Timeliness and Quality of Care for Elderly Patients With Acute Myocardial Infarction Under Health Maintenance Organization vs Fee-for-Service Insurance

ORIGINAL INVESTIGATION

Timeliness and Quality of Care for Elderly Patients With Acute Myocardial Infarction Under Health Maintenance Organization vs Fee-for-Service Insurance

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Background: A commonly voiced concern is that health maintenance organizations (HMOs) may withhold or delay the provision of urgent, essential care, especially for vulnerable patients like the elderly.

Objective: To compare the quality of emergency care provided in Minnesota to elderly patients with acute myocardial infarction (AMI) who are covered by HMO vs fee-for-service (FFS) insurance.

Methods: We reviewed the medical records of 2304 elderly Medicare patients who were admitted with AMI to 20 urban community hospitals in Minnesota (representing 91% of beds in areas served by HMOs) from October 1992 through July 1993 and from July 1995 through April 1996.

Main Outcome Measures: Use of emergency transportation and treatment delay (>6 hours from symptom onset); time to electrocardiogram; use of aspirin, thrombolytics, and β-blockers among eligible patients; and time from hospital arrival to thrombolytic administration (door-to-needle time).

Results: Demographic characteristics, severity of symptoms, and comorbidity characteristics were almost identical among HMO (n = 612) and FFS (n = 1692) patients. A cardiologist was involved as a consultant or the attending physician in the care of 80% of HMO patients and 82% of FFS patients ($P = .12$). The treatment delay, time to electrocardiogram, use of thrombolytic agents, and door-to-needle times were almost identical. However, 56% of HMO patients and 51% of FFS patients used emergency transportation ($P = .02$); most of this difference was observed for patients with AMIs that occurred at night (60% vs 52%; $P = .02$). Health maintenance organization patients were somewhat more likely than FFS patients to receive aspirin therapy (88% vs 83%; $P = .03$) and β-blocker therapy (73% vs 62%; $P = .04$); these differences were partly explained by a significantly larger proportion of younger physicians in HMOs who were more likely to order these drug therapies. All differences were consistent across the 3 largest HMOs (1 staff-group model and 2 network model HMOs). Logistic regression analyses controlling for demographic and clinical variables produced similar results, except that the differences in the use of β-blockers became insignificant.

Conclusions: No indicators of timeliness and quality of care for elderly patients with AMIs were lower under HMO vs FFS insurance coverage in Minnesota. However, two indicators of quality care were slightly but significantly higher in the HMO setting (use of emergency transportation and aspirin therapy). Further research is needed in other states, in different populations, and for different medical conditions.

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AT THE TIME of this report, approximately 5 million Medicare patients received care from capitated health maintenance organizations (HMOs), representing a 360% increase from 1991; this number is expected to grow to more than 12 million by 2005.[1] A common perception is that economic incentives in HMOs may reduce the speed and provision of urgent, essential care, especially in vulnerable patients like the elderly.[2-4] Unfortunately, there are virtually no data showing how the rapid shift to managed care may be affecting the quality of acute care for elderly patients.[5,6]

Some organizational processes and incentives in HMOs may raise the quality of care for acute conditions, while others may lower quality. For example, large HMOs often have 24-hour telephone triage systems and patient education to encourage patients with acute conditions to use emergency transportation to the hospital. Health maintenance organizations may also be more likely to establish quality-improvement systems (eg, treatment protocols or clinical pathways).[7] Finally, HMOs are more

METHODS

SETTING

The sample of elderly patients with AMI was drawn from a larger study of compliance with national drug treatment guidelines in 37 community hospitals.[19-21] In the present study, we included 20 hospitals in Minneapolis, St Paul, Duluth, and St Cloud, representing virtually all areas served by Medicare HMOs in Minnesota. The 20 study hospitals accounted for 91% of the community hospital beds for adults in these urban areas.

STUDY PATIENTS

As described previously,[19-21] patients were included in the study if they were aged 65 years or older; had an admission diagnosis of AMI, rule out AMI, or suspected AMI; and met 2 of the following criteria: (1) typical symptoms of AMI (ie, chest discomfort, arm or shoulder pain, diaphoresis, dyspnea, nausea or vomiting, and neck or jaw pain); (2) explicit medical record documentation by a physician that ECG findings were considered compatible with AMI; and (3) elevated serum creatine kinase and MB isoenzyme levels above the upper limits of normal (as specified by the laboratory at each participating hospital). We excluded patients who died before admission, who were transferred from a nonstudy hospital, or who had suffered an AMI during the 2 weeks before the hospital admission. We included all eligible patients with AMI who were admitted from October 1, 1992, through July 31, 1993, and from July 1, 1995, through April 30, 1996.

Insurance status was determined from hospital records of the primary payer for each patient's hospital stay (Medicare HMOs or Medicare FFS). We validated insurance coverage against a statewide discharge database for about half of the sample and found a rate of agreement of 94% between data sources.

DELAY VARIABLES

We defined delay as 6 or more hours between the onset of symptoms suggestive of AMI and hospital presentation. This delay was chosen because of the much higher mortality reduction observed in eligible patients who receive thrombolytic agents within 6 hours of symptom onset.[17] The length of delay was missing for only 6% of patients in an earlier analysis of the first year of these data.[18] Other indicators of rapid access to effective treatment included use of emergency transportation as the first medical contact (vs an office visit prior to admission or other first medical contact)[17] and the time from hospital presentation to ECG (time to ECG).

USE OF EFFECTIVE MEDICATIONS IN ELIGIBLE PATIENTS

We measured eligibility for and acute use of 3 lifesaving drug therapies: aspirin, β-blockers, and thrombolytics. To be eligible for treatment with these agents, patients had to have all indications for each treatment and no absolute or relative contraindications, based largely on the 1990 American College of Cardiology/American Heart Association Task Force guidelines that were in effect during the observation period (**Table 1**).[22] Important clinical data necessary to define eligibility (presence of ST-segment elevation on ECG, delay between onset and hospital presentation, etc) were complete and reliable.[18-21] Because of the important influence of speed of access to thrombolytic agents on the rate of survival,[17] we also measured the time (<30, 30-59, or ≥60 minutes) that elapsed from hospital presentation to the administration of a thrombolytic agent.

CHARACTERISTICS OF ATTENDING AND CONSULTING PHYSICIANS

Previous data have shown that patients with AMI who are treated by cardiologists (attending physicians or consultants) are more likely to receive aspirin, β-blocker, or thrombolytic therapy than those treated by a generalist attending physician only.[23] In addition, other studies have found a negative association between a physician's age and the prescription of new and effective drug therapies.[8,9] Because of concerns that HMOs may reduce access to specialists,[3] we obtained data on the specialty of all consultant or attending physicians for all study patients (cardiologist attending or consultant vs generalist attending only).[23] In addition, we obtained reliable data on the ages of all attending physicians from the *American Medical Association Directory of Physicians in the United States* (35th ed).[24]

PATIENT CHARACTERISTICS

The demographic and socioeconomic patient variables included age (65-74 or >74 years), sex, race (white or nonwhite), median annual income determined by a patient's residence within a ZIP-code region and 1993 US Census data (<$30 000, $30 000-$39 999, or ≥$40 000), distance between a patient's ZIP-code region and the hospital,[25] and living arrangements (alone, with somebody, or in a long-term care facility).

likely to employ younger physicians, who may have more up-to-date knowledge about the safety and efficacy of newer drug treatments.[8,9]

On the other hand, in efforts to contain costs, primary care gatekeepers in HMOs attempt to reduce the inappropriate use of emergency departments, specialty care, and hospital care. Conceivably, this might result in delays in approval of the necessary use of ambulances and emergency departments. DeMaria et al[4] have also expressed concern that such gatekeepers might reduce access to appropriate specialty care in emergency conditions.

The treatment of acute myocardial infarction (AMI) provides an ideal model for studying the quality of acute care for elderly HMO patients. Cardiovascular disease is the leading cause of disability and death in the elderly; 80% of all deaths caused by AMI occur in those aged 65 years or older.[10] Strong evidence from large randomized clinical trials shows that early treatment with aspirin, thrombolytic agents, and

Clinical characteristics noted at the time of admission included a history of angina, AMI, coronary artery bypass graft surgery or percutaneous transluminal coronary angioplasty, diabetes, or hypertension; the presence of chest pain, cardiogenic shock, or heart failure at presentation; AMI location (anterior, inferior-posterior, or non–Q wave/other); and the time of day of symptom onset (6:00 AM–5:59 PM or 6:00 PM–5:59 AM).[18,19]

We used the index of coexistent disease to measure the burden of comorbidity among study patients.[26] This index includes 2 dimensions: the severity of coexisting medical conditions and the degree of physical impairment as determined by information contained in the medical record at the time of admission. For this study, we identified the number of severe comorbid conditions (0, 1, 2-4, or ≥5) and the number of severe physical impairments (0, 1, or ≥2).

Because previous studies have shown that advanced age and severe comorbid conditions are associated with greater delay and reduced use of effective drug therapy for AMI[18-20] and that such patient characteristics may also be associated with enrollment in FFS settings,[27,28] all patient characteristics were examined as potential confounding variables in the analyses described below.

DATA COLLECTION AND INTEGRITY

As described elsewhere,[19] trained nurses experienced in cardiology retrieved detailed medical record data regarding AMI inclusion and exclusion criteria, admission data (first medical contact and time to presentation), inpatient procedures, ECG and laboratory evidence of AMI, medical history and comorbid conditions at the time of admission,[26] clinical findings at the time of presentation and during the first 24 hours of hospitalization, identity and time of administration of all drugs given during the first 48 hours (including the time during emergency transportation and in the emergency department), study drug indications and contraindications, and living arrangements. Abstractors were required to demonstrate ongoing interrater agreement of 95% or higher with the criterion reviewer. Reviewers from the Minnesota Clinical Comparison and Assessment Program randomly audited 10% of each abstractor's completed cases to ensure that this standard was met.

STATISTICAL ANALYSIS

We compared the demographic and clinical characteristics of HMO and FFS patients; the significance of all insurance-related differences was computed using the χ^2 test. Further univariate analyses examined whether there were any differences between HMO and FFS patients with respect to the age of the attending physicians and cardiologist involvement (two intermediate variables that may explain insurance-related differences in the use of effective medications for the treatment of AMI). We then conducted univariate analyses comparing quality-of-care indicators (eg, the proportion of eligible patients receiving each drug therapy, treatment delay, and the use of emergency transportation) of HMO vs FFS patients using the χ^2 test. For variables with missing values (**Table 2**), we tested whether the outcomes and the patient characteristics for the missing and nonmissing categories were similar; this was done separately for HMO and FFS patients using χ^2 tests. For all variables with missing values, the percentage missing did not significantly differ by insurance status.

We conducted multivariate logistic regression analyses to determine the size and significance of any insurance-related (HMO vs FFS) differences in quality-of-care indicators, controlling for age, sex, and potentially confounding clinical or demographic characteristics (Table 2). Because of changes over time in the likelihood of receiving aspirin and other medications that effectively treat AMI,[29] we included the year of admission as an additional control variable. For each model, we retained any of the control variables that were associated with $P \leq .10$. Age and sex were forced into the models regardless of the significance level. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated directly from the estimated regression coefficients and their SEs.

We also examined whether intermediate variables, such as physician age and cardiologist involvement, may have explained differences in rates of drug therapy use between HMO and FFS patients by entering these variables into the final multivariate models. If these variables were significant independent predictors of the use of effective drug therapy and reduced the significance of the HMO vs FFS variable, it would suggest that part of the insurance-related difference in drug therapy use is attributable to younger physicians or the reduced involvement of cardiologists in HMO settings.

Finally, we conducted several analyses to determine whether the inclusion of about one fourth of the study patients who were randomized to a previous intervention to improve adherence to national AMI guidelines[21] might have affected the conclusions of the current study. These included stratified analyses with and without intervention sites (postintervention only) and inclusion of dummy (control) variables in the final multivariate models. These analyses indicated that the intervention did not affect the results of this study, mainly because our randomized design resulted in similar distributions of insurance status (HMO vs FFS) across experimental and control sites.

β-blockers increases the rate of survival among elderly patients with AMI.[11-16] Because the benefits of treatment with thrombolytics decline rapidly within 6 hours after initial symptom onset,[17] the time from symptom onset to hospital presentation is an important determinant of survival. Unfortunately, elderly patients with AMI are more likely to have atypical symptoms, delayed hospital presentation,[18] and less frequent use of thrombolytic, β- blocker, and aspirin therapy.[19]

In this study, we reviewed the medical records of 2304 elderly patients admitted with AMI at 20 urban community hospitals in Minnesota to compare the quality of emergency care under HMO vs FFS insurance coverage. Specifically, we compared the use of emergency transportation, treatment delay (≥6 hours), time to electrocardiogram (ECG), use of drug treatments known to reduce morbidity and mortality in eligible patients with AMI (aspirin, thrombolytics, and β-blockers), and time from hospital arrival to thrombolytic administration (door-

Table 1. Eligibility and Contraindications for Acute Myocardial Infarction (AMI) Drug Therapy*

Oral Aspirin Therapy
Eligible population
All patients with AMI and without any contraindications
Absolute contraindications
History of allergy to aspirin
Serious gastrointestinal bleeding
Relative contraindications
Asthma
Nasal polyps (aspirin could lead to anaphylaxis)
History of bleeding/significant risk of bleeding
History of peptic ulcer disease
β-Blocker Therapy
Eligible population
All patients with AMI and without any contraindications
Absolute contraindications
Heart rate too low (<60 beats/min)
Low systolic blood pressure (<100 mm Hg)
Severe left ventricular failure (rales >10 cm from base of lungs [10 cm = ⅓ from base])
Severe bronchospastic lung disease
Signs of peripheral hypoperfusion
Atrial ventricular conduction abnormalities
History of adverse reaction to β-blockers
Relative contraindications
Systolic blood pressure <110 mm Hg
History of asthma
Severe peripheral vascular disease
Difficult-to-control, severe insulin-dependent diabetes
Thrombolytic Therapy
Eligible population
All patients with AMI or suspected AMI presenting within 12 h of onset of symptoms
ST-segment elevation ≥1 mm
Without any contraindications
Absolute contraindications
Active internal bleeding
Suspected aortic dissection
Prolonged or traumatic cardiopulmonary resuscitation
Recent head trauma (within 2 wk)
Intracranial neoplasm
Hemorrhagic ophthalmic conditions
Pregnancy
Previous allergic reaction to the thrombolytic agent
Sustained systolic blood pressure >180 mm Hg or diastolic blood pressure >110 mm Hg
Any recorded blood pressure >200/120 mm Hg on admission
Trauma or surgery in past 2 wk
AMI onset >24 h before admission
Relative contraindications
Major bleeding
Recent trauma or surgery (>2 wk and <2 mo)
History of chronic severe hypertension with or without drug therapy
History of CVA
Current warfarin anticoagulant therapy
Prior streptokinase or APSAC (if they are the agents of choice) therapy
Significant liver dysfunction
Active peptic ulcer
AMI onset >12 h before admission

**CVA indicates cerebrovascular accident; APSAC, anisoylated plasminogen streptokinase activator complex.*

to-needle time). Unlike previous investigations,[5] we attempted to identify specific mechanisms that might explain any observed insurance-related differences in quality of care, such as use of specialists.

RESULTS

There were 2304 elderly patients with AMI at the 20 hospitals; 612 (27%) were enrolled in an HMO (Table 2). Among the HMO patients, 30% were enrolled in a single large staff-group model HMO, 59% in 1 of 2 large network model HMOs, and 11% in 1 of several smaller plans.

The demographic and clinical characteristics of elderly patients with AMI and HMO insurance or FFS coverage were generally comparable (Table 2). While FFS patients were slightly older ($P = .13$), history of cardiovascular disease, the number of severe comorbid conditions, and the number of severe physical impairments among HMO and FFS patients were almost identical (Table 2). Although more FFS patients lived 10 or more miles away from the admitting hospital ($P = .001$), the clinical characteristics of HMO and FFS patients at the time of presentation (chest pain, ST-segment elevation, heart failure, AMI location, and time of day of symptom onset) were also comparable. About one third of the study patients in each group lived alone, and 4% to 6% were institutionalized in a long-term care facility at the time of their AMI.

Table 3 provides data on cardiologist involvement and the age of attending physicians according to insurance status. Cardiologists were involved as consultants or attending physicians in the care of 80% of HMO patients and 82% of FFS patients ($P = .12$). However, among patients with some cardiologist involvement, HMO patients were somewhat more likely to have a cardiologist consultation rather than an attending cardiologist (81%, vs 72% among FFS patients; $P = .001$). Attending physicians caring for HMO patients were significantly younger than physicians caring for FFS patients; 30% of the attending physicians in FFS settings were aged 50 years or older, as compared with 19% of attending physicians caring for HMO patients ($P = .001$). The majority of attending physicians (82% [n = 944]) cared exclusively for HMO or FFS study patients (but not both).

Unadjusted comparisons of the measures of rapidity and quality of care are provided in **Table 4**. Overall, quality of care provided to HMO and FFS patients based on these measures was similar. Although about one third of all patients delayed presentation to the hospital for more than 6 hours, the time from symptom onset to hospital presentation was almost identical among the HMO and FFS patients. However, 56% of HMO patients and 51% of FFS patients used emergency transportation ($P = .02$). Because we hypothesized that 24-hour telephone triage was more likely to be available in large HMOs, we investigated whether the increased use of ambulances among HMO patients was more likely to occur at night. Between 6 PM and 6 AM, 60% of HMO patients used emergency transportation compared with 52% of FFS patients ($P = .02$). During daytime hours, insurance-related differences in emergency transit use were smaller (53% of HMO patients vs 49% of FFS patients).

The time from hospital presentation to first ECG was also similar in the 2 study groups (Table 4). Time to ECG was greater than 60 minutes for about one fourth of HMO and FFS patients.

Table 2. Patient Characteristics (N = 2304)*

Characteristics	No. (%) of Patients HMO (n = 612)	FFS (n = 1692)	P
Age, y			
65-74	291 (48)	744 (44)	.13
≥75	321 (52)	948 (56)	
Female	292 (48)	841 (50)	.42
White	557 (91)	1579 (93)	.17
History			
Angina	219 (36)	646 (38)	.29
AMI	164 (27)	527 (31)	.04
CABG or PTCA	79 (13)	246 (15)	.32
Diabetes	159 (26)	444 (26)	.90
Hypertension	372 (61)	961 (57)	.09
Smoking status†			
Current smoker	91 (15)	214 (14)	.52
Past smoker	353 (60)	972 (61)	
Never smoked	146 (25)	396 (25)	
No. of severe comorbid conditions‡			
0	130 (21)	335 (20)	.86
1	181 (30)	516 (31)	
2-4	274 (45)	759 (45)	
≥5	27 (4)	82 (5)	
No. of severe physical impairments‡			
0	506 (83)	1396 (83)	.99
1	77 (13)	217 (13)	
≥2	29 (5)	79 (5)	
Chest pain at presentation†	528 (94)	1435 (92)	.04
ST-segment elevation	300 (49)	859 (51)	.46
Heart failure	161 (26)	480 (28)	.44
Cardiogenic shock	67 (11)	200 (12)	
Time of day of symptom onset†			
6 AM to 5:59 PM	326 (53)	880 (52)	.59
6 PM to 5:59 AM	281 (47)	798 (48)	
AMI location			
Anterior	134 (22)	437 (26)	.15
Inferior/posterior	212 (35)	568 (34)	
Non–Q wave/other	266 (44)	687 (41)	
Median income, $/y†§			
<30 000	93 (15)	332 (21)	.01
30 000-39 999	258 (43)	677 (42)	
≥40 000	256 (42)	610 (38)	
Living arrangements†			
Alone	193 (32)	576 (34)	.13
Not alone	386 (63)	991 (59)	
Institutionalized	25 (4)	102 (6)	
Distance between residence and hospital, km†‖			
<3.2	91 (15)	275 (17)	.001
3.2-6.2	170 (28)	330 (20)	
6.4-9.4	188 (31)	433 (27)	
9.6-15.8	104 (17)	299 (18)	
≥16	54 (9)	296 (18)	

*HMO indicates health maintenance organization; FFS, fee-for-service insurance; AMI, acute myocardial infarction; CABG, coronary artery bypass graft surgery; and PTCA, percutaneous transluminal coronary angioplasty.

†Variables with missing values.

‡Based on the index of coexistent disease (Greenfield et al[26]).

§Determined by residence within ZIP-code region and 1993 US Census data.

‖Based on distance between centers of residence and hospital ZIP-code regions.

The rates of use of thrombolytic agents among eligible patients and door-to-needle times were virtually identical in patients with HMO vs FFS insurance (Table 4). However, HMO patients were somewhat more likely than FFS patients to receive aspirin therapy (88% vs 83%; $P = .03$) and β-blocker therapy (73% vs 62%; $P = .04$).

Observed insurance-related differences in emergency transit use and the use of aspirin and β-blocker therapy among eligible patients were not caused by a dominant HMO or model type; in fact, quality of care for these measures was higher among the HMO patients than among the FFS patients, both in the staff-group model and in the two network-model plans that, taken together, provided care for 89% of the HMO patients (**Figure**).

Controlling for age, sex, year of admission, and patient clinical characteristics, including comorbid conditions (Table 2), the logistic regression results in **Table 5** confirmed the equivalent quality of care provided to HMO and FFS patients with respect to time from symptom on-

Table 3. Age of Attending Physicians and Involvement of Cardiologists According to Insurance Status*

	No. (%) of Patients HMO (n = 612)	FFS (n = 1692)	P
Involvement of cardiologist			
No cardiologist	125 (20)	297 (18)	.12
Cardiologist as consultant or attending physician	487 (80)	1395 (82)	
Age of attending physician, y†			
<40	200 (36)	431 (28)	.001
40-49	254 (45)	662 (43)	
≥50	105 (19)	458 (30)	

*HMO indicates health maintenance organization; FFS, fee-for-service insurance.

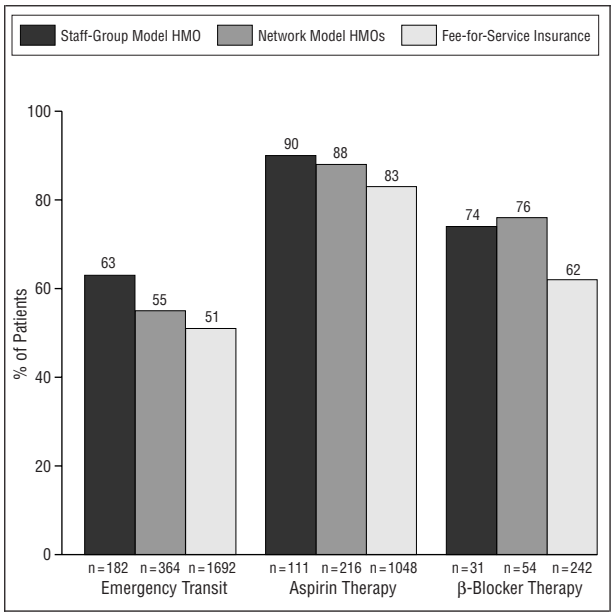
†Eight percent of observations were missing values; the total number of attending physicians was 944.

Table 4. Univariate Comparisons of Quality of Care Indicators According to Insurance Status*

Measure	No. (%) of Patients HMO	FFS	P
Emergency transportation	343 (56) [n = 612]	863 (51) [n = 1692]	.02
Delay ≤6 h	395 (65) [n = 607]	1117 (66) [n = 1692]	.58
Time to ECG, min			
<30	298 (67) [n = 445]	820 (64) [n = 1281]	.52
30-59	36 (8) [n = 445]	115 (9) [n = 1281]	
≥60	116 (26) [n = 445]	346 (27) [n = 1281]	
Therapy use in eligible patients			
Aspirin	323 (88) [n = 367]	870 (83) [n = 1048]	.03
β-Blocker	71 (73) [n = 97]	150 (62) [n = 242]	.04
Thrombolytic	105 (64) [n = 164]	329 (66) [n = 498]	.70
Door-to-needle time, min†			
<30	22 (14) [n = 155]	81 (18) [n = 449]	.34
30-59	71 (46) [n = 155]	184 (41) [n = 449]	
≥60	64 (41) [n = 155]	184 (41) [n = 449]	

*HMO indicates health maintenance organization; FFS, fee-for-service insurance.

†Time from hospital presentation to thrombolysis (thrombolytic therapy recipients only).



Insurance-related differences in the use of emergency transit and aspirin and β-blocker therapy. Samples for drug use outcomes include only those eligible for aspirin or β-blocker therapy.

set to hospital presentation, time to ECG, thrombolytic agent use, and speed of access to thrombolysis. However, after controlling for demographic variables, severity of illness, and comorbid conditions, HMO patients were significantly more likely than FFS patients to arrive at the hospital in emergency transit vehicles (OR, 1.37; 95% CI, 1.12-1.67) and to receive aspirin therapy during the first 24 hours after the AMI (OR, 1.60; 95% CI, 1.07-2.41). In the multivariate analysis, the adjusted OR for β-blocker therapy continued to be higher in HMO patients than in FFS patients, but the difference was no longer statistically significant (OR, 1.42; 95% CI, 0.79-2.55).

We hypothesized that insurance-related differences in access to specialists and younger physicians might partially explain the differences in the frequency of use of aspirin and β-blocker therapy. Because access to consulting or attending cardiologists was similar for Medicare HMO and FFS patients (Table 3), this variable could not explain observed insurance-related differences in the frequency of aspirin or β-blocker therapy. However, the mean age of attending physicians was significantly higher in FFS settings (Table 3). After controlling for demographic variables, severity of illness, and comorbid conditions, patients with older attending physicians were significantly less likely than patients with younger attending physicians to receive aspirin therapy (OR for each 10-year increase, 0.81; 95% CI, 0.68-0.96) or β-blocker therapy (OR for each 10-year increase, 0.71; 95% CI, 0.54-0.95). Moreover, inclusion of the age of the physician in the multivariate model substantially reduced the size and significance of HMO insurance as a correlate of increased use of aspirin therapy (OR, 1.42; $P = .10$) and β-blocker therapy (OR, 1.23; $P = .51$), indicating that the age of attending physicians represented one mechanism that explains why HMO patients were more likely to receive these agents that effectively treat AMI.

Table 5. Multivariate Logistic Regression Results Comparing Quality of Care Indicators for Health Maintenance Organization (HMO) vs Fee-for-Service (FFS) Patients

Measure	OR (95% CI) for HMO vs FFS	*P*
Emergency transportation*	1.37 (1.12-1.67)	.002
Delay ≤6 h†	1.11 (0.90-1.38)	.31
Time to ECG <30 min‡	0.90 (0.70-1.18)	.45
Therapy use in eligible patients		
Aspirin§	1.60 (1.07-2.41)	.02
β-Blocker‖	1.42 (0.79-2.55)	.24
Thrombolytic¶	0.77 (0.49-1.21)	.26
Door-to-needle time ≤60 min#	1.08 (0.79-1.77)	.41

**Controlled for age, sex, hospital type, angina, number of severe comorbid conditions, number of serious physical impairments, chest pain, diabetes, current smoker, acute myocardial infarction location, and distance to hospital.*

†Controlled for age, sex, chest pain, history of previous coronary artery bypass graft or percutaneous transluminal coronary angioplasty, time of symptom onset, admitting year, and distance to hospital.

‡Controlled for age, sex, chest pain, and current smoker.

§Controlled for age, sex, hospital type, cardiogenic shock, number of severe comorbid conditions, number of serious physical impairments, chest pain, ST-segment elevation, and admitting year.

‖Controlled for age, sex, angina, number of severe comorbid conditions, number of serious physical impairments, ST-segment elevation, and admitting year.

¶Controlled for age, sex, number of severe comorbid conditions, time from symptom onset, chest pain, acute myocardial infarction location, and institutionalized.

#Controlled for age, sex, hospital type, chest pain, admitting year, and living alone.

COMMENT

To our knowledge, this investigation represents the first large-scale study in the era of thrombolytic therapy comparing the rapidity and quality of care for elderly patients with AMI covered by Medicare HMO and FFS insurance. Widespread public concerns and anecdotal data have suggested that primary care gatekeeping may increase the delay in presentation to the emergency department and reduce the use of lifesaving drug therapies among patients with suspected AMI.[30,31] Such concerns have led 25 states to pass laws restricting HMO gatekeeping in the emergency department,[32] and emergency care is 1 of 4 categories of rights in the White House's proposed National Bill of Patients' Rights.[33] However, this study of the majority of older patients with AMI who were treated at community hospitals in Minnesota strongly suggests that no indicators of the quality of urgent care for elderly patients with AMI are lower under HMO vs FFS insurance coverage in this state.

Two indicators of quality care were slightly but significantly higher in the HMO settings (use of aspirin therapy and emergency transportation). Most of the increase in the use of ambulances among HMO patients occurred among patients whose symptoms began at night, suggesting that 24-hour call-in lines or other services available from HMOs may have helped patients to access emergency transportation. The difference in a patient's access to a specialist was not an important factor for predicting an insurance-related difference in the use of effective medications to treat AMI. However, the higher

percentage of younger attending physicians caring for HMO patients partially explained the increased use of aspirin and β-blocker therapy compared with patients in FFS settings. Although aspirin and β-blocker therapy should ideally be administered in the emergency department, we found that about one half of the first orders for aspirin therapy and 88% of the first orders for β-blocker therapy occurred after the patient was admitted to the intensive care unit or coronary care unit. Thus, many attending physicians had the opportunity to correct for earlier errors of omission by ordering these medications soon after admission. The above differences were not confounded by individual hospitals or groups of hospitals because there were similar proportions of HMO patients in virtually all hospitals studied.

The generalizability of these findings needs to be carefully examined in future studies conducted in other states, for other conditions, and including for-profit HMOs. Other managed care organizations might not provide the same quality of care.[34] Recent critical reviews of the extant literature do not indicate a pattern of a lower quality of care in HMOs.[5,6,35] Braveman and colleagues[36] found that treatment outcomes for acute appendicitis among nonelderly patients were significantly better in HMOs, while other studies suggest a higher quality of care for chronic conditions in FFS settings.[5] However, none of these studies observed the quality of care provided within the last 5 years, a period of dramatic growth in Medicare HMOs, and none examined the quality of urgent, essential care in elderly populations.

A limitation of this and previous research is the lack of solid data on the relationship between specific characteristics of HMOs and quality of care. In addition, because patients in our study were not randomly assigned to HMO or FFS insurance coverage, unobserved differences in patient characteristics could have biased observed differences in quality of care.

The validity of our results was enhanced by including more than 90% of community hospital beds in the metropolitan areas served by HMOs in a state with a higher-than-average Medicare HMO penetration rate.[1] The observed rates of use of effective drug therapy for elderly patients with AMI were also comparable with rates in 4 other states.[37] Furthermore, our finding suggesting that more HMO than FFS patients receive β-blocker therapy is similar to the finding of a 1997 National Committee for Quality Assurance report indicating a substantially higher rate of prophylactic β-blocker therapy following AMI in HMOs than in FFS settings.[38]

Despite a total sample size of 2304 patients, one limitation of our study is that the number of patients eligible for thrombolytic therapy was small, resulting in a low statistical power for this measure. To detect a true difference in the rates of thrombolytic therapy between HMO and FFS patients of 2% (the observed difference), we would need a total sample size of more than 40 000 elderly patients with AMI. However, our sample size was sufficient to detect small differences in other measures.

Do our data suggest any insurance-related differences in health or mortality outcomes? In-hospital mortality was 12% among HMO patients and 14% among FFS patients. Moreover, the similar pattern of delay and use of most lifesaving treatments would predict comparable outcomes. Nevertheless, assuming an attributable mortality reduction of 25%[39] and a baseline mortality rate of 14%, if rates of aspirin therapy among the 1048 eligible FFS patients increased from 83% to 88% (the rate among HMO patients), 2 additional lives might have been saved among FFS patients had they been treated comparably to HMO patients. The more frequent use of emergency transportation among HMO patients may also improve outcomes. For example, more than 30% of patients in the 1996 sample who used emergency transportation received aspirin therapy in transit.

In summary, this study suggests that the timeliness and quality of emergency care provided to elderly patients with AMI in Minnesota are generally similar for HMO and FFS insurance coverage. However, the use of emergency transit and one lifesaving therapy (aspirin) were somewhat higher among the elderly patients who were enrolled in HMOs. The differences in medication use were associated with a younger panel of HMO physicians, and the differences in emergency transit use may have been related to 24-hour call-in systems that are available in large HMOs. However, other reasons for the observed insurance-related differences remain largely unknown and merit further investigation. Research is also needed to examine the possible effects of HMO processes and economic incentives on the quality of care for other emergency, time-sensitive conditions in the elderly, such as stroke and acute appendicitis.

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