Urban-Rural Differences in the Quality of Care for Medicare Patients With Acute Myocardial Infarction

Kazim Sheikh, MD; Claudia Bullock

Background: There are urban-rural differences in health care utilization in Kansas. This study was conducted to determine if similar differences exist in the quality of inpatient care provided for patients with acute myocardial infarction (AMI).

Methods: All acute care hospitals in the state were stratified into 12 urban, 31 semirural, and 76 rural hospitals according to their location. Data from medical records of 2521 Medicare patients 65 years and older who had survived AMI and were discharged alive from hospitals during an 8-month period in 1994/1995 were abstracted. The measures of the quality of care (quality indicators [QIs]) were the use of aspirin (during hospital stay and at discharge) and the administration of β-blockers, intravenous (IV) nitroglycerin, heparin, and reperfusion by thrombolytic therapy or primary angioplasty.

Results: A significantly higher proportion of ideal candidates for the use of aspirin during hospital stay and at discharge, heparin, and IV nitroglycerin received these medications in urban hospitals, and a lower proportion of similar patients received these medications in rural hospitals compared with the patients in semirural hospitals (P < .001). Similar trends in each of the 6 QIs were observed for less than ideal patients (P < .05). Patient age was associated with a relatively poor quality of care in terms of the 6 QIs. Except for the administration of IV nitroglycerine to less than ideal patients, age adjustments did not change the observed urban-rural differences in the QI measures.

Conclusion: Relatively poor quality of care for patients with AMI was provided by rural hospitals where greater opportunity for improvement exists.

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Regional, interstate, and intrastate variations in the health insurance coverage and utilization by the elderly population are well known to the Health Care Financing Administration (HCFA) and the health care industry. The HCFA's administrative data have also shown that marked differences exist between urban and rural areas of the country with respect to the distributions of health care providers and utilization. Inappropriate or greater utilization of health care is known to be associated with lower socioeconomic status of patients and residency in rural areas.

In a previous study, Medicare beneficiaries residing in the rural counties of the state of Kansas seemed to have had equal access to primary care providers, but their utilization of health care was greater than that of the beneficiary populations in the urban counties possibly due to untimely, inadequate, unnecessary, and/or substandard health care provided to the residents of rural counties. This article describes the results of a study of Medicare beneficiaries that explored the possibility that the quality of health care in the rural areas of Kansas was poorer than that in the urban areas. Preexisting data on inpatient care for acute myocardial infarction (AMI) were used for this descriptive study. This topic was chosen because direct, specific measures of the quality of care for AMI based on the clinical guidelines and reliable clinical data were available for the study.

Results: The characteristics of all eligible patients are given in Table 2. The patients in the urban hospitals were younger, and those in rural hospitals were older than those in semirural hospitals. The average number of patients with AMI discharged from each of the 12 urban, 31 semirural, and 76 rural hospitals in Kansas were 106, 18, and 6, respectively. The corresponding average number of beds in the hospitals were 458, 105, and 39, respectively.

From the Health Care Financing Administration, Kansas City, Mo (Dr Sheikh and Ms Bullock).
METHODS

Health care data collected for HCFA’s Cooperative Cardiovascular Project (CCP)6 were available for this study, hence the topic of AMI. The CCP was the first national project in HCFA’s Health Care Quality Improvement Program.7 This program was initiated in 1992 with the objectives of reducing variation among providers and improving the quality of care in selected clinical areas provided to Medicare beneficiaries.8 After a pilot run in 1993, CCP was implemented nationwide in 1995. The indicators of good quality inpatient care of patients with AMI were developed by a panel of experts convened by HCFA and the American Medical Association. They were based on the American College of Cardiology (ACC) and American Heart Association’s (AHA) clinical guidelines.9 Good quality of care was, therefore, defined as good clinical practice measured by compliance with the ACC/AHA guidelines. The data collection tools and data analysis programs developed for the pilot project and used for the nationwide project have been previously described.8,10,11 Eligibility for a medication or a procedure was defined as a confirmed first AMI in a patient who was discharged alive. Those eligible patients for whom the treatment would almost always be indicated (no contraindications) using ACC/AHA guidelines were regarded as the “ideal” candidates, and the remaining “less than ideal” patients were those for whom the therapy could be controversial.12 The criteria for administering therapy in the 2 groups of patients were identical: both groups should have received similar, appropriate therapy. These criteria and definitions (Table 1) were used to develop appropriate algorithms, which were converted into simple computer programs for data analysis.

A sample of discharge diagnosis-specific inpatient medical records of acute care hospitals from each state were abstracted in a preset, standard manner, and the quality of the clinical data and the validity of the quality indicators (QIs) were assured. Data reliability was assessed by reabstracting a sample of medical records and examining interabstractor agreements.13 All discrepancies were analyzed, and the data abstraction process was improved to achieve acceptable data quality. Similarly, the measures of QIs, eligibility, and ideal candidate status derived from a sample of abstracted data elements were validated against the reabstracted data on the therapies administered and were found to be reliable.12,13 The diagnosis of AMI (International Classification of Diseases, Ninth Edition Revision, Clinical Modification code 410) was confirmed by documentation in the medical records of either a serum creatine kinase MB fraction above 5%, a serum lactate dehydrogenase level more than 1.5 times the upper limit of the normal value and a lactate dehydrogenase isoenzyme 1 level greater than that of lactate dehydrogenase isoenzyme 2, or 2 of the following 3 criteria: chest pain, a serum creatine kinase level twice that hospital’s normal value, and a new AMI reported in an electrocardiogram report. The severity of illness was estimated according to the Medicare Mortality Predictor System (MMPS), which predicts disease-specific 30-day mortality.14 The Acute Physiology and Chronic Health Evaluation score15 (a disease severity classification) is one of the variables used in MMPS.

The CCP baseline (preintervention) sampling frame for each state was all state-specific, fee-for-service hospital bills (UB-92 claims) for inpatient services provided during a specified period in the Medicare National Claims History File.6 The 100% sample for Kansas consisted of 2321 records for Medicare patients discharged alive from non-governmental acute care hospitals during an approximate 8-month period in 1995 with a diagnosis of AMI. The CCP’s postintervention data were not available for this study. The data on 6 major QIs were used in this study of urban-rural differences. These QIs were (1) administration of aspirin during hospital stay; (2) prescription of aspirin at hospital discharge; (3) intravenous (IV) administration of nitroglycerin to patients with persistent chest pain; (4) administration of full- or low-dose heparin during hospitalization; (5) reperfusion by administration of thrombolytic therapy or primary angioplasty within 12 hours of arrival at the hospital; and (6) prescription of β-blockers at hospital discharge. The inclusion and exclusion criteria for these QIs are given in Table 1. The main eligibility criterion was that the patients must have been discharged alive. This restriction was introduced so that there would be opportunities for administering the therapies of interest during the hospitalizations, particularly the prescription of β-blockers at discharge. Other CCP QIs were not selected for this study because of the small number of ideal candidates who received these therapies. The analyses were based on the data for 2285 eligible patients.

The state of Kansas was divided into 3 categories of counties according to the classification used in the previous study of urban-rural differences in health care utilization in the state.3 Four counties with more than 20000 beneficiaries residing in each were regarded as the urban counties. Twenty counties, each having 4000 to 20000 beneficiaries living in them, were regarded as the semirural counties. Eighty-one counties were the rural counties. Accordingly, 38.4%, 30.8%, and 30.8% of the beneficiaries enrolled in Medicare any time during 1995 resided in the urban, semirural, and rural counties, respectively. The purpose of using this classification was to have roughly equal numbers of beneficiaries in each category for comparisons. This arbitrary classification correlates well with those based on the general population density. The study sample of medical records from the participating acute care hospitals in Kansas were assigned to the 3 county categories according to the location of the hospitals.

The statistical significance of the differences between means, proportions, and their trends were estimated using the t test, uncorrected χ² test, and χ² for linear trend, respectively. The direct standardization method, with the state patient population as the standard, was used for age adjustments.16

The numbers and percentages of eligible patients and ideal candidates for the therapy or procedure in each of the 6 QIs are given in Table 3. Variations in the numbers of patients found to be eligible for each QI and the percentage of eligible patients regarded as the ideal candidates were to be expected because different eligibility criteria, indications, and contraindications were used for individual QIs.10

Table 4 gives the number of ideal and less than ideal candidates for each QI according to the location of the hospital and percentage of patients in each category who received therapy or procedures as determined by the QI.
Compared with the eligible patients in semirural and rural hospitals, significantly lower proportions of eligible patients in the urban hospitals were ideal candidates for heparin and IV nitroglycerine therapy (P < .05). In the case of b-blocker therapy, the trend was in the opposite direction. Aspirin was administered during hospital stay to 87.8%, 83.9%, and 75.0% of the ideal candidates in the urban, semirural, and rural hospitals, respectively; the corresponding respective percentages for the less than ideal patients were 79.9%, 59.1%, and 56.0% (Table 4). These trends are statistically significant (P < .001).

Heparin was more frequently administered to the ideal candidates in urban hospitals and less frequently to the ideal candidates in rural hospitals than it was in semirural hospitals (P < .001). Similarly, a significantly higher proportion of less than ideal patients in the urban hospitals received heparin compared with patients in nonurban hospitals (P < .001), but there was no significant difference between the semirural and rural hospitals (Table 4).

Intravenous nitroglycerine was ideally indicated for 596 patients with persistent chest pain during hospitalization (Table 4). In the case of both ideal and less than ideal candidates, IV nitroglycerin was administered more often to patients in the urban hospitals and less often to patients in rural hospitals than it was in semirural hospitals (P < .03).

Reperfusion (thrombolytic therapy or primary angioplasty) was performed on 83.3% of those ideal candidates who had been hospitalized in the urban hospitals compared with 72.3% of patients in semirural hospitals and 67.9% of patients in rural hospitals. However, these differences were statistically insignificant. The percentage of less than ideal candidates who received reperfusion was highest (24.6%) in the urban hospitals and lowest (11.6%) in the rural hospitals (Table 4). Similarly, the percentages of the combination of ideal and less than ideal patients who received reperfusion therapy were 28.9%, 22.8%, and 15.8% in the urban, semirural, and rural hospitals, respectively. These trends are statistically significant (P < .001).

Table 4 shows that for both the ideal and less than ideal candidates, a higher proportion of patients in the urban hospitals and a lower proportion of patients in rural hospitals were prescribed aspirin at discharge than the proportion of patients in semirural hospitals (P < .001). B-Blockers were prescribed at discharge to 31.3%, 25.0%, and 22.5% of less than ideal candidates who had been hospitalized in the urban, semirural, and rural hospitals, respectively (Table 4), a statistically significant trend (P < .05). However, the numbers of ideal candidates who had been hospitalized in nonurban hospitals were too small for meaningful comparisons.

The Figure shows that the age of the patient was inversely correlated with the likelihood of the ideal candidates receiving aspirin during hospital stay and at discharge, IV nitroglycerin, and heparin. There was no

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**Table 1. Exclusion Criteria for Quality Indicators of Initial Hospitalization for Patients With AMI**

<table>
<thead>
<tr>
<th>Exclusion Criteria</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration of aspirin during hospitalization</td>
<td>(a)</td>
</tr>
<tr>
<td>Administration of heparin and IV nitroglycerine therapy</td>
<td>(c)</td>
</tr>
<tr>
<td>Administration of thrombolytic agents</td>
<td>(e)</td>
</tr>
<tr>
<td>Administration of more than 4000 U of heparin (full or low dose) per 24 hours, excluding those just receiving heparin flushes</td>
<td>(d)</td>
</tr>
<tr>
<td>Administration of intravenous nitroglycerin for persistent chest pain</td>
<td>(b)</td>
</tr>
</tbody>
</table>

*AMI indicates acute myocardial infarction; LVEF, left ventricular ejection fraction.*
Regional variation in the clinical management of AMI in terms of the ACC and AHA guidelines within the United States is well known.5,17,18 Considerable variation in the rate of coronary angioplasty procedures performed on Medicare patients was also found among 13 large areas in the United States. However, medically necessary procedures could not be distinguished from unnecessary procedures.19 Although coronary angiography for clinically similar groups of Medicare patients with AMI was performed more often in Texas than in New York State, the 2-year postdischarge mortality rate was greater and angina reported by the patients was more frequent in Texas than in New York.20

The results of this study suggest that in 1994/1995, the quality of inpatient care for AMI, in terms of 6 major QIs, provided to Medicare beneficiaries by acute care hospitals in Kansas was inferior in rural areas compared with the hospitals in the urban areas. It may be that the greater utilization of health care by rural beneficiaries relative to the beneficiaries residing in the urban areas of Kansas seen in our previous study5 may be partly explained by the relatively poor quality of care provided by rural hospitals. This hypothesis is supported by evidence from other studies of Medicare patients that show relatively poor quality of inpatient care for AMI, congestive heart failure, pneumonia, stroke, hip fracture, and chronic atrial fibrillation provided by small rural hospitals compared with larger urban hospitals.21,22 Care for diabetes has also been found to be relatively inferior in the rural areas of Alabama, Iowa, and Maryland.23

As expected, the AMI case volume of urban hospitals in Kansas far exceeded that of semirural and rural hospitals, and it may be that these small rural hospitals were also not as well equipped with cardiology services. The relationship between hospital case volume and outcome is well known.24 A recent analysis of data on a national CCP sample has also confirmed an association of higher AMI case volume and rural location of the hospitals with increased risk of death.25 Another independent analysis of the same data set showed that a higher percentage of Medicare patients hospitalized for AMI who were ideal candidates for aspirin and β-blockers received these medications in “top-ranked cardiology hospitals” and a lower percentage of similar patients received these medications in hospitals not equipped for cardiac catheterization, coronary angioplasty, and coronary bypass surgery than patients in hospitals that were equipped for these procedures but were not in the top rank.11 Almost all of the top-ranked hospitals were located in urban areas of the country, and most of the non-equipped hospitals were small community and rural hospitals.11 Consequently, the results of our study in Kansas are consistent with those of these 2 studies11,25 which suggests that the urban-rural disparity observed in our study is not limited to Kansas.

The data used in these studies excluded data on Medicare beneficiaries enrolled in the managed care sector, mainly in the urban areas of the country. Consequently, comparisons between the fee-for-service and managed care sectors were not possible. Since the collection of CCP data, the quality of care for elderly patients with AMI has improved to some extent.6,26 Future studies should use recent data, examine time trends and patterns of care after discharge, and identify modifiable characteristics or practices of health care providers, all
of which could be used to develop effective interventions and achieve further improvement in the quality of care. It would be useful to study similar variance in adherence to the clinical guidelines for AMI care in patient populations younger than 65 years and to compare the quality of care provided in the inner cities with that provided in affluent and suburban neighborhoods in urban areas.

The reliability of the data used in this study was partly dependent on the reliability of documentation in the hospital medical records. It may be that documentation in medical records of urban hospitals in Kansas was more accurate and complete than that in the rural hospitals. Although data were abstracted from all medical records in a standard manner by the same group of abstractors and efforts were made to control the quality of data abstraction process, there may have been errors in interpretation, which may have distorted the evidence for the administration of therapies. However, owing to the randomness of such errors, there was no reason to suspect bias.

The algorithms for the QIs, eligibility criteria, and contraindications were developed on the basis of the clinical guidelines. Adjustments for hospital and patient characteristics, the severity of illness, case mix, etc, were considered unnecessary because the same set of variables, criteria, and algorithms were used in determining adherence to the guidelines in each group of hospitals. Consequently, patients in the 3 groups of hospitals were similar with respect to their eligibility for therapy. Similar eligibility criteria were used for the ideal and less than ideal patients, and there were no differences between the 2 groups with respect to the appropriateness of therapy. The measures of QIs were adjusted for age because age seemed to be a confounding variable. However, these ad-

<table>
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<tr>
<th>Quality Indicator</th>
<th>Location of Hospitals</th>
<th>Total No.</th>
<th>Crude %</th>
<th>P†</th>
<th>Age-Adjusted %</th>
<th>P†</th>
<th>Total No.</th>
<th>Crude %</th>
<th>P†</th>
<th>Age-Adjusted %</th>
<th>P†</th>
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<td></td>
<td>83.9</td>
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<td>&lt;.001</td>
<td>1247</td>
<td></td>
<td>&lt;.001</td>
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<td>56.0</td>
<td>&lt;.001</td>
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<td>49.0</td>
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<td>135</td>
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<td>&lt;.001</td>
<td>&lt;.001</td>
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<td>(c) Administration of IV nitroglycerin for persistent chest pain during hospital stay</td>
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<td>&lt;.001</td>
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<td>&lt;.001</td>
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<td>&gt;.05</td>
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<td></td>
<td>69.5</td>
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<td>414</td>
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<tr>
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<td>83.3</td>
<td>&lt;.05</td>
<td>1647</td>
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<td></td>
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<td>80.2</td>
<td>627</td>
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<tr>
<td>Rural</td>
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<td></td>
<td></td>
<td>62.9</td>
<td></td>
<td>141</td>
<td>41.9</td>
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<tr>
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<td>&lt;.001</td>
<td>80.2</td>
<td>&lt;.001</td>
<td>905</td>
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<td>&lt;.001</td>
<td>70.0</td>
<td>&lt;.001</td>
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<td>(f) Prescription of ß-blockers at discharge from hospital</td>
<td>Urban</td>
<td>162</td>
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<td>&gt;.05</td>
<td>36.4</td>
<td>750</td>
<td>31.3</td>
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<tr>
<td>Rural</td>
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<td></td>
<td>30.7</td>
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<td>160</td>
<td>22.5</td>
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<td>21.9</td>
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<tr>
<td>All</td>
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<td>36.4</td>
<td>&lt;.05</td>
<td>1082</td>
<td></td>
<td>&lt;.05</td>
<td>30.8</td>
<td>&lt;.05</td>
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</table>

*AMI indicates acute myocardial infarction; CCP, Cooperative Cardiovascular Project; and IV, intravenous.
†P values denote the statistical significance of the observed trends.
justments did not materially change the urban-rural differences. Although the prevalence of comorbidities and the adverse effects of certain drugs are associated with age, the age of the patient should not by itself influence the protocol for managing AMI.27 The QIs based on ACC/AHA guidelines account for all contraindications and eligibility criteria, and these guidelines do not discriminate on the basis of age.9 Those clinical trials that included older patients with AMI do not support the restriction against treating these patients with β-blockers and thrombolytic agents.24,27 Although the risks from these drugs are greater in older patients, the opportunities for reducing the risk of AMI-related complications and death are also greater because the risk of these adverse outcomes is also age-related.

In this study, aggregate frequencies of the use of medications and procedures for ideal candidates in one group of hospitals were compared with those for similar patients in other groups. It may be that severely ill patients or those with serious comorbidities from rural areas of Kansas were transferred from rural hospitals to hospitals in the urban areas. If this was the case, it would not have altered the observed differences between the 2 groups of hospitals because the same standard criteria for eligibility for the therapies were used across the state. Accordingly, if there were more sicker patients in the urban hospitals, those with contraindications due to their comorbidities would not have been eligible, and they would have been excluded. Furthermore, if a therapy was withheld in urban hospitals because the patients were too sick, it would have resulted in underestimation, not exaggeration, of the urban-rural differences. Consequently, differential severity of illness could not have biased the results of this study.

This preliminary study used preexisting CCP data available to the investigators. These data included the actual, specific, and direct measures of the quality of care for patients with AMI that were based on the accepted clinical guidelines. Consequently, there was no need for using inferior, nonspecific, indirect QIs such as mortality, complications, or readmissions to study the urban-rural differences. The inverse relationship between the quality of care for patients with AMI and postdischarge mortality has been established in several clinical trials26-30 and previous studies of CCP data.6,10,11,25,31 Replication of their findings was considered unnecessary. It is recognized that if reliable process measures are available, there are substantiated benefits to using these measures instead of measuring outcomes.32 CCP and other data clearly show that aspirin, β-blocker, and thrombolytic therapy reduce post-AMI mortality by as much as 25% in Medicare patients and in younger patients.6,10,11,25,30,31 Yet, approximately a third of elderly Medicare patients with AMI who had no contraindications to aspirin did not receive it within the first 2 days of hospitalization,31 half of the ideal candidates were not prescribed β-blockers at discharge,4 and 24% of the ideal candidates for thrombolytic therapy did not receive it.30 Even the urban hospitals in this study and the top-ranked hospitals in the national CCP sample12 failed to prescribe aspirin and β-blockers at discharge to 4% to 18% and 25% to 63% of the ideal candidates, respectively. Failure to adhere to the clinical guidelines was much more severe in small rural hospitals.

The length of stay in rural hospitals was much shorter than in urban hospitals. Since the length of stay was not an indication or contraindication for the therapies of interest, it could not have confounded the urban-rural differences in the quality of care. The prevalence of left ventricular ejection fraction (LVEF) below 41% among the patients in the rural hospitals was also much lower than that in the urban hospitals. Left ventricular ejection fraction was associated with the eligibility for only 1 QI (prescription of β-blockers at discharge). However, the urban-rural differences with respect to other QIs could not have been affected by the differences in LVEF. There were fewer cardiologists in rural counties than in urban areas of Kansas.3 It may be that hospitals with attending cardiologists provided better care for patients with AMI. However, another recent study of the CCP data for California suggested that the differences in the use of recommended therapies by physician specialty are generally small and do not explain the differences in patient outcome.33

Some of the patients with AMI were deprived of reperfusion therapy because of the delay in presentation.26 Such delays would be expected to be more frequent in rural areas. Even though thrombolytic therapy is increasingly used in AMI cases, physicians are reluctant to administer thrombolytic agents because of the risk of cerebral hemorrhage, particularly in elderly patients.26 It is understandable that the decision to prescribe a simple drug like aspirin to elderly patients is complicated by frequent comorbidities and drug interactions,10 but why are such decisions more difficult to make in rural hospitals? It has been suggested that nonclinical factors may be responsible for variation in the use of aspirin and β-blockers in the management of AMI.8 Relatively poor quality of health care in rural areas has also been attributed to poor access to health care, poor access to medical education, delays in initiating critical therapy, and to rural hospitals being accustomed to providing “charity” care.24 Furthermore, a relatively higher proportion of rural beneficiaries in Kansas were dually eligible (eligible for both Medicaid and Medicare),2 and compared with those beneficiaries eligible for only Medicare, the dually eligible beneficiaries have been known to receive relatively inferior health care35 and have a higher risk of death.36 Our study and several other studies suggest that there are greater opportunities for improving the delivery of care in more than 1 clinical area in the rural districts than there are in metropolitan regions.
REFERENCES


