Socioeconomic Status and Outcome Following Acute Myocardial Infarction in Elderly Patients

Sunil V. Rao, MD; Kevin A. Schulman, MD; Lesley H. Curtis, PhD; Bernard J. Gersh, MB, ChB, DPhil; James G. Jollis, MD

Background: Although the Medicare entitlement provides universal hospital care coverage for elderly Americans, disparities in care processes after acute myocardial infarction still exist. Whether these disparities account for increased mortality among elderly poor patients is not known.

Methods: To determine the association between socioeconomic status and acute myocardial infarction treatment, procedure use, and 30-day and 1-year mortality, we analyzed data from 132,130 elderly Medicare beneficiaries hospitalized for acute myocardial infarction between January 1994 and February 1996. Patients were categorized into 10 groups of increasing income using the median income of the ZIP code of residence.

Results: The highest-income beneficiaries received higher rates of evidence-based medical therapy and had lower adjusted 30-day and 1-year mortality rates compared with the middle-income beneficiaries (30-day relative risk, 0.89 [95% confidence interval, 0.85-0.94]; and 1-year relative risk, 0.92 [95% confidence interval, 0.88-0.97]). Conversely, the lowest-income beneficiaries received lower rates of evidence-based medical treatment and had higher adjusted 30-day and 1-year mortality rates relative to the middle-income beneficiaries (30-day relative risk, 1.09 [95% confidence interval, 1.04-1.13]; and 1-year relative risk, 1.05 [95% confidence interval, 1.00-1.10]). Coronary revascularization rates were similar among income groups.

Conclusions: Despite the Medicare entitlement, there remain significant socioeconomic disparities in medical treatment and mortality among elderly patients following acute myocardial infarction. Income was independently associated with short- and long-term mortality. More research is required to determine the mechanisms contributing to adverse outcomes among poor elderly patients and to determine whether expansion of Medicare coverage will alleviate these disparities.

Arch Intern Med. 2004;164:1128-1133

A ccording to the US Census Bureau, 11% of the US population falls below the poverty level. Americans older than 65 years account for 17% of those defined as poor. For these elderly Americans, “universal” hospital care coverage is provided in the form of Medicare Part A, but this federal program falls short of covering many medical expenses. Studies in the United States and in countries with greater levels of universal health care have documented socioeconomic disparities in the medical and invasive treatment of acute myocardial infarction (MI). For example, an analysis of the Cooperative Cardiovascular Project (CCP) found that poor elderly patients with acute MI were somewhat less likely to receive reperfusion therapy on hospital admission, aspirin during the hospitalization, and aspirin and β-blockers at hospital discharge. However, whether these disparities in care processes account for increased mortality among poor elderly patients was not examined. Furthermore, to our knowledge, the issue of whether higher-income Medicare beneficiaries receive better care and have better outcomes has never before been considered. Therefore, we sought to determine the association between socioeconomic status (SES), MI treatment, and mortality across an income spectrum of Medicare beneficiaries.
ience an acute MI. Patients in the CCP include a sample of Medicare beneficiaries discharged from a nongovernmental acute-care hospital in the United States following initial hospitalization for acute MI between January 1994 and February 1996, with the exception of MI-related readmissions (International Classification of Diseases, Ninth Revision, Clinical Modification code 410.x0 or 410.x1). Subjects (n = 206986) were identified based on UB-92 claims in the Medicare National Claims History File associated with hospitalizations during a random 8-month period, which varied for each state. Sampling was modified in Alabama, Connecticut, Iowa, and Wisconsin because these states participated in the CCP pilot sample. Sampling was also modified in Minnesota because of an ongoing state study.

Medical records for each sampled hospitalization were forwarded to data abstraction centers. The methods of abstraction have been described in detail, and included more than 140 variables from each record. Data were collected regarding demographics, medications, medical history, clinical presentation, admission therapies, diagnostic tests, laboratory test results, procedures, in-hospital events, and discharge therapies. Data quality was maintained by trained technicians, software abstraction modules, and random data auditing.

STUDY SAMPLE

The present analysis was limited to patients 65 years and older with a confirmed diagnosis of MI. Myocardial infarction was defined, as in previous studies, as elevation of the creatine kinase–MB level by more than 5%, elevation of lactate dehydrogenase levels with isoenzyme reversal (lactate dehydrogenase, > lactate dehydrogenase), or 2 of the following criteria: chest pain during the previous 48 hours, a 2-fold elevation in creatine kinase level, or electrocardiographic changes (ST-segment elevation or new Q waves). For patients with multiple admissions for MI or readmissions during the study period, only data from the first admission were used. In addition, patients with invalid ZIP codes, those treated outside the 50 states and the District of Columbia, and those transferred to another acute-care facility were excluded.

DEFINITIONS AND END POINTS

Socioeconomic status was defined according to the ZIP code of residence. Subjects were grouped into 10 deciles of increasing income (income cutoﬀs for each decile were as follows: ≤$18382, $18382–$21146, $21146–$23180, $25525–$27569, $30406–$33353, $37539, and $44647). The lowest income decile corresponded approximately to median annual incomes at or below twice the weighted average poverty threshold in 1995 for householders 65 years or older, as defined by the US Census Bureau. Patients residing in ZIP codes where the median annual incomes were in this income decile of the CCP were defined as low income. Patients residing in ZIP codes where the median annual incomes were in the highest income decile of the CCP (>$44647) were defined as high income. Patients residing in ZIP codes where the median annual incomes were between the lowest and highest income deciles ($21146–$37539) were grouped together and defined as middle income.

The primary end points were 30-day and 1-year mortality. All patients who met the inclusion criteria were considered for the 30-day end point; only patients surviving to 30 days were considered for the 1-year end point.

PREDICTOR VARIABLES

Based on clinical experience and a published 1-year mortality model using the CCP, the following candidate predictor variables were identiﬁed for inclusion in the mortality models; age; sex; race; heart rate; systolic blood pressure at hospital arrival; serum urea nitrogen level; MI location; Killip class at admission; prior acute MI or coronary artery bypass surgery; current smoking status; diabetes mellitus; history of hypertension, stroke, dementia, chronic obstructive pulmonary disease, or congestive heart failure; inability to walk or incontinence before admission; chest pain for more than 12 hours before admission; refusal of thrombolytic agents; and cardiomegaly. Hospital characteristics that were considered in the mortality models were the presence of a cardiac catheterization laboratory, medical school afﬁliation, and rural location.

STATISTICAL ANALYSIS

χ2 Tests and an analysis of variance were used to examine differences in categorical and continuous variables, respectively. The associations between income level and 30-day and 1-year mortality among the high- and low-income groups were determined using the middle-income group as the reference. Stepwise logistic regression procedures were used to identify 30-day and 1-year mortality models based on clinical variables only, retained terms with a Wald χ2>20. Dummy variables indicating missing values were included in the multivariate analyses. During model development, we tested for nonlinear associations and for the potential inﬂuence of out-of-range values. Interaction terms were used to explore the effect of age, race, and sex on income level in predicting mortality.

To assess whether differences in medical therapy or revascularization procedures accounted for differences in 30-day and 1-year mortality, treatment variables for reperfusion therapy (either thrombolytic therapy or primary angioplasty), aspirin, β-blockers, coronary angioplasty, and bypass surgery were added to the mortality models. To assess if differences in hospital characteristics accounted for differences in 30-day and 1-year mortality, hospital variables for the presence of cardiac catheterization facilities, medical school afﬁliation, and rural location were added to the ﬁnal mortality models.

For both models, the robustness of the ﬁndings was explored by repeating the analysis using deciles of income and including an indicator variable signifying “ideal” candidates for reperfusion and medical therapy during hospitalization and at discharge based on the absence of previously described contraindications. Each model adjusted for clustering of patients according to hospital. Odds ratios were converted to relative risk ratios using the method proposed by Zhang and Yu. Model discrimination was assessed using the C statistic, and model calibration was assessed using the Hosmer-Lemeshow χ2 statistic.

RESULTS

Of the CCP population, 132130 patients 65 years and older with acute MI met the study criteria; 13354 patients met the deﬁnition of low income, and 13214 patients met the deﬁnition of high income. Table 1 shows the baseline characteristics of the groups deﬁned by income. Low-income subjects were aged a mean of 76 years and were more likely to be black and female compared with the middle- and high-income subjects. They were also more likely to have risk factors for coronary artery disease, such as smoking, diabetes mellitus, hypertension, and a previous history of stroke, and other chronic medical conditions, such as incontinence and immobility. Low-income patients presented later and were more likely to present with an anterior infarction. They were
also less likely to be admitted to teaching hospitals or hospitals with cardiac catheterization facilities.

The converse was true for high-income patients. They were older, less likely to be smokers, and less likely to have a history of diabetes mellitus and prior stroke compared with the middle- and low-income patients. They were, however, more likely to have a history of bypass surgery. High-income patients presented earlier than the low- and middle-income subjects and were more likely to present with an ST-segment elevation. They were also more likely to be treated at teaching hospitals and hospitals with cardiac catheterization laboratories.

Table 2 shows the rates of medical therapies and in-hospital revascularization procedures for the low-, middle-, and high-income patients. As documented in a related study regarding medications and poverty, significantly fewer low-income patients received reperfusion therapy at admission, aspirin during hospitalization, β-blockers at discharge, and smoking cessation counseling. The rates of reperfusion therapy, aspirin use during hospitalization, and β-blockers at discharge increased with higher income. Although there were fewer smokers in the high-income group, they received more smoking cessation counseling. There were no clinically significant differences among the income cohorts in the use of angioplasty or bypass surgery.

**Figure 1** shows the unadjusted 30-day and 1-year mortality rates according to deciles of income. Mortality was higher at 30 days and 1 year for lower-income subjects ($P < .01$ for trend for 30-day and 1-year mortality). After adjustment for clinical characteristics, evidence-based medical therapy, revascularization, hospital characteristics, and patient clustering, the relative risk of death at 30 days continued to be significantly higher for low-income patients and lower for high-income patients compared with the middle-income group (Figure 2). Among those surviving to 30 days, income level also was associated with 1-year mortality after similar adjustment for patient characteristics, treatment, hospital characteristics, and patient clustering (Figure 3). Low-income patients had a higher 1-year mortality and high-income patients had a lower 1-year mortality compared with the middle-income patients. There was a significant interaction between income and mortality was concentrated in patients younger than 75 years.

The association between SES and outcome could not be accounted for by the imbalance in race across the income groups, because black patients had lower adjusted 30-day and 1-year mortality rates regardless of income level. The findings regarding 30-day and 1-year mortal-

### Table 1. Baseline Characteristics for the 3 Income Groups*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Low-Income Group (n = 13,354)</th>
<th>Middle-Income Group (n = 105,562)</th>
<th>High-Income Group (n = 13,214)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, mean ± SD, y</td>
<td>76.7 ± 7.5</td>
<td>76.9 ± 7.5</td>
<td>77.4 ± 7.6</td>
</tr>
<tr>
<td>Female sex†</td>
<td>52.2</td>
<td>49.6</td>
<td>47.9</td>
</tr>
<tr>
<td>Black race†</td>
<td>19.7</td>
<td>5.3</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited mobility†</td>
<td>4.3</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Incontinent†</td>
<td>8.9</td>
<td>7.6</td>
<td>7.5</td>
</tr>
<tr>
<td>Smoker†</td>
<td>17.0</td>
<td>14.6</td>
<td>12.1</td>
</tr>
<tr>
<td>Prior myocardial infarction†</td>
<td>38.9</td>
<td>39.1</td>
<td>39.9</td>
</tr>
<tr>
<td>Prior bypass surgery†</td>
<td>10.6</td>
<td>12.9</td>
<td>13.1</td>
</tr>
<tr>
<td>Diabetes mellitus†</td>
<td>33.5</td>
<td>30.8</td>
<td>27.8</td>
</tr>
<tr>
<td><strong>Risk factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension†</td>
<td>64.2</td>
<td>61.6</td>
<td>61.7</td>
</tr>
<tr>
<td>Stroke†</td>
<td>15.6</td>
<td>14.8</td>
<td>13.6</td>
</tr>
<tr>
<td>Dementia</td>
<td>7.0</td>
<td>6.7</td>
<td>7.3</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease†</td>
<td>23.0</td>
<td>21.0</td>
<td>17.6</td>
</tr>
<tr>
<td><strong>Admission findings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST-segment elevation†</td>
<td>39.2</td>
<td>40.9</td>
<td>41.2</td>
</tr>
<tr>
<td>Systolic blood pressure, mean, mm Hg</td>
<td>142.6</td>
<td>142.2</td>
<td>141.9</td>
</tr>
<tr>
<td>Pulse rate, mean, beats/min</td>
<td>88.4</td>
<td>88.2</td>
<td>87.6</td>
</tr>
<tr>
<td>Serum urea nitrogen level, mean, mg/dL†</td>
<td>23.9</td>
<td>24.2</td>
<td>24.9</td>
</tr>
<tr>
<td>Refused thrombolytic agents†</td>
<td>8.9</td>
<td>8.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Killip class &gt;2</td>
<td>38.9</td>
<td>39.1</td>
<td>39.9</td>
</tr>
<tr>
<td>Shock</td>
<td>2.7</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Anterior myocardial infarction</td>
<td>49.1</td>
<td>47.0</td>
<td>48.0</td>
</tr>
<tr>
<td>Chest pain for &gt;12 h†</td>
<td>30.6</td>
<td>25.4</td>
<td>21.8</td>
</tr>
<tr>
<td>Second- or third-degree heart block</td>
<td>1.3</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Hospital characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical school affiliation</td>
<td>18.1</td>
<td>20.3</td>
<td>27.6</td>
</tr>
<tr>
<td>Catheterization laboratory</td>
<td>70.4</td>
<td>72.8</td>
<td>75.9</td>
</tr>
</tbody>
</table>

*SI conversion factor: To convert urea nitrogen to millimoles per liter, multiply by 0.357.

*Data are given as percentage of subjects in each group unless otherwise indicated.

†$P < .01$ across income groups.
ity remained apparent after adjusting for ideal status and when patients in the middle-income range were further subdivided into deciles of income (Figure 4). Relative to the sixth decile of income, the greatest differences in mortality continued to be identified at the income extremes.

COMMENT

This study confirmed socioeconomic differences in the evidence-based medical treatment of acute MI and documented an association between SES and outcome after acute MI. The highest-income Medicare beneficiaries presented earlier to the hospital, were more likely to be treated at hospitals with catheterization facilities and a medical school affiliation, received higher rates of evidence-based medical therapy, and had better survival at 30 days and 1 year. Conversely, the poorest elderly Americans presented later, received lower rates of evidence-based medical treatment, and had higher 30-day and 1-year mortality rates. After adjusting for differences in patient and hospital characteristics and differences in medical treatment, SES was independently associated with mortality. To our knowledge, this study is the first to evaluate the impact of SES on mortality from acute MI in the United States. To our knowledge, it is also the first to identify better care and outcomes for the higher-income Americans in the Medicare system.

The findings of this study are consistent with those of studies6,10,12 conducted in other countries with greater levels of universally available health care. For example, a study from the FINMONICA MI Register in Finland found that low-income patients had twice the risk of pre-hospital death after MI than high-income patients. After

---

**Table 2. Unadjusted Rates of Medical Therapy at Hospital Admission and Discharge, In-Hospital Revascularization Procedures, and 30-Day and 1-Year Mortality**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low-Income Group</th>
<th>Middle-Income Group</th>
<th>High-Income Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin given during hospitalization†</td>
<td>77.1</td>
<td>78.1</td>
<td>79.1</td>
</tr>
<tr>
<td>Reperfusion therapy given at hospital admission†‡</td>
<td>15.6</td>
<td>18.1</td>
<td>18.5</td>
</tr>
<tr>
<td>Given at hospital discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin</td>
<td>69.7</td>
<td>69.6</td>
<td>68.6</td>
</tr>
<tr>
<td>β-Blocker†</td>
<td>33.3</td>
<td>38.5</td>
<td>42.7</td>
</tr>
<tr>
<td>Revascularization procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angioplasty or bypass surgery</td>
<td>23.3</td>
<td>23.6</td>
<td>24.2</td>
</tr>
<tr>
<td>Only angioplasty</td>
<td>14.7</td>
<td>15.2</td>
<td>15.3</td>
</tr>
<tr>
<td>Only bypass surgery</td>
<td>8.6</td>
<td>8.5</td>
<td>8.9</td>
</tr>
<tr>
<td>Smoking cessation counseling (among smokers)†</td>
<td>31.0</td>
<td>36.0</td>
<td>35.4</td>
</tr>
<tr>
<td>Mortality†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 d</td>
<td>22.0</td>
<td>20.6</td>
<td>18.9</td>
</tr>
<tr>
<td>1 y</td>
<td>22.3</td>
<td>21.3</td>
<td>20.4</td>
</tr>
</tbody>
</table>

*Data are given as percentage of subjects in each group.
†P<.01 across income groups.
‡Either thrombolytic therapy or primary angioplasty.
Alter and colleagues examined the Ontario Myocardial Infarction Database to determine the effect of income on the use of invasive procedures and outcome from MI. By using neighborhood income to define poverty, they found that patients from poor communities were less likely to undergo coronary angiography and revascularization, and had a higher 1-year mortality. The persistence of socioeconomic differences in health systems with greater levels of universal care and the finding of treatment differentials during hospitalization in the US system suggest that expansion of the Medicare program may not entirely relieve economic health care disparities.

Factors associated with SES other than differences in hospital treatment and discharge medications may be responsible for the adverse outcome seen in poor elderly patients. For example, 2 studies have found that poor patients are less likely to undergo secondary prevention measures and are less likely to attend cardiac rehabilitation. Studies also suggest that environmental influences cannot be ignored. Neighborhoods differ in access to medical care facilities, the number of advertisements for tobacco products, and safety, all of which may influence mortality. In addition, SES may be associated with certain behaviors that affect outcome, such as noncompliance with discharge medications because of financial constraints. Because medication costs represent a substantial expense that is not covered by Medicare, it is possible that disparities in medical therapy in the year following discharge contributed to differences in 1-year mortality. Whether the provision of federal medication insurance would lead to better outcomes for low-income elderly patients is unknown.

Some of the differences in admission and discharge therapy shown in our study can be explained by differences in patient characteristics among the 3 income levels. For example, low-income patients were less likely to receive reperfusion therapy at admission but also presented later than patients in the higher-income groups. It is likely that the later presentation removed some patients from consideration for thrombolytic therapy. In addition, higher rates of chronic obstructive pulmonary disease among low-income elderly patients may have led to lower rates of ß-blocker prescription at discharge. However, 2 factors that cannot be accounted for by patient characteristics are the lower rates of aspirin use during hospitalization and the lower rate of smoking cessation counseling despite a higher rate of smoking among the low-income patients.

The similarity in the rates of coronary angioplasty and bypass surgery across the 3 income levels seen in our study differs from previous analyses that have found lower rates of cardiac catheterization and revascularization among the poor. The former studies differed from our analysis in that they were based on data from a single state registry, were conducted outside the United States, or did not specifically focus on elderly patients. The lack of disparity in revascularization rates in our study may be explained by 2 other federally established health insurance programs available to elderly patients to cover procedures: Medicare Part B and Medicaid. Approximately 96% of elderly persons are covered by Medicare Part B, and 40% of poor elderly persons are covered by Medicaid. Both of these programs also cover physician fees, and the latter program also provides some outpa-
dent medication benefits. In concert with the Medicare Part A universal hospital entitlement, these government-
tal health insurance programs may have mitigated any
differences in the rates of cardiac procedures among persons of varying socioeconomic levels.

There are some limitations to our analyses. First, we
deﬁned income level using the median income from the
ZIP code of residence. Although this approach has been
used by most studies examining socioeconomic dispar-
ties, it may misclassify individual patients whose in-
comes do not follow the average for that region. Such mea-
surement error has been found to lead to downward bias in
the coefﬁcient of SES in statistical models. Therefore,
our analyses are likely to have underestimated the
true association of income level with survival. Second,
it is possible that our analyses are a reﬂection of com-
munity characteristics rather than a reﬂection of per-
sonal income. Diez Roux et al examined the Athero-
sclerosis Risk in Communities population and found that
residence in a disadvantaged neighborhood almost
doubled the hazard ratio for coronary heart disease after
adjusting for age, personal income, occupation, and edu-
cational level. Third, we did not distinguish between car-
diovascular- and non–cardiovascular-related mortality.
The increased 1-year mortality among the lowest-
income patients could have been secondary to noncar-
diac causes of death. The data available in CCP do
not include information on treatment occurring after hospi-
talization, such as cardiac rehabilitation, compliance with
discharge medications, secondary prevention measures,
or additional revascularization procedures, all of which
influence cardiac-related mortality but would not neces-
sarily affect non–cardiac-related mortality.

In conclusion, these data show that even in a set-
ing of universal hospital care coverage for elderly pa-
tients in the United States, there is a signiﬁcant income-
related difference in mortality following acute MI. This
association between SES and outcome was independent
of patient and hospital characteristics, and persisted af-
ter adjustment for disparities in care processes. The
wealthiest Medicare beneficiaries presented earlier, were
more likely to receive evidence-based care, and had the
lowest adjusted mortality, while the converse ﬁndings of
later presentation, less evidence-based care, and the high-
est mortality were observed among the lowest-income ben-
eficiaries. Further study is needed to determine the rea-
sons for the increased mortality among poor elderly
patients and to determine if expansion of the Medicare
program would reduce these disparities.

Accepted for publication June 30, 2003.

This study was supported by contract 500-96-P623 from
the Delmarva Foundation for Medical Care, Inc, Balti-
more, Md; and by the Centers for Medicare & Medicaid
Services, US Department of Health and Human Services, Balti-
more.

The contents of this article do not necessarily reﬂect
the views of the US Department of Health and Human Ser-
dices, nor does mention of trade names, commercial pro-
ducts, or organizations imply endorsement by the US gov-
ernment. The authors assume full responsibility for the
accuracy and completeness of the ideas presented. This ar-
ticle is a direct result of the Health Care Quality Improve-
ment Program initiated by the Centers for Medicare & Med-
icaid Services, which has encouraged identiﬁcation of quality
improvement projects derived from analysis of patterns of
care.

Corresponding author: Sunil V. Rao, MD, Duke Clini-
cal Research Institute, 2400 Pratt St, Durham, NC 27715
(e-mail: sunil.rao@duke.edu).

REFERENCES

2. MacKay AP, Fingerhut LA, Duran CR. Health, United States, 2000. With Adoles-
treatment of acute myocardial infarction in the elderly. Circulation. 2000;102:
642-648.
4. Philbin EF, McCullough PA, DiSalvo TG, et al. Socioeconomic status is an im-
portant determinant of the use of invasive procedures after acute myocardial in-
cidence of, management of, and survival after myocardial infarction and coro-
nary death: analysis of community coronary event register. BMJ. 1997;314:541-
546.
to invasive cardiac procedures and on mortality after acute myocardial infarc-
Medicare patients with acute myocardial infarction: results from the Coopera-
8. Krumholz HM, Chen J, Chen Y, et al. Predicting one-year mortality among el-
derly survivors of hospitalization for an acute myocardial infarction: results from
10. Thomas SA, Qureshi AI, Suri MF, Guterman LR, et al. Cardiac rehabilitation:
clinically beneﬁcial, but how does it improve outcomes? J Am Coll Cardiol.
1999;34:475-482.
ency of coronary heart disease. J Epidemiol Community Health. 2001;55:475-
482.
13. Qureshi AI, Suri MF, Guterman LR, et al. Ineffective secondary prevention in sur-
vivors of cardiovascular events in the US population: report from the Third Na-
tional Health and Nutrition Examination Survey. Arch Intern Med. 2001;161:
1621-1628.
patients are less likely to attend but patients ineligible for thrombolysis are less
15. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and inci-
dence of, management of, and survival after myocardial infarction and coro-
101:1913-1918.
to the incidence and prehospital, 28-day, and 1-year mortality rates of acute coro-
nary events in the FINMONICA myocardial infarction register study. Circulation.
2000;101:1913-1918.
the case fatality, prognosis and treatment of myocardial infarction events: the FIN-
MONICA MI Register Study. J Epidemiol Community Health. 2001;55:475-
482.
18. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and inci-
to invasive cardiac procedures and on mortality after acute myocardial infar-
cidence of, management of, and survival after myocardial infarction and coro-
nary death: analysis of community coronary event register. BMJ. 1997;314:541-
546.
to invasive cardiac procedures and on mortality after acute myocardial infarc-
Medicare patients with acute myocardial infarction: results from the Coopera-
24. Krumholz HM, Chen J, Chen Y, et al. Predicting one-year mortality among el-
derly survivors of hospitalization for an acute myocardial infarction: results from
26. Thomas SA, Qureshi AI, Suri MF, Guterman LR, et al. Ineffective secondary prevention in sur-
vivors of cardiovascular events in the US population: report from the Third Na-
tional Health and Nutrition Examination Survey. Arch Intern Med. 2001;161:
1621-1628.
patients are less likely to attend but patients ineligible for thrombolysis are less
28. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and inci-
30. Pucci LG, Joseph HM Jr, Siegel M. Outdoor tobacco advertising in six Boston
31. Shefler SE, Rathore SS, Gersh BJ, et al. Time to presentation with acute myo-
cardial infarction in the elderly: associations with race, sex, and socioeconomic
32. Pamuk E, Makuc D, Heck K, et al. Socioeconomic Status and Health Chartbook:
Health, United States, 1998. Hyattsville, Md: National Center for Health Statis-
tics; 1998.