a principal discharge diagnosis that identifies the condition for which, in retrospect, the patient was admitted to the hospital. The writing committee also recognizes that in some cases the principal discharge diagnosis code may identify patients who may not be appropriate for these measures. In part because of this, all measures are written with exclusions that permit clinicians to document reasons for not applying particular measures to individual patients.

2.2. 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 for evaluation. 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 in which evidence was lacking and prevented duplication of measures within the set. The relevant dimensions of care included diagnostics, patient education, and treatment. Self-management and monitoring of disease status may be best evaluated in the outpatient setting (see Table 5). The writing committee focused exclusively on hospitalized patients with AMI. Other ACC/AHA performance measure sets apply to patients with AMI who have made the transition to the outpatient setting. Although focusing primarily on processes of care, the writing committee also considered measures of structures of care (eg, the implementation of dosing protocols for antithrombotic agents) and outcomes (eg, risk-adjusted mortality).

2.3. Literature Reviewed

As the primary sources for updating the 2006 STEMI/NSTEMI measure set[5] and for deriving new measures, as specified in the ACC/AHA methodology for developing process measures,[8] the writing committee reviewed the 2004 ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (STEMI guideline),[19] the 2007 Focused Update of the ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (STEMI guideline focused update),[20] and the 2007 ACC/AHA Guidelines for the Management of Patients With Unstable Angina/Non–ST-Elevation Myocardial Infarction (UA/NSTEMI guideline).[21] The chair of this writing committee also participated on the writing committee of the STEMI guideline and the STEMI guideline focused update. In addition, the chair of the 2007 UA/NSTEMI guideline writing committee was a member of this writing committee. As participants on the guideline writing committees, they were able to offer insights into measurement issues and to provide suggestions for clarity and specificity of guideline recommendations.

In addition, existing measure sets, including those developed by TJC, CMS, and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR)/ACC/AHA, were reviewed by the writing committee. See the Discussion section below for details on our efforts to align the ACC/AHA measures with the measure sets of other organizations.

2.4. Definition and Selection of Measures

Explicit criteria exist for the development of process performance measures so that they accurately reflect the quality of

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Table 5. 2008 ACC/AHA STEMI/NSTEMI Performance Measurement Set: Dimensions of Care Inpatient Measures Matrix

Measure Name	Diagnostics	Patient Education	Treatment	Self-Management*	Monitoring of Disease Status*
Performance measures					
1. Aspirin at arrival			√		
2. Aspirin prescribed at discharge			√		
3. Beta-blocker prescribed at discharge			√		
4. Statin prescribed at discharge			√		
5. Evaluation of LVSF	√				
6. ACEI or ARB for LVSD			√		
7. Time to fibrinolytic therapy			√		
8. Time to primary PCI			√		
9. Reperfusion therapy			√		
10. Time from ED arrival at STEMI referral facility to ED discharge from STEMI referral facility in patients transferred for primary PCI			√		
11. Time from ED arrival at STEMI referral facility to primary PCI at STEMI receiving facility among transferred patients			√		
12. Adult smoking cessation advice/counseling		√			
13. Cardiac rehabilitation patient referral from an inpatient setting[6]		√	√		
Test measures					
T-1. LDL cholesterol assessment	√				
T-2. Excessive initial heparin dose			√		
T-3. Excessive initial enoxaparin dose			√		
T-4. Excessive initial abciximab dose			√		
T-5. Excessive initial eptifibatide dose			√		
T-6. Excessive initial tirofiban dose			√		
T-7. Anticoagulant dosing protocol (structural measure)			√		
T-8. Anticoagulant error tracking system (structural measure)			√		
T-9. Clopidogrel prescribed at discharge for medically treated AMI patients			√		

ED indicates emergency department.

*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.

care, including a strong evidence base, quantification of the numerator and denominators of potential measures, and evaluation of the interpretability, applicability, and feasibility of the proposed measure.[8] The writing committee sought to identify measures for which there was strong evidence and clear consensus about their importance in the care of AMI patients. To determine the processes of care with adequate evidence support to be considered for inclusion in the performance measurement set, the writing committee reviewed and prioritized the Class I and Class III recommendations from the 2004 STEMI guideline, the STEMI guideline focused update, and the 2007 UA/NSTEMI guideline,[19–21] with particular attention to changes in any guideline recommendations on which the 2006 ACC/AHA STEMI/NSTEMI performance measures (2006 measures)[5] were based.

From the analysis of these recommendations, the writing committee identified potential new measures relevant to the treatment of STEMI and NSTEMI patients and potential revisions of the 2006 measures. After extensive writing committee discussion and additional literature review, consensus was reached on revisions to be made to the 11 measures included in the 2006 document. Ten potential new measures also were considered for full specification. All measures were written to assess high-quality care in appropriate patients, allowing for the exclusion of patients with contraindications to the process of care.

Using the ACC/AHA Performance Measure Rating Form and Guide (Appendix D), writing committee members independently evaluated each of the substantially revised 2006 measures and all of the potential new measures against the ACC/AHA Attributes of Performance Measures (Table 6)

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Table 6. ACC/AHA Attributes of Performance Measures

Consideration	Attribute
Useful in improving patient outcomes	Evidence based
	Interpretable
	Actionable
Measure design	Denominator precisely defined
	Numerator precisely defined
	Validity type
	Face
	Content
	Construct
	Reliability
Measure implementation	Feasibility
	Reasonable effort
	Reasonable cost
	Reasonable time period for collection
Overall assessment	Overall assessment of measure for inclusion in measurement set

using a 5-point Likert scale (1=lowest rating, 5=highest rating). Member ratings were collated and discussed by the full writing committee to reach consensus on which measures should advance for inclusion in the final measure set. After additional writing committee discussion and further refinement of the measure specifications, the writing committee conducted a confidential vote on whether to include each measure and whether to designate any of the measures as test measures in the final set. Writing committee members were required to recuse themselves from voting on any measures for which they had significant relevant relationships with industry. The writing committee met again for further discussion to reach consensus on those measures for which the vote was not unanimous. After the comment period, further deliberation occurred, and refinements were made to the measures.

2.5. Outcomes Measures

Although measures focusing on processes of care have substantial appeal as a means of reflecting quality, such measures assess only a small proportion of all of the care delivered and apply to only subsets of the population with a particular condition. Furthermore, while determining whether a particular process of care was delivered, such measures do not convey information on the effectiveness of the process. Finally, although patients presumably care about the processes of care that they receive, this interest reflects an assumption that better processes of care ultimately result in better outcomes. For these reasons, outcomes measures have been proposed as a means of complementing process measurement as a reflection of quality.[22]

The writing committee considered the development of outcomes measures beyond its scope, but it discussed standards for outcomes measures for AMI. A multidisciplinary AHA Scientific Statement, which is endorsed by the ACC, identified 7 central attributes for the statistical models used for publicly reported outcome measures.[9] These attributes include (1) a clear and explicit definition of an appropriate patient sample, (2) clinical coherence of model adjustment variables, (3) sufficiently high-quality and timely data, (4) designation of an appropriate reference time before which covariates are derived and after which outcomes are measured, (5) use of an appropriate outcome and a standardized period of outcome assessment, (6) application of an analytical approach that takes into account the multilevel organization of data, and (7) disclosure of the methods used to compare outcomes, including disclosure of performance of risk-adjustment methodology in derivation and validation samples. The writing committee recognizes the importance of outcomes measures and their alignment with the published standards but did not endorse a particular measure because that was not its charge.

3. STEMI/NSTEMI Performance Measures

3.1. Inpatient Population and Care Period

The target population for these measures consists of hospitalized patients 18 years of age or older with a principal discharge diagnosis of AMI (STEMI and NSTEMI), meaning a focus on patients admitted with this condition. Inclusion and exclusion criteria specific to each inpatient measure were developed. The general period of assessment is the inpatient hospitalization or related emergency department visit, and the specific time period of interest for each measure is further defined in the full measure specifications (see Appendix C).

3.2. Brief Summary of the 2008 Measurement Set

Table 7 shows the ACC/AHA STEMI/NSTEMI Performance Measurement Set: those measures with the highest level of evidence and guideline support that met the additional criteria for performance measures and that generated consensus support among the writing committee members. Appendix C provides the detailed specifications for each inpatient performance measure, including numerator, denominator, period of assessment, method of reporting, sources of data, rationale, clinical recommendations, and challenges to implementation. The interest in providing these specifications was for consistency in efforts across institutions. It is understood that the spirit of the measure could be maintained with some modification in the exact specifications to facilitate implementation.

3.3. Data Collection

To aid in the collection of hospital data for performance measurement, 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. 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.[23]

3.4. Alignment With CMS/TJC Measures

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

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Table 7. 2008 ACC/AHA STEMI/NSTEMI Performance Measures: Inpatient Measure Descriptions

Measure Name	Measure Description
Performance measures	
1. Aspirin at arrival	AMI patients who received aspirin within 24 h before or after hospital arrival
2. Aspirin prescribed at discharge	AMI patients who are prescribed aspirin at hospital discharge
3. Beta-blocker prescribed at discharge	AMI patients who are prescribed a beta-blocker at hospital discharge
4. Statin at discharge	AMI patients who are prescribed a statin at hospital discharge
5. Evaluation of LVSF†	AMI patients with documentation in the hospital record that LVSF was evaluated during hospitalization or is planned after discharge
6. ACEI or ARB for LVSD	AMI patients with LVSD who are prescribed an ACEI or ARB at hospital discharge (for purposes of this measure, LVSD is defined as chart documentation of an LVEF less than 40% or a narrative description of LVSF consistent with moderate or severe systolic dysfunction)
7. Time to fibrinolytic therapy	Median time from hospital arrival to administration of fibrinolytic therapy in AMI patients with ST-segment elevation or LBBB on the ECG performed closest to hospital arrival time; AMI patients with ST-segment elevation or LBBB on the ECG closest to hospital arrival time receiving fibrinolytic therapy during the hospital stay with a time from hospital arrival to fibrinolysis of 30 min or less
8. Time to PCI	Median time from hospital arrival to primary PCI in AMI patients with ST-segment elevation or LBBB on the ECG performed closest to arrival time; AMI patients with ST-segment elevation or LBBB on the ECG closest to hospital arrival time receiving primary PCI during the hospital stay with a time from hospital arrival to PCI of 90 min or less
9. Reperfusion therapy	AMI patients with ST-segment elevation or LBBB on the ECG performed closest to arrival receiving either fibrinolysis or primary PCI or who are transferred to another facility for primary PCI
10. Time from ED arrival at STEMI referral facility to ED discharge from STEMI referral facility in patients transferred for primary PCI†	Median time from ED arrival at STEMI referral facility to ED discharge from STEMI referral facility for AMI patients with ST-segment elevation or LBBB on the ECG performed closest to hospital arrival time who are transferred to a STEMI receiving facility for primary PCI
11. Time from ED arrival at STEMI referral facility to primary PCI at STEMI receiving facility among transferred patients†	Median time from patient arrival at a STEMI referral facility's ED to time of primary PCI at a STEMI receiving facility for AMI patients presenting with ST-segment elevation or LBBB on the ECG performed closest to first hospital arrival time who are transferred to a STEMI receiving facility for primary PCI
12. Adult smoking cessation advice/counseling	AMI patients with a history of smoking cigarettes who are given smoking cessation advice or counseling during hospital stay
13. Cardiac rehabilitation patient referral from an inpatient setting†[6]	All patients hospitalized with a primary diagnosis of AMI referred to an early outpatient CR program
Test measures*	
T-1. LDL cholesterol assessment	AMI patients with documentation of LDL cholesterol level in the hospital record or documentation that LDL cholesterol testing was done during the hospital stay or is planned after discharge
T-2. Excessive initial heparin dose†	AMI patients who receive excess dosing of UFH initially
T-3. Excessive initial enoxaparin dose†	AMI patients who receive excess dosing of subcutaneous enoxaparin initially
T-4. Excessive initial abciximab dose†	AMI patients who receive excess dosing of abciximab initially
T-5. Excessive initial eptifibatide dose†	AMI patients who receive excess dosing of eptifibatide initially
T-6. Excessive initial tirofiban dose†	AMI patients who receive excess dosing of tirofiban initially
T-7. Anticoagulant dosing protocol†	Presence of a protocol or other clinical aid (eg, nomogram, electronic order entry) in the hospital record of AMI patients that addresses dosing of anticoagulant therapy and parenteral antiplatelet therapy (ie, UFH, low-molecular-weight heparin, and glycoprotein IIb/IIIa inhibitors)
T-8. Anticoagulant error tracking system†	Evidence of a tracking system for identifying dosing errors in anticoagulation therapy in the hospital record of AMI patients.
T-9. Clopidogrel prescribed at discharge for medically treated AMI patients†	Medically treated AMI patients who are prescribed clopidogrel or ticlopidine at hospital discharge

LVEF indicates left ventricular ejection fraction; LBBB, left bundle-branch block; ECG, electrocardiographic; ED, emergency department; CR, cardiac rehabilitation/secondary prevention; and UFH, unfractionated heparin.

*Test measures have been designated for use in internal quality improvement programs only and are not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

†New measures.

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farction address many of the same processes of care in earlier measurement sets published by other organizations but have been developed through the use of the ACC/AHA methodology for developing performance measure sets.[8] The writing committee is cognizant of previous efforts of other organizations 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 the CMS and TJC.

In the development of these measures, the writing committee thus considered the specifications of performance measures that have been developed and implemented by the CMS and TJC. In addition, the writing committee reviewed areas of nonalignment between the 2006 measures and corresponding AMI measures currently in use by the CMS and TJC to determine whether to revise the 2006 measures to harmonize the 2 measure sets. Wherever possible, the writing committee incorporated changes to achieve this alignment. For most of the 2006 measures, changes made are limited to changes to the excluded population lists in the denominators to better align the measures with the current CMS/TJC measures. In general, it was considered appropriate to use identical specification for those measures used by the CMS/TJC. In some cases, although the definition of a specific measure inclusion or exclusion criterion used may not be completely identical, the measures shared by the ACC/AHA and the CMS/TJC are conceptually aligned. The writing committee acknowledges that differences in the description of some components of measures specifications might be modified to facilitate implementation.

3.5. Approach to Contraindications to Therapy

The current flow of the CMS/TJC measures requires that all patients be assessed for potential contraindications and that all such patients are excluded regardless of whether the treatment was provided at discharge. Because many of the possible contraindications are relative or may resolve between the time of documentation and the time of the provision of the therapy, this approach may result in false exclusions of patients who were appropriately treated from the measure. Thus, despite the provision of care that is aligned with the guidelines, clinicians caring for patients who are falsely excluded are not appropriately rewarded for their actions. In addition to the elimination of false exclusions, this approach also decreases the burden of data abstraction. Furthermore, it is concordant with the approach used with other measure sets for inpatient and outpatient care both within and outside the cardiovascular arena. The ACC/AHA Performance Measures Task Force has supported a change in approach whereby all patients who receive the treatment would be included in the numerator and denominator of the measures and the assessment of potential documented contraindications to therapy would be assessed only among the remaining patients who did not receive the therapy; those without contraindications would join the denominator. The measures in this set have been modified to reflect this approach.

4. Discussion

With this document, we present a current set of AMI performance measures, renewing and refining some old measures, dropping a measure, introducing some new ones, and providing some as test measures. Table 3 summarizes the changes in this updated measure set. The set remains parsimonious, and we continue to lack measures in self-monitoring and assessment of disease status. We also lack many measures in diagnostics and patient education. In addition, there are no measures that address overuse of tests and procedures. These types of measures are needed.

The assessment of care remains challenging, and this document provides modest changes in the current efforts. Continuing research on which to base future measurement remains necessary, not only to produce new knowledge about interventions to promote better patient outcomes but also to inform the measurement of quality and the promotion of safe and effective care. Nevertheless, this document should be useful to those who want an updated, consensus list of measures that can be used to assess clinical performance in the care of patients with AMI.

The writing committee considered many approaches to modifying the structure of the measures but generally opted to implement the approach used in the first version of these measures. As such, consistent with the prior ACC/AHA performance measures, this writing committee agreed that it was important to maintain exclusion criteria to the measures to recognize the justifiable reasons for not meeting the process performance measures. These reasons are included in the "reasons documented by physician, advanced practice nurse, physician assistant, or PharmD for not. . .." Documentation of such factors should be encouraged and will provide valuable data for future research and conducting in-depth quality improvement for situations in which 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 when applicable. In general, the requirements for documentation are an important challenge of any measurement effort. The acknowledgment of these challenges is not intended as an argument against measurement. Rather, the challenges should be considered cautionary notes that draw attention to areas where additional focus on research and improvement of the measures should be considered.

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. Quality improvement 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.

4.1. Major Revisions to the 2006 STEMI/NSTEMI Measure Set

The writing committee examined the 11 performance measures included in the 2006 STEMI/NSTEMI Performance

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Measure set and considered whether any of the measures should be retired or updated based on revised guideline recommendations or experience from implementation of the measures such as very high rates. The writing committee also considered whether measures with very high rates could be retained but changed to an "emeritus" status to designate their clinical importance while recognizing that performance is already high.

4.1.1. Revised Performance Measure: Statin Therapy at Discharge

Compelling scientific evidence indicates that HMG Co-A reductase inhibitors (statins) reduce the risk of recurrent coronary events and improve survival in patients after MI.[24–28] The benefits of this therapy apply to both men and women, to patients older and younger than 65 years of age, and to diabetics.[29–32] The magnitude of benefit with statins matches or exceeds benefits with other secondary prevention medications such as aspirin, beta-blockers, and angiotensin-converting enzyme inhibitors (ACEIs) in the patient after MI.[26,33] On the basis of available data, the majority of individuals are candidates for statins at the time of discharge for AMI.

Despite the effectiveness of statins in altering subsequent cardiovascular mortality, several prior studies have documented low treatment rates in patients with established coronary artery disease.[34–39] Current gaps in care are less well characterized, however, because many of these studies involved patients from a single or a limited number of centers, enrolled in randomized clinical trials, or treated before dissemination of the most convincing clinical trial evidence.

After careful consideration of the guideline recommendations and the data supporting these recommendations, the writing committee voted to adopt statin therapy at hospital discharge as a performance measure. The writing committee discussed whether to include all forms of lipid-lowering therapy in the numerator of this measure. The ACC/AHA STEMI and UA/NSTEMI guidelines recommend somewhat different approaches to lipid-lowering therapy. Although the 2007 STEMI guideline focused update provides a Class I indication for lipid-lowering therapy with relatively little guidance regarding the specific agent used, the 2007 UA/NSTEMI guidelines specifically provide a Class I indication for statin drugs. Both guidelines, however, acknowledge that the preponderance of evidence with respect to post-MI outcomes and low-density lipoprotein (LDL) lowering has been demonstrated with statins. On the basis of this information, the measure was restricted to statin therapy only.

The writing committee decided to exclude patients with a known LDL less than 100 mg/dL. This decision was made to focus the measure on those who are most likely to benefit and because there was a lack of consensus about whether patients with an LDL less than 100 mg/dL should be placed on statins. This exclusion was felt to assist in the acceptance of the measure.

4.1.2. Test Measure: LDL Cholesterol Testing During Inpatient Hospitalization for AMI

Accumulating data for lipid-lowering therapy, particularly for statin drugs, have substantially increased the proportion of patients with AMI who are potential candidates for lipid-lowering therapy. Indeed, the ACC/AHA UA/NSTEMI guideline considers statin drugs in the absence of contraindications, regardless of baseline LDL cholesterol and diet modification, a Class I recommendation. Both the UA/NSTEMI and STEMI guidelines also consider LDL targets of less than 70 mg/dL reasonable.

Both the STEMI and UA/NSTEMI guidelines support fasting lipid profiles within 24 hours of admission in hospitalized patients to help guide lipid-lowering therapy. The recommendation that such testing be performed earlier is motivated by evidence that lipid values obtained more than 24 hours after an acute coronary event may be misleading.[40] On the basis of guideline recommendations, the previous ACC/AHA STEMI/NSTEMI Performance Measures included a measure for lipid testing. However, such a measure generates substantial data collection burden, may be difficult to ascertain from chart review, and may not necessarily improve quality regarding the ultimate goal of ensuring that patients appropriate for lipid-lowering therapy receive a discharge prescription. The current writing committee agreed that the modified construction of the measure of statin therapy at discharge largely renders moot a specific performance measure for LDL testing. Nevertheless, there were varying opinions in the group, and because of this, the measure was retained as a test measure.

4.1.3. Omitted Measure: Early Beta-Blockers

Older clinical trial data show that beta-blockers administered early during AMI hospitalization significantly reduce postinfarction angina and reinfarction.[41,42] Whether early beta-blocker use reduces mortality in AMI patients remains controversial, however. Although some individual clinical trials did show a modest, statistically significant mortality benefit associated with early beta-blocker therapy,[41] a large meta-analysis, published in 1999, of 29 260 patients enrolled in 51 clinical trials of early beta-blocker therapy showed no mortality benefit associated with this approach (odds ratio, 0.96; 95% CI, 0.85 to 1.08).[43]

More recent data from the Clopidogrel and Metoprolol in Myocardial Infarction Trial (COMMIT) also raised questions about the early use of beta-blockers in patients with AMI.[44] In the COMMIT study, 45 852 AMI patients (93% with STEMI and 50% receiving fibrinolytic therapy) were randomized to 15 mg metoprolol intravenously over 10 minutes immediately after presentation and then 50 mg metoprolol orally every 6 hours afterward or placebo. Importantly, patients with cardiogenic shock were excluded, but those with heart failure on presentation (Killip class 2 or 3) were not explicitly excluded.

The primary outcome (composite outcome of death, reinfarction, or cardiac arrest) and all-cause mortality at 30 days were similar between groups. Although beta-blockers significantly reduced the risk of arrhythmic death and reinfarction, they significantly increased the risk of cardiogenic shock within the first 24 hours of hospitalization. The most potent patient risk factors associated with the increased risk of developing cardiogenic shock with early beta-blockers included heart failure (Killip class 3) and hemodynamic instability on presentation.

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Balancing the evidence from COMMIT and the earlier studies, the ACC/AHA STEMI and UA/NSTEMI guidelines currently give Class I (Level of Evidence: B) recommendation for early oral beta-blockers, a Class IIa recommendation for early intravenous beta-blockers in hypertensive patients without specific contraindications (including signs of heart failure, evidence of a low output state, increased risk for cardiogenic shock [defined as age more than 70 years, systolic blood pressure less than 120 mm Hg, heart rate of 110 bpm or higher, and increased time since onset of symptoms]), and Class III (Level of Evidence: A) recommendation for intravenous beta-blockers in patients with specific contraindications to early beta-blocker therapy.

The writing committee carefully considered these guideline recommendations. Because of the complexity of integrating these recommendations, which would require the distinction between intravenous and oral administration and the ascertainment of a large number of patient factors that constituted contraindications, the writing committee chose to omit early beta-blocker use from this performance measure set.

4.2. New Performance Measures in This Update

4.2.1. Evaluation of Left Ventricular Systolic Function

Left ventricular systolic function (LVSF) is important from a therapeutic and prognostic standpoint for patients with AMI. Patients with left ventricular systolic dysfunction (LVSD) may be candidates for specific drug therapies (eg, ACEI and angiotensin receptor blocker [ARB]) or may warrant prompt invasive management during acute coronary syndrome (ACS) hospitalization (eg, coronary angiography). In addition, systolic dysfunction after AMI predicts long-term survival. Accordingly, clinical practice guidelines have incorporated the assessment of LVSF, by any method, as a Class I recommendation in patients with AMI (NSTEMI or STEMI).

The writing committee discussed modeling the LVSF assessment for AMI measure on the corresponding measure for patients with heart failure. However, given that AMI patients have experienced an event that may acutely affect LVSF, the writing committee felt that LVSF assessments performed before the AMI hospitalization should not be considered as meeting the performance measure.

The writing committee voted to adopt LVSF assessment for AMI patients as a performance measure. As with the existing performance measure for heart failure, credit would also be given in cases in which there is a documented plan for LVSF testing after discharge because there may be instances when it is difficult to obtain the test during the stay (eg, very short stays or weekend admissions).

4.2.2. Timely Reperfusion in STEMI

Acute reperfusion remains an important focus of quality assessment because of both the positive impact of timely reperfusion on clinical outcomes and the understanding of persistent gaps in the delivery of this effective therapy. The measurement of the quality of reperfusion therapy, however, involves greater complexity than many other process measures and has raised questions regarding the scope of the existing reperfusion performance measures and the possible need for additional measures to better characterize quality in this domain.

In response to these questions, the ACC/AHA Performance Measures Task Force convened a workgroup to evaluate the existing reperfusion measures and to suggest additional measures for consideration. A complete discussion of the proceedings of this workgroup is reported elsewhere[45]; however, the reperfusion measures reported in this document reflect a consideration of all of the workgroup's recommendations.

In brief, specific issues addressed in detail in the document deserve mention. First, the reperfusion measures contain exclusions for those situations when a patient-centered factor results in a delay in providing therapy. An example of a patient-centered factor is the initial refusal of a patient. Systemic reasons for delay do not result in exclusions. With respect to the measures of primary percutaneous coronary intervention (PCI), the time at which measurement stops is the time of the first use of a device intended to restore flow (eg, balloon, stent, or thrombectomy device). Although this does not account for the relatively small number of cases when flow is present before device deployment, it also does not create penalties for the failure to achieve procedural success.

A particular recommendation of the workgroup was to include a measure for the timeliness of primary PCI in patients who are transferred from the facility to which they present to another facility for the procedure. In the current era, total door-to-balloon time for these transferred patients is less than 2 hours in a little more than 25% of patients, between 2 and 4 hours in a little more than 50% of patients, and 4 hours or greater in about 20% of patients.[46] The previous measures explicitly excluded such patients, rendering invisible the performance of those institutions that routinely use transfer for PCI as their principal approach to reperfusion. This measure does not have a set benchmark, acknowledging the controversy about a time that represents an unacceptable delay. It is intended to make clear the time involved in obtaining reperfusion therapy for these patients. For patients who can receive fibrinolytic therapy, referring clinicians should have a sense of the time that will be required to provide primary PCI. This knowledge can inform the decision about which form of reperfusion therapy is in the patient's best interest. Moreover, such knowledge may stimulate efforts for referral and receiving hospitals, along with transportation companies and agencies, to sit together to review and improve their joint performance. The writing committee understands that in rural areas there may be long distances that are required for transfer. The opinion of the group, however, is that if reasonable primary PCI times could not be achieved then fibrinolytic therapy should be administered, which is consistent with recommendations of the STEMI guidelines. Because patients with contraindications to fibrinolytic therapy may have different considerations regarding the time to primary PCI, the committee recommends that that group be reported separately. The committee also recommends that times be collected on all patients, even those with patient reasons for delay, for the purpose of internal

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quality improvement and review. Two additional measures are included to reflect the timeliness of primary reperfusion: (1) measuring the time from arrival to and discharge from an emergency department in patients transferred for primary PCI ("door-in-door-out" time) and (2) a comprehensive measurement of the time from presentation at the first facility to the time of PCI at the receiving institution.

A consideration in the measurement of time to transfer for primary PCI is the subgroup of patients for whom fibrinolytic therapy is contraindicated. Although the time to transfer is undoubtedly important in this population, because the option of providing fibrinolytic therapy is not available, clinicians may opt for transfer even if the capacity to do so in a timely manner is not available. In contrast, among patients for whom fibrinolytic therapy is a therapeutic option, fibrinolysis should be provided if transfer will be delayed. Thus, the workgroup concluded that these transfer measures should be reported separately for patients with and without documented contraindications to fibrinolytic therapy.

Currently, evidence-based recommendations or accepted national performance benchmarks for measures of the time of transfer for primary PCI do not exist. Thus, although the writing committee believed that targets of 30 minutes for time from presentation to transfer and 90 minutes for time from presentation at 1 facility to PCI at another were reasonable targets given current guideline recommendations for reperfusion timeliness, no specific performance target is prescribed by the measures.

Beyond the specification of these measures, the issue of attribution of these times is critical. In the case of the "door-in-door-out" time (Measure 10), attribution is straightforward (ie, the facility at which the patient presents is largely accountable for all aspects of the process). For the measure of time of presentation to PCI among patients who are transferred (Measure 11), the question of accountability is less clear given the participation of the hospital to which the patient presents, the providers of the transfer, and the hospital at which the PCI occurs. Although arguments for several approaches are reasonable, both institutions providing care for a patient who is transferred for primary PCI should be invested in ensuring that the transfer is performed in a timely manner and, if this is not possible, should consider fibrinolytic therapy. Thus, the writing committee recommends that for the measurement of the time from presentation at 1 hospital to the time of PCI in another, the results should be attributed to both institutions. This approach to attribution will stimulate efforts for both types of institutions to collaborate with each other to optimize the care of their patients with STEMI who require acute reperfusion therapy.

The workgroup also considered the issue of the use of the time of first system contact rather than the time of hospital presentation as the start time for the reperfusion measures. The workgroup concluded that measures used for the purposes of accountability should migrate toward including the time before hospital presentation in measurement. However, until several issues regarding this approach are resolved, it was proposed that measures starting with the time of first system contact were more appropriate for the purposes of quality improvement within systems and that systems should be encouraged to measure and improve these times.

Finally, it is possible that attempts to decrease the time to reperfusion for STEMI may result in the delivery of reperfusion strategies to patients who do not meet reperfusion criteria. Identifying a population for whom angiography or fibrinolytic therapy is clearly inappropriate through the use of retrospective criteria is likely to pose substantial challenges if public accountability for such measurement is considered. However, for the purposes of quality improvement, it may be useful to review cases of "false alarm" catheterization laboratory activations or cases when fibrinolysis is administered when it is unclear that reperfusion criteria were met. Such measures are proposed as secondary measures for consideration for quality improvement.

4.3. New Test Measures in This Update

4.3.1. Clopidogrel at Discharge

Data on the benefits of dual antiplatelet therapy (aspirin plus clopidogrel) for patients with ACS have accumulated over the past several years. Accordingly, the prescription of clopidogrel for ACS patients has been incorporated into the ACC/AHA clinical practice guideline recommendations. Specifically, clopidogrel at hospital discharge for patients presenting with ACS, including UA, NSTEMI, and STEMI, received a Class I guideline recommendation in the 2007 updates of the STEMI and UA/NSTEMI guidelines. Class I recommendations are relevant to several patient populations, including all patients receiving coronary stents and patients not receiving stents who are managed medically. After careful consideration of the guideline recommendations and the data supporting these recommendations, the writing committee agreed to adopt clopidogrel at hospital discharge for medically treated AMI patients as a test performance measure. The rationale for this recommendation is discussed further below.

Data from the NCDR ACTION Registry-GWTG, a national ACS registry, demonstrate significant variability in the prescription of clopidogrel at hospital discharge for ACS patients depending on in-hospital treatment. Among those undergoing PCI and stenting, clopidogrel is prescribed to a very high percentage of patients. Because rates of clopidogrel prescription are already very high in these patients, the writing committee decided to exclude them from the test measure. This decision was based on balancing considerations of the burden of data abstraction among a population for which evidence suggests that gaps in care are not substantial. The decision does not question the importance of thienopyridine therapy in the population receiving stents.

The writing committee also discussed this therapy among patients undergoing coronary artery bypass graft surgery during AMI hospitalization. Because of the limited data on the benefit of dual antiplatelet therapy in this population, the writing committee concluded that patients undergoing coronary artery bypass graft during AMI hospitalization should also be excluded from the measure.

In contrast, there is evidence of substantially greater variability in rates of clopidogrel prescription at hospital

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discharge for medically treated patients.[47] The population that does not undergo angiography and PCI is likely very heterogeneous, including some of the sickest and frailest patients and those who refuse treatment. However, given the demonstrated benefit of clopidogrel in medically treated ACS patients enrolled in clinical trials and the potential gaps in care identified in contemporary registries, the writing committee considered thienopyridine therapy in medically treated patients as a potential opportunity to improve care. A test performance measure focused on these patients would be important in this regard and would provide a better understanding of AMI patients treated medically in clinical practice. Furthermore, as with all performance measures, the heterogeneity of this patient population is acknowledged with the exclusion of those patients for whom a clinician documents any reason for not prescribing the therapy.

The writing committee also discussed whether to restrict the measure to clopidogrel only or to include the entire class of thienopyridine derivatives. Current clinical practice guidelines specify an explicit preference for clopidogrel, reserving ticlopidine for patients with contraindications to clopidogrel. Because of the approach in the guidelines and no evidence for clinically meaningful occurrence of contraindications specific to clopidogrel, the writing committee limited the measure to clopidogrel only. Although emerging evidence suggests the benefits of other agents, current guidelines do not yet include recommendations for their use.

4.3.2. Initial Parenteral Anticoagulant and Antiplatelet Dosing

Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well established. However, excess dosing in patients with UA/NSTEMI is a common occurrence,[48,49] particularly in vulnerable populations (eg, the elderly, those with impaired renal function). Although these patients may stand to benefit the most from anticoagulant therapy, they also are the most likely to receive excess dosing and experience bleeding complications. Importantly, in these observational studies, higher rates of bleeding and in-hospital mortality were associated with excess dosing after accounting for potential confounders.

Given the high frequency of dosing errors that have been reported and their potential negative consequences, the writing committee believed that performance measures focused in this area (and including intravenous glycoprotein IIb/IIIa inhibitors) would have an important impact on quality improvement and patient care despite the lack of definitive randomized clinical trial data and the potential burden of data collection for institutions. The burden of data collection is due primarily to assessments of glomerular filtration rates for many agents. Estimations of glomerular filtration rates are usually performed with either the Cockroft-Gault or the Modification of Diet in Renal Disease formula. Hospitals may vary in their preference for using a specific formula, which could lead to minor differences. It is noteworthy that clinical studies have relied primarily on the Cockroft-Gault formula to generate dosage adjustments. An additional concern is that these agents are frequently administered urgently in the emergency department (particularly for unfractionated heparin) before a patient's weight is obtained. A measure therefore could potentially delay or diminish the use of these agents in this setting. However, this concern needs to be balanced against the significant risk for bleeding associated with excess dosing. The fact that measures for unfractionated heparin and enoxaparin have an added margin of error well above recommended doses also emphasizes true outlier doses.

The writing committee specifically focused on 5 performance measures for the most commonly used agents (unfractionated heparin, enoxaparin, eptifibatide, tirofiban, and abciximab) and focused on initial doses (bolus and infusion), including recommendations for maximum acceptable doses when applicable. We excluded patients who received treatment initially in the catheterization laboratory because doses for these agents may vary in the setting of PCI or may be adjusted directly by monitoring coagulation studies like activated clotting times. For a similar reason, the performance measure for unfractionated heparin also excluded patients with STEMI who underwent primary PCI because higher doses of unfractionated heparin may be used in anticipation of the procedure. A comparable performance measure focused on dosing of fibrinolytic therapy in STEMI also was considered, although data on the impact of overdosing in this population are less conclusive.[50] The writing committee believed that because of the smaller number of patients with STEMI and recent declines in the use of fibrinolytic therapy in the United States, the impact of such a measure may be more limited. Future performance measure development efforts may need to reconsider this issue in STEMI. In addition to a process measure assessing the dosing of commonly used anticoagulant and antiplatelet agents, the writing committee has developed 2 structural performance measures that assess formal approaches within a facility to minimize dosing errors for anticoagulant therapy and similar agents. This would be relevant for all patients, including those with NSTEMI, UA, and STEMI.

All measures dedicated to assessing anticoagulation dosing were unanimously considered most appropriate as test measures by the writing committee. Although we recognize that the 5 performance measures related to dosing of specific agents are based primarily on observational studies, are complex, and may add to the potential burden of data collection for institutions, contemporary data suggest that there is a substantial opportunity to improve patient processes of care and outcomes in this area. As test measures, these metrics are considered most appropriate for use for internal quality improvement programs but not other functions (eg, pay for performance, physician ranking, or public reporting) until the validity of these measures and the effort needed to collect the necessary data are better understood.

4.4. Endorsement of AACVPR/ACC/AHA Cardiac Rehabilitation Performance Measures

There is vast scientific evidence that physical activity is beneficial to health in general and for the prevention of ischemic heart disease and its complications specifically. The growing problem of obesity, which in turn has spurred an epidemic of diabetes, is related in part to the low level of physical activity among adults in the United States. Patients

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with cardiovascular disease are even less likely than the general public to participate in regular physical activity.[51] The AHA/ACC and the federal government advocate regular physical activity for all persons, including those with established heart disease. Meta-analyses and systematic reviews indicate that exercise-based cardiac rehabilitation programs improve risk factors among patients with established heart disease. Pooled data from randomized clinical trials of cardiac rehabilitation demonstrate a reduction in total mortality of approximately 20% to 30% and a reduction in cardiac mortality of approximately 30%.[52–57] Trials to date have not demonstrated superiority of comprehensive cardiac rehabilitation programs over those that incorporate exercise only.[53,57]

In 2007, the ACC/AHA, in conjunction with the AACVPR, published a performance measurement set related to referral to cardiac rehabilitation programs and more specific measures regarding the structure and process of cardiac rehabilitation for patients with cardiovascular disease.[6] It was the expectation of that group that the general measure related to referral for cardiac rehabilitation would be incorporated into the performance measurement sets developed by other ACC/AHA groups. The STEMI/NSTEMI Performance Measures Writing Committee reviewed the recently published AACVPR/ACC/AHA Cardiac Rehabilitation measures. The measure specifically relevant to the inpatient AMI population is that all patients hospitalized with a primary diagnosis of AMI should be referred to an early outpatient cardiac rehabilitation/secondary prevention program.

After extensive discussion and deliberation, the writing committee ultimately concluded that the AACVPR/ACC/AHA process measure should be adopted as published, restricted in this case to the survivors of AMI hospitalization. This will promote consistency across measurement sets, more feasible data collection, and better opportunities for providers to develop a system that addresses their care as it relates to multiple cardiac conditions rather than require different strategies to deal with different performance measure sets for similar conditions.

4.5. Outcomes Measures: 30-Day Risk-Adjusted Mortality

The writing committee strongly endorses the use of outcomes measures to complement process measures provided that these measures meet the criteria delineated by the AHA for the public reporting of outcomes measures as discussed above. Several outcomes could be the focus of such measures, including mortality, morbidity, health status, and symptom severity. At this point in time, however, few of these outcomes can be practically measured in large populations. Currently, only measures of risk-adjusted mortality have been implemented on a large scale. On the basis of existing knowledge about the feasibility and validity of measures of outcomes, the writing committee endorsed hospital-level 30-day risk-adjusted mortality as an appropriate outcomes performance measure for AMI. Although the writing committee did not consider official endorsement of any particular measure as part of its change, the CMS currently reports a previously validated measure of hospital-level 30-day risk-adjusted mortality after AMI that conforms to the attributes delineated by the AHA and thus would be considered reasonable for use in public reporting. The writing committee acknowledges that other measures of mortality or other patient outcomes that meet the criteria delineated by the AHA may emerge over time and that, after adequate evaluation, further outcomes measures may be adopted. Ideally, any future outcomes measures would be endorsed by the National Quality Forum because this endorsement process provides the necessary scrutiny by multiple stakeholders.

4.6. Potential Measures Considered but Not Included in This Set

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.

4.6.1. Early Clopidogrel Therapy

The writing committee investigated early clopidogrel therapy as a potential performance measure. Areas discussed were (1) clopidogrel administration within 24 hours after hospital arrival in patients with aspirin hypersensitivity or intolerance, (2) upstream clopidogrel in patients undergoing early invasive strategy, and (3) clopidogrel administration within 24 hours in patients undergoing conservative strategy. For patients with aspirin hypersensitivity or intolerance, both the STEMI and UA/NSTEMI guidelines recommend administration of clopidogrel in lieu of aspirin therapy. However, the writing committee felt that the number of patients with aspirin hypersensitivity or intolerance would be too small for this potential measure to be useful given the burden of abstraction that would be required.

With regard to the upstream clopidogrel administration, the writing committee felt that the complexity of decision making regarding this therapy precluded translation into a performance measure. The recommendations for clopidogrel in the early stages of AMI are dependent on several factors, including treatment strategy (interventional versus early conservative), and other "upstream" medical therapy with glycoprotein IIb/IIIa inhibitors. Because of the complexity of decision making in the determination of the appropriate antiplatelet therapy in medically managed patients and the difficulty in identifying appropriate populations for the denominator, the writing committee thought that it would be extremely difficult, if not impossible, to develop a meaningful measure in this subgroup of patients.

4.6.2. Early Anticoagulant Therapy

Clinical trial data support the use of anticoagulant therapy in patients with UA/NSTEMI.[21] However, the specific agent recommended depends on the type of initial treatment approach chosen (ie, early invasive versus selective invasive strategy) and patient factors (ie, high bleeding risk or chronic renal insufficiency). Although the level of evidence for each agent varies, the UA/NSTEMI guidelines currently support 4

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options as Class I recommendations: unfractionated heparin, enoxaparin, bivalirudin, and fondaparinux. In patients with STEMI, use of anticoagulant therapy is a Class I recommendation after fibrinolytic therapy with options including unfractionated heparin, enoxaparin, and fondaparinux.[20] For primary PCI, use of anticoagulant therapy typically is limited to the cardiac catheterization laboratory.

The writing committee strongly considered a performance measure in this area. Ultimately, however, a measure was not developed for 2 reasons. First, the complexity of clinical options and scenarios involving this therapy made the construction of a measure challenging and potentially confusing for clinicians. Second, use of anticoagulant therapy is already high among patients with ACS, approaching 90% for unfractionated heparin or low-molecular-weight heparin.[58] This suggests that a performance measure in this area would identify only limited opportunities for quality improvement.

4.6.3. Influenza Vaccination

The writing committee discussed a performance measure centering on the provision of an influenza vaccination for patients after an AMI. The 2007 ACC/AHA UA/NSTEMI guidelines[21] have a Class I recommendation: An annual influenza vaccination is recommended for patients with cardiovascular disease (Level of Evidence: B). The 2007 STEMI guideline focused update[20] also has a Class I recommendation: Patients with cardiovascular disease should have an annual influenza vaccination (Level of Evidence: B). Over the past decade, more chronic diseases have been added to the list of indications for this vaccine, and there appears to be little, if any, risk of harm. However, seasonal administration and the potential difficulty of finding vaccine administration documentation if previously given outside the hospital have presented barriers to measurement feasibility in other settings. Given these challenges, the writing committee felt that influenza vaccination should not be considered for a performance measure specifically for AMI at this time.

4.6.4. Avoidance of Nonsteroidal Antiinflammatory Drugs

The writing committee discussed a performance measure on nonsteroidal antiinflammatory drug (especially COX-2 inhibitor) avoidance in AMI patients. The 2007 ACC/AHA UA/NSTEMI guidelines and the 2007 STEMI guideline focused update both recommend that nonsteroidal antiinflammatory drugs with increasing degrees of relative COX-2 selectivity should not be administered to AMI patients with chronic musculoskeletal discomfort when therapy with acetaminophen, small doses of narcotics, nonacetylated salicylates, or nonselective nonsteroidal antiinflammatory drugs provides acceptable levels of pain relief (Level of Evidence: C). However, previous experience with measures implementation reveals the challenges of constructing a "negative" measure (ie, one focused on measuring a therapy that is given inappropriately) because of the need to identify a denominator for which the therapy is clearly inappropriate. Furthermore, given the extensive publicity regarding COX-2 inhibitors, it is not clear whether these agents are still being prescribed acutely in the hospital setting in this patient population. For these reasons, the writing committee concluded that a measure of avoiding nonsteroidal antiinflammatory drugs and COX-2 inhibitors should not be pursued at this time.

4.6.5. Aldosterone Blockade

The writing committee carefully reviewed the evidence and guideline recommendations in regard to aldosterone blockade in patients hospitalized with AMI. The principal evidence for this therapy derives from the Eplerenone Post-AMI Heart Failure Efficacy and Survival Study (EPHESUS), in which aldosterone blockade with eplerenone initiated within 3 to 14 days improved outcomes in post-AMI patients with either heart failure or diabetes.[59] All patients were receiving optimal medical therapy, including ACEIs, beta-blockers, and aspirin when appropriate. Half of the population was treated with statins. Reflecting these findings, current clinical guidelines give Class I recommendations to long-term aldosterone receptor blockade for AMI patients without significant renal dysfunction or hyperkalemia who are already receiving therapeutic doses of an ACEI, have a left ventricular ejection fraction less than or equal to 0.40, and have either symptomatic heart failure or diabetes mellitus.

The writing committee considered the addition of a new performance measure for aldosterone blockade but believed that a measure for this treatment for hospitalized AMI patients should not be developed. Several factors influenced this decision. First, identifying candidates for the denominator of this measure would create significant abstraction burden and likely identify a relatively small proportion of AMI patients (those with estimated creatinine clearance higher than 30 mL/min, patients with potassium of 5 mEq/L or lower, those receiving therapeutic doses of ACEI, those with left ventricular ejection fraction of 40% or lower, and patients with either symptomatic heart failure or diabetes). Second, patients enrolled in EPHESUS were randomized to eplerenone between 3 and 14 days after AMI, which for most patients represents an early postdischarge period. Accordingly, the writing committee felt that initiation of aldosterone blockade as a layered therapy (in patients treated with ACEI and beta-blockers) may be most appropriate in the early postdischarge setting. Finally, the writing committee also had some concerns about recent evidence in regard to the use of aldosterone blockade in patients with contraindications to this therapy,[60] which in some cases puts patients at risk for hyperkalemia. The committee believed that, in addition to an outpatient measure for the use of aldosterone antagonists, a parallel measure of inappropriate use may be warranted.

4.6.6. Facilitated PCI

In the 2007 STEMI guideline focused update, facilitated PCI refers to "a strategy of planned immediate PCI after administration of an initial pharmacological regimen intended to improve coronary patency before the procedure." Pharmacological regimens for facilitated PCI have been variably defined and include high-dose heparin, glycoprotein IIb/IIIa inhibitors, and fibrinolytic therapy. Clinical trial data suggest that the routine use of this approach does not provide any advantages and may result in harm when full-dose fibrino-

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lytic therapy is used as the initial pharmacological regimen. The latter approach was considered a Class III recommendation in the 2007 STEMI guideline focused update. The writing committee considered a performance measure in this area to assess the use of this potentially harmful strategy. In the end, however, the writing committee chose not to pursue this further because of the challenges of constructing a performance measure that could accurately distinguish between facilitated PCI in which full-dose fibrinolytic therapy is used as the initial pharmacological regimen and other forms of facilitated PCI or rescue PCI.

4.6.7. Early Invasive Strategy for High-Risk NSTEMI Patients

The UA/NSTEMI guidelines recommend an early invasive strategy (ie, coronary angiography with PCI if appropriate) for patients with UA/NSTEMI who have evidence of refractory symptoms and hemodynamic or electric instability (Class I; Level of Evidence: B) or an elevated risk for clinical events based on clinical characteristics, including elevated biomarkers or electrocardiographic abnormalities (Class I; Level of Evidence: A). A conservative (or selectively invasive) strategy also is considered reasonable (Class IIb; Level of Evidence: B) for stable patients, including those with elevated biomarkers. The writing committee considered an AMI performance measure to evaluate the use of an early invasive strategy in patients with NSTEMI. However, a measure was not endorsed at this time because of the complexity of the guideline recommendations and the challenges in translating these recommendations into a measure that can be implemented feasibly. Particular considerations include concerns about identifying high-risk clinical characteristics reliably from abstracted data, particularly with respect to the accurate classification of ECG abnormalities, and the importance of considering overuse given the invasive nature of coronary angiography. Current initiatives through registries (eg, ACTION or the National Cardiovascular Data Registry CathPCI) may be valuable in exploring feasible approaches to identifying the "eligible" population for early invasive strategy and to inform the construction of a quality or performance measure on this topic in the future.

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Appendixes

Appendix A. Author Relationships With Industry and Other Entities: ACC/AHA 2008 Clinical Performance Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction

Name	Research Grant	Speakers' Bureau/Honoraria/Expert Witness	Stock Ownership/Equity Interests	Consultant/Advisory Board/Steering Committee
Harlan M. Krumholz	None	Vioxx litigation for plaintiff	None	Alere Amgen UnitedHealth* VHA, Inc*
Jeffrey L. Anderson†	ThromboVision AstraZeneca Merck	Thrombovision DiaDexus Novartis Merck* BMS/Sanofi Pfizer	None	Merck
Brian L. Bachelder	None	None	None	None
Francis M. Fesmire	None	None	None	None
Stephan D. Fihn	None	None	None	None

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Appendix A. Continued

Name	Research Grant	Speakers' Bureau/Honoraria/Expert Witness	Stock Ownership/Equity Interests	Consultant/Advisory Board/Steering Committee
JoAnne M. Foody	None	Merck	None	Merck
		Novartis		Novartis
		Pfizer		Pfizer
		Sanofi-Aventis		Sanofi-Aventis
P. Michael Ho	None	Novartis	None	None
Mikhail N. Kosiborod‡		Vascular Biology Working Group	None	Sanofi-Aventis
		Diaved		
Frederick A. Masoudi	Amgen*	UnitedHealth	None	None
		Amgen		
		Takeda		
Brahmajee K. Nallamothu	None	None	None	None

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*Significant (greater than $10 000) relationship.

†Recused from voting on measures 4 and T-9.

‡Recused from voting on measure T-9.

Appendix B. Peer Reviewer Relationships With Industry and Other Entities: ACC/AHA 2008 Clinical Performance Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction

Name	Representation	Research Grant	Speakers' Bureau/Honoraria/Expert Witness	Stock Ownership/Equity Interests	Consultant/Advisory Board/Steering Committee
Eric R. Bates	Official reviewer–ACCF Board of Trustees	Lilly*	GlaxoSmithKline	None	None
			Lilly		
			PDL BioPharma		
			Sanofi-Aventis		
			The Medicines Company		
			Hoffman-LaRoche		
Michael Del Core	Official reviewer–ACCF Board of Governors	None	None	None	None
David Goff	Lead reviewer–ACC/AHA Task Force on Performance Measures	Merck*	Spriggs & Hollingsworth	None	None
			Scientific Evidence*		
Christopher Granger	Official reviewer–AHA	AstraZeneca*	None	None	AstraZeneca*
		Boehringer Ingelheim*			Bristol-Myers Squibb
		Bristol-Myers Squibb*			Genentech
		deCode Genetics*			GlaxoSmithKline*
		Genentech*			INO Therapeutics
		GlaxoSmithKline*			Novartis
		Novartis*			Sanofi-Aventis
		Sanofi-Aventis*			Takeda
		The Medicines Company*			The Medicines Company*
Glenn Levine	Official reviewer–AHA	None	The Medicines Co, Sanofi-Aventis, Bristol-Myers Squib	None	None

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Appendix B. Continued

Name	Representation	Research Grant	Speakers' Bureau/Honoraria/Expert Witness	Stock Ownership/Equity Interests	Consultant/Advisory Board/Steering Committee
Elliott Antman	Content reviewer–2007 ACC/AHA STEMI Guideline Focused Update Writing Committee	Novartis Pharmaceuticals, Accumetrics, Pfizer, Inc, Roche Diagnostics GmbH, Roche Diagnostics Corp, Biosite Inc, Beckman Coulter, Inc, Amgen, GlaxoSmithKline, Sanofi-Synthelabo Recherche, Ortho-Clinical Diagnostics, Inc, Bayer Healthcare LLC, Integrated Therapeutics Corp, Schering-Plough Research Institute, Eli Lilly & Co,* Inotek Pharmaceuticals Corp, CV Therapeutics, Nuvelo, Inc, Millennium Pharmaceuticals, Sanofi-Aventis,* Bristol-Myers Squibb Pharmaceutical Research Institute, Merck & Co	Eli Lilly, Sanofi-Aventis	None	None
Paul W. Armstrong	Content reviewer–ACC/AHA STEMI Guideline Focused Update Writing Committee	Portola,* Scios/Ortho Biotech,* Schering Plough Research Institute,* Boehringer Ingelheim,* Hoffmann LaRoche*	KAI Pharmaceuticals,* Sanofi-Aventis, Hoffmann LaRoche, Abbott, Medicure	None	Medicure
Christopher P. Cannon	Content reviewer–ACC/AHA ACS Clinical Data Standards Writing Committee and AHA Get with the Guidelines Program Committee	Glaxo Smith Kline,* Sanofi-Aventis/Bristol-Myers Squibb Partnership,* Schering Plough,* Merck/Schering Plough Partnership,* Merck,* AstraZeneca,* Accumetrics*	None	None	None
Donald E. Casey, Jr	Content reviewer–AHA Get with the Guidelines Program	None	None	None	None
William E. Chavey, II	Content Reviewer—ACC/AHA UA/NSTEMI Guideline Writing Committee	None	Nitromed	None	None
Jose Diez	Content reviewer– ACCF Catheterization and Intervention Committee	None	Sanofi-Aventis	None	None
Joseph P. Drozda, Jr	Content reviewer–ACC Quality Strategic Directions Committee	Takeda,* Shionogi,* Sanofi Aventis,* Novartis,* AstraZeneca,* Abbott Laboratories*	None	None	None
Steven Dunn	Content reviewer–ACCF Prevention of Cardiovascular Disease Committee	None	None	None	None
Ted Feldman	Content reviewer–ACC/AHA PCI Guideline Focused Update Writing Committee	Abbott, Atritech, Boston Scientific Corp, Cardiac Dimensions, Edwards, Evalve, Myocor, St Jude	Boston Scientific	None	Abbott, Cardiac Dimensions, Coherex, Cordis, WL Gore, Myocor

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Gregg C. Fonarow	Content reviewer–AHA Get with the Guidelines Program	Medtronic,* GlaxoSmithKline*	Abbott, Novartis,* Nitromed, AstraZeneca, Bristol Myers-Sanofi,* Scios, Guidant, Pfizer, Merck-Schering Plough,* Medtronic,* GlaxoSmithKline*	None	None
Lee Green	Content reviewer–2007 ACC/AHA STEMI Guideline Focused Update Writing Committee	None	None	None	None
Mary Hand	Content reviewer–2007 ACC/AHA STEMI Guideline Focused Update Writing Committee	None	None	None	None
Kalon Ho	Content reviewer—NCScientific Oversight Committee	None	None	None	Boston Scientific Corp*
Morton Kern	Content reviewer—2007 ACC/AHA PCI Guideline Focused Update Writing Committee	None	Radi Medical, Volcano Therapeutics, Merit Medical*	None	None
Douglass Morrison	Content reviewer—2007 ACC/AHA PCI Guideline Focused Update Writing Committee	None	None	None	None
Srihari S. Naidu	Content reviewer–ACCF Catheterization and Intervention Committee	None	None	None	None
Matthew Roe	Content reviewer–NCACTION Registry Subcommittee, Research and Publications	Daiichi-Sankyo, Lilly,* KAI Pharmaceuticals,* BMS Sanofi-Aventis,* Schering Plough*	BMS Sanofi-Aventis,* Schering Plough,* KAI Pharmaceuticals, Daiichi-Sankyo	Genentech,* Novartis*	None
John Spertus	Content reviewer–individual	BMS/Sanofi Aventis Partnership,* Lilly,* Amgen*	St Jude's Medical	PRISM Texhnology, SAQ (copyright),* KCCQ (copyright),* PAQ (copyright),* CV Outcomes, Inc, Outcomes Instruments, LLC,* Health Outcomes Sciences, LLC	None
Barry Uretsky	Content reviewer—ACCF Catheterization and Intervention Committee	None	None	None	None
John Webb	Content reviewer—ACCF Catheterization and Intervention Committee	None	Heart Leaflet Technologies, Guided Delivery Systems, Edwards Lifesciences	Kardium, Mitralign	None

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Appendix C: ACC/AHA STEMI/NSTEMI Measurement Set Specifications

1. Aspirin at Arrival

Acute myocardial infarction (AMI) patients 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.
	Included populations: Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4.
	Excluded populations:
	▪ Patients less than 18 years of age
	▪ Patients transferred to another hospital for inpatient care on day of or day after arrival
	▪ Patients received in transfer from the inpatient, outpatient, or emergency department of another facility
	▪ 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 comfort measures only documented on day of or day after arrival
	▪ Patients with one or more of the following reasons for not receiving aspirin on arrival documented in the medical record:
	  ▪ Aspirin allergy
	  ▪ Coumadin/warfarin as pre-arrival medication
	  ▪ Other reasons documented by physician/advanced practice nurse/physician assistant/PharmD

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 myocardial infarction.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 2007 UA/NSTEMI Guidelines[21]
Class I
Aspirin should be administered to UA/NSTEMI patients as soon as possible after hospital presentation and continued indefinitely in patients not known to be intolerant of that medication. *(Level of Evidence: A)*

Method of Reporting

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

Challenges to Implementation

None

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2. Aspirin Prescribed at Discharge

Acute myocardial infarction (AMI) patients who are prescribed aspirin at hospital discharge

Numerator	AMI patients who are prescribed aspirin at hospital discharge.

Denominator	AMI patients.
	Included populations: Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4.
	Excluded populations:
	▪ Patients less than 18 years of age
	▪ Patients transferred to another hospital for inpatient care
	▪ Patients who expired
	▪ Patients who left against medical advice
	▪ Patients discharged to hospice or for whom comfort measures only is documented
	▪ Patients with one or more of the following reasons for not prescribing aspirin at discharge documented in the medical record:
	  ▪ Aspirin allergy
	  ▪ Coumadin/warfarin prescribed at discharge
	  ▪ Other reasons documented by physician/advanced practice nurse/physician assistant/PharmD

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 myocardial infarction.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines(remains in effect)[19]
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 2007 STEMI Guideline Update[20]
Class I
For all post-PCI STEMI stented patients without aspirin resistance, allergy, or increased risk of bleeding, aspirin 162 mg to 325 mg daily should be given for at least 1 month after BMS implantation, 3 months after sirolimus-eluting stent implantation, and 6 months after paclitaxel-eluting stent implantation, after which long-term aspirin use should be continued indefinitely at a dose of 75 mg to 162 mg daily. (*Level of Evidence: B)*

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Aspirin should be administered to UA/NSTEMI patients as soon as possible after hospital presentation and continued indefinitely in patients not known to be intolerant of that medication. *(Level of Evidence: A)*

Method of Reporting

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

Challenges to Implementation

None

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3. Beta-Blocker Prescribed at Discharge

Acute myocardial infarction (AMI) patients who are prescribed a beta-blocker at hospital discharge

Numerator	AMI patients who are prescribed a beta-blocker at hospital discharge.

Denominator	AMI patients.
	Included populations: Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4.
	Excluded populations:
	▪ Patients less than 18 years of age
	▪ Patients transferred to another hospital for inpatient care
	▪ Patients who expired
	▪ Patients who left against medical advice
	▪ Patients discharged to hospice or for whom comfort measures only is documented
	▪ Patients with one or more of the following reasons for not prescribing a beta-blocker at discharge documented in the medical record:
	  ▪ Beta-blocker allergy
	  ▪ 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/advanced practice nurse/physician assistant/PharmD

Period of Assessment	Hospital discharge.
Sources of Data	Administrative data and medical records.

Rationale

Beta-blockers administered chronically reduce the risk of recurrent ischemic events and long-term mortality in patients surviving myocardial infarction.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
It is beneficial to start and continue beta-blocker therapy indefinitely in all patients who have had MI, acute coronary syndrome, or LV dysfunction with or without HF symptoms, unless contraindicated. *(Level of Evidence: A)*

Patients with early contraindications within the first 24 hours of STEMI should be reevaluated for candidacy for beta-blocker therapy as secondary prevention. *(Level of Evidence: C)*

Patients with moderate or severe LV failure should receive beta-blocker therapy as secondary prevention with a gradual titration scheme. *(Level of Evidence: B)*

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
1. Beta-blockers are indicated for all patients recovering from UA/NSTEMI unless contraindicated. (For those at low risk, see Class IIa recommendation below.) Treatment should begin within a few days of the event, if not initiated acutely, and should be continued indefinitely. *(Level of Evidence: B)*
2. Patients recovering from UA/NSTEMI with moderate or severe LV failure should receive beta-blocker therapy with a gradual titration scheme. *(Level of Evidence: B)*

Class IIa
It is reasonable to prescribe beta-blockers to low-risk patients (i.e., normal LV function, revascularized, no high-risk features) recovering from UA/NSTEMI in the absence of absolute contraindications. *(Level of Evidence: B)*

Method of Reporting

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

Challenges to Implementation

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4. Statin Prescribed at Discharge

Acute myocardial infarction (AMI) patients who are prescribed a statin at hospital discharge

Numerator	AMI patients who are prescribed a statin medication at hospital discharge.

Denominator	AMI patients.
	Included populations: Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4
	Excluded populations:
	▪ Patients less than 18 years of age
	▪ Patients transferred to another hospital for inpatient care
	▪ Patients who expired
	▪ Patients who left against medical advice
	▪ Patients discharged to hospice or for whom comfort measures only is documented
	▪ Patients with LDL less than 100 mg/dL and not discharged on a statin
	▪ Patients with one or more of the following reasons for not prescribing a statin medication at discharge documented in the medical record:
	  ▪ Statin medication allergy
	  ▪ Other reasons documented by a physician/advanced practice nurse/physician assistant/PharmD

Period of Assessment	Hospital discharge.
Sources of Data	Administrative data and medical records.

Rationale

HMG Co-A reductase inhibitors (statins) re duce the risk of vascular events and death in patients surviving myocardial infarction.

Corresponding Guideline(s)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Hydroxymethyl glutaryl-coenzyme A reductase inhibitors (statins), in the absence of contraindications, regardless of baseline LDL-C and diet modification, should be given to post-UA/NSTEMI patients, including postrevascularization patients. *(Level of Evidence: A)*

For hospitalized patients, lipid-lowering medications should be initiated before discharge. *(Level of Evidence: A)*

For UA/NSTEMI patients with elevated LDL-C (greater than or equal to 100 mg/dL), cholesterol-lowering therapy should be initiated or intensified to achieve an LDL-C of less than 100 mg/dL. *(Level of Evidence: A)*

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
For hospitalized patients, initiation of lipid-lowering medication is indicated as recommended below before discharge according to the following schedule (*Level of Evidence: A*):

- LDL-C should be less than 100 mg/dL (*Level of Evidence: A*), and
- If baseline LDL-C is greater than or equal to 100 mg/dL, LDL lowering drug therapy should be initiated.* (*Level of Evidence: A)*
- If on-treatment LDL-C is greater than or equal to 100 mg/dL, intensifying LDL-lowering drug therapy (may require LDL lowering drugcombination†) is recommended. (*Level of Evidence: A)*

*When LDL-lowering medications are used, obtain at least a 30% to 40% reduction in LDL-C levels. If LDL-C less than 70 mg/dL is the chosen target, consider drug titration to achieve this level to minimize side effects and cost. When LDL-C less than 70 mg/dL is not achievable because of high baseline LDL-C levels, it generally is possible to achieve reductions of greater than 50% in LDL-C levels by either statins or LDL-C–lowering drug combinations.

†Standard dose of statin with ezetimibe, bile acid sequestrant, or niacin.

Method of Reporting

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

Challenges to Implementation

None

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5. Evaluation of LV Systolic Function

Acute myocardial infarction (AMI) patients with documentation in the hospital record that left ventricular (LV) systolic function was evaluated during hospitalization or is planned for after discharge

Numerator	AMI patients with documentation in the hospital record that LV systolic function testing was performed during the hospitalization or is planned for after discharge. Description of left ventricular systolic function can be quantitative or qualitative.
Denominator	AMI patients **Included populations:** Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4. **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients transferred to another hospital for inpatient care ▪ Patients who expired ▪ Patients who left against medical advice ▪ Patients discharged to hospice of for whom comfort measures only is documented ▪ Patients with reason(s) documented by a physician/advanced practice nurse/physician assistant/PharmD for no LV systolic function evaluated.
Period of Assessment	Inpatient admission
Sources of Data	Administrative data and medical records.

Rationale

Left ventricular systolic function (LVSF) is important from a therapeutic and prognostic standpoint for patients with AMI. Patients with LV systolic dysfunction may be candidates for specific therapies, such as ACE-inhibitor or ARB treatment, or the presence of LV systolic dysfunction may prompt invasive management during ACS hospitalization (eg, coronary angiography). In addition, systolic dysfunction following AMI predicts long-term survival. Accordingly, clinical practice guidelines have incorporated the assessment of LVSF via any modality (echocardiogram, radionuclide angiogram, or left ventriculography) as a Class I recommendation in patients with AMI (NSTEMI or STEMI).

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines[19]
Class I
Left ventricular ejection fraction should be measured in all STEMI patients. (*Level of Evidence: B*)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
A noninvasive test (echocardiogram or radionuclide angiogram) is recommended to evaluate LV function in patients with definite ACS who are not scheduled for coronary angiography and left ventriculography. (*Level of Evidence: B*)

ACC/AHA/ASE 2003 Guideline Update for the Clinical Application of Echocardiography[61]
Class I
Recommendations for echocardiography in risk assessment, prognosis, and assessment of therapy in acute myocardial ischemic syndromes:
- Assessment of infarct size and extent of jeopardized myocardium (*no evidence rating*)
- In-hospital assessment of ventricular function when the results are used to guide therapy (*no evidence rating*)

Method of Reporting

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

Challenges to Implementation

None

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6. ACEI or ARB for LVSD at Discharge

Acute myocardial infarction (AMI) patients with left ventricular systolic dysfunction (LVSD) 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.
	Included populations: Discharges with:
	▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 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 hospital for inpatient care
	▪ Patients who expired
	▪ Patients who left against medical advice
	▪ Patients discharged to hospice or for whom comfort measures only is documented
	▪ Patients with BOTH a reason for not prescribing an ACEI at discharge AND a 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/advanced practice nurse/physician assistant/PharmD (physician/APN/PA/PharmD) documentation of BOTH a reason for not prescribing an ACEI at discharge AND a reason for not prescribing an ARB at discharge Note: Documentation of a reason for not prescribing one class (either ACEI or ARB) should be considered implicit documentation of a reason for not prescribing the other class for the following 5 conditions only:
	  - Angioedema
	  - Hyperkalemia
	  - Hypotension
	  - Renal artery stenosis
	  - Worsening renal function/renal disease/dysfunction
	  ▪ Reason documented by physician/APN/PA/PharmD for not prescribing an ARB at discharge AND an ACEI allergy
	  ▪ Reason documented by physician/APN/PA/PharmD 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

ACE inhibitors reduce the risk of vascular events and death in patients with established coronary artery disease. Among patients surviving myocardial infarction, the benefits of ACE inhibitors are greatest in patients with left ventricular systolic dysfunction. Angiotensin receptor blockers are reasonable alternatives to ACE inhibitors in patients with MI and left ventricular systolic dysfunction or who are intolerant to ACE inhibitors.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Update[20]

Class I
ACE inhibitors should be started and continued indefinitely in all patients recovering from STEMI with LVEF less than or equal to 40% and for those with hypertension, diabetes, or chronic kidney disease, unless contraindicated. (*Level of Evidence: A)*

ACE inhibitors should be started and continued indefinitely in patients recovering from STEMI who are not lower risk (lower risk defined as those with normal LVEF in whom cardiovascular risk factors are well controlled and revascularization has been performed), unless contraindicated. *(Level of Evidence: B*)

Use of angiotensin receptor blockers is recommended in patients who are intolerant of ACE inhibitors and have HF or have had an MI with LVEF less than or equal to 40%. *(Level of Evidence: A)*

It is beneficial to use angiotensin receptor blocker therapy in other patients who are ACE-inhibitor intolerant and have hypertension. (*Level of Evidence: B)*

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Class IIa
Among lower-risk patients recovering from STEMI (ie, those with normal LVEF in whom cardiovascular risk factors are well controlled and revascularization has been performed), use of ACE inhibitors is reasonable. *(Level of Evidence: B)*

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Angiotensin-converting enzyme inhibitors should be given and continued indefinitely for patients recovering from UA/NSTEMI with HF, LV dysfunction (LVEF less than 0.40), hypertension, or diabetes mellitus, unless contraindicated. *(Level of Evidence: A)*

An angiotensin receptor blocker should be prescribed at discharge to those UA/NSTEMI patients who are intolerant of an ACE inhibitor and who have either clinical or radiological signs of HF and LVEF less than 0.40. *(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 less than 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 in-hospital 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.

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7. Time to Fibrinolytic Therapy

Median time from hospital arrival to administration of fibrinolytic therapy in acute myocardial infarction (AMI) 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) patients with ST-segment elevation or LBBB on the ECG closest to arrival time receiving fibrinolytic therapy during the hospital stay and having a time from hospital arrival to fibrinolysis of 30 minutes or less

Numerator	AMI patients whose time from hospital arrival to fibrinolytic therapy is 30 minutes 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 4 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 the inpatient, outpatient, or emergency department of another facility ▪ Patients who did not receive fibrinolytic therapy within 30 minutes and had a reason for delay documented by a physician/advanced practice nurse/physician assistant/PharmD (eg, social, religious, initial concern or refusal, cardiopulmonary arrest, balloon pump insertion, respiratory failure requiring intubation)
Period of Assessment	Within 6 hours after hospital arrival.
Sources of Data	Administrative data and medical records.

Rationale

Acute reperfusion therapy for patients with STEMI significantly reduces the risk of death. This benefit is most effective when provided promptly after presentation.

Corresponding Guideline(s)

Door-to-Data (ECG) Time
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 minutes 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 2007 UA/NSTEMI Guidelines[21]
Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician as soon as possible after ED arrival, with a goal of within 10 minutes of ED arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of ACS. *(Level of Evidence: B)*

Data-to-Indications for Fibrinolytic Therapy
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
Class I
1. In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and ST elevation greater than 0.1 mV in at least 2 contiguous precordial leads or at least 2 adjacent limb leads. *(Level of Evidence: A)*
2. 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)*

Data-to-Decision Time
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 2007 UA/NSTEMI Guidelines[21]
Class I
Patients with definite ACS and ST-segment elevation in leads V_7 to V_9 due to left circumflex occlusion should be evaluated for immediate reperfusion therapy. *(Level of Evidence: A)*

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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 for Quality Improvement
▪ Door-to-ECG time interval ▪ ECG-to-decision to provide fibrinolysis time interval ▪ Decision to provide fibrinolysis to the administration of fibrinolytic therapy time interval ▪ First system contact to administration of fibrinolytic therapy time interval
Challenges to Implementation
The challenges to implementation are outlined in detail in a recent document on measuring the quality of reperfusion therapy.[45] ECG time is easily measured but may not reflect actual time if processes are not in place to ensure immediate physician interpretation and appropriate action based upon the interpretation. A measure of the decision time would require consistent documentation of decision making, which is currently inconsistent. Such a measure would also not capture delays from the time of decision-making to the time of therapy. Developing specifications for the reasons for delay of reperfusion for abstraction from medical records which capture clinically appropriate reasons while not excluding inappropriate delays is an important challenge.

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8. Time to Primary PCI

Median time from hospital arrival to primary percutaneous coronary intervention (PCI) in acute myocardial infarction (AMI) 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) patients with ST-segment elevation or LBBB on the ECG closest to arrival time receiving primary PCI during the hospital stay with a time from hospital arrival to PCI of 90 minutes or less

Numerator	AMI patients whose time from hospital arrival to primary PCI is 90 minutes or less.
Denominator	AMI patients with ST-segment elevation or LBBB on ECG who received primary PCI. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 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 the inpatient, outpatient, or emergency department of another facility ▪ Patients administered fibrinolytic agent prior to PCI ▪ PCI described as non-primary by a physician/advanced practice nurse/physician assistant (physician/APN/PA) ▪ Patients who did not receive PCI within 90 minutes and had a reason for delay documented by a physician APN/PA (eg, social, religious, initial concern or refusal, cardiopulmonary arrest, balloon pump insertion, respiratory failure requiring intubation)
Period of Assessment	Within 24 hours after hospital arrival.
Sources of Data	Administrative data and medical records.

Rationale

Acute reperfusion therapy for patients with STEMI significantly reduces the risk of death. This benefit is most effective when provided promptly after presentation.

Corresponding Guideline(s)

Door-to-Data (ECG) Time
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 minutes 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 2007 UA/NSTEMI Guidelines[21]
Class I
A 12-lead ECG should be performed and shown to an experienced emergency physician as soon as possible after ED arrival, with a goal of within 10 minutes of ED arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of ACS. *(Level of Evidence: B)*

Indications for Primary PCI
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 minutes 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)*

Data-to-Decision Time
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 2007 UA/NSTEMI Guidelines[21]
Class I
Patients with definite ACS and ST-segment elevation in leads V_7 to V_9 due to left circumflex occlusion should be evaluated for immediate reperfusion therapy. *(Level of Evidence: A)*

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Door-to-Delivery Time (Primary PCI)
ACC/AHA 2007 STEMI Guideline Update[20]
Class I
STEMI patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 minutes of first medical contact as a systems goal. (*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 for Quality Improvement

- Door-to-ECG time interval
- ECG-to-decision to provide primary PCI time interval
- Decision-to-catheterization laboratory arrival time interval
- Catheterization laboratory arrival-to-PCI time interval
- First system contact to primary PCI time interval

Challenges to Implementation

The challenges to implementation are outlined in detail in a recent document on measuring the quality of reperfusion therapy.[45] The biggest difficulty is likely to be variability in documentation of device use in the catheterization laboratory. Measurement efforts must also be specific and consistent in defining the time of first device use. Developing specifications for the reasons for delay of reperfusion for abstraction from medical records which capture clinically appropriate reasons while not excluding inappropriate delays is an important challenge.

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9. Reperfusion Therapy

Acute myocardial infarction (AMI) patients with ST-segment elevation or left-bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival, receiving either fibrinolysis or primary percutaneous coronary intervention (PCI) or who are transferred to another facility for primary PCI.

Numerator	AMI patients who receive fibrinolytic therapy, receive primary PCI, or who are transferred to another facility for primary PCI)
Denominator	AMI patients with ST-segment elevation or LBBB that is not know to be previously present on ECG. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ ST-segment elevation or LBBB that is not know to be previously present on the ECG performed closest to hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients with comfort measures only documented on the day of or day after arrival ▪ Patients who left against medical advice ▪ Patients with reason(s) documented by a physician, advanced practice nurse or physician assistant for not providing fibrinolysis and for not providing primary PCI/ transferring the patient to another facility for primary PCI
Period of Assessment	Within 12 hours of symptom onset.
Sources of Data	Administrative data and medical records.

Rationale

Acute reperfusion therapy for patients with STEMI significantly reduces the risk of death and should be provided to all eligible patients.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 2007 UA/NSTEMI Guidelines[21]
Class I
Patients with definite ACS and ST-segment elevation in leads V_7 to V_9 due to left circumflex occlusion should be evaluated for immediate reperfusion therapy. *(Level of Evidence: A)*

Indications for Fibrinolytic Therapy
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
Class I
1. In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and ST elevation greater than 0.1 mV in at least 2 contiguous precordial leads or at least 2 adjacent limb leads. *(Level of Evidence: A)*
2. 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)*

Indications for Primary PCI
ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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 minutes 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

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

Secondary Measures to Consider for Quality Improvement

- Fibrinolysis in patients not meeting reperfusion criteria
- Angiography in patients not meeting reperfusion criteria

Challenges to Implementation

The challenges to implementation are outlined in detail in a recent document on measuring the quality of reperfusion therapy.[45] Determination of the denominator population requires detailed adjudication of the ECG to ensure the presence of the ECG criteria for reperfusion as recommended in the guidelines.

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10. Time from Emergency Department (ED) Arrival at STEMI Referral Facility to ED Discharge from STEMI Referral Facility in Patients Transferred for Primary Percutaneous Coronary Intervention (PCI)

Median time from emergency department (ED) arrival at STEMI referral facility to ED discharge from STEMI referral facility for acute myocardial infarction (AMI) patients with ST-segment elevation or left bundle-branch block (LBBB) on the electrocardiogram (ECG) performed closest to ED arrival time. who are transferred to a STEMI receiving facility for primary percutaneous coronary intervention (PCI)

Numerator	N/A. The measure will report the median time from ED arrival to ED discharge among those in the denominator.
Denominator	Emergency department (ED) AMI patients with ST-elevation or LBBB on ECG who were transferred for primary PCI. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ ST-segment elevation or LBBB on the ECG performed closest to ED arrival AND ▪ E/M code for an ED encounter AND ▪ Transferred to another facility for primary PCI **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients who received fibrinolytic therapy ▪ Patients transferred for a PCI that is described as nonprimary by a physician/advance practice nurse/physician (physician/APN/PA) ▪ Patients who were transferred after a delay and had a reason for delay documented by a physician/APN/PA (eg, social, religious, initial concern, refusal, cardiopulmonary arrest, balloon pump insertion, respiratory failure requiring intubation)
Period of Assessment	Within 24 hours before or after hospital arrival.
Sources of Data	Administrative data and medical records.

Rationale

The benefits of timely acute reperfusion for STEMI with either fibrinolysis or primary percutaneous coronary intervention (PCI) are substantial. In centers where PCI is not available on-site, patients may be transferred to another facility for treatment. Because delayed PCI may not be as beneficial as timely fibrinolysis, opting for transfer for PCI rather than fibrinolysis requires that transfer be performed in a timely manner.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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)*
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 minutes 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)*

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
STEMI patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 minutes of first medical contact as a systems goal. (*Level of Evidence: A*)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Patients with definite ACS and ST-segment elevation in leads V_7 to V_9 due to left circumflex occlusion should be evaluated for immediate reperfusion therapy. *(Level of Evidence: A)*

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
STEMI patients presenting to a hospital without PCI capability and who cannot be transferred to a PCI center and undergo PCI within 90 minutes of first medical contact should be treated with fibrinolytic therapy within 30 minutes of hospital presentation as a systems goal unless fibrinolytic therapy is contraindicated. (*Level of Evidence: B)*

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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.
NOTE: The median times should be reported separately for patients without contraindications to fibrinolysis and those with contraindications for fibrinolysis.

Secondary Measures to Consider for Quality Improvement
▪ Door-to-ECG time interval
▪ ECG-to-decision to transfer patient for PCI time interval
▪ Decision to transfer patient for primary PCI to ED departure time interval
▪ First system contact to ED departure time interval

Challenges to Implementation
The challenges to implementation are outlined in detail in a recent document on measuring the quality of reperfusion therapy.[45] Developing specifications for the reasons for delay of reperfusion for abstraction from medical records that capture clinically appropriate reasons while not excluding inappropriate delays is an important challenge.

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11. Time from Emergency Department (ED) Arrival at STEMI Referral Facility to Primary Percutaneous Coronary Intervention (PCI) at STEMI Receiving Facility Among Transferred Patients*

Median time from patient arrival at a STEMI referral facility's emergency department (ED) to time of primary percutaneous coronary intervention (PCI) at a STEMI receiving facility for acute myocardial infarction (AMI) patients presenting with ST-segment elevation or left bundle-branch block (LBBB) on the electrocardiogram (ECG) performed closest to first hospital arrival time who are transferred to a STEMI receiving facility for primary PCI.

Numerator	N/A. The measure will report the median time to primary PCI among those in the denominator.†
Denominator	Emergency department (ED) AMI patients with ST-elevation or LBBB on ECG who were transferred from a STEMI referral facility to a STEMI receiving facility for primary PCI and received primary PCI. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 at the receiving facility AND ▪ ST-segment elevation or LBBB on the ECG performed closest to time of arrival at the referral facility AND ▪ E/M code for an ED encounter at the referral facility AND ▪ Transferred from the referral facility to the receiving facility for primary PCI **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients who received fibrinolytic therapy at the receiving facility ▪ Patients transferred for a PCI that is described as nonprimary by a physician/advanced practice nurse/physician assistant (physician/APN/PA) ▪ Patients who had a patient-centered reason for delay in transfer from the referring hospital documented by a physician/APN/PA (eg, social, religious, initial concern, refusal, cardiopulmonary arrest, ballon pump insertion, and respiratory failure requiring intubation)‡ ▪ Patients who had a patient-centered reason for delay in PCI at the receiving hospital documented by a physician/APN/PA (eg, social, religious, initial concern, refusal, cardiopulmonary arrest, balloon pump insertion, respiratory failure requiring intubation)‡
Period of Assessment	Within 24 hours before or after hospital arrival.
Sources of Data	Administrative data and medical records.

Rationale

The benefits of timely acute reperfusion for STEMI with either fibrinolysis or primary percutaneous coronary intervention (PCI) are substantial. In centers where PCI is not available on-site, patients may be transferred to another facility for treatment. Because delayed PCI may not be as beneficial as timely fibrinolysis, opting for transfer for PCI rather than fibrinolysis requires that transfer be performed in a timely manner.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
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)*

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 minutes 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)*

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
STEMI patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 minutes of first medical contact as a systems goal. (*Level of Evidence: A*)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Patients with definite ACS and ST-segment elevation in leads V_7 to V_9 due to left circumflex occlusion should be evaluated for immediate reperfusion therapy. *(Level of Evidence: A)*

ACC/AHA 2007 STEMI Guideline Update[20]

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Class I
STEMI patients presenting to a hospital without PCI capability and who cannot be transferred to a PCI center and undergo PCI within 90 minutes of first medical contact should be treated with fibrinolytic therapy within 30 minutes of hospital presentation as a systems goal unless fibrinolytic therapy is contraindicated. (*Level of Evidence: B)*

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.

NOTE: The median times should be reported separately for patients without contraindications to fibrinolysis and those with contraindications for fibrinolysis.

Secondary Measures to Consider for Quality Improvement

- Door-to-ECG time interval
- ECG-to-decision to transfer patient for PCI time interval
- Decision to transfer patient for primary PCI to ED departure time interval
- Departure from ED of STEMI referral center to arrival at STEMI receiving center
- Arrival at STEMI receiving center to primary PCI time interval
- First system contact to primary PCI at STEMI receiving center time interval

Challenges to Implementation

The challenges to implementation are outlined in detail in a recent document on measuring the quality of reperfusion therapy.[45] The identification of both the time of presentation in the first facility and the time that PCI was performed at the second facility may present challenges due to data availability. This process of care is determined by actions at 2 facilities as well as those involved in transfer, raising issues around the attribution of this time. The writing committee recommends the exchange of information and open communication between the 2 facilities.
Developing specifications for the reasons for delay of reperfusion for abstraction from medical records that capture clinically appropriate reasons while not excluding inatppropriate delays is an important challenge.

* Both institutions providing care for a patient who is transferred for primary PCI should be invested in ensuring that the transfer is performed in a timely manner, and if this is not possible, to consider fibrinolytic therapy. Thus, the writing committee recommends that for the measurement of the time from presentation at one hospital to the time of PCI in another, the results should be attributed to both institutions. This approach to attribution will stimulate efforts for both types of institutions to collaborate with one another to optimize the care of their patients with STEMI who require acute reperfusion therapy.

† This measure does not have a set benchmark, acknowledging the controversy about a time that represents an unacceptable delay. It is intended to make clear the time involved in obtaining reperfusion therapy for these patients. For patients who can receive fibrinolytic therapy, referring clinicians should have a sense of the time that will be required to provide primary PCI. This knowledge can inform the decision about which form of reperfusion therapy is in the patient's best interest. Moreover, such knowledge may stimulate efforts for referral and receiving hospitals, along with transportation companies and agencies, to sit together to review and improve their joint performance. The writing committee understands that in rural areas there may be long distances that are required for transfer. The opinion of the group, however, is that if reasonable primary PCI times could not be achieved then fibrinolytic therapy should be administered, which is consistent with recommendations of the STEMI guidelines. Because patients with contraindications to fibrinolytic therapy may have different considerations regarding the time to primary PCI, the committee recommends that group be reported separately. The committee also recommends that times be collected on all patients, even those with patient reasons for delay, for the purpose of internal quality improvement and review.

‡ For purposes of internal quality improvement, it is recommended that facilities track the time for all patients, including those for whom these exclusions may apply. For purposes of reporting, all exclusions should apply.

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12. Adult Smoking Cessation Advice/Counseling

Acute myocardial infarction (AMI) 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 4 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 hospital for inpatient care ▪ Patients who expired ▪ Patients who left against medical advice ▪ Patients discharged to hospice or for whom comfort measures only is documented
Period of Assessment	Hospital discharge.
Sources of Data	Administrative data and medical records.

Rationale

Smoking cessation is essential to their recovery, long-term health, and prevention of subsequent reinfarction in patients surviving MI.

Corresponding Guideline(s)

ACC/AHA 2004 STEMI Guidelines (remains in effect)[19]
Class I
Patient counseling to maximize adherence to evidence-based post-STEMI treatments (eg, 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*)

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
Goal: Complete cessation, no exposure to environmental tobacco smoke.
1. Status of tobacco use should be asked about at every visit. (*Level of Evidence: B*)
2. Every tobacco user and family members who smoke should be advised to quit at every visit. (*Level of Evidence: B*)
3. The tobacco user's willingness to quit should be assessed. (*Level of Evidence: B*)
4. The tobacco user should be assisted by counseling and developing a plan for quitting. (*Level of Evidence: B*)
5. Follow-up, referral to special programs, or pharmacotherapy (including nicotine replacement and pharmacological treatment) should be arranged. (*Level of Evidence: B*)
6. Exposure to environmental tobacco smoke at work and home should be avoided. (*Level of Evidence: B*)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Smoking cessation and avoidance of exposure to environmental tobacco smoke at work and home are recommended. Follow-up, referral to special programs, or pharmacotherapy (including nicotine replacement) is useful, as is adopting a stepwise strategy aimed at smoking cessation (the 5 As are: Ask, Advise, Assess, Assist, and Arrange). *(Level of Evidence: B)*

Detailed discharge instructions for post-UA/NSTEMI patients should include education on medications, diet, exercise, and smoking cessation counseling (if appropriate), referral to a cardiac rehabilitation/secondary prevention program (when appropriate), and the scheduling of a timely follow-up appointment. Low-risk medically treated patients and revascularized patients should return in 2 to 6 weeks, and higher-risk patients should return within 14 days. *(Level of Evidence: C)*

Method of Reporting

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

Challenges to Implementation

None

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Updated Performance Measure 13

13. Cardiac Rehabilitation Patient Referral From an Inpatient Setting*

All patients hospitalized with a primary diagnosis of acute myocardial infarction (AMI) referred to an early outpatient cardiac rehabilitation/secondary prevention (CR) program.

Numerator	Number of AMI patients who have been referred to an outpatient CR program† prior to hospital discharge or have a documented medical, patient or system reason why such a referral was not made. (Note: The program may include a traditional CR program based on face-to-face interactions and training sessions or may include other options such as home-based approaches. If alternative CR approaches are used, they should be designed to meet appropriate safety standards.) A referral is defined as an official communication between the health care provider and the patient to recommend and carry out a referral order to an early outpatient CR program. This includes the provision of all necessary information to the patient that will allow the patient to enroll in an early outpatient CR program. This also includes a written or electronic communication between the healthcare provider or healthcare system and the cardiac rehabilitation program that includes the patient's enrollment information for the program. A hospital discharge summary or office note may potentially be formatted to include the necessary patient information to communicate to the CR program (the patient's cardiovascular history, testing, and treatments, for instance). All communications must maintain appropriate confidentiality as outlined by the 1996 Health Insurance Portability and Accountability Act (HIPAA). *Exclusion Criteria:* ▪ Patient factors (patient to be discharged to a nursing care facility for long-term care, for example) ▪ Medical factors (patient deemed by provider to have a medically unstable, life-threatening condition, for example) ▪ Health care system factors (no cardiac rehabilitation program available within 60 minutes of travel time from the patient's home, for example)
Denominator	Number of hospitalized patients in the reporting period hospitalized with a qualifying event/diagnosis who do not meet any of the exclusion criteria mentioned above (Note: Patients with a qualifying event who are to be discharged for a short-term stay in an inpatient medical rehabilitation facility are still expected to be referred to an outpatient cardiac rehabilitation program by the in-patient team during the index hospitalization. This referral should be reinforced by the care team at the medical rehabilitation facility.)
Period of Assessment	Inpatient hospitalization
Sources of Data	Administrative data and/or medical records.

Rationale

A key component to outpatient CR program utilization is the appropriate and timely referral of patients. Generally, the most important time for this referral to take place is while the patient is hospitalized for a qualifying event/diagnosis (MI, CSA, CABG, PCI, cardiac valve surgery, or cardiac transplantation).
This performance measure has been developed to help health care systems implement effective steps in their systems of care that will optimize the appropriate referral of a patient to an outpatient CR program.
This measure is designed to serve as a stand-alone measure or, preferably, to be included within other performance measurement sets that involve disease states or other conditions for which CR services have been found to be appropriate and beneficial (eg, following MI, CABG surgery). This performance measure is provided in a format that is meant to allow easy and flexible inclusion into such performance measurement sets.
Effective referral of appropriate inpatients to an outpatient CR program is the responsibility of the health care team within a health care system that is primarily responsible for providing cardiovascular care to the patient during the hospitalization.

Corresponding Guidelines and Clinical Recommendations

ACC/AHA 2004 Guideline Update for Coronary Artery Bypass Graft Surgery[62]
Class I
Cardiac rehabilitation should be offered to all eligible patients after CABG. (*Level of Evidence: B*)

ACC/AHA 2007 Update of the Guidelines for the Management of Patients with ST-Elevation Myocardial Infarction[20]
Class I
Advising medically supervised programs (cardiac rehabilitation) for high-risk patients (eg, recent acute coronary syndrome or revascularization, heart failure) is recommended. (*Level of Evidence: B*)

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ACC/AHA 2007 Guidelines for the Management of Patients with Unstable Angina and Non–ST-Segment Elevation Myocardial Infarction[21]
Class I
Cardiac rehabilitation/secondary prevention programs are recommended for patients with UA/NSTEMI, particularly those with multiple modifiable risk factors and/or those moderate- to high-risk patients in whom supervised exercise training is particularly warranted. (*Level of Evidence: B*)

Cardiac rehabilitation/secondary prevention programs, when available, are recommended for patients with UA/NSTEMI, particularly those with multiple modifiable risk factors and those moderate- to high-risk patients in whom supervised or monitored exercise training is warranted. (*Level of Evidence: B*)

ACC/AHA 2007 Chronic Angina Focused Update of the Guidelines for the Management of Patients With Chronic Stable Angina[64]
Class I
Medically supervised programs (cardiac rehabilitation) are recommended for at-risk patients (eg, recent acute coronary syndrome or revascularization, heart failure). (*Level of Evidence: B*)

ACC/AHA Guidelines for the Evaluation and Management of Chronic Heart Failure in the Adult[65]
Class I
Exercise training is beneficial as an adjunctive approach to improve clinical status in ambulatory patients with current or prior symptoms of heart failure and reduced left ventricular ejection fraction (LVEF). (*Level of Evidence: B*)

AHA Evidence-Based Guidelines for Cardiovascular Disease Prevention in Women: 2007 Update[66]
Class I
A comprehensive risk-reduction regimen, such as cardiovascular or stroke rehabilitation or a physician-guided home- or community-based exercise training program, should be recommended to women with a recent acute coronary syndrome or coronary intervention, new-onset or chronic angina, recent cerebrovascular event, peripheral arterial disease(Level of Evidence A), or current/prior symptoms of heart failure and an LVEF <40%. (*Level of Evidence B*).

ACC/AHA/SCAI 2007 Focused Update of the Guidelines for Percutaneous Coronary Intervention[68]
Class I
Advising medically supervised programs (cardiac rehabilitation) for high-risk patients (eg, recent acute coronary syndrome or revascularization, heart failure) is recommended. (*Level of Evidence: B*)

Method of Reporting

Proportion of health care system's patients with a qualifying event/diagnosis who had documentation of their referral to an outpatient CR program

Challenges to Implementation

Identification of all eligible patients in an inpatient setting will require that a timely, accurate, and effective system be in place. Communication of referral information by the inpatient hospital service team to the outpatient CR program represents a potential challenge to the implementation of this performance measure. However, this task is generally performed by an inpatient cardiovascular care team member or a hospital discharge planning team member.

*The format of this measure differs somewhat from others in this set since it was taken almost verbatim from the previously published AACVPR/ACC/AHA Cardiac Rehabilitation/Secondary Prevention Performance Measure Set documents.[69,70]
†The definition used by the U.S. Public Health Service and by the AACVPR/ACC/AHA Cardiac Rehabilitation/Secondary Prevention Performance Measures Writing Committee is as follows:
"Cardiac rehabilitation services are comprehensive, long-term programs involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling. These programs are designed to limit the physiologic and psychological effects of cardiac illness, reduce the risk for sudden death or re-infarction, control cardiac symptoms, stabilize or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients."[67]

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T-1. LDL-Cholesterol Assessment*

Acute myocardial infarction (AMI) 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 4. **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients transferred to another hospital for inpatient care ▪ Patients who expired ▪ Patients who left against medical advice ▪ Patients discharged to hospice or for whom comfort measures only is documented ▪ Lipid-lowering medication as prearrival medication ▪ Patients with reason documented by a physician/advanced practice nurse/physician assistant/PharmD for no LDL-C testing
Period of Assessment	Inpatient admission.
Sources 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)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Lipid management should include assessment of a fasting lipid profile for all patients, within 24 hours of hospitalization *(Level of Evidence: C)*

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
A fasting lipid profile should be assessed in all patients and within 24 hours of hospitalization for those with an acute cardiovascular or coronary event. (*Level of Evidence: A)*

Method of Reporting

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

Challenges to Implementation

None

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting, programs.

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Corrected Test Measure T-2

T-2. Excessive Initial Unfractionated Heparin (UFH) Dose*

Acute myocardial infarction (AMI) patients who received excess dosing of unfractionated heparin (UFH) initially

Numerator	AMI patients who received: ▪ An initial bolus dose of UFH greater than 70 U/kg OR ▪ A total initial bolus dose exceeding 4000 U OR ▪ An initial infusion greater than15 U/kg per hour OR ▪ A total initial infusion greater than 1000 U per hour.
Denominator	AMI patients who received intravenous UFH. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ Intravenous UFH therapy within 24 hours after hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients whose initial dose is given in the catheterization laboratory ▪ Patients with STEMI who received primary PCI ▪ Patients given another anticoagulant therapy (enoxaparin, bivalirudin, or fondaparinux) prior to intravenous UFH
Period of Assessment	Reporting year
Sources of Data	Prospective flowsheet, retrospective medical record review, electronic medical record, inpatient pharmacy records

Rationale

Recommended doses for anticoagulant therapy (and intravenous glycoprotein IIb/IIIa inhibitors) are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is common.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
UFH (initial intravenous bolus 60 U/kg [maximum 4000 U]) followed by an intravenous infusion of 12 U/kg per hour (maximum 1000 U per hour) initially, adjusted to maintain the activated partial thromboplastin time at 1.5 to 2.0 times control (approximately 50 to 70 seconds) (*Level of Evidence: C*). (Note: the available data do not suggest a benefit of prolonging the duration of the infusion of UFH beyond 48 hours in the absence of ongoing indications for anticoagulation; more prolonged infusions of UFH increase the risk of development of heparin-induced thrombocytopenia.)

For patients undergoing PCI after having received an anticoagulant regimen, the following dosing recommendations should be followed:
a. For prior treatment with UFH, administer additional boluses of UFH as needed to support the procedure, taking into account whether GP IIb/IIIa receptor antagonists have been administered. (*Level of Evidence: C*)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Section 3.2.5.1. Many clinicians have traditionally prescribed a fixed initial dose of UFH (eg, 5,000 U bolus, 1,000 U per hour initial infusion); clinical trials have indicated that a weight-adjusted dosing regimen can provide more predictable anticoagulation than the fixed-dose regimen. The weight-adjusted regimen recommended is an initial bolus of 60 U per kg (maximum 4,000 U) and an initial infusion of 12 U/kg per hour (maximum 1,000 U per hour).

Method of Reporting

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

Challenges to Implementation

The performance measure will require accurate assessments of patient weight (in kilograms) and timing and dose of initial therapy including bolus and infusion rate.

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking or public reporting programs.

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T-3. Excessive Initial Enoxaparin Dose*

Acute myocardial infarction (AMI) patients who received excess dosing of subcutaneous enoxaparin initially

Numerator	AMI patients who received an initial dose of subcutaneous enoxaparin greater than 1.05 mg/kg.
Denominator	AMI patients who received subcutaneous enoxaparin. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ Subcutaneous enoxaparin therapy within 24 hours after hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients whose initial dose is given in the catheterization laboratory ▪ Patients given another anticoagulant therapy (unfractionated heparin, bivalirudin, or fondaparinux) prior to subcutaneous enoxaparin
Period of Assessment	Reporting year
Sources of Data	Prospective flowsheet, retrospective medical record review, electronic medical record, inpatient pharmacy records

Rationale

Recommended doses for anticoagulant therapy (and intravenous glycoprotein IIb/IIIa inhibitors) are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is common.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Update[20]
Class I
An initial 30-mg intravenous bolus is given, followed 15 minutes later by subcutaneous injections of 1.0 mg/kg every 12 hours; for patients at least 75 years of age, the initial intravenous bolus is eliminated and the subcutaneous dose is reduced to 0.75 mg/kg every 12 hours. Regardless of age, if the creatinine clearance (using the Cockroft-Gault formula) during the course of treatment is estimated to be less than 30 mL per minute, the subcutaneous regimen is 1.0 mg/kg every 24 hours. (*Level of Evidence: A)*

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Table 13: Initial Medical Treatment: Enoxaparin: Loading Dose of 30 mg IV bolus may be given. Maintenance Dose = 1 mg/kg subcutaneous every 12 hours; extend dosing interval to 1 mg/kg every 24 hours if estimated creatinine clearance less than 30 mL per minute.

Method of Reporting

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

Challenges to Implementation

The performance measure will require accurate assessments of patient weight (in kilograms) and timing of initial therapy.

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

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T-4. Excessive Initial Abciximab Dose*

Acute myocardial infarction (AMI) patients who received excess dosing of abciximab initially	
Numerator	AMI patients who received: ▪ An initial bolus dose of abciximab greater than 0.25 mg/kg OR ▪ An initial infusion rate greater than 0.125 mcg/kg per minute OR ▪ A total initial infusion rate greater than 10 mcg per minute.
Denominator	AMI patients who received intravenous abciximab. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ Intravenous abciximab therapy within 24 hours after hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients whose initial dose is given in the catheterization laboratory. ▪ Patients given another intravenous glycoprotein IIb/IIIa inhibitor (eptifibatide, tirofiban) prior to abciximab
Period of Assessment	Reporting year
Sources of Data	Prospective flowsheet, retrospective medical record review, electronic medical record, inpatient pharmacy records
Rationale	
Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is a common occurrence.	
Corresponding Guideline(s)	
ACC/AHA 2007 STEMI Guideline Update[20] No specific dose mentioned. ACC/AHA 2007 UA/NSTEMI Guidelines[21] Table 13: No specific dose mentioned for Initial Medical Treatment. But for PCI, loading dose of IV bolus of 0.25 mg/kg followed by maintenance dose of IV infusion of 0.125 mcg/kg per minute is recommended.	
Method of Reporting	
Proportion of patients receiving excess dosing of abciximab.	
Challenges to Implementation	
The performance measure will require accurate assessments of patient weight (in kilograms).	

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T-5. Excessive Initial Eptifibatide Dose*

Acute myocardial infarction (AMI) patients who received excess dosing of eptifibatide initially	
Numerator	AMI patients with a creatinine clearance of greater than 50 mL per minute who received: ▪ An initial bolus dose of eptifibatide greater than 180 mcg/kg OR ▪ A total initial bolus dose exceeding 22.6 mg OR ▪ An initial infusion rate greater than 2.0 mcg/kg per minute OR ▪ A total initial infusion rate exceeding 15 mcg per hour. PLUS: AMI patients with a creatinine clearance of less than 50 mL per minute who received: ▪ An initial bolus dose of eptifibatide greater than 180 mcg/kg OR ▪ An initial infusion rate greater than 1.0 mcg/kg per minute.
Denominator	AMI patients who received intravenous eptifibatide. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ Intravenous eptifibatide therapy within 24 hours after hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients whose initial dose is given in the catheterization laboratory. ▪ Patients given another intravenous glycoprotein IIb/IIIa inhibitor (abciximab, tirofiban) prior to eptifibatide
Period of Assessment	Reporting year
Sources of Data	Prospective flowsheet, retrospective medical record review, electronic medical record, inpatient pharmacy records
Rationale	
Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is a common occurrence.	
Corresponding Guideline(s)	
ACC/AHA 2007 STEMI Guideline Update[20] No specific dose mentioned. ACC/AHA 2007 UA/NSTEMI Guidelines[21] Table 13: Initial Medical Treatment: Loading dose of IV bolus of 180 mcg/kg followed by maintenance dose of IV infusion of 2.0 mcg/kg per minute; reduce infusion by 50% in patients with estimated creatinine clearance less than 50 mL per minute	
Method of Reporting	
Proportion of patients receiving excess dosing of eptifibatide.	
Challenges to Implementation	
The performance measure will require accurate assessments of patient weight (in kilograms) and their creatinine clearance at the time of initial therapy.	

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

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T-6. Excessive Initial Tirofiban Dose*

Acute myocardial infarction (AMI) patients who received excess dosing of tirofiban initially

Numerator	AMI patients with a creatinine clearance of greater than 30 mL per minute who received: ▪ An initial bolus dose of tirofiban greater than 0.4 mcg/kg per minute for 30 minutes OR ▪ An initial infusion rate greater than 0.1 mcg/kg per minute. PLUS: Patients with a creatinine clearance of less than 30 mL per minute who received: ▪ An initial bolus dose of tirofiban greater than 0.4 mcg/kg per minute for 30 minutes OR ▪ An initial infusion rate greater than 0.05 mcg/kg per minute.
Denominator	AMI patients who received intravenous tirofiban. **Included populations:** Discharges with: ▪ An ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4 AND ▪ Intravenous tirofiban therapy within 24 hours after hospital arrival **Excluded populations:** ▪ Patients less than 18 years of age ▪ Patients whose initial dose is given in the catheterization laboratory. ▪ Patients given another intravenous glycoprotein IIb/IIIa inhibitor (abciximab, eptifibatide) prior to tirofiban
Period of Assessment	Reporting year
Sources of Data	Prospective flowsheet, retrospective medical record review, electronic medical record, inpatient pharmacy records

Rationale

Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is a common occurrence.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Update[20]
No specific dose mentioned.

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Table 13: Initial Medical Treatment: Loading dose of IV bolus of 0.4 mcg/kg per minute for 30 minutes followed by maintenance dose of IV infusion of 0.1 mcg /kg per minute; reduce infusion by 50% in patients with estimated creatinine clearance less than 30 mL per minute.

Method of Reporting

Proportion of patients receiving excess dosing of tirofiban.

Challenges to Implementation

The performance measure will require accurate assessments of patient weight (in kilograms) and their creatinine clearance at the time of initial therapy.

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

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T-7. Anticoagulant Dosing Protocol*

Presence of a protocol or other clinical aid (eg, nomogram, electronic order entry) in the hospital record of acute myocardial infarction (AMI) patients that addresses dosing of anticoagulant therapy and intravenous an tiplatelet therapy (ie, unfractionated heparin, low-molecular-weight heparin, and glycoprotein IIb/IIIa inhibitors)

Numerator	N/A
Denominator	N/A
Period of Assessment	Reporting year
Sources of Data	QI Personnel

Rationale

Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well-established. However, recent national registry data suggest that excess dosing of these therapies in patients with acute coronary syndromes is a common occurrence.

Corresponding Guideline(s)

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Section 3.2.5.1. Because of variation among hospitals in the control aPTT values, nomograms [for unfractionated heparin] should be established at each institution that are designed to achieve aPTT values in the target range (eg, for a control PTT of 30 seconds, the target range [1.5 to 2.5 times control] would be 45 to 75 seconds). Delays in laboratory turnaround time for aPTT results also can be a source of variability in care, resulting in over- or underanticoagulation for prolonged time periods and should be avoided. Measurements should be made 6 hours after any dosage change and used to adjust UFH infusion until the aPTT exhibits a therapeutic level.

Method of Reporting

Yes or No

Challenges to Implementation

None

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

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T-8. Anticoagulant Error Tracking System*

Evidence of a tracking system for identifying dosing errors in anticoagulation therapy in the hospital record of acute myocardial infarction (AMI) patients	
Numerator	N/A
Denominator	N/A
Period of Assessment	Reporting year
Sources of Data	QI personnel

Rationale

Recommended doses for anticoagulant therapy and intravenous glycoprotein IIb/IIIa inhibitors are well-established. However, recent national registry data suggest that excess dosing in patients with acute coronary syndromes is a common occurrence.

Corresponding Guideline(s)

ACC/AHA UA/NSTEMI Guidelines[21]
Section 3.2.5.1. Because of variation among hospitals in the control aPTT values, nomograms [for unfractionated heparin] should be established at each institution that are designed to achieve aPTT values in the target range (eg, for a control aPTT of 30 seconds, the target range [1.5 to 2.5 times control] would be 45 to 75 seconds). Delays in laboratory turnaround time for aPTT results also can be a source of variability in care, resulting in over- or underanticoagulation for prolonged time periods and should be avoided. Measurements should be made 6 hours after any dosage change and used to adjust UFH infusion until the aPTT exhibits a therapeutic level.

Method of Reporting

Yes or No

Challenges to Implementation

None

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting, programs.

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T-9. Clopidogrel Prescribed at Discharge for Medically Treated AMI Patients*

	Medically treated acute myocardial infarction (AMI) patients who are prescribed clopidogrel or ticlopidine at hospital discharge
Numerator	AMI patients who are prescribed clopidogrel (or ticlopidine) at hospital discharge

Denominator	Medically treated AMI patients
	
	Included populations: Discharges with an ICD-9-CM Principal Diagnosis Code for AMI as defined in Table 4.
	Excluded populations:
	▪ Patients who had a coronary artery bypass graft (CABG) procedure done during hospital stay or scheduled CABG after discharge
	▪ Patients who received percutaneous coronary intervention (PCI) with or without stent placement
	▪ Patients less than 18 years of age
	▪ Patients transferred to another hospital for inpatient care
	▪ Patients who expired
	▪ Patients who left against medical advice
	▪ Patients discharged to hospice or for whom comfort measures only is documented
	▪ Patients with one or more of the following reasons for not prescribing clopidogrel or ticlopidine at discharge documented in the medical record:
	  ▪ Allergy to both clopidogrel and ticlopidine
	  ▪ Other reasons documented by a physician/advanced practice nurse/physician assistant/PharmD

Period of Assessment	Hospital discharge
Sources of Data	Administrative data and medical records

Rationale

For ACS patients who are treated medically without PCI and stenting, dual antiplatelet therapy has been demonstrated to reduce recurrent cardiovascular events. For UA/NSTEMI patients, the CURE trial demonstrated the benefit of clopidogrel versus placebo in addition to aspirin for reducing cardiovascular death, MI, or stroke. There was a 20% relative risk reduction for patients treated with clopidogrel for an average of 9 months following ACS hospitalization. For STEMI patients, the COMMIT trial showed a 9% relative risk reduction of clopidogrel versus placebo in addition to aspirin for the combined end point of death, reinfarction, or stroke at 30 days among medically treated patients not planned to receive PCI. Patients received an average of 15 days of clopidogrel.

Corresponding Guideline(s)

ACC/AHA 2007 STEMI Guideline Focused Update[20]
Class I
Clopidogrel 75 mg per day orally should be added to aspirin in patients with STEMI regardless of whether they undergo reperfusion with fibrinolytic therapy or do not receive reperfusion therapy. (*Level of Evidence: A*) Treatment with clopidogrel should continue for at least 14 days. (*Level of Evidence: B*)

For all STEMI patients not undergoing stenting (medical therapy alone or PTCA without stenting), treatment with clopidogrel should continue for at least 14 days. *(Level of Evidence: B)*

Class IIa
Long-term maintenance therapy (eg, 1 year) with clopidogrel (75 mg per day orally) is reasonable in STEMI patients regardless of whether they undergo reperfusion with fibrinolytic therapy or do not receive reperfusion therapy. *(Level of Evidence: C)*

ACC/AHA 2007 UA/NSTEMI Guidelines[21]
Class I
Clopidogrel (loading dose followed by daily maintenance dose) should be administered to UA/NSTEMI patients who are unable to take ASA because of hypersensitivity or major gastrointestinal intolerance. *(Level of Evidence: A)*

For UA/NSTEMI patients treated medically without stenting, aspirin (75 to 162 mg per day) should be prescribed indefinitely *(Level of Evidence: A)*; clopidogrel (75 mg per day) should be prescribed for at least 1 month *(Level of Evidence: A)* and ideally up to 1 year. (*Level of Evidence: B*)

Clopidogrel 75 mg daily (preferred) or ticlopidine (in the absence of contraindications) should be given to patients recovering from UA/NSTEMI when ASA is contraindicated or not tolerated because of hypersensitivity or gastrointestinal intolerance (but with gastroprotective agents such as proton-pump inhibitors). (*Level of Evidence: A*)

Method of Reporting

Aggregate rate (standard error) generated from count data reported as a proportion for medically treated AMI patients.

Challenges to Implementation

None

*This measure has been designated for use in internal quality improvement programs only. It is not appropriate for any other use, eg, pay for performance, physician ranking, or public reporting programs.

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Appendix D: Sample Rating Form and Guide

Rating Form

Name of Measure:					
Numerator:					
Denominator:					
Measure:					
Rate this measure on the following criteria	**Disagree**		**Moderate Agreement**		**Agree**
	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					
4. Denominator: The patient group to whom this measure applies (denominator) is clinically meaningful.	1	2	3	4	5
5. Numerator: The definition of conformance for this measure is clinically meaningful.	1	2	3	4	5
6. Face validity: The measure appears to measure what it is intended to.	1	2	3	4	5
7. Content validity: The measure captures most meaningful aspects of care.	1	2	3	4	5
8. Construct validity: The measure correlates well with other measures of the same aspect of care.	1	2	3	4	5
9. Reliability: The measure is likely to be reproducible across organizations and delivery settings.	1	2	3	4	5
Measure Implementation					
10. Effort feasibility: The data required for the measure is likely to be obtained with reasonable effort.	1	2	3	4	5
11. Cost feasibility: The data required for the measure is likely to be obtained at reasonable cost.	1	2	3	4	5
12. Time feasibility: 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					
13. Considering your assessment of this measure on all dimensions above, rate this measure overall for inclusion in the ACC/AHA STEMI/NSTEMI Performance Measurement Set.	**Do Not Include**		**Could Include**		**Must Include**
	1	2	3	4	5

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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	
4. **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.
5. **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.
6. **Face validity:** The measure appears to measure what it is intended to.	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 healthcare construct underlying the measure is associated with important healthcare processes/outcomes.
7. **Content validity:** The measure captures most meaningful aspects of care.	
8. **Construct validity:** The measure correlates well with other measures of the same aspect of care.	
9. **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	
10. **Effort feasibility:** The data required for the measure is likely to be obtained with reasonable effort.	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.
11. **Cost feasibility:** The data required for the measure is likely to be obtained at reasonable cost.	
12. **Time feasibility:** The data required for the measure is likely to be obtained within the period allowed for data collection.	
Overall Assessment	
13. 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.

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KEY WORDS: ACC/AHA Performance Measures ■ myocardial infarction/therapy/inpatient care ■ outcome and process assessment ■ percutaneous coronary intervention

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Correction

In the article by Krumholz et al, "ACC/AHA 2008 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 for ST-Elevation and Non–ST-Elevation Myocardial Infarction)," which published in the December 9, 2008, issue of the journal (*Circulation.* 2008;118:2596–2648), several corrections are needed.

1. On page 2609, Section 4.3.1. Clopidogrel at Discharge, in the right column, the first sentence of the last paragraph in the column, the reference number was incorrectly listed. The sentence read, "In contrast, there is evidence of substantially greater variability in rates of clopidogrel prescription at hospital discharge for medically treated patients.[46]" It has been updated to read, "In contrast, there is evidence of substantially greater variability in rates of clopidogrel prescription at hospital discharge for medically treated patients.[47]"

2. On page 2610, Section 4.3.2. Initial Parenteral Anticoagulant and Antiplatelet Dosing, in the left column, the second sentence under the section heading, the references were incorrectly numbered. The sentence read, "However, excess dosing in patients with UA/NSTEMI is a common occurrence,[47,48] …." It has been updated to read, "However, excess dosing in patients with UA/NSTEMI is a common occurrence.[48,49] …."

3. On page 2610, Section 4.3.2. Initial Parenteral Anticoagulant and Antiplatelet Dosing, in the right column, the first complete paragraph, a sentence has been added after the second sentence: "For a similar reason, the performance measure for unfractionated heparin also excluded patients with STEMI who underwent primary PCI because higher doses of unfractionated heparin may be used in anticipation of the procedure."

4. On pages 2634 and 2635, in Appendix C, Performance Measure 13 (13. Cardiac Rehabilitation Patient Referral From an Inpatient Setting*) was adapted from a measure included in Thomas RJ, King M, Lui K, et al. AACVPR/ACC/AHA 2007 performance measures on cardiac rehabilitation for referral to and delivery of cardiac rehabilitation/secondary prevention services (*Circulation*. 2007;116:1611–1642), which was updated in Thomas RJ, King M, Lui K, et al. AACVPR/ACCF/AHA 2010 update: performance measures on cardiac rehabilitation for referral to cardiac rehabilitation/secondary prevention services (*Circulation*. 2010;122:1342–1350). Measure 13, therefore, has been updated in the article to reflect the changes in the 2010 update of the cardiac rehabilitation measures from which it was adapted. Revised Measure 13 also includes the following new references:

   68. King SB III, Smith SC Jr, Hirshfeld JW Jr, et al. 2007 focused update of the ACC/AHA/SCAI 2005 guideline update for percutaneous coronary intervention: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2008;117:261–95.

   69. Thomas RJ, King M, Lui K, et al. AACVPR/ACC/AHA 2007 performance measures on cardiac rehabilitation for referral to and delivery of cardiac rehabilitation/secondary prevention services. Circulation. 2007;116:1611–42.

   70. Thomas RJ, King M, Lui K, et al. AACVPR/ACCF/AHA 2010 update: performance measures on cardiac rehabilitation for referral to cardiac rehabilitation/secondary

(*Circulation*. 2011;123:e214-e215.)
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prevention services: a report of the American Association of Cardiovascular and Pulmonary Rehabilitation and the American College of Cardiology Foundation/American Heart Association Task Force on Performance Measures (Writing Committee to Develop Clinical Performance Measures for Cardiac Rehabilitation). Circulation. 2010;122:1342–50.

5. On page 2637, Test Measure T-2 (T-2. Excessive Initial Unfractionated Heparin (UFH) Dose*), has been replaced in the article with corrected measure specifications.

Test measure T-2 has been in use in ACTION Registry-GWTG since shortly after the 2008 ACC/AHA Performance Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction was published. Over the course of time, it became apparent that the upper limit for dosing was, in some cases, capturing patients who go for planned primary PCI who may have appropriately received higher doses of UFH. The intention in the 2008 paper was to exempt this group from the measure by excluding patients who receive their initial dose of UFH in the cardiac catheterization laboratory. Experience in ACTION Registry-GWTG, however, has shown that not all patients who are going for planned primary PCI receive their initial dose in the catheterization laboratory. Some patients, for example, receive the initial dose in the emergency department prior to transfer to the catheterization laboratory. These patients are then inappropriately identified as having received an excessive dose. This measure is therefore being corrected to ensure that it more accurately captures excessive dosing of UFH as intended.

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