Quality of Care by Classification of Myocardial Infarction

Treatment Patterns for ST-Segment Elevation vs Non–ST-Segment Elevation Myocardial Infarction

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Background: Practice guidelines for acute ST-segment elevation myocardial infarction (STEMI) and non-STEMI (NSTEMI) recommend similar therapies and interventions, but differences in patterns of care between MI categories have not been well described in contemporary practice.

Methods: In-hospital treatments with similar recommendations from practice guidelines were compared with outcomes in 185 968 eligible patients (without listed contraindications) with STEMI (n = 53 417; 29%) vs NSTEMI (n = 132 551; 71%) from 1247 US hospitals participating in the National Registry of Myocardial Infarction 4 between July 1, 2000, and June 30, 2002. Hierarchical logistic regression modeling was used to determine adjusted differences in treatment patterns in MI categories.

Results: Unadjusted in-hospital mortality rates were high for NSTEMI (12.5%) and STEMI (14.3%), and the use of guideline-recommended medications and interventions was suboptimal in both categories of patients with MI. The adjusted likelihood of receiving early (within 24 hours of presentation) aspirin, β-blockers, and angiotensin-converting enzyme inhibitors was higher in patients with STEMI. Similar patterns of care were noted at hospital discharge: the adjusted likelihood of receiving aspirin, β-blockers, angiotensin-converting enzyme inhibitors, lipid-lowering agents, smoking cessation counseling, and cardiac rehabilitation referral was higher in patients with STEMI.

Conclusions: Evidence-based medications and lifestyle modification interventions were used less frequently in patients with NSTEMI. Quality improvement interventions designed to narrow the gaps in care between NSTEMI and STEMI and to improve adherence to guidelines for both categories of patients with MI may reduce the high mortality rates associated with acute MI in contemporary practice.

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THE TREATMENT OF ACUTE myocardial infarction (AMI) has been redefined during the past 20 years with the incorporation of evidence from multiple large-scale clinical trials[1-5] into clinical practice guidelines that provide recommendations for the use of evidence-based therapies and interventions designed to reduce morbidity and mortality rates. Although previous studies[6-8] have focused on improving quality of care for patients with acute ST-segment elevation MI (STEMI), patients with non-STEMI (NSTEMI) have been underrepresented in AMI quality improvement initiatives despite the fact that the proportion of patients with AMI and NSTEMI (compared with STEMI) has consistently increased during the past decade. Because clinical practice guidelines contain similar recommendations for all patients with AMI (such as aspirin, β-blockers, angiotensin-converting enzyme [ACE] inhibitors for left ventricular systolic dysfunction, and secondary prevention interventions), quality indicators for AMI do not differentiate between patients with NSTEMI vs STEMI.[1-5,9] However, given the substantial differences in the clinical presentation, demographic characteristics, and diagnostic evaluation of patients with NSTEMI vs STEMI, the quality of MI care may vary based on MI classification.[10]

We analyzed the National Registry of Myocardial Infarction 4 (NRMI-4) database to evaluate the quality of care provided to a large consecutive series of patients with AMI in US hospitals. Specifically, we compared the use of medications and secondary pre-

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vention interventions with similar recommendations in practice guidelines for patients with STEMI vs NSTEMI.

METHODS

STUDY DESCRIPTION

The NRMI is an observational registry that analyzes in-hospital care patterns for patients with the confirmed diagnosis of AMI based on an *International Classification of Diseases, Ninth Revision* discharge diagnosis code of 410.X1 and 1 or more of the following criteria: (1) creatine kinase or creatine kinase MB levels 2 or more times the upper limit of normal or elevations of alternative cardiac markers, (2) typical electrocardiographic (ECG) evidence of AMI, and (3) echocardiographic, scintigraphic, or pathologic evidence of AMI. The NRMI-4 began on July 1, 2000, and includes more than 1000 US acute care hospitals. The data collection process for the NRMI has been described previously (consecutive patients with AMI, determined by medical record review and data abstraction by a trained data abstractor, were included).[8]

STUDY POPULATION

Patients enrolled in the NRMI-4 database between July 1, 2000, and June 30, 2002, were included in this analysis. We excluded patients who were transferred to an NRMI hospital from another institution more than 24 hours after symptom onset (because acute care delivery was not relevant to the NRMI hospital), those who were transferred out of an NRMI hospital (owing to incomplete collection of clinical outcomes and lack of discharge treatment data because of privacy regulations that restricted data collection after transfer), and those with a known old left bundle branch block or Q waves on the initial ECG (due to potential confounding of initial ECG interpretation, inability to determine acuity of ECG changes relative to presentation, and difficulties with classifying MI category and evaluating acute care processes with this scenario).

VARIABLES AND DEFINITIONS

Data collected on the NRMI-4 case report form included baseline clinical characteristics (demographic and medical history information), early therapies (administered within 24 hours of presentation), use of invasive cardiac procedures, in-hospital clinical outcomes, and hospital discharge therapies and interventions. Contraindications to certain therapies were recorded (**Table 1**). Clinical outcomes were reported by sites without central adjudication and included all-cause mortality, stroke (permanent neurologic deficit), major bleeding (requiring interventions such as transfusion or surgery), and reinfarction (recurrent MI with new ischemic ECG changes or repeated elevation of cardiac markers).

Patients included in this analysis were categorized as having STEMI or NSTEMI based on initial ECG findings. Patients with STEMI had ST elevation or a new or unknown left bundle branch block on the initial ECG. Patients with NSTEMI had ST depression, nonspecific ST-T wave changes, T wave inversions, a right bundle branch block, or other ECG abnormalities or normal ECG findings.

STATISTICAL ANALYSIS

We report baseline characteristics, use of medications early (within 24 hours), use of invasive cardiac procedures, unadjusted clinical outcomes, and use of discharge medications and secondary prevention interventions (among hospital survivors) to fully characterize the clinical and treatment profiles of STEMI vs NSTEMI. However, the primary comparisons focus on differences in quality of care for medications and interventions that share common recommendations for both MI types in practice guidelines (**Table 2**).[1-4]

Differences in baseline characteristics, invasive cardiac procedures, and unadjusted clinical outcomes were compared between the overall STEMI and NSTEMI populations using χ^2 tests for categorical variables and Kruskal-Wallis tests for continuous variables. Furthermore, similar analyses were performed only at tertiary care hospitals with revascularization capabilities (percutaneous coronary intervention, coronary artery bypass grafting, or both) to account for potential biases related to the transfer of patients from community hospitals to tertiary care hospitals for invasive cardiac procedures. We hypothesized that tertiary care hospitals would be unlikely to transfer patients with either STEMI or NSTEMI who presented directly to their institutions.

The use of early and hospital discharge medications and secondary prevention interventions was compared between STEMI and NSTEMI populations only in eligible patients without contraindications to the specific medication classes or interventions given class IA or IB recommendations by the American College of Cardiology/American Heart Association (ACC/AHA) guidelines.[1-4] Contraindications to medication classes and interventions used in this analysis are listed in Table 1. Given the period of this analysis (2000-2002), the 1999 ACC/AHA revised STEMI and 2000 ACC/AHA unstable angina/NSTEMI guideline recommendations were used for comparisons. Recommendations from the 2002 updated ACC/AHA guidelines for unstable angina/NSTEMI were not incorporated into this analysis because these guideline revisions were announced at the end of the study analysis period (March 2002).[2]

Table 1. Contraindications to the Use of Medications and Hospital Discharge Interventions

Medication or Intervention	Contraindications
Aspirin	Active internal bleeding or known bleeding diathesis; recent surgery or trauma; bleeding disorder; contraindication to early or discharge use recorded; use of warfarin ≤24 h before arrival; aspirin allergy listed
β-Blockers	Second- or third-degree atrioventricular block; cardiogenic shock; hypotension requiring any intervention; chronic obstructive pulmonary disease; congestive heart failure/pulmonary edema receiving treatment; contraindication to early or discharge use recorded
Angiotensin-converting enzyme inhibitors	Cardiogenic shock; hypotension requiring any intervention; chronic renal insufficiency; contraindication to early or discharge use recorded
Lipid-lowering agents	No hypercholesterolemia or previous statin/lipid-lowering therapy recorded; contraindication to discharge use recorded
Smoking cessation counseling	No current smoking listed under medical history

Table 2. Guideline Recommendations for STEMI and NSTEMI*

	STEMI	NSTEMI
Early care		
Aspirin	Class IA	Class IA
β-Blockers	Class IA	Class IB
ACE inhibitors	Class IA†	Class IB‡
Hospital discharge care		
Aspirin	Class IA	Class IA
β-Blockers	Class IB	Class IB
Lipid-lowering agents	Class IA§	Class IA§
ACE inhibitors	Class IA†	Class IA||
Cardiac rehabilitation referral	Class IB	Class IB
Smoking cessation counseling	Class IB	Class IB

Abbreviations: ACE, angiotensin-converting enzyme; NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.

*Class IA consists of conditions for which there is evidence or general agreement that a given procedure or treatment is useful and effective, with data derived from multiple randomized clinical trials that involved large numbers of patients. Class IB consists of conditions for which there is evidence or general agreement that a given procedure or treatment is useful and effective, with data derived from a limited number of randomized trials that involved small numbers of patients or from careful analyses of nonrandomized studies or observational registries.[1-4]

†Early and hospital discharge ACE inhibitors for STEMI: patients with an anterior infarct, signs of heart failure, or an ejection fraction less than 40%.

‡Early ACE inhibitors for NSTEMI: when hypertension persists despite treatment with nitroglycerin and a β-blocker in patients with left ventricular systolic dysfunction, congestive heart failure, or diabetes mellitus.

§Discharge lipid-lowering agents for STEMI and NSTEMI: used together with diet in patients with low-density lipoprotein cholesterol levels greater than 125 mg/dL (>3.24 mmol/L).

||Discharge ACE inhibitors for NSTEMI: patients with congestive heart failure, left ventricular dysfunction (ejection fraction <40%), hypertension, or diabetes mellitus.

Table 3. Clinical and Hospital Characteristics by Patient Group

Variable	STEMI (n = 53 417)	NSTEMI (n = 132 551)	*P* Value
Demographics			
Age, y*	69 (56-80)	75 (63-83)	<.001
White race, %	83.5	82.4	<.001
Female sex, %	40.4	45.8	<.001
Presenting characteristics			
Chest pain, %	73.2	50.7	<.001
Killip class, %			<.001†
I	75.4	70.0	
II	14.5	20.6	
III	7.2	8.7	
IV	2.8	0.7	
Systolic BP, mm Hg*	139 (117-160)	144 (122-166)	<.001
Heart rate, beats/min*	82 (68-100)	88 (73-105)	<.001
Medical history, %			
Current smoking	28.3	18.9	<.001
Hypertension	56.7	64.3	<.001
Diabetes mellitus	26.5	34.0	<.001
Hyperlipidemia	31.8	31.4	.10
Renal insufficiency‡	8.5	14.9	<.001
Previous CHF	14.8	24.3	<.001
Previous stroke	8.9	12.9	<.001
Previous MI	21.6	27.8	<.001
Previous PCI	11.1	11.9	<.001
Previous CABG	10.5	17.1	<.001
Hospital features§			
Beds, No.*	292 (200-408)	283 (188-400)	<.001
Cath capabilities, %	91.1	87.5	<.001
PCI capabilities, %	79.2	71.0	<.001
CABG capabilities, %	72.5	64.8	<.001
Teaching hospital, %	11.0	11.1	.66

Abbreviations: BP, blood pressure; CABG, coronary artery bypass grafting; Cath, cardiac catheterization; CHF, congestive heart failure; MI, myocardial infarction; NSTEMI, non–ST-segment elevation MI; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation MI.

*Data are given as median (25th-75th percentiles).

†This *P* value compares the distribution of Killip class results.

‡Baseline creatinine level greater than 2.5 mg/dL (>221 μmol/L).

§Data for the 9 hospital regions are not shown because there were no statistically significant differences in the distribution of patients with STEMI vs NSTEMI by region.

Stepwise, hierarchical, multivariable logistic regression modeling was used to determine the adjusted likelihood of early medication use, hospital discharge medication and intervention use, and invasive cardiac procedure use in the overall NSTEMI vs STEMI populations (not restricted by hospital revascularization capabilities). Separate models were constructed for each medication class and each invasive procedure. Variables used to construct these models included demographics (age, race, and sex), initial characteristics (chest pain, heart rate, Killip class, and systolic blood pressure), medical history (diabetes mellitus, hypertension, hyperlipidemia, current/recent smoking, peripheral vascular disease, and renal insufficiency), previous cardiac events (MI, heart failure, and stroke), previous revascularization procedures, and hospital features (bed size, teaching hospital status, capabilities for catheterization and revascularization, and geographic region).

RESULTS

STUDY POPULATION

The NRMI-4 database included 356 205 patients admitted to 1247 US hospitals between July 1, 2000, and June 30, 2002. We excluded 77 801 patients (22%) who were transferred from other hospitals to an NRMI-participating hospital more than 24 hours after initial presentation, 70 306 (20%) who were transferred to another institution, and 22 130 (6%) who had an old left bundle branch block or Q waves on the first ECG. The analysis population thus consisted of 185 968 patients (52% of the original population), of whom 53 417 had STEMI (29% of the analysis population) and 132 551 had NSTEMI (71% of the analysis population).

Compared with patients with STEMI, those with NSTEMI were significantly older; more likely to be female; more likely to have diabetes mellitus, chronic renal insufficiency, and signs of congestive heart failure on presentation; and less likely to have chest pain when first seen (**Table 3**). Patients with NSTEMI were more likely to be treated at hospitals without full revascularization capabilities (percutaneous coronary intervention and coronary artery bypass grafting).

UNADJUSTED IN-HOSPITAL OUTCOMES

The frequencies of mortality, reinfarction, sustained ventricular arrhythmias, cardiogenic shock, and stroke were

higher in patients with STEMI (**Table 4**). Patients with NSTEMI were more likely to develop congestive heart failure, new atrial fibrillation, and major bleeding.

CARE PATTERNS

Patients with STEMI were more likely to receive early (within 24 hours) aspirin, β-blockers, and ACE inhibitors compared with those with NSTEMI (**Table 5**). For both categories of patients with MI, approximately 12% to 15% of patients did not receive aspirin, and 22% to 28% did not receive a β-blocker. Patients with STEMI were more likely to undergo cardiac catheterization or percutaneous coronary intervention but were less likely to undergo coronary artery bypass grafting (Table 5).

Patients with STEMI were more likely to receive aspirin, β-blockers, ACE inhibitors, smoking cessation counseling, and cardiac rehabilitation referral on hospital discharge compared with patients with NSTEMI (**Table 6**). For both categories of patients with MI, approximately 10% to 20% of patients were not discharged taking aspirin or a β-blocker, less than one-third were referred for cardiac rehabilitation, and only half of the smokers received smoking cessation counseling.

Early and hospital discharge care patterns at tertiary care hospitals with revascularization capabilities were similar to those of the overall cohort (**Table 7**). The use of guideline-recommended medications and interventions was low in both categories of patients with MI, although patients with STEMI were more likely to receive all the analyzed therapies.

Table 4. Unadjusted In-Hospital Clinical Outcomes

Outcome	STEMI, % (n = 53 417)	NSTEMI, % (n = 132 551)	*P* Value
Death	14.3	12.5	<.001
Reinfarction	1.6	1.4	<.001
Recurrent ischemia	7.6	7.6	.88
Congestive heart failure	19.3	24.3	<.001
Cardiogenic shock	7.8	3.4	<.001
Stroke	1.7	1.4	<.001
VT/VF arrest	8.9	3.8	<.001
New atrial fibrillation	7.9	9.3	<.001
Bleeding*	11.3	13.4	<.001

Abbreviations: NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction; VF, ventricular fibrillation; VT, ventricular tachycardia.

*Bleeding requiring an intervention such as red blood cell transfusion or surgery.

COMMENT

We demonstrated greater use of evidence-based medications and interventions in contemporary US practice for patients with STEMI. However, adherence to guidelines was suboptimal in both categories of patients with MI because approximately 10% to 20% of eligible patients were not treated with aspirin or β-blockers, and a large percentage of patients did not receive secondary prevention interventions. Thus, the quality of care for AMI in contemporary practice has substantial room for improvement regardless of MI classification.

DIAGNOSTIC AND TREATMENT UNCERTAINTIES FOR AMI

Previous studies[6,7,10,11] of acute care patterns for patients with AMI have focused mainly on patients with STEMI, perhaps because these patients are usually identified rapidly after hospital presentation based on initial ECG findings and because guideline-recommended early therapies for STEMI have been studied more thoroughly. Conversely, identification of patients with NSTEMI is often delayed owing to the frequent lack of definitive ECG changes initially and to uncertainty about the definition of AMI with elevated cardiac troponin levels for patients who do not have persistent ST elevation when first seen.[12,13] Although we could not ascertain how the timing and absolute values of troponin samples affected treatment decisions for patients with NSTEMI, we demonstrated that almost half of the patients with NSTEMI did not have chest pain when first seen. Atypical symptoms of ischemia initially may have been overlooked in many patients with NSTEMI, or the diagnosis of AMI may have been confounded by coexisting medical conditions. Nonetheless, approximately 50% of patients with NSTEMI in contemporary US practice are found to have elevated troponin levels when first seen, and 90% of patients have elevated troponin levels identified within 20 hours of presentation, so elevated troponin levels should have affected early (within 24 hours) care delivery for most patients with NSTEMI.[14] Thus, although analyses of acute care for NSTEMI vs STEMI should account for differences in the presentation and diagnosis of AMI in the respective populations, we demonstrated that the quality of acute care delivered to both categories of patients with MI was suboptimal.

HOSPITAL DISCHARGE MANAGEMENT

After the initial diagnostic and treatment uncertainties for patients with NSTEMI have been clarified, comprehensive hospital discharge care can successfully initiate the disease management process regardless of MI classification. However, the adjusted likelihood of the use of aspirin, β-blockers, ACE inhibitors, smoking cessation counseling, and cardiac rehabilitation referral on hospital discharge was approximately 20% to 40% higher in patients with STEMI, and the use of these guideline recommendations was suboptimal in both categories of patients with MI. Treatment differences in the STEMI and NSTEMI populations may be related to preexisting treatment biases because underutilization of evidence-based therapies for AMI has been demonstrated in subgroups with a higher risk of mortality, such as the elderly, women, and patients with congestive heart failure—features that were more likely in the NSTEMI population.[15-17] Patients with NSTEMI also were more likely to have chronic renal insufficiency, which may be an underrecognized treatment bias because patients with AMI complicated by renal insufficiency have an increased risk of mortality but are frequently excluded from clinical trials that establish the benefits of therapies recommended by prac-

Table 5. Early Medications and Invasive Cardiac Procedures*

Medication or Procedure	STEMI, % (n = 53 417)	NSTEMI, % (n = 132 551)	Adjusted OR (95% CI)†
Aspirin	88.0 (n = 46 112)	84.9 (n = 105 044)	1.13 (1.08-1.17)
β-Blockers	77.8 (n = 39 580)	72.2 (n = 93 324)	1.21 (1.18-1.26)
ACE inhibitors	36.4 (n = 47 575)	34.2 (n = 111 939)	1.22 (1.19-1.26)
Cardiac catheterization	62.2	42.3	1.50 (1.45-1.56)
PCI	42.7	19.8	1.94 (1.88-2.00)
CABG	6.9	7.6	0.69 (0.66-0.72)

Abbreviations: ACE, angiotensin-converting enzyme; CABG, coronary artery bypass grafting; CI, confidence interval; NSTEMI, non–ST-segment elevation myocardial infarction; OR, odds ratio; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction.

*"Early" refers to medications given within less than 24 hours. The number of eligible patients without contraindications for each medication class is listed next to the percentage. Adjusted $P<.001$ for all medications and procedures for STEMI vs NSTEMI (adjusted for differences in patient and hospital characteristics as detailed in the "Methods" section).

†For STEMI vs NSTEMI, data are adjusted for differences in patient and hospital characteristics as detailed in the "Methods" section.

Table 6. Hospital Discharge Medications and Interventions*

Medication or Intervention	STEMI, % (n = 53 417)	NSTEMI, % (n = 132 551)	Adjusted OR (95% CI)†	Adjusted *P* Value†
Aspirin	88.9 (n = 39 686)	83.8 (n = 91 851)	1.22 (1.17-1.28)	<.001
β-Blockers	83.4 (n = 26 896)	78.3 (n = 64 340)	1.23 (1.17-1.29)	<.001
ACE inhibitors	58.0 (n = 32 910)	51.2 (n = 83 230)	1.31 (1.27-1.35)	<.001
Lipid-lowering agents	86.7 (n = 5339)	85.7 (n = 16 562)	1.15 (1.04-1.27)	.008
Cardiac rehabilitation referral	28.8 (n = 45 655)	18.0 (n = 161 892)	1.33 (1.29-1.38)	<.001
Smoking cessation counseling	56.1 (n = 14 049)	45.7 (n = 23 137)	1.21 (1.15-1.28)	<.001

Abbreviations: ACE, angiotensin-converting enzyme; CI, confidence interval; NSTEMI, non–ST-segment elevation myocardial infarction; OR, odds ratio; STEMI, ST-segment elevation myocardial infarction.

*The number of eligible patients for each medication class and secondary prevention intervention is listed next to the percentage.

†For STEMI vs NSTEMI, data are adjusted for differences in baseline characteristics as detailed in the "Methods" section.

tice guidelines.[18] However, guideline recommendations do not endorse withholding hospital discharge therapies from high-risk subgroups of patients with AMI, so further analyses are needed to understand how clinical characteristics affect discharge management.[1,4]

QUALITY OF CARE AND CLINICAL OUTCOMES FOR AMI

Notwithstanding the treatment differences demonstrated between STEMI and NSTEMI, overall compliance with guidelines was suboptimal in both categories of patients with MI. Beneficial medications, such as aspirin and β-blockers, were not used in 10% to 20% of eligible patients, and many patients did not receive ACE inhibitors within 24 hours or at hospital discharge. These treatment deficiencies probably contributed to the high in-hospital mortality rates observed in the STEMI and NSTEMI populations. Because recent studies have demonstrated that comprehensive guideline compliance is associated with decreased long-term mortality rates for patients with NSTEMI, lower use of discharge therapies for patients with NSTEMI may lead to higher postdischarge mortality rates compared with patients with STEMI, who were more likely to received guideline-recommended discharge therapies.[19,20] Quality indicators for AMI have been developed to motivate institutions to improve compliance with guidelines, but these indicators do not differentiate between MI classifications (except for reperfusion therapy for STEMI) and thus do not account for differences in the diagnosis and management of STEMI vs NSTEMI.[1-4,9] Therefore, the enlarging population of patients with NSTEMI may not be adequately targeted with current AMI quality indicators. Creating separate achievable benchmarks of care for individual therapies in the STEMI vs NSTEMI populations may be a worthwhile strategy to increase awareness of poor adherence to practice guidelines for all patients with AMI and to delineate realistic therapeutic targets for both categories of patients with MI.[21]

LIMITATIONS

Certain limitations were present with this analysis. First, multiple exclusions were used to analyze a consistent population of patients treated at a single institution during the entire hospitalization. A selection bias may have affected the results because 48% of the patients were excluded from the original data set. Second, contraindications to guideline recommendations were not prospectively collected but rather were ascertained from retrospective data collection at NRMI sites and from clinical characteristics. However, medication contraindications are often poorly documented in medical records and are not clearly defined by practice guidelines, so identifying "ideal" patients to evaluate the use of individual guideline recommendations remains challenging for any ob-

Table 7. Early and Discharge Care at 548 Tertiary Care Hospitals With Revascularization Capabilities*

Variable	STEMI, % (n = 42 331)	NSTEMI, % (n = 94 228)	*P* Value
Early (<24 h) medications			
Aspirin	89.7 (n = 37 337)	86.9 (n = 76 289)	<.001
β-Blockers	79.1 (n = 32 043)	73.2 (n = 67 934)	<.001
ACE inhibitors	36.6 (n = 38 162)	33.6 (n = 80 192)	<.001
Procedures			
Cardiac catheterization	75.3	55.2	<.001
PCI	53.8	27.9	<.001
CABG	8.7	10.6	<.001
Discharge medications and interventions			
Aspirin	90.7 (n = 33 251)	86.4 (n = 68 053)	<.001
β-Blockers	84.3 (n = 22 713)	79.1 (n = 48 640)	<.001
ACE inhibitors	58.5 (n = 27 128)	51.7 (n = 60 522)	<.001
Lipid-lowering agents	87.3 (n = 4565)	86.1 (n = 12 623)	.04
Cardiac rehabilitation referral	32.5 (n = 37 482)	22.1 (n = 84 197)	<.001
Smoking cessation counseling	58.7 (n = 12 352)	49.6 (n = 18 270)	<.001

Abbreviations: ACE, angiotensin-converting enzyme; CABG, coronary artery bypass grafting; NSTEMI, non–ST-segment elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction.
*The number of eligible patients for each medication class and secondary prevention intervention is listed next to the percentage.

servational analysis.[1-4] In this analysis, this phenomenon was most evident in the calculation of lipid-lowering agent use at hospital discharge because the guidelines specify this medication class for patients with a documented low-density lipoprotein cholesterol level greater than 125 mg/dL (>3.24 mmol/L), but cholesterol data were not collected in the NRMI. Thus, we had to infer appropriate use in a highly selected population of patients with a listed history of hypercholesterolemia. Third, follow-up after hospital discharge was not available in the NRMI registry given current privacy regulations, so the impact of discharge treatment disparities could not be ascertained. Fourth, unmeasured diagnostic uncertainties in patients with NSTEMI that could not be accounted for using multivariable modeling may have contributed to lower use of medications in these patients. Fifth, although we demonstrated statistically significant treatment differences between NSTEMI and STEMI, the relative clinical impact of 10% to 20% higher adjusted rates of medication use in patients with STEMI could not be clearly defined, so further studies are needed to delineate how these treatment differences would be expected to affect mortality rates and quality improvement initiatives. Sixth, the recommendations for ACE inhibitor use from the practice guidelines used for this analysis linked treatment with the documentation of left ventricular dysfunction, but the ejection fraction was not systematically determined in NRMI patients, so we could report only overall ACE inhibitor use. Finally, we could not verify whether consecutive patients with AMI were included by participating sites.

CONCLUSIONS

The contemporary management of patients with AMI is limited by treatment deficiencies for both categories of patients with MI and by lower use of beneficial medications and interventions in patients with NSTEMI. The inpatient hospitalization is the optimal time to initiate evidence-based medications and secondary prevention interventions regardless of MI classification, so treatment disparities in the enlarging population of patients with NSTEMI represent a further obstacle toward reducing long-term mortality rates and recurrent ischemic events for both categories of patients with MI.[19,20] As clinical practice guidelines continue to evolve for STEMI and NSTEMI, differentiation of quality indicators by MI classification may clarify treatment decisions and improve overall AMI care.[5,9] However, rigorous study of quality improvement techniques is needed to ascertain whether common or separate quality improvement strategies will be most successful for improving adherence to guidelines in patients with STEMI vs those with NSTEMI.

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