Differences in Triage Thresholds for Patients Presenting with Possible Acute Coronary Syndromes: More than Meets the Eye

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ABSTRACT

Background: Many studies have shown differences in cardiac care by racial/ethnic groups without accounting for institutional factors at the location of care.

Objective: Exploratory analysis of the effect of hospital funding status (public vs private) on emergency department (ED) triage decision making for patients with symptoms suggestive of acute coronary syndromes (ACSs) and on the likelihood of ED discharge for patients with confirmed ACS.

Study Design and Setting: Secondary analysis of data from a randomized controlled trial of 10,659 ED patients with possible ACS in five urban academic public and five private hospitals. The main outcome measures were the sensitivity and specificity of hospital admission for the presence of ACS at public and private hospitals and the adjusted odds of a patient with ACS not being hospitalized at public versus private hospitals.

Results: Of 10,659 ED patients, 1,856 had confirmed ACS. For patients with suspected ACS, triage decisions at private hospitals were considerably more sensitive (99 vs 96%; $p < .001$) but less specific (30 vs 48%; $p < .001$) than at public hospitals. The difference between hospital types persisted after adjustment for multiple patient-level and hospital-level characteristics.

Conclusion: Significant differences in triage for patients with suspected ACS exist between public and private hospital EDs, even after adjustment for multiple patient demographic, clinical, and institutional factors. Further studies are needed to clarify the causes of the differences.

Key Words: acute coronary syndrome, evaluation, emergency department triage, public/private hospitals, quality of care, institutional factors

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Patients who present to the emergency department (ED) with acute coronary syndromes (ACSs) (acute myocardial infarction [AMI] or unstable angina pectoris [UAP]) require hospitalization. Of the approximately 7 million patients in the United States who present to EDs annually with symptoms suggestive of ACS, less than 25% actually have ACS.[1–4] Of the 75% of patients without ACS, more than 50% of patients are hospitalized, using hospital resources often without any clear medical benefit. On the other hand, 2 to 4%—approximately 26,000 patients—are inadvertently discharged home from the ED and thereby do not have access to critical treatment for their ACS. Complications and mortality are higher in those inadvertently discharged.[4–7]

Previous studies have shown that race, sex, age, types of symptoms, and electrocardiogram (ECG) changes affect triage of patients with ACS.[5–9] Disparities in provision of cardiac care and in clinical outcomes have also been found among different types of hospitals.[10–19] Yet few studies have examined the relative contributions of patient and institutional factors to the observed disparities in care, specifically the source of funding on which the hospital is dependent.

Hospital funding source may affect health care delivery, but its effect on ED triage has not been previously investigated. We therefore undertook an exploratory investigation of the impact of hospital funding source (private vs public) on ED triage for patients presenting with signs and symptoms suggestive of ACS.

METHODS

Study Design

We analyzed prospectively collected data from the 1993 multicenter Acute Cardiac Ischemia Time-Insensitive Predictive Instrument (ACI-TIPI) Trial, which tested the effect of a predictive instrument on ED triage of patients with symptoms of possible ACS.[4] We used regression analyses to determine the odds of ED discharge for a patient with ACS from public and private hospitals, adjusting for a variety of patient and institutional characteristics.

Setting

The 10 participating hospitals were located in six states in the northeastern, southeastern, and midwestern United States. All were nonprofit teaching or teaching affiliated hospitals in or near urban centers. We categorized hospitals as publicly funded if they were state, county, or city owned. Data on hospital characteristics included bed number and staff size, cardiac catheterization capabilities, coronary care unit (CCU) bed availability at the time of patient presentation to the ED, ED size and volume, and the presence of an ED residency program and separate department of emergency medicine.

Patients

Patients in the clinical trial were at least 30 years old (or at least 18 years old and suspected or reported to have used cocaine) and were eligible if they presented to the ED with any symptom suggestive of ACS, including chest discomfort; left arm, jaw, or epigastric pain; shortness of breath; and syncope. Of 11,618 eligible ED patients, 10,689 (92%) patients at 10 sites were included in the trial. Because the intervention tested in the clinical trial did not alter the rates of ED discharge for patients with or without ACS, data from the entire trial were used for the analyses. The sample for our analyses consisted of all trial patients who had a confirmed final diagnosis and known ED triage disposition. We excluded 30 patients who left against medical advice or who died in the ED. Thirty-day outcome data were available for 96% of all patients.

Definition of ACS

Clinical, ECG, and laboratory data were collected on ED arrival and 24 to 72 hours later for both hospitalized and nonhospitalized patients. A study physician at each site used these data to assign one final diagnosis for each patient at his or her site. AMI was defined according to World Health Organization criteria[20] based on at least two of the following: symptoms, ECG, and creatine kinase–MB isoform measurements. UAP was defined as angina of Canadian Cardiovascular Society class 4 or as class 3[21] with new or increased symptoms within 3 days of ED presentation. For this analysis, ACS included AMI and UAP. Mortality was assessed at 30 days.

Outcome Measures and Predictors

The dependent variable was ED triage disposition for a patient, either hospitalization or discharge home. The main predictor variable was hospital funding status: private or public. Covariates included patient, hospital, and ED characteristics. Patient characteristics included demographic information (age, sex, race, health insurance type, socioeconomic level [median household income by zip code from census data]); clinical presentation (type and duration of primary symptom, ambulance transport to ED); presenting ECG (normal or nondiagnostic vs abnormal: ≥ 1 mm ST-segment elevation or depression, elevated or inverted T waves, or pathologic Q waves); a history of AMI or UAP; comorbidities (diabetes, hypertension, a history of stroke or ulcer disease); and the severity of ACS (based on Killip class[22] and the probability of ACS as estimated by a predictive instrument for the diagnosis of ACS [the ACI-TIPI], which calculates the risk of ACS based on patient age, sex, primary symptom, and ECG variables).[23] Our previous studies found that age, sex, and their interaction were strongly predictive of ED triage.[7] In these analyses, we therefore used the four age-sex categories that yielded the strongest predictors (women/men at least 55 years of age or less than 55 years of age).

Statistical Analyses

Differences in patient characteristics between public and private hospitals were compared using chi-square tests for categorical variables and *t*-tests for continuous variables. All comparisons were two-sided.

Sensitivity of triage decision making was determined by the proportion of patients with confirmed ACS who were hospitalized, and specificity was determined by the proportion of patients without ACS who were discharged. Thus, for the purpose of this analysis, we ignored other comorbidities that might have affected the decision for admission. Similarly, the accuracy of triage decision making was determined by the proportion of patients who had the "correct" decision with respect to the presence or absence of ACS alone. These proportions were compared by unadjusted chi square.

To focus specifically on the important cases of patients with ACS who were inadvertently discharged, univariate analyses and multivariable logistic regression were used to determine the odds ratios (ORs) for a patient with ACS not being hospitalized in public versus private hospitals. Because of the small number of outcomes (41 patients with ACS not hospitalized), we assessed the stability of the OR and its 95% confidence interval (CI) for patients with ACS discharged from public versus private hospital EDs using three methods. The first was exploratory, using stepwise regression to sequentially add multiple covariates to the model to determine the magnitude of change in the OR and significance of the hospital type variable with each successive covariate addition. We performed multiple regression analyses, each time changing the order of entry of successive variables. Because of high correlation between several covariates, we did not use any two highly

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correlated variables simultaneously in the same model. For example, we used either ED volume or hospital size or either household income or insurance status in the same model. Variables found to be consistently significant were then used in the hierarchical models described below.

The second method used traditional logistic regression in which a specific covariate was added to a base model composed of age-sex category, race, socioeconomic level, and hospital type. This method limited the number of terms in each model to seven or less (to correspond with the relatively few outcomes) and still allowed for adjustment for important patient characteristics (eg, race, gender, socioeconomic level) that have been shown to affect quality of care. To account for clustering of patients within hospitals, we modeled ED triage using general estimating equations (GEEs). This method estimates the effect of variables in the model after accounting for the effect of similar patients within hospitals on the outcome (ED triage disposition). We did not use GEE with the first method because of the large number of predictors.

The third method used propensity scores[24] to adjust for differences in patient characteristics between patient populations presenting to public and private hospitals while simultaneously limiting the number of predictors in the model, thereby reducing the chance of overfitting the model to this data set. We used logistic regression to create propensity scores for each patient to estimate the likelihood of presentation to a public hospital ED based on age, sex, race, type of health insurance, ambulance transport, presenting symptoms, history of AMI and UAP, diabetes, initial ECG findings, severity of ACS, ED volume, and presence of an ED residency program and a separate department of emergency medicine. The propensity score was then used as an independent predictor in the main regression model that included hospital type as the main predictor and ED triage as the outcome.

Mortality Rates

Mortality at 30 days and risk-adjusted predicted mortality, estimated from a regression model based on patient demographic characteristics and disease severity,[25] were compared between patients with ACS at public versus private hospitals.

RESULTS

Hospital and Patient Characteristics

ED triage dispositions and final diagnoses were available for 10,659 ED patients, of whom 53% were seen at private hospitals. Table 1 shows the institutional and patient characteristics at the five private and five public hospitals in the study. The public hospitals were larger, busier, and more likely to be located in major urban centers. Patients presenting to public hospitals were younger and were more likely to be nonwhite and have Medicaid or no health insurance, shortness of breath and/or nausea/vomiting and/or dizziness at presentation, a normal initial ECG, and longer duration of symptoms (nearly twice as long) than patients presenting to private hospitals. Twenty-two percent of all private hospital ED patients and 13% of all public hospital ED patients had a final confirmed diagnosis of ACS ($p < .001$).

Of the total 1,856 ED patients assigned a final diagnosis of ACS, 1,215 (65%) presented to private EDs and 641 (35%) presented to public EDs. The mean age was 66 years, 59% were male, 24% were nonwhite, 52% had UAP, and 48% had AMI. There were no statistically or clinically significant differences between patients at the two types of hospitals with respect to the proportion presenting with chest pain as a primary symptom or ambulance transport to the ED, estimated risk of ACS based on clinical characteristics and presentation, type and severity of ACS, diabetes, and history of previous AMI, UAP, and/or ulcer disease (Table 2).

ED Discharge Rates

Among all hospitals in the cohort, 2.2% (range 0–11%) of patients with a final diagnosis of ACS and 39% (range 25–65%) of patients without ACS were discharged from the ED. ED triage differed substantially and significantly between public and private hospitals, as shown in Figure 1. Among patients with ACS, only 1.1% (13 of 1,215) from private hospital versus 4.4% (28 of 641) from public hospital EDs were discharged ($p < .001$). However, public hospitals were more specific. Among patients without ACS, 30% from private hospital versus 48% from public hospital EDs were discharged ($p < .001$).

To further investigate these triage differences, we plotted each hospital's "performance" for appropriately triaging patients presenting to the ED with possible ACS. As shown in Figure 2, individual hospital performance clearly segregates by hospital type, with almost no overlap. The performance of public hospitals is shifted to the left in the figure, indicating higher rates of discharge for patients without ACS (higher "specificity"), and has more interhospital variability (range at public hospitals 32 to 65% vs 25 to 33% at private hospitals) compared with private hospitals. The performance of private hospitals is shifted to the right and is slightly higher, indicating better "sensitivity" (96 vs 99%, $p < .001$) but lower specificity compared with public hospitals.

We also investigated differences in patient characteristics among patients with ACS who were discharged from the ED. Although the proportions of patients with UAP and AMI and the severity of ACS were similar between hospital types, the proportions of patients with AMI and with more severe symptoms were substantially higher among patients discharged from public versus private hospital EDs: 61% (17 of 28, of whom 7% had Killip class II or

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TABLE 1 Characteristics of Hospitals ($N = 10$) and Patients ($N = 10,659$)

Characteristics	*Private Hospitals (n = 5)*	*Public Hospitals (n = 5)*
Institutional		
Teaching	5	5
Large metropolitan location	2	4
Tertiary care center	4	5
Cardiac catheterization capability	4	4
Attending in ED	5	5
Emergency medicine department	4	3
Emergency medicine residency program	1	3
Hospital beds, median (range)	465 (341–816)	681 (350–1,019)
Physician staff, median (range)	536 (329–800)	750 (500–1,100)
ED size (number of beds), median (range)	17 (12–36)	23 (15–96)
ED volume (annual number of visits), median (range)	33,000 (15,000–93,000)	70,000 (35,000–108,000)
Patient		
Age (mean)†	63	54
Female (%)†	47	51
Nonwhite (%)†	18	61
Ambulance transport (%)‡	38	37
Insurance type†		
Commercial/Medicare (%)	76	40
Medicaid/uninsured (%)	18	58
Other/unknown (%)	6	2
Presenting symptoms		
Chest discomfort (%)‡	69	69
Shortness of breath (%)†	49	63
Nausea/vomiting (%)†	22	34
Dizziness/feeling faint (%)†	22	32
Symptom duration, median (min)†	150	270
Abnormal initial ECG†	58	49
Predicted risk of ACS§ (%), median†	25	23
Confirmed diagnosis of ACS (%)†	22	13

ACS = acute coronary syndrome; ECG = electrocardiogram; ED = emergency department.
*Because of the small sample, statistical comparisons were not performed.
†$p < .001$.
‡p = not significant.
§Predicted risk of ACS calculated using a validated predictive model based on patient age, sex, chief complaint, and ECG variables.[23]

higher) compared with 15% (2 of 13, all with Killip class I) ($p = .02$), a fourfold difference in missed AMI.

Regression Analyses

Table 3 shows the results of the first method, sequential regression analysis. The unadjusted odds of discharge for a patient with ACS was 4.2 times higher at public versus private hospital EDs. After adjustment for eight covariates, the odds of a patient with ACS discharged from a public hospital ED were 3.5 times that at a private hospital ED. Regardless of the order of entry of variables, the final OR for hospital type remained between 3 and 3.5 and was statistically significant. When hospital size was included as a

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TABLE 2 Characteristics of Patients with Acute Coronary Syndrome Evaluated at Public and Private Hospital Emergency Departments

Characteristic	*Private Hospitals (n = 1,215)*	*Public Hospitals (n = 641)*	p *Value*
Female (%)	38	46	.002
Age < 55 yr (%)	17	32	< .001
Nonwhite* (%)	11	50	< .001
Insurance type			< .001
Commercial/Medicare (%)	83	54	
Medicaid/uninsured (%)	13	45	
Other/unknown (%)	4	1	
Household median income ($), median†	33,000	26,000	< .001
Abnormal ECG (%)‡	75	69	.01
Predicted risk of ACS§ (%), median	49	44	< .001
Symptom duration, median (min)	150	270	< .001
Chest pain is primary symptom (%)	89	85	.019
Shortness of breath on ED presentation (%)	49	70	< .001
Ambulance transport to ED (%)	47	45	.6
ED wait time, median (min)	21	15	< . 001
Confirmed ACS severity			.15
All UAP (% of all patients with ACS)	53	51	
AMI, Killip class‖ I (%)	31	35	
AMI, Killip classes II–IV (%)	16	14	
Patient has diabetes mellitus (%)	30	34	.043
Previous AMI (%)	45	44	
History of UAP (%)	60	60	
History of ulcer (%)	14	18	.02

ACS = acute coronary syndrome; AMI = acute myocardial infarction; ECG = electrocardiogram; ED = emergency department; UAP = unstable angina pectoris.
*Includes Asian, black, and Hispanic.
†Obtained from census data based on patient's zip code.
‡Abnormal ECG defined as ≥ 1 mm ST-segment elevation or depression, elevated or inverted T waves, or pathologic Q waves.
§Predicted risk of ACS calculated using a validated predictive model based on patient age, sex, chief complaint, and ECG variables.[23]
‖Killip classes defined as I = no evidence of congestive heart failure; II = basilar rales only; III = pulmonary edema without shock; IV = pulmonary edema with shock.[22]

covariate instead of ED volume, hospital type remained a significant predictor of failure to hospitalize (OR 2.7, 95% CI 1.1–6.7). Adjusting for type of health insurance increased the adjusted difference in ED discharge rates between private and public hospitals (the OR for the hospital type variable increased to over 4); patients with commercial and/or Medicare health insurance were more likely to be discharged from either type of hospital than patients with Medicaid or no health insurance.

The results of the second method, "traditional" regression models, are shown in Table 4. Hospital funding status was a consistently significant predictor, regardless of model covariates, and the magnitude of its effect was relatively stable (OR 3.2–4.2). Repeating the analyses using GEE, the ORs for the hospital type variable did not change and remained significant, although the width of the 95% CI increased.

In the third method using propensity scores, the resulting OR for patients discharged from a public versus private hospital ED was 3.9 (95% CI 1.6–9.4).

Sensitivity Analyses

Because one public hospital had a much higher rate of not hospitalizing patients with ACS than any other hospital, we repeated the analyses excluding this hospital. This decreased the failure to hospitalize rate for public hospitals to 3.2% (17 of 539 patients; $p = .002$ for the difference between private and public hospitals). After adjustment for age-sex categories, median household income, ACS severity, primary symptom of chest pain, chest pain on presentation, and hospital size, the OR for a patient with ACS discharged from a public versus private hospital ED was still significantly higher (2.7; 95% CI 1.2–6).

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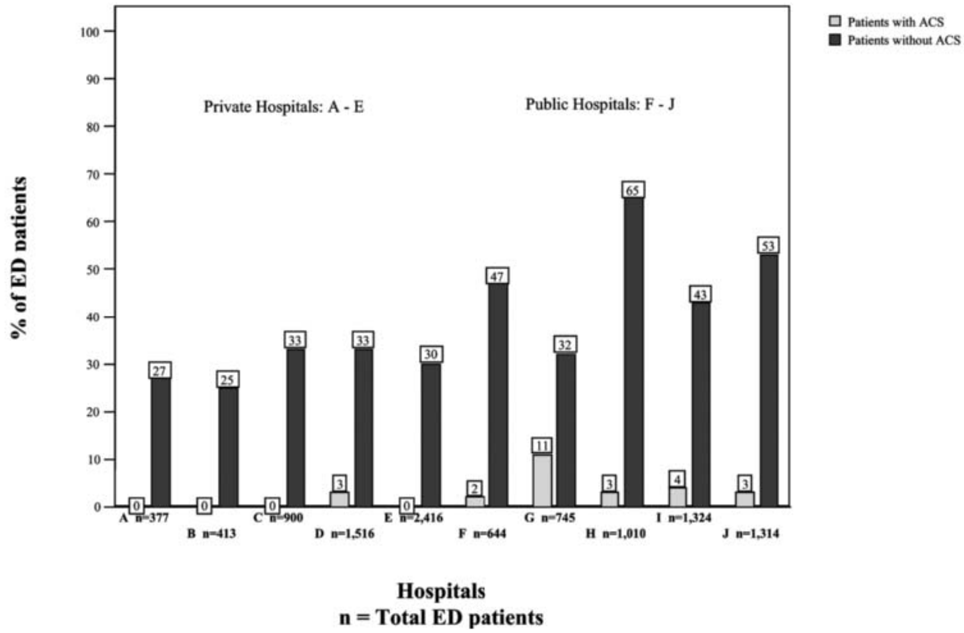

FIGURE 1 Proportion of emergency department (ED) patients with and without acute coronary syndrome (ACS) discharged from each hospital.

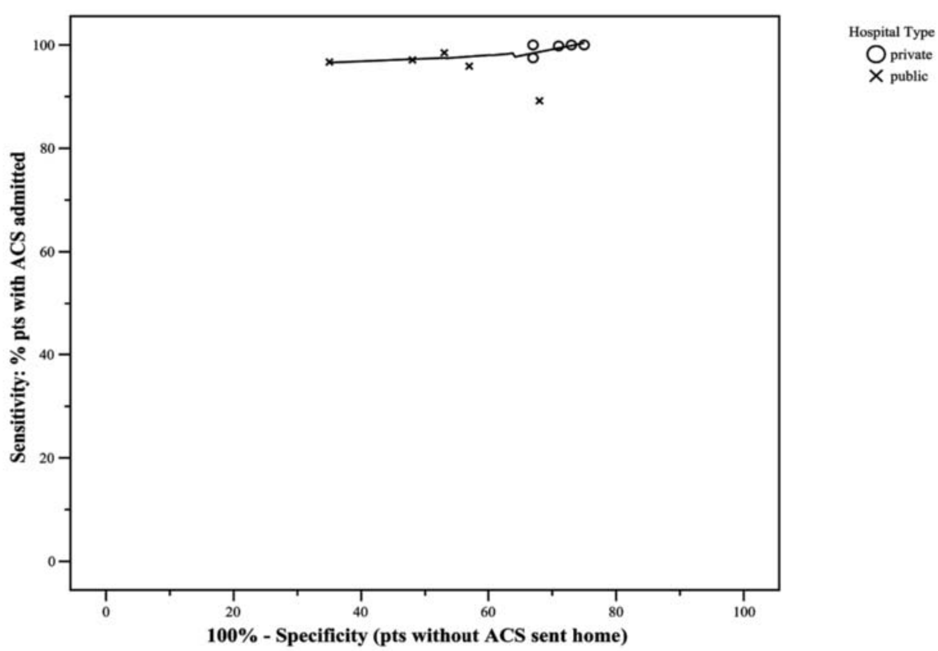

FIGURE 2 Overall accuracy of emergency department triage among private and public hospitals. ACS = acute coronary syndrome.

We also tested whether the difference in ED discharge rates may have been due to higher overall hospitalization rates (ie, hospitalization of patients with and without ACS) at private hospitals (see Figure 2). After adjusting for age, sex, race, and household income, patients seen at public hospital EDs, irrespective of ACS status, were more likely to be discharged than patients at private hospitals: OR for patients with ACS, 3.7; 95% CI 1.7–7.9; OR for patients without ACS, 1.5; 95% CI 1.3–1.7. Yet the magnitude of the difference in triage disposition was significantly larger for patients with ACS than for those without ACS: patients without ACS were 60% more likely to be discharged from public versus private hospital EDs compared with a four-fold unadjusted difference for patients with ACS (p value for the interaction term ACS status * hospital type = .01).

30-Day Mortality Outcomes

Overall, 6% of all patients with ACS died within 30 days of ED presentation: 5.9% at private ($n = 72$) and 6.5% at public hospitals ($n = 37$) ($p = .7$). Although the mean predicted mortality for patients with ACS was the same for both hos-

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TABLE 3 Effect on the Odds Ratio for Patients with Acute Coronary Syndrome Not Being Hospitalized at Public versus Private Hospitals: Sequential Addition of Variables

Variables Added at Each Step	n *for Each Model*	*Odds Ratio for Hospital Type*	*95% Confidence Interval*
Hospital type (public vs private)	1,856	4.2	2.2–8.2
Age-sex*	1,856	4.1	2.1–8.1
Race (white vs nonwhite)	1,853	3.9	1.9–8.2
Chest pain is primary symptom	1,853	3.8	1.8–8.0
Symptoms present in ED	1,853	3.8	1.8–8.0
ACS severity (UAP, Killip class I, Killip classes II–IV)†	1,853	3.7	1.8–7.8
ED volume (low vs high)‡	1,853	3.9	1.8–8.2
History of AMI or UAP	1,835	3.9	1.9–8.4
SOB as a presenting symptom	1,809	5.1	2.3–11.1
Household income§	1,770	4.6	2.1–10.4

ACS = acute coronary syndrome; AMI = acute myocardial infarction; ED = emergency department; SOB = shortness of breath; UAP = unstable angina pectoris.
*Four categories as described in the Methods section: female < or ≥ 55 years of age; male < or ≥ 55 years of age.
†Defined as in Table 2.
‡Low: 35,000 annual ED visits; high: > 50,000 annual ED visits.
§Based on patient's zip code, obtained from census data.

TABLE 4 Effect on the Odds Ratio for Patients with Acute Coronary Syndrome Not Being Hospitalized at Public versus Private Hospitals: Multivariable Models

Variables Added to Base Model	n *for Each Model*	*Odds Ratio for Hospital Type*	*95% Confidence Interval*
Base model: age-sex categories, race, and household income*	1,814	3.7	1.7–7.9
ACS severity*	1,814	3.6	1.7–7.7
Normal ECG*	1,411	3.6	1.6–8
Chest pain in ED	1,814	3.7	1.7–7.8
SOB as a presenting symptom	1,786	4.9	2.2–10.8
Predicted probability of ACS*	1,609	3.5	1.6–7.5
Symptom duration	1,547	4.0	1.7–9.9
Comorbidities: diabetes mellitus, previous AMI or UAP, stroke, or ulcer	1,717–1,796	3.8–3.9	1.8–8.4
Cardiac unit bed availability	1,582	3.2	1.4–7.4
Hospital has a department of emergency medicine	1,814	4.2	1.8–9.7

ACS = acute coronary syndrome; AMI = acute myocardial infarction; ECG = electrocardiogram; ED = emergency department; SOB = shortness of breath; UAP = unstable angina pectoris.
Variable definitions as in Table 2.

pital groups (4%), the actual mortality rate of those discharged from public hospital EDs was nearly three times that predicted, although not statistically significant: no deaths among patients with ACS who were discharged from private hospitals compared with three deaths (11%) among patients with ACS discharged from public hospitals ($p = .2$).

DISCUSSION

Our analysis of a multicenter study of 10,659 ED patients shows that ED triage of patients presenting with symptoms of possible ACS may differ between public and private hospitals. In our study, the rate of discharge of patients with ACS from publicly funded hospitals was 4.4%, whereas the rate from privately funded hospitals was 1.1%. This difference in the rate of inadvertent discharge of patients with ACS remained significant even after controlling for many patient and institutional factors that may also affect hospitalization decision making. Indeed, in this study, hospital type (public vs private) was an influential predictor of the likelihood of ED discharge. Interestingly, certain clinical features made the odds of inappropriate discharge from a public hospital for a patient with ACS

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even higher; patients presenting with SOB (and not necessarily as a chief complaint), a history of diabetes mellitus, coronary artery disease, stroke, or ulcer and with a longer duration of symptoms at presentation were more likely to be inappropriately discharged from public versus private hospitals.

It is tempting to describe these large differences in triage practices between the public and private hospitals in our study as indicating lower-quality care in publicly funded hospitals for patients with suspected ACS. However, our results are more complex. Although it is clear that the sensitivity of triage for ACS in these public hospital EDs is lower than at the private hospitals, it is also apparent that the specificity of admission is considerably higher. Indeed, based on the receiver operator characteristic (ROC) curves shown in Figure 2, the capacity to discriminate between true cardiac ischemia and symptoms and signs that mimic it appears to be roughly equal in both types of institutions. That is, a single curve connects the 10 points, indicating that the hospitals perform along the same ROC curve, reflecting the same diagnostic performance and the same trade-off between sensitivity and specificity. However, Figure 2 also shows that along the same curve, the points representing the public hospitals and the points representing the private hospitals are aggregated on opposite sides of an apparent threshold. Thus, rather than having better diagnostic acumen, the private hospitals are operating at a section on the curve that minimizes false-negative results while accepting more false-positive results. This highlights the fact that the major influence on public hospitals is pressure or a preference for not admitting patients rather than different diagnostic performance and thereby accepting more false-negative results while reducing false-positive results.

One possible explanation for the difference in triage decisions among ED physicians at public versus private hospitals could be the differences in the patient populations, including symptom presentation and the prevalence of true ACS. Our results show that the patient populations presenting to public and private EDs did, indeed, differ. For example, in our study, patients with ACS who presented to public hospitals may have appeared to be "less sick." They were, on average, younger, had lower predicted probabilities of ACS, waited longer before coming to the ED, and more often had a normal ECG than patients presenting to private hospital EDs. Additionally, patients with or without ACS presenting to public hospitals were more likely to present with "atypical" complaints, such as nausea and dizziness, in addition to "chest pain." Perhaps the presence of multiple complaints could have made the diagnosis of ACS more difficult. Furthermore, the prevalence of true ACS was lower among patients presenting to public versus private hospital EDs.

The differences between the patient populations presenting to public versus private hospitals may transcend symptom presentation and disease prevalence. Public hospitals care for indigent, disadvantaged, and immigrant populations, specifically those who do not have other health care options, who do not receive preventive or continuity care, and who are often themselves burdened with substantial social problems that might be eased—even temporarily—by hospital admission.[26] A major role for the public-hospital ED physician is to sort out such patients from those who actually meet the medical criteria for admission. Again, this environment may engender a more discriminating style of practice, designed to protect the medical commons against the perpetual threat of inappropriate use.

Thus, a bayesian explanation to the findings could explain the differences in triage decision making among public and private ED physicians: the lower prevalence of ACS and atypical and possibly more complex presentations among patients presenting to public EDs may lead public hospital ED physicians to operate on the section of that curve that minimizes false-positive results and maximizes true-negative results.

Another possible explanation for the findings we observed is the differences in funding and reimbursement sources between public and private hospitals. Private hospitals are more likely to be reimbursed for each patient admitted, whereas public hospitals cannot rely on health insurance reimbursement and are more likely to have a fixed budget. These different reimbursement modalities may potentially "shift" the orientation of the ED physician working in each of these settings. Whereas private hospital ED physicians may admit any patient who might possibly have ACS (especially when beds are not filled), public hospital ED physicians must also act as the guardian of a "medical commons." That is, their responsibility to protect limited medical resources from inappropriate use becomes relatively more important compared with that of their colleagues practicing in private hospitals. Indeed, private hospitals admitted a higher proportion of patients without ACS compared with public hospitals (48 vs 30%).

The consequences of health care disparities, whatever the cause, may themselves disproportionately affect those most disadvantaged. In our study, the mortality rate for patients with ACS discharged from public EDs, albeit a small sample, was three times the rate predicted by the severity of the patients' symptoms at ED presentation.

To our knowledge, this is the first study evaluating ED triage of patients with suspected ACS in public versus private hospitals, and there have been only a few studies evaluating the quality of care differences in other domains. One study showed that teaching and privately owned hospitals had higher scores on several quality of care indices.[27] A study of mortality rates for 20 different medical and surgical conditions showed a 40% increase in risk-adjusted mortality at public teaching hospitals compared with private teaching hospitals.[28] In a study by Hartz and col-

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leagues, both teaching and nonteaching public hospitals were found to have higher mortality rates than private nonprofit hospitals after adjustment for severity of illness, patient race and ethnicity, and health insurance type.[29]

LIMITATIONS

There are several limitations to our study. First, the data were collected in 1993 and may not reflect current practice, which includes use of new biomarkers and ED-based chest pain units. However, chest pain units are not available in all hospitals, and biomarkers are often obtained after the decision to admit.

Second, the clinical trial was not explicitly designed to evaluate disparities in ED triage between public and private hospitals, and the included hospitals are not necessarily representative of public and private hospitals generally. For example, regional differences between the hospitals may have also played a role, although there is some evidence that regional differences are less important among teaching hospitals.[27–34] We also categorized hospitals on other institutional differences, such as ED volume, hospital size, CCU bed availability, and the presence of an ED residency program, ED residents in the ED, or a separate department of emergency medicine, and found that none of these factors were significantly associated with differences in triage.

Despite its limitations, our study demonstrates the importance of considering hospital characteristics in investigations of health care delivery. Unfortunately, studies evaluating disparities in health care have focused on patient characteristics, without consistently including the effects of institutional factors that may contribute to such disparities or how institutional factors affect disparities associated with patient characteristics.[35–41] In our study, for example, although race appeared to be an independent determinant of ED triage when considering patient-level variables, this effect was not found after adjustment for hospital funding status type. Other studies have found that racial disparities may be minimized after adjustment for institutional factors[42] or even eliminated when access to care is equalized.[19,43] Given the geographic distribution of minorities in large urban areas and the generally stated emergency medical system practice of transporting patients to the closest hospital, it is possible that the racial differences in treatment for AMI may be due in part to transport of patients to hospitals with different evaluation and treatment capacities and practices. Thus, some of the observed differences in the health care of nonwhite or disadvantaged patients may, in fact, be due to concentration of their care at institutions with differences in evaluation and/or treatment capabilities.

In conclusion, assessments of type and quality of health care provided to patients must include the settings in which the care is provided. The growing evidence of differential health care in this country provides even more reason to focus on remedying the institutional factors that contribute to health care disparities. The results of this analysis should be used to stimulate prospective study of the patient, physician, and system factors and their interactions and the effect of financial constraints that contribute to disparities in health care access and provision.

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