Elderly Patients Receive Less Aggressive Medical and Invasive Management of Unstable Angina

Potential Impact of Practice Guidelines

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Background: The Agency for Health Care Policy and Research (AHCPR) released a practice guideline on the diagnosis and management of unstable angina in 1994.

Objective: To examine practice variation across the age spectrum in the management of patients hospitalized with unstable angina 2 years before release of the AHCPR guideline.

Design: Retrospective cohort.

Setting: Urban academic hospital.

Patients: All nonreferral patients diagnosed as having unstable angina who were hospitalized directly from the emergency department to the intensive care or telemetry unit between October 1, 1991, and September 30, 1992.

Measurements: Percentage of eligible patients receiving medical treatment concordant with 8 important AHCPR guideline recommendations.

Results: Half of the 280 patients were older than 66 years; women were older than men on average (70 vs 64 years; P<.001). After excluding those with contraindications to therapy, patients in the oldest quartile (age, 75.20-93.37 years) were less likely than younger patients to receive aspirin (P<.009), β-blockers (P<.04), and referral for cardiac catheterization (P<.001). Overall guideline concordance weighted for the number of eligible patients declined with increasing age (87.4%, 87.4%, 84.0%, and 74.9% for age quartiles 1 to 4, respectively; χ², P<.001). Increasing age, the presence of congestive heart failure at presentation, previous myocardial infarction, increasing comorbidity, and elevated creatinine concentration were associated with care that was less concordant with AHCPR guideline recommendations; only age and congestive heart failure at presentation remained significant in the multivariate analysis (odds ratios, 1.28 per decade [95% confidence interval, 1.02-1.61] and 3.16 [95% confidence interval, 1.57-6.36], respectively).

Conclusions: Older patients were less likely to receive standard therapies for unstable angina before release of the 1994 AHCPR guideline. Patients presenting with congestive heart failure also received care that was more discordant with guideline recommendations. The AHCPR guideline allows identification of patients who receive nonstandard care and, if applied to those patients with the greatest likelihood to benefit, could lead to improved health care delivery.

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IN 1994, the Agency for Health Care Policy and Research (AHCPR) released a guideline1 on the diagnosis and management of unstable angina, a diagnosis that leads to more than 650,000 hospitalizations per year in the United States.2 Although there has been assessment of the quality of care for Medicare patients with acute myocardial infarction,3 no similar analysis has been reported for patients with unstable angina. Elderly patients with acute myocardial infarction are less likely to receive therapies that reduce mortality, including aspirin3-6 and β-blockers.3,7,8 Elderly patients with acute myocardial infarction are also less likely to receive heparin3 and to undergo invasive procedures.4,9

Challenges to the conduct of research on practice variation in unstable angina have included (1) lack of a universally accepted clinical definition and classification system for unstable angina

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PATIENTS AND METHODS

PATIENT SELECTION

We screened all adults admitted from the emergency department to the cardiac or medical intensive care unit or cardiac telemetry unit of a large, urban teaching hospital (Figure). Between October 1, 1991, and September 30, 1992, there were 49,600 adult visits to the emergency department resulting in 13,909 adult admissions. Patients with an admission diagnosis of probable acute coronary syndrome (ie, unstable angina or acute myocardial infarction) were included. A manual screen of the emergency department log identified 603 such patients, and a separate computerized search of primary and secondary billing diagnoses (International Classification of Diseases, Ninth Revision, codes 410-414) identified an additional 164 patients. After excluding patients transferred from other inpatient hospitals (n = 48) and those initially admitted to the medical ward (n = 45), we identified a total of 674 nonreferral patients admitted to the intensive care or telemetry unit with probable acute coronary syndrome.

CLINICAL DATA COLLECTION

Using prespecified definitions, the 674 patient medical records were abstracted by 1 of 6 trained physicians (3 cardiologists, 2 internists, and an emergency physician). Hospital charts were available for 99% of patients, and computer records were available for 100%. Patients were categorized into unstable angina, with (n = 110) and without (n = 304) myocardial infarction, and myocardial infarction with ST elevation (n = 123) groups. One hundred thirty-seven patients were categorized as “not acute coronary artery disease,” eg, pericarditis. We excluded 98 patients with unstable angina caused by a precipitant (eg, gastrointestinal hemorrhage, sepsis, or severe anemia), 21 patients with preexisting high risk for mortality (eg, metastatic cancer, acquired immunodeficiency syndrome, or prehospital cardiac arrest), and 15 patients with both a precipitant and a high-risk condition because the AHCPR guideline recommends individualized therapy for these patients. The final cohort for analysis consisted of 280 nonreferral patients admitted to the intensive care or telemetry unit with primary unstable angina.

Data were collected on these 280 patients regarding baseline cardiovascular risk factors, presenting clinical characteristics and electrocardiographic findings, time of presentation, duration of symptoms, use of cardiac medications, and in-hospital outcomes. Demographic and hospital data (age, sex, time of admission, and hospital location) were independently verified by comparison with the computerized billing database. A modified Charlson comorbidity score (modified because of the exclusion of those with metastatic cancer or acquired immunodeficiency syndrome) ranging from 0 to 25 was calculated by determining the presence of comorbid illnesses from review of the medical record. The presence of acute myocardial infarction was defined as an elevation in total creatine kinase concentration with a positive creatine kinase-MB fraction within the first 24 hours of presentation to the emergency department. Patients were classified by type of unstable angina presentation and likelihood of coronary artery disease using criteria in the 1994 AHCPR guideline. End points were over-read by consensus of the 6 trained physicians.

SELECTION OF IMPORTANT GUIDELINE RECOMMENDATIONS

We reviewed the 95 recommendations of the AHCPR guideline and selected 8 common clinical decisions that had strong scientific evidence to support them and that could be reliably assessed by review of the medical record. These 8 recommendations are listed in Table 1; the primary data as described in the AHCPR guideline in support of these recommendations are referenced.

For each recommendation, we established criteria a priori to define patients who were eligible to receive the therapy. For the recommendation regarding cardiac catheterization, we used the guideline-specified “conservative approach” (ie, that patients should be referred if they exhibit 1 or more “high-risk” features; see Table 1). Thus, patients without a high-risk feature were not considered eligible for the catheterization guideline analysis. Likewise, for the analysis of the coronary artery bypass surgery guideline recommendations, patients were included in the analysis only if they were found to have significant 3-vessel or left main coronary disease at catheterization during the index admission.

STATISTICAL ANALYSIS

Study patients were stratified into age quartiles, each of which contained 70 patients. The age range of each quartile was 30.17 to 57.92 years (quartile 1), 57.94 to 65.68 years (quartile 2), 66.16 to 73.08 years (quartile 3), and 75.20 to 93.37 years (quartile 4). Baseline characteristics by age quartile were compared using the χ² test, the Fisher exact test, Wilcoxon rank sum test, or 1-way ANOVA test, as appropriate.

For each of the 8 guidelines, concordance was determined according to criteria outlined in Table 1. Concordance was defined as the number of eligible patients meeting the guideline criteria divided by the total number of patients eligible for the guideline therapy. We also calculated the overall average of the percentage of guidelines followed for each age quartile, weighted by the number of patients eligible for each of the guideline recommendations. The concordance rates for each individual guideline recommendation and the weighted averages of concordance for all guidelines were compared across the age quartiles by the χ² test.

For each patient, we also determined the percentage of guideline recommendations followed. Patients who received all the therapies for which they were eligible were defined as having 100% concordance of care with the recommendations. We constructed logistic models to predict 100% concordance after identifying univariate associations with variables that were preselected for their potential effect on adherence to the guideline recommendations. Sex was included in the model because of its clinical importance, despite the lack of a statistically significant univariate association. All univariate predictors (P<.05) plus sex were entered into a logistic model using commercially available software (STATA 3.0, Stata Corp, College Station, Tex) to identify multivariate predictors of 100% concordance and the corresponding odds ratios and 95% confidence intervals. Logistic models were also constructed to predict unadjusted and adjusted concordance with at least 80% of the guideline recommendations.
and (2) the presence of selection bias in previous studies of unstable angina. The difficulty in defining and identifying patients with unstable angina is evident in the different entry criteria of recent registries and clinical trials. Available descriptive studies have focused on younger patients, male patients, those with the presence of typical chest pain or ischemic electrocardiographic changes, and patients who were eligible for angiography. Thus, data are sparse on a consecutive series of general patients hospitalized with unstable angina.

Release of the 1994 AHCPR Unstable Angina Clinical Practice Guideline provides a consensus definition of unstable angina and a comprehensive, evidence-based guideline with recommendations regarding appropriate care of patients with unstable angina. We sought to investigate the degree of practice variation in the management of elderly patients with unstable angina and the potential impact of the AHCPR guideline.

### RESULTS

#### DESCRIPTION OF PATIENT POPULATION

Half of the patients were older than 66 years, and approximately one quarter of the patients were older than 75 years; women were older on average than men (69.8 ± 13.3 vs 64.3 ± 11.6 years [mean ± SD]; P<.001). Patient characteristics are shown in Table 2. Patients were predominantly white men with typical angina occurring at rest. Half of the patients had a history of myocardial infarction, and nearly one third had a history of congestive heart failure. Enzymatic evidence of a myocardial infarction within 24 hours of presentation to the emergency department was documented in 24% of patients.

#### OVERALL CONCORDANCE WITH 8 IMPORTANT GUIDELINE RECOMMENDATIONS

In Table 3, the overall concordance of care for each of 8 important guideline recommendations ranged from 69% (for appropriate referral for bypass surgery) to more than 99% (for appropriate withholding of thrombolytic therapy). Concordance rates for initial use of aspirin and β-blockers were 85% and 74%, respectively. Seventy-six percent of patients who had 1 or more high-risk features (Table 1) were referred for angiography.

#### CONCORDANCE WITH GUIDELINES BY INCREASING AGE

There was a consistent decrease in concordance of care with increasing age among men and women (χ², P<.001). Concordance rates were 53%, 51%, 36%, and 21% across the 4 age groups. Concordance with at least 80% of the guidelines similarly demonstrated a significant decline across increasing age groups (80%, 74%, 69%, and 60% for age quartiles 1 to 4, respectively; χ², P<.01).

Table 3 summarizes the concordance of care according to quartiles of age. For each of the 8 guidelines, patients in the oldest quartile were less likely to receive the recommended therapy compared with the rest of the cohort. For the recommendations of initial aspirin use, initial β-blocker use, referral for catheterization, and referral for coronary artery bypass surgery, there were significantly lower rates of concordance in the oldest age quartile. Overall guideline concordance weighted for the number of eligible patients demonstrated a significant decline with increasing age (87%, 87%, 84%, and 75% for age quartiles 1 to 4, respectively; χ², P<.001).

#### PREDICTORS OF CONCORDANCE

We identified 6 variables (age, history of congestive heart failure, history of myocardial infarction, modified Charlson score, congestive heart failure at presentation, and elevated creatinine concentration) that were associated with higher discordance on univariate analysis. When entered into a multivariate logistic model with sex, only increasing age and presence of congestive heart failure at presentation were independently associated with care that was discordant with the 8 guideline recommendations (Table 4). Similar univariate and multivariate associations were seen in separate logistic models predicting concordance with at least 80% of the guideline recommendations.

When the cohort was stratified by the presence of congestive heart failure at presentation, increasing age did not seem to be associated with decreasing concordance in patients with congestive heart failure. However, inclusion of an interaction term between age and congestive heart failure in the logistic model was not significant (P = .24), and thus an interaction term was not included in the final model.
Table 1. Eight Important Guideline Recommendations

(1) No intravenous thrombolytics 18-20,23-28
Potential candidates: All patients.
Exclusions: Left bundle-branch block.
Criterion: Did not receive intravenous thrombolytics for presenting ischemic episode within 24 h of presentation.

(2) Initial aspirin 11,14,15,29-31
Initial aspirin 11,14,15,29-31
Potential candidates: All patients.
Exclusions: Patients with blood in the stool sample or other evidence of active bleeding at presentation, aspirin allergy, hemorrhagic stroke within 6 mo, gastrointestinal tract bleeding within 1 mo, coagulopathy (platelet count, <150 000/cm³; prothrombin time, >15 sec; activated partial thromboplastin time, >45 sec; or known cloting factor deficiency), or warfarin therapy on admission.
Criterion: Administration of aspirin within 24 h of presentation.

(3) Initial heparin 15,32-33
Initial heparin 15,32-33
Potential candidates: All patients.
Exclusions: Patients with blood in the stool sample or other evidence of active bleeding at presentation, heparin allergy, hemorrhagic stroke within 6 mo, gastrointestinal tract bleeding with 1 mo, coagulopathy (platelet count, <150 000/cm³; prothrombin time, >15 sec; activated partial thromboplastin time, >45 sec; or known clotting factor deficiency), or warfarin therapy on admission.
Criterion: Administration of intravenous heparin within 24 h of presentation.

(4) Initial β-blocker 17,35,37-39
Initial β-blocker 17,35,37-39
Potential candidates: All patients.
Exclusions: Patients with heart rate <60 beats/min or systolic blood pressure <90 mm Hg at presentation, history of severe left ventricular dysfunction (<0.30), and history of congestive heart failure.
Criterion: Administration of β-blocker within 24 h of admission.

(5) Avoidance of calcium channel blockers 17,35-37,39
Avoidance of calcium channel blockers 17,35-37,39
Potential candidates: All patients.
Exclusions: Patients with systolic blood pressure >180 mm Hg at presentation.
Criterion: Administration of nifedipine within 24 h without concomitant use of a β-blocker, or use of a calcium channel blocker in a patient with known left ventricular dysfunction of at least moderate severity (<0.40) or with pulmonary edema at presentation.

(6) Referral for cardiac catheterization 20,40
Referral for cardiac catheterization 20,40
Potential candidates: Patients with ≥ 1 of the following “high-risk” features: (1) history of revascularization, (2) presence of left-sided heart failures (S3, rales >half of lung fields or congestive heart failure on chest X-ray) at presentation, (3) previous abnormal left ventricular function (<0.50), (4) presence of a malignant ventricular arrhythmia (sustained a ventricular tachycardia >30 sec or associated with angina or systolic blood pressure <90 mm Hg, ventricular fibrillation) during the hospitalization, (5) recurrent ischemia (recurrent angina or anginal equivalent with ST or T-wave changes or prolonged symptoms >20 min), or a markedly positive noninvasive assessment of ischemia (at least one of the following: (a) >2 mm ST depression in at least 3 contiguous leads before completion of stage 2 of a Bruce Protocol, (b) fall in systolic blood pressure >10 mm Hg with peak exercise compared with baseline, (c) >4 reversible segments on exercise thallium by a blinded reviewer, (d) reversible left ventricular cavity dilation on exercise thallium, and (e) pulmonary uptake >50% of cardiac uptake on exercise thallium in a patient who achieved at least 85% of the maximum predicted heart rate for age).
Exclusions: Cardiac catheterization within 1 mo, documentation of increased risk of catheterization (eg, bleeding risk, renal failure, and stroke).
Criterion: Documentation of a physician’s consideration or recommendation for cardiac catheterization.

(7) Referral for coronary artery bypass surgery 40-48
Referral for coronary artery bypass surgery 40-48
Potential candidates: Patients who underwent catheterization during the admission and were found to have either (1) left main stenosis ≥50% or (2) significant stenoses (>70%) of the 3 major epicardial vessels (left anterior descending, right coronary, and left circumflex arteries) in patients without previous bypass grafts, or in patients with previous coronary bypass stenoses ≥70% of all bypass graft plus ≥70% stenoses of the major bypassed native vessels.
Exclusions: Severe distal disease of the native vessels or documentation of excessive risk of surgery (eg, bleeding risk, renal failure, and stroke).
Criterion: Documentation of physician’s consideration or recommendation for bypass surgery.

(8) Discharge aspirin 11,14
Discharge aspirin 11,14
Potential candidates: All patients.
Exclusions: Patients with blood in the stool sample or other evidence of active bleeding at presentation, aspirin allergy, hemorrhagic stroke within 6 mo, gastrointestinal tract bleeding within 1 mo, coagulopathy (platelet count, <150 000/cm³; prothrombin time, >15 sec; activated partial thromboplastin time, >45 sec; or known clotting factor deficiency), or warfarin therapy on admission.
Criterion: Prescribed aspirin at discharge.

COMMENT

We demonstrated substantial variation in the management of elderly patients hospitalized with unstable angina in 1992; management often differed from the AHCPR Clinical Practice Guideline published in 1994. Half of all hospitalized patients were older than 66 years, and one quarter were at least 75 years old. Although 40% of patients received care that was concordant with all 8 guidelines, patients older than 66 years were less likely than younger patients to receive aspirin, β-blockers, and diagnostically cardiac catheterization. The significant discordance of management according to the AHCPR guideline recommendations suggests that implementation and ongoing adherence to the guidelines could have a dramatic impact on patient care among the elderly.

Our data add to the literature demonstrating similar findings in patients hospitalized with myocardial infarction. Lower use of aspirin, β-blockers, and cardiac catheterization has been noted in older patients hospitalized with acute myocardial infarction.5-9 The effect of sex on treatment of acute myocardial infarction and unstable angina remains controversial. Although several studies of acute myocardial infarction have suggested that women are less likely to receive efficacious medical therapy49-51 and cardiac catheterization,5,52 other studies have found no sex-based differences.50,53-55 It is important to adjust for age in sex comparisons because the on-
set of clinically apparent coronary artery disease is later in women. In our age-adjusted multivariate model, we found no significant effect of sex on overall concordance of care with guideline recommendations, although our study power limits our ability to exclude a small difference.

In the adjusted analysis of the TIMI III Registry, a study of 3318 patients with unstable angina and non–Q-wave myocardial infarction that reported on the effect of race, sex, and age on risk factors, intensity of inpatient care, and short-term outcome, only age remained an independent predictor for death, myocardial infarction, or recurrent ischemia by 6 weeks. Our findings that the elderly are less likely to receive aspirin and β-blockers suggest that an opportunity exists to improve medical care among the elderly. By administering these proven therapies to those most likely to benefit, it may be possible to decrease the incidence of death, myocardial infarction, and recurrent ischemia in patients presenting with unstable angina. However, to date, empirical data addressing the question of whether the guideline reflects the highest standard of care are lacking, and at least 1 recent study suggests that there may be practical limitations to application of the guideline.

### Table 2. Patient Characteristics According to Quartiles of Age

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Patients (N = 280)</th>
<th>Quartile 1 (30-58 y) (n = 70)</th>
<th>Quartile 2 (58-66 y) (n = 70)</th>
<th>Quartile 3 (66-75 y) (n = 70)</th>
<th>Quartile 4 (75-94 y) (n = 70)</th>
<th>P (Quartile 4 vs Quartiles 1-3)</th>
<th>P (Across All 4 Quartiles)</th>
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<tr>
<td>Median age, y</td>
<td>66</td>
<td>52</td>
<td>62</td>
<td>70</td>
<td>81</td>
<td>NA*</td>
<td>NA*</td>
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<tr>
<td>Men, %</td>
<td>68</td>
<td>76</td>
<td>76</td>
<td>67</td>
<td>51</td>
<td>.001</td>
<td>.006</td>
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<td>White, %</td>
<td>91</td>
<td>87</td>
<td>91</td>
<td>94</td>
<td>93</td>
<td>.62</td>
<td>.47</td>
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<td>Previous myocardial infarction, %</td>
<td>50</td>
<td>46</td>
<td>50</td>
<td>57</td>
<td>46</td>
<td>.51</td>
<td>.59</td>
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<td>Previous revascularization, %</td>
<td>39</td>
<td>39</td>
<td>40</td>
<td>44</td>
<td>32</td>
<td>.18</td>
<td>.56</td>
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<td>Previous congestive heart failure, %</td>
<td>28</td>
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<td>24</td>
<td>35</td>
<td>39</td>
<td>.02</td>
<td>.003</td>
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<td>Current cigarette smoker, %</td>
<td>22</td>
<td>44</td>
<td>33</td>
<td>9</td>
<td>3</td>
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<td>&lt;.001</td>
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<td>Hypertension, %</td>
<td>56</td>
<td>76</td>
<td>56</td>
<td>59</td>
<td>35</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
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<td>Diabetes requiring therapy, %</td>
<td>34</td>
<td>30</td>
<td>31</td>
<td>40</td>
<td>32</td>
<td>.75</td>
<td>.61</td>
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<td>Median modified Charlson score, %</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>.05</td>
<td>.005</td>
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<tr>
<td>History of cancer, %</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>9</td>
<td>.12</td>
<td>.16</td>
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<td>Dementia, %</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>.15</td>
<td>.34</td>
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<td>Do not resuscitate within 24 h, %</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>.01</td>
<td>.03</td>
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<td>Typical angina, %</td>
<td>67</td>
<td>71</td>
<td>66</td>
<td>67</td>
<td>65</td>
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<td>.88</td>
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<td>Rest angina, %</td>
<td>79</td>
<td>78</td>
<td>79</td>
<td>81</td>
<td>77</td>
<td>.91</td>
<td>.94</td>
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<tr>
<td>Congestive heart failure at presentation, %</td>
<td>33</td>
<td>7</td>
<td>36</td>
<td>37</td>
<td>50</td>
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<td>≤1 mm STD at presentation, %</td>
<td>25</td>
<td>16</td>
<td>23</td>
<td>26</td>
<td>34</td>
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<td>.07</td>
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<td>Elevated creatinine level at presentation, %</td>
<td>18</td>
<td>9</td>
<td>16</td>
<td>19</td>
<td>30</td>
<td>.003</td>
<td>.01</td>
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<td>Admitted to telemetry unit, %</td>
<td>74</td>
<td>67</td>
<td>76</td>
<td>77</td>
<td>76</td>
<td>.75</td>
<td>.52</td>
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<tr>
<td>Rule-in for myocardial infarction, %</td>
<td>24</td>
<td>23</td>
<td>26</td>
<td>20</td>
<td>27</td>
<td>.47</td>
<td>.76</td>
</tr>
</tbody>
</table>

*NA indicates not applicable.
†Previous total cholesterol level >6.20 mmol/L (240 mg/dL) or taking lipid lowering drugs at presentation.
‡Serum creatinine level >110 µmol/L (1.5 mg/dL).

### Table 3. Effect of Age on Concordance of Care

<table>
<thead>
<tr>
<th>Recommendation (No. Eligible)</th>
<th>Overall Concordance (N = 280)</th>
<th>Quartile 1 (30-58 y) (n = 70)</th>
<th>Quartile 2 (58-66 y) (n = 70)</th>
<th>Quartile 3 (66-75 y) (n = 70)</th>
<th>Quartile 4 (75-94 y) (n = 70)</th>
<th>P (Quartile 4 vs Quartiles 1-3)</th>
<th>P (Across All 4 Quartiles)</th>
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<tr>
<td>No thrombolytic, %</td>
<td>99.6</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>98.4</td>
<td>.07</td>
<td>.36</td>
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<tr>
<td>Initial aspirin, %</td>
<td>85</td>
<td>85</td>
<td>91</td>
<td>89</td>
<td>75</td>
<td>.009</td>
<td>.06</td>
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<tr>
<td>Initial heparin, %</td>
<td>79</td>
<td>82</td>
<td>85</td>
<td>77</td>
<td>71</td>
<td>.09</td>
<td>.27</td>
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<tr>
<td>Initial β-blocker, %</td>
<td>74</td>
<td>84</td>
<td>90</td>
<td>54</td>
<td>59</td>
<td>.04</td>
<td>&lt;.001</td>
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<tr>
<td>Avoid calcium channel blocker, %</td>
<td>78</td>
<td>86</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>.55</td>
<td>.36</td>
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<tr>
<td>Angiography referral, %</td>
<td>77</td>
<td>82</td>
<td>82</td>
<td>87</td>
<td>57</td>
<td>&lt;.001</td>
<td>.001</td>
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<tr>
<td>Coronary artery bypass surgery, %</td>
<td>69</td>
<td>100</td>
<td>71</td>
<td>80</td>
<td>38</td>
<td>.03</td>
<td>.14</td>
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<td>Discharge aspirin, %</td>
<td>89</td>
<td>89</td>
<td>90</td>
<td>94</td>
<td>85</td>
<td>.21</td>
<td>.52</td>
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<tr>
<td>Weighted average, %</td>
<td>83.5</td>
<td>87.4</td>
<td>87.4</td>
<td>84.0</td>
<td>74.9</td>
<td>&lt;.001</td>
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</table>

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Possible explanations for the findings of lower rates of aspirin, β-blocker, and referral for cardiac catheterization in the elderly include greater perceived risk associated with catheterization because of advanced age, greater comorbidity, higher prevalence of congestive heart failure, and more risk-averse behavior by older patients. We identified markers of increased risk (eg, renal failure and bleeding risk) and excluded these patients from the catheterization analysis in an attempt to limit the effects of differing risks for angiography. Although the elderly did have higher modified Charlson comorbidity scores on average, patients not eligible to receive the treatment because of a comorbid condition (eg, previous congestive heart failure [β-blockers] or recent hemorrhagic stroke [aspirin]) were excluded from that analysis. Incomplete documentation of comorbid conditions potentially limits our ability to account for all possible contraindications to therapy.

The presence of congestive heart failure at presentation was associated with a 3-fold higher likelihood for care to be discordant with guideline recommendations in the adjusted analysis. It is possible that physicians focused on the evaluation and treatment of congestive heart failure in those patients and that the presence of ischemia was either masked or overlooked. The AHCPR guideline emphasizes that patients with congestive heart failure are at high risk and deserve aggressive care. Because of the relatively small number of patients with congestive heart failure in our cohort, we cannot exclude that there is a significant (\(P = .24\)) interaction between age and the presence of congestive heart failure. The observed associations of lower guideline concordance among elderly patients and those presenting with congestive heart failure supports the need for prospective research in these high-risk groups.

Although we were unable to account for possible differences in risk taking with respect to age, patients for whom there was documentation of procedure refusal were considered to have been referred for that procedure. Regardless, patient preference is much less likely to affect the initial prescription of aspirin and β-blockers. We anticipate that implementation of the guideline recommendations might lead to significantly more aspirin and β-blocker use and possibly improved care among elderly patients. Strict adherence to the guideline could lead to substantial increases in the use of diagnostic cardiac catheterization in patients 75 years of age or older.

There are several potential study limitations. First, the study was performed at a single institution, which may limit the generalizability of the results. The practice patterns in our urban, academic hospital may not reflect those in other settings, and cardiology practice patterns are known to vary by region in the United States,\(^9,38-63\) by decade,\(^64\) and by treating physician.\(^65-69\) There are few studies of practice variation in unstable angina, thus, validation of our findings in different hospital settings (eg, nonacademic and rural) should be undertaken. Second, data collection was retrospective, and information bias may have occurred. We attempted to minimize this form of bias by selecting guideline recommendations that could be reliably and reproducibly assessed, using multiple sources for data abstraction, training the physician abstractors, and using standardized definitions. Finally, our analyses considered only a few guidelines (8 of 95 recommendations), which may not reflect overall concordance of practice with all AHCPR guideline recommendations. However, many of the recommendations could not be analyzed (eg, importance of taking a medical history) or were less relevant to an analysis of unstable angina management (eg, appropriate follow-up of stable coronary artery disease). Thus, the recommendations we selected for analysis represent important components of therapy in the management of unstable angina.

In summary, for patients who are considered ideal candidates, rates of aspirin and β-blocker administration should increase with strict guideline adherence, especially among elderly patients. Similarly, referral for cardiac catheterization might also increase by as much as one third, with most of this increase occurring in older patients. Because of the retrospective method, we were unable to ascertain other factors that may have driven the decision not to proceed to angiography or whether this decision was appropriate in most older patients. Increasing age and presence of congestive heart failure at presentation were associated with care that was discordant with the guideline recommendations in the multivariate analysis. Given the large potential impact on hospital management and costs of implementing these guidelines, larger prospective studies comparing implementation of guidelines with usual care are warranted. In particular, clarification is needed regarding the possibility of inappropriate underuse of recommended therapies in the elderly vs the need for refinement of the guidelines when applied to older patients.

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### Table 4. Predictors of Discordance

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds Ratio (95% Confidence Interval)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Univariate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, decades</td>
<td>1.47 (1.20-1.81)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Men</td>
<td>0.83 (0.49-1.39)</td>
<td>.48</td>
</tr>
<tr>
<td>Congestive heart failure at presentation</td>
<td>4.49 (2.47-8.18)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Previous congestive heart failure</td>
<td>2.60 (1.44-4.68)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Modified Charlson score</td>
<td>1.32 (1.14-1.53)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td>1.87 (1.15-3.04)</td>
<td>.01</td>
</tr>
<tr>
<td>Elevated creatinine level*</td>
<td>2.63 (1.20-5.77)</td>
<td>.02</td>
</tr>
<tr>
<td><strong>Multivariate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, decades</td>
<td>1.28 (1.02-1.61)</td>
<td>.04</td>
</tr>
<tr>
<td>Men</td>
<td>0.78 (0.44-1.40)</td>
<td>.40</td>
</tr>
<tr>
<td>Congestive heart failure at presentation</td>
<td>3.16 (1.57-6.36)</td>
<td>.001</td>
</tr>
<tr>
<td>Previous congestive heart failure</td>
<td>0.76 (0.33-1.78)</td>
<td>.53</td>
</tr>
<tr>
<td>Modified Charlson score</td>
<td>1.10 (0.89-1.37)</td>
<td>.38</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td>1.51 (0.81-2.82)</td>
<td>.19</td>
</tr>
<tr>
<td>Elevated creatinine level*</td>
<td>1.72 (0.67-4.40)</td>
<td>.26</td>
</tr>
</tbody>
</table>

*Serum creatinine level > 110 µmol/L (1.5 mg/dL).


23. TIMI IIIA Investigators. Early effects of tissue-type plasminogen activator added to conventional therapy on the culprit coronary lesion in patients presenting with ischemic cardiac pain at rest. Circulation. 1993;87:38-52.


