UNIVERSITY OF NORTH TEXAS
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1970

Dinesh Boppana, The Association Between Medical Insurance Coverage, In-hospital Case Fatality Rate and Length of Hospital Stay Following Admission for Acute Myocardial Infarction in Texas Hospitals. Master of Public Health, July 2002, 53pp., 22 tables, bibliography, 63 titles.

This study reports the possible association between type of medical insurance coverage, in-hospital case fatality rates and length of hospital stay following admission for acute myocardial infarction (AMI) in Texas hospitals for the year of 1999.

Methods. The data source was the Texas Health Care Information Council public use data file. Crude and multivariable-adjusted analyses were used to examine the relation between type of medical insurance coverage, length of hospital stay and in-hospital case-fatality rates following AMI.

Results. Relative to the referrent group of private or commerical insurance patients (odds ratio, 1.0) the multi-variable adjusted odds for dying during acute hospitalization were 1.98 (95 % CI, 1.53-2.52) for Medicaid, 1.45 (95 % CI, 1.27-1.64) for Medicare. The mean length of hospital stay in days after excluding patients with a prolonged hospitalization was 8.53 (95% CI, 7.93-9.14) for Medicaid, 6.75 (95%CI, 6.52-6.95) for Medicare, and 5.58 (95% CI, 5.37-5.79) for commercial insurance.

Conclusions. The findings suggest that patients enrolled in Medicaid and Medicare insurance program had increased in-hospital mortality, and higher length of hospital stay following admission with AMI when compared to the patients enrolled in commercial insurance.

THE ASSOCIATION BETWEEN MEDICAL INSURANCE COVERAGE, IN-HOSPITAL CASE FATALITY RATE, AND LENGTH OF HOSPITAL STAY FOLLOWING ADMISSION FOR ACUTE MYOCARDIAL INFARCTION IN TEXAS HOSPITALS

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THESIS

Presented to the School of Public Health

University of North Texas
Health Science Center at Fort Worth

in Partial Fulfillment of the Requirements

for the Degree of

Master of Public Health

By

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Fort Worth, Texas
July 2002

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CHAPTER 1

INTRODUCTION

The health care system in the United States has undergone dramatic changes in the last decade. There has been an effort to control the cost of health care, and a number of policies have been initiated to attain this goal. Health maintenance organizations (HMOs) control their costs by using a number of strategies including limiting admissions and referrals, and reducing the utilization rates of procedures. There is concern that these restrictive guidelines may adversely affect the clinical outcomes (Paul, 2000). Patients with different type of health insurance but similar types of medical problems may receive different treatment strategies, as well as intensity of treatment, with varying short-term and long-term outcomes. Concern exists among physicians and other health care professionals that managed care patients may receive substandard care that may be related to poorer outcomes (Kreindel, Rosetti, Goldberg, Savageau, Yarzebski, Gore, Russo, and Bieglow, 1997).

According to the American Heart Association, the costs for all cardiovascular diseases in the U.S. in 2001 exceeded $298 billion (AHA, 1999). Acute myocardial infarction is the leading cause of death in the U.S., for both men and women (Mortality and Morbidity Weekly Report, 2001). Acute myocardial infarction (AMI) represents a disease that frequently results in extensive utilization of hospital resources. In 1996, an estimated 731,868 patients were discharged from U.S. with the primary diagnosis of AMI, incurring $15.6 billion in hospital charges (Brooks, McClellan, Wong, 2000). According to the American Heart Association nearly 1.1 million persons will suffer a recurring or new heart attack every year in the U.S. (AHA, 1999).

Although the causes of cardiovascular disease are well documented, less is known about why there are differences in the population groups. One approach to this problem is to look at factors that affect the treatment and detection of cardiovascular disease. Some of these factors include differences in the treatment between males and females, differences in access to health care among different ethnic groups and differences in health care outcome for cardiovascular disease among the insured and under-insured.

Objectives

The purpose of this study is to examine the association between the type of medical insurance coverage, in-hospital case fatality rates and length of hospital stay following admission for acute myocardial infarction in Texas hospitals for the year 1999. Specific objectives include:

1) To describe selected characteristics of patients admitted to Texas hospitals with a principal diagnosis of acute myocardial infarction;
2) To determine if the differences in distribution with respect to type of insurance are associated with the patient discharge status;
3) To determine if the length of stay following admission for AMI is associated with patient's type of insurance.
4) To determine if demographic characteristics of age, gender, and race/ethnicity are associated with discharge status or the length of hospital stay.

Hypotheses

The major research question addressed is the relationship between the type of insurance and the outcome following acute myocardial infarction. Two hypotheses guided this study:

HI. Patients enrolled in Medicare or Medicaid has a higher case fatality rate than patients enrolled in commercial insurance after adjusting for available risk factors.

H2. Patients enrolled in Medicare or Medicaid has a greater length of stay than patients enrolled in commercial insurance after adjusting for available risk factors.

CHAPTER 2

REVIEW OF LITERATURE

Definition of myocardial infarction

The term necrosis describes the death or necrosis of myocardial cells. Atherosclerotic heart disease is the most common underlying cause of myocardial infarction. The left ventricle is the predominant site of infarction, however, right ventricular infarction coexists with the infarction of the inferior wall of the left ventricle. The appearance of the pathological Q waves is the most characteristic ECG finding of transmural myocardial infarction of the left ventricle.

During acute myocardial infarction the central area of the necrosis is generally surrounded by an area of injury, which in turn is surrounded by an area of ischemia. Thus, various stages of myocardial damage can coexist. Transient myocardial ischemia that produces T wave, and sometimes ST segment abnormalities, can be reversible without producing permanent damage and is not accompanied by serum enzyme elevation. Two types of myocardial infarction can be observed electrocardiographically: Q wave infarction, which is diagnosed by pathological Q waves and is also called transmural infarction. However transmural infarction is not always present, hence, the term Q wave infarction may be preferable for ECG description. Non-Q wave infarction is diagnosed in the presence of ST depression and T wave abnormalities. Elevation of serum enzymes is expected in both types of infarction. In the absence of enzyme elevation, ST and T wave abnormalities are interpreted as due to injury or ischemia rather than infarction. The ECG is regularly used to localize the site of ischemia and infarction. The location of the infarct can be detected fairly accurately from the analysis of the 12-lead ECG. The classic changes of necrosis (Q waves), injury (ST elevation), and ischemia (T wave inversion) may all be seen during infarction (MedicineNet, Inc., July 2, 2002).

Prompt initiation of therapy is the central goal in the management of patients with AMI. This approach is based largely on the results of trails of the thrombolytic agents, which have demonstrated that the life saving benefits of these drugs are time dependent (Weaver, 1995; The Lancet Publishing Group, 1986; The Gusto Investigators, 1993; Late Study Group, 1993). However for many patients there are long gaps between the onset of symptoms and delivery of care. Some of this delay occurs in the hospitals but about two- thirds of the time to therapy is attributable to delays between symptom onset and hospital arrival (Newby et al., 1996). In addition although studies indicated that older age, female gender, and diabetes are associated with delayed presentation, association with other clinical issues and with race and socioeconomic characteristics have yet to be fully characterized (Weaver, 1995; Schmidt, 1990; Yarzebski, 1994; GISSI Study Group, 1995; Maynard, 1989; Goff, 1999; and National Heart Attack Alert Program Coordinating Committee, 1993).

Time to treatment

Narrowing the gap between symptom onset and hospital arrival time can impact AMI outcomes substantially. However, the National Registry for Myocardial Infarction data show the interval from symptom onset to hospital arrival decreased only marginally between 1990 and 1999 (Rogers et al., 2000). Certain groups of patients with AMI including the women, elderly, diabetic patients, and minorities, exhibit delays to hospital arrival and treatment in the emergency setting. Patients with higher education levels, professional occupations, and private health insurance arrive at the hospital sooner and receive treatment more quickly (Gibler et al., 2002).

Time to treatment in AMI has been of great interest since the advent of thrombolytic therapy. The rapid achievement of reperfusion, with either thrombolysis or primary angioplasty minimizes the infarct size, reduces the degree of left ventricular dysfunction and improves survival. Recent studies have confirmed the benefits of reducing the time to treatment to thrombolysis (between onset of pain to initiation of thrombolysis) and that of more rapid drug reperfusion time with more aggressive thrombolytic regimens (between the initiation of thrombolytic therapy and actual achievement of reperfusion). Furthermore, their affects are additive (and in some cases synergistic) confirming the benefits of rapid reperfusion. For primary angioplasty, the same relationship has been observed. More rapid treatment seems to be associated with improved outcome. The "door-to-balloon" time is a major determinant of overall time to reperfusion and, as such is a crucial component of overall strategy. This approach can also be extended to the pre-hospital phase of treating AMI in two ways: 1) for patients to rapidly identify the symptoms of AMI and to present earlier to the hospital is critical in reducing the overall time to treatment and 2) in emergency medical care, rapid identification of AMI patients, electrocardiographic monitoring, and defibrillation as needed for ventricular arrhythmias has been shown to be lifesaving (Cannon, 1998).

One of the major limitations in realizing the full potential of life saving effects of thrombolytic therapy has been the failure to initiate the treatment in the first 1 to 1.5 hours after symptom onset. The barriers to early treatment include the following: 1) most patients fail to react rapidly and appropriately to symptoms; 2) few emergency medical/paramedic systems have established effective triage systems for patients or have implemented pre-hospital electrocardiography to better manage patients with possible AMI and; 3) time to treatment after hospital arrival currently averages 1 to 1.5 hours which is two to three times longer than should be necessary to initiate therapy in the patient with typical electrocardiographic and clinical findings and co-morbid risk factors. Trails evaluating the effects of pre-hospital-initiated therapy have all shown trends towards a reduction in mortality (18%) associated with early treatment; however none has been large in and of itself to be conclusive (Weaver, 1995).

Length of Hospital Stay

Between 1990 and 1999 the median duration of hospital stay related to AMI in the U.S. dropped from 8.3 to 4.3 days (Tiefenbrunn, Chandra, French, Gore, & Rogers, 1998). Thrombolytic treatment reduces mortality in patients with AMI, but is associated with recurrent thrombotic events after admissions, consequently it is unclear whether current practices of early hospital discharge after thrombolytic treatment are safe (Wilkinson, Stevenson, Ranjadayalan, Marchant, Roberts, & Timmins, 1995). Payer status may be associated with use and appropriateness of invasive cardiac procedures but it may not be associated with the length of hospital stay after AMI (Sada, French, Carlise, Chandra, Gore, & Rogers, 1998). Health care strategies that shift the care of elderly patients from cardiologists to primary care physicians lower rates of resources (and potentially lower costs), but they may also cause decreased survival. Additional information is needed to elucidate how primary care physicians and specialists should interact in the care of severely ill patients (Jollis et al., 1996).

Mortality

Between 1990 and 1999 the in-hospital AMI mortality decreased from 11.2 to 9.4 percent in the U.S. (MMWR, 1999). Findings show that mortality rate increases for very 30 minutes that elapse before a patient with ST- segment elevation is recognized and treated (French, 2002). "Door-to-balloon" times of over two hours were associated with increased hospital mortality among patients undergoing primary angioplasty (Cannon, 2002).

In patients with AMI, those admitted to staff model health maintenance organizations were less likely to undergo invasive cardiac procedures than patients admitted to fee-for-service hospitals Although no major differences in hospital mortality have been reported, their remains a concern that the cost reduction strategies used by managed care organizations could result in reduced quality of care in hospitalized patients (Berwick, 1996). Other studies point to a higher risk-adjusted mortality among Medicaid patients than in other payer groups. The mortality differences persisted even after incorporating treatments such as coronary angioplasty and bypass surgery into the adjustment models (Gornick, et al., 1996). Socioeconomic status affects not only death rates but also event rates and chance of admission. This should be taken into account when different groups of patients are compared. Because social deprivation is associated with more deaths outside of the hospital, primary and secondary preventions are more likely than acute hospital care to reduce the socioeconomic variation in mortality (Morrison, Woodward, Leslie, & Tunstall-pedoe, 1997). Disadvantaged patients receive fewer specialized procedures because of higher levels of severity and financial barriers (Shen, Wan, & Perlin, 2002).

Gender

After a first AMI, elderly women experience a more complicated hospital course than elderly men. The increase in mortality risk seems to be related to the impact of cardiovascular risk factors on left ventricular function more than to gender itself (Bueno, Vidan, Almazan, Lopez-Sendon, & Delcan, 1995). There are considerable differences in the diagnosis and treatment of AMI between men and women of different ethnicities.

Women are also less likely to receive thrombolytic therapy, cardiac catheterization, coronary bypass surgery, aspirin, heparin, beta-blockers in the treatment of coronary artery disease (Chandra, et al., 1998).

Table 1

Age-Adjusted Death Rates for Acute Myocardial Infarction for Males and Females Aged > 35 Years Based on Race and Ethnicity in the U.S in 1998.

	Male		Female	
	Number	Rate	Number	Rate*
White	95,617	196.7	85,248	113.2
African-American	9,185	198.7	9,873	140.4
Hispanic	3,735	121.6	3,102	76.7
Asian/Pacific islander	1,417	109.1	607	62.2
American Indian	377	120.9	268	69.3

* Rate per 100,00 population.

Source: Mortality and Morbidity Weekly Report. February 16, 2001, 50(06), 90-3.

Studies show that women younger than 50 years were twice likely to die within hospital after an AMI than men in the same age group (Vaccarino, Parsons, Every, Barron, & Krumhozl, 1999). Relative to the appropriate comparison groups, hospitalization for an AMI increases the risk of death and the total costs and length of stay of subsequent hospitalization for women more than for men. Therefore increased primary prevention, diagnosis, and treatment efforts should be directed towards women (Wolinsky, Wyrwich, & Gurney, 1999). In-hospital complications of heart attack are similar in women and men. In-hospital mortality after heart attack is slightly higher in women. Mortality 1 to 3 years after hospital discharge is similar, and possibly slightly better, in women. Beta-blockers substantially improve survival after heart attack in women and possibly are greater benefit to women than men. Despite this, women are less likely to be prescribed a beta-blocker (MedicineNet, Inc., July 2, 2002).

Most of the 1 million U.S. patients who suffer a heart attack each year are candidates for reperfusion therapy. In a study of nearly 27,000 Medicare beneficiaries who met the strict criteria for reperfusion therapy between February 1994 and July 1995 only 44 percent of eligible African-American women received the treatment compared with 59 percent of White men, 50 percent of African-American men, and 56 percent of white women (Canto, et al., 1998). This study of over 12,000 women and men treated for heart attack in Seattle area hospitals between 1998 and 1994 found that even after accounting for differences between men and women in cardiac procedures, age, and health factors, the women were still 20 percent more likely to die than men. Women also were less likely than men to receive thrombolytic therapy promptly or undergo coronary angiography, angioplasty, or bypass surgery (Maynard, Every, Martin, Kudenchuk, & Weaver, 1997). Chen and Taylor (1994) have reported that women are also more likely to have increased length of hospital stay compared to men.

Race

Barron, et al. (1998) reported that although African-Americans are less likely to receive thrombolytic therapy and coronary artery bypass surgery, there are no significant differences in in-hospital mortality between African-Americans and Whites. Patients from ethnic minorities are also less likely to undergo reperfusion therapy. African-Americans have an increased rate of cardiac events after AMI, and a lower socioeconomic status may contribute to the adverse outcome in this ethnic group (Nakamura, Moss, Brown, Kinoshita, & Kawai, 1999).

The precise role of ethnicity in access to cardiovascular procedures is unknown, particularly because of difficulty in isolating ethnicity from financial and other socioeconomic factors (Taylor, Meyer, Morse, & Pearson, 1996). A study funded by Agency for Healthcare Research and Quality finds that African-American Medicare beneficiaries, regardless of gender, are significantly less likely than Whites to receive reperfusion therapies. The study, conducted by researchers at the University of Alabama at Birmingham, adds to the current body of evidence on racial disparities in access to health care. According to the researchers, the reasons for the lower rate of reperfusion therapy use in African-Americans are not readily apparent, but they may include the preferences of the patient, the expertise and preference of the physician, hospital barriers to treatment, or unrecognized differences in patients symptoms associated with race. Other likely explanations are clinical ambiguity about the treatments, physician's own preferences or biases. Finally cultural barriers may have contributed to racial disparities in the administration of these therapies (Canto, et al., 2000).

Recent increases in the number of Americans without health insurance have spurred research designed to identify factors related to non-coverage. One study indicates that even after accounting for health insurance correlates such as education and income, non-Hispanic African-Americans and Hispanics have significantly higher probabilities of not having insurance coverage than their non-Hispanic White counter parts (Pol, Mueller, & Adidam, 2002).

Age

Recent studies have shown that younger women are more likely to die during and after hospitalization for AMI than older women and men of all ages (Xue, Taha, Reddy, Wright, & Aufderheide, 2001). The majority of persons sustaining AMI are older, and in these older persons morbidity and mortality are high (Tresch, 1998). Clinical presentations and characteristics are significantly different between older and younger infarction patients. Older infarction patients are more likely to be female and to have a history of heart failure, but they are also less likely to have a family history of myocardial infarction, elevated cholesterol, or to smoke (Frishman, 1993). Older patients will frequently have unrecognized or silent myocardial infarction or, when present, symptoms will be atypical. Instead of chest pain, older patients may have shortness of breath or neurological symptoms, such as confusion. Also, older infarction patients will delay longer in seeking medical assistance after onset of symptoms, and often will not demonstrate ST elevation or Q waves on their electrocardiograms (Tresch, 1998). Not infrequently, older infarction patients will demonstrate major complications such as heart failure or right ventricular infarction on hospital admission, and their presenting complaints will reflect these complications (Tresch, 1998).

Older patients often have medical conditions that may aggravate coexisting cardiovascular problems or interfere with conventional pharmaco-therapy (Frishman, 1993). For these reason many physicians who treat cardiovascular problems aggressively in younger patients are reluctant to do so in older individuals. A study by Mehta, et al., (2001) also indicated significant age-associated differences in clinical characteristics in elderly patients with AMI, which account for some of the age-associated differences in mortality. The study also reported that grouping older patients together as a single age group may obscure important age-associated differences.

Table 2

Age-Specific Death Rates for Acute Myocardial Infarction in United States, 1998

Age Group	Number	Rate*
<25	88	0.1
25-34	488	1.3
35-44	3,489	7.8
45-54	11,196	32.4
55-64	22,227	98.0
65-74	43,730	237.7
75-84	66,288	554.6
85+	56,038	1,382.4

Rate per 100,000 population. Source: Mortality and Morbidity Weekly Report

Insurance status

Approximately 5 million Medicare patients receive care from HMOs, representing a 360 % increase since 1991. 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 (Kassirer, 1994; Demaria, 1994; Miller, 1997). 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 have 24-hour telephone triage systems and patient education to encourage patients with acute conditions to use emergency transportation to the hospital. HMOs may also more likely to establish quality-improvement systems (e.g., treatment protocols or clinical pathways) (Miller, 1997).

Patients with Medicaid insurance who are treated for AMI are less likely to undergo invasive procedures than are those of other forms of insurance. However, the Medicaid population differs from other insurance groups in terms of age, sex and race mix, socioeconomic status (SES), and the prevalence of coexistent illness (Every, 1995; Leape, 1999).

Medicaid patients receive their care in hospitals with characteristics and clinical services different than those of hospitals that provide care to other groups (Lepae, 1999; Every, & Larson, 1993). Thus, lower procedure use among patients of low SES may be symptomatic of more global treatment preferences based on age, gender, race, coexistent illness, insurance, or hospital-to-hospital variation (Gurwitz, et al.2002). Conversely, low

SES may have an independent influence on the delivery of care for coronary artery disease or AMI. In a study of patients with coronary artery disease who had undergone catheterization, Leape, and colleagues (1999) noted that PTCA and coronary arterial bypass graft under-utilization was greater among patients treated at hospitals that do not provide these services on-site, with uninsured patients experiencing more under-utilization than those with private, Medicare, or Medicaid insurance. After adjustment for age, gender, and co-morbid illness, Carlise, Leake, Sharpiro, (1997) found that uninsured ethnic minority patients and minority patients with Medicaid, Medicare, and HMO insurance were less likely to undergo catheterization, PTCA, and CABG than were Whites within the same insurance class. Gornick, et al. (1996) reported that income-adjusted use of PTCA and CABG was lower among African-American Medicare beneficiaries than among White beneficiaries. Sada, et al.(1998) reported that Medicaid patients, a group presumed to be of low SES, undergo fewer invasive procedures after AMI than do HMO or indemnity patients.

In aggregate, these studies address important issues that surround race, insurance, and SES- based differences in the management of coronary artery disease and suggest that insurance may be an important modifier of the relationship between race or SES and the use of procedures. Philbin, et al. (2001) in their study noted that most of the Medicaid patients were older, were more frequently African-American and female, and had lower median household incomes. They also had a higher prevalence of hypertension, diabetes, renal disease, and peripheral vascular disease. After adjustment for these and other factors, Medicaid patients were less likely to undergo cardiac catheterization, percutaneous transluminal coronary angioplasty, and any revascularization procedure.

In a study conducted by Canto, et al.(2002) the possible association between payer status on management and subsequent survival in AMI was examined. Separate Cox regression analyses were performed for Medicare, Medicaid, HMOs, and commercial payer groups to ascertain variables that were predictive of mortality in the study population. The study concluded that no significant variations among the payer classes existed in the management and mortality among patients after acute myocardial infarction.

Another study by Canto, et al. (2000) examined the association between payer status and the utilization of hospital resources in AMI. A national cohort of 332,221 patients with AMI enrolled from June 1994 to July 1996 were compared within 5 payer groups to ascertain the influence of payer status on hospital resource allocation for AMI in the United States. The study concluded that significant variation by payer status existed in the management of AMI throughout the United States, but no important differences in mortality was observed among the Medicare, commercial, and HMO payer groups.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

The data source used in this study is from the Texas Health Care Information Council (THCIC) public use data file for the year 1999. It was created by the 74th Texas Legislature in 1995, and operates under the umbrella of the Texas Health and Human Services Commission. The THCIC public use data file contains information on individual hospital discharges from Texas hospitals for the year, 1999 (Texas Hospital Inpatient Discharge Public Use Data File). Patient identities are protected in the data file. The file contains demographic data about the patient, including age group, sex, race and ethnicity with some exceptions. The file also contains geographic data, including the patient's ZIP code, with some exceptions. Diagnosis and procedures are included. The primary source of payment is included, but hospital charges are not.

The following are the relevant list of data elements and definitions that were selected from the inpatient hospital discharge data file and used in this study:

1. Patient Sex-sex of the patient as recorded at date of admission or start of care. If ICD-9-CM indicates HIV diagnosis or alcohol or drug use gender is suppressed
2. Length of stay in days-Length of stay equals end of service date minus Admission/start of care date
3. Age of the patient on date of discharge

4. Patient Status-Code indicating patient status as of the end of service date for the period of care reported
5. Patient Race-Code indicating the patient's race.
6. Standard Source of Primary Payment-Code indicating standard source of the primary payment
7. Patient Ethnicity-Code indicating the Hispanic origin of the patient
8. Principal Diagnosis Code-Full ICD-9-CM diagnosis code, including the 4th and 5th digits if applicable, that describes the principal diagnosis, the condition established to be responsible for causing the hospitalization or use of other hospital services.

Analysis

The objective was to examine possible associations between medical insurance coverage and in-hospital case-fatality rates and length of hospital stay in a large number of patients with acute myocardial infarction after controlling for a variety of confounding that might affect these end points. All the patients with a discharged diagnosis code of AMI were included irrespective of other criteria. Patients who had a hospital length of stay of more than sixty days were excluded. Information on all hospital discharges in Texas during 1999 with International Classification of Diseases, Ninth Revision, and Clinical Modification (ICD-9-CM) codes 410.0-410.9 in the principal diagnosis was obtained from the data file. This method of case selection, based on ICD-9-CM, identified a cohort of patients whose principal diagnosis was acute myocardial infarction, irrespective of procedures coded or diagnosis related group assigned.

The study sample was classified into five mutually exclusive medical insurance coverage groups based on their expected source of payment at the time of hospital admission. The five groups were self-pay or other, private or commercial insurance, Medicaid, Medicare and membership in a HMO. Self-pay/other included payment for hospitalization that was expected from patient, spouse, family or next of kin , or workers' compensation. Medicaid included patients covered by governmental source and provided to medically indigent patients. Medicare included patients aged 64 years or older whose payment was covered by governmental source or patients entitled to Social Security. Commercial or private insurance included patients whose payment was provided by non-governmental sources and covered under traditional indemnity plans or a commercial carrier. HMO included patients who had a membership in a health maintenance membership which included CHAMPUS and Blue Cross.

Differences in distribution of selected characteristics between patients with AMI in each of the five insurance groups were examined with the use of chi-square tests for discrete variables and analysis of variance for continuous variables. The simultaneous effect of several potentially confounding variables that might influence in-hospital case fatality rate in different insurance groups were controlled by logistic regression analysis. Variables such as patient's age, gender, race, can be potentially confounding variables. Regression analysis was used to examine the association between insurance coverage and length of the hospital stay while controlling for selected covariates.

CHAPTER 4

RESULTS

Descriptive Results

The study population consisted of 36,320 subjects of whom 21,827 (60.1%) were males and 14,493 (39.9%) were females. The patients were stratified into five medical insurance groups for purposes of analysis (Table 3).

Table 3

Distribution of Patients by Type of Medical Insurance Coverage

Type of Insurance	n	Percent
Self-pay/other	3,654	10.1
HMO	1,599	4.4
Medicare	19,056	52.5
Medicaid	1,148	3.2
Commercial	10,863	29.9

Patients with Medicare coverage accounted for 52.5 % of the study population. Patients with commercial insurance coverage made up 29.9%, HMO were 4.4%, Medicaid 3.2% and self-pay/other made up 10.1% of the study population.

The age of the patients was stratified into two groups. 35-64 age group and 65+ age group. The age characteristics of the patients in the insurance groups are reported in Table 4.

Table 4

The Age Distribution of Patients by Insurance Groups

Type of Insurance	35-64*	Percent	65 +*	Percent
Self-pay/other	3,031	19.2	623	3.0
HMO	1,403	8.9	196	1.0
Medicare	1,656	10.5	17,400	84.7
Medicaid	1,037	6.6	111	0.5
Commercial	8,655	54.8	2,208	10.8

* Age of the Patient in Years

As expected the vast majority of patients aged 65 or above were in the Medicare group. Patients aged 35-64 were more often in the commercial insurance group.

The racial/ethnic characteristics of the patients in the insurance groups are reported in the Table 5. Seventy-four percent of the study population was White, 9.1% African-American, 0.8% Asian-Pacific Islander, 0.3% American-Indian/Eskimo and 15.8% was classified as others. Overall 15.9% of the population was of Hispanic origin.

Table 5

Racial/Ethnic Characteristics of the Patients by Insurance Type

Type of Insurance	White		African-American		Hispanic		Other	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Self-pay/other	2,115	59.0	385	10.5	884	24.2	230	6.8
HMO	1,186	74.2	116	7.3	202	12.6	95	5.9
Medicare	13,687	71.8	1,642	8.6	2,859	15.0	868	4.6
Medicaid	446	38.9	207	18.0	397	34.6	98	8.5
Commercial	7,917	72.9	897	8.3	1,419	13.1	630	5.8

Table 6

Chi-Square Test of the Racial Characteristics of the Patients

	Value	df	p-value
Pearson Chi-Square	920.75	12	<0.01
Likelihood Ratio	844.33	12	<0.01

The gender characteristics are reported in Table 7. 52.3 percent of patients enrolled in Medicaid were female and in commercial insurance, 23.7 % of the patients enrolled were females. Among males 47.7 % were enrolled in Medicare and 36.2% were enrolled in commercial insurance group.

Table 7

Distribution of Gender by Insurance Type

Type of Insurance	Male		Female	
	No.	Percent	No.	Percent
Self-pay/other	2,444	66.9	1210	33.1
HMO	1,148	71.8	451	28.2.
Medicare	9,787	51.4	9,269	48.6
Medicaid	548	47.7	600	52.3
Commercial	7,900	72.7	2,963	27.3

Table 8

Chi-Square Test of the Distribution of the Gender by Insurance Type

	Value	df	p-value
Pearson Chi-Square	1563.57	4	<0.01
Likelihood Ratio	1592.76	4	<0.01

Among females, the least number of patients were enrolled in HMO (3.1%) followed by 4.1% in Medicaid, whereas in males, the least number were enrolled in Medicaid (2.5%), followed by 5.3% in HMO. Also the percentage of males enrolled in commercial insurance (36.2%) was substantially higher than the percentage of females enrolled in the commercial group (20.4%).

Among the study population, there were 2,944 patients who expired after admission (8.1%) and 33376 patients who were either discharged/alive or admitted to another hospital or unit (91.9%). The patient vital status among the various insurance groups is reported in Table 9.

Table 9

Vital Status of the Patients by Insurance Type

Type of Insurance	Survived		Expired	
	No.	Percent	No.	Percent
Self-pay/other	3,456	94.6	198	5.4
HMO	1,547	96.7	52	3.3
Medicare	16,898	88.7	2,158	11.3
Medicaid	1,065	92.8	83	7.2
Commercial	10,410	95.8	453	4.2

Eleven percent of the patients enrolled in the Medicare expired while 5% of the patients enrolled in the commercial insurance group expired. Of Medicaid patients, 7.2 % died in-hospital.

Table 10

Chi-Square Test of the Vital Status of the Patients by Insurance Type

	Value	df	p-value
Pearson Chi-Square	578.11	4	<0.01
Likelihood Ratio	614.44	4	<0.01

Table 11

The Mean Length of Hospital Stay (in days) are reported in the Table 11

Mean Length of Hospital Stay (in days) by Insurance Type

Type of Insurance		95% Confidence Interval	
	Mean	Lower	Upper
Self-pay/other	5.51	5.33	5.68
HMO	5.01	4.75	5.28
Medicare	6.63	6.55	6.71
Medicaid	7.11	6.79	7.42
Commercial	5.00	4.90	5.10

Patients enrolled in the Medicaid program had the highest mean length of hospital stay of 7.11 days (95% CI, 6.79-7.42), while patients enrolled in the commercial insurance program had the lowest mean of length of hospital stay of 5.00 days (95% CI, 4.901-5.107). Patients enrolled in self-pay/other and HMO had similar mean lengths of hospital stay.

Table12

Test of Between-Subjects Effects

Source	Mean Square	F	Sig
Corrected Model	5559.02	186.07	<0.01
Intercept	1297670.69	43434.62	<0.01
Source of payment	5559.02	186.07	<0.01

Patients enrolled in Medicare had the mean length of stay of 6.63 days (95% CI, 6.55-6.71). The mean lengths of stay reported in Table 11 are the crude descriptive statistics without controlling for any potential confounding variables.

Analytic Results

The crude odds ratios by insurance types for the patients dying after admission are reported in Table 13. The commercial insurance group was used as the reference group. The odds ratios are 2.93 (95% CI, 2.64-3.25) for Medicare, 1.79 (95% CI, 1.41-2.28) for Medicaid, 1.32 (95 % CI, 1.10-1.56) for Self-pay/other and 0.77(95 % CI .58-1.03) for HMO.

Table 13

Crude Logistic Regression Model of Patients Vital Status by Insurance Group

Type of Insurance	Odds Ratio	95% CI Lower	95% CI Upper
Self-pay/other	1.32	1.10	1.56
HMO	0.77	0.58	1.03
Medicare	2.93	2.64	3.26
Medicaid	1.79	1.41	2.28
Commercial*	1.00	-	-

* Reference Group

The odds ratios for the racial/ethnic groups when compared to Whites are reported in Table 13. The odds ratio for African-American is 1.05 (95 % CI, .94-1.16), 1.03 (95 % CI, .91-1.19) for Hispanic and 0.92 (95% CI, .77-1.10) for other.

Table 14

Logistic Regression Model of Vital Status by the Race/Ethnic Groups

Type of Insurance		95% CI	
	Odds Ratio	Lower	Upper
African-American	1.05	0.94	1.16
Hispanic	1.03	0.91	1.19
Other	0.92	0.77	1.10
White*	1.00	-	-

* Reference Group

After controlling for potential confounding factors like age, race, gender, the odds ratio for patients dying after admission by insurance type were calculated (Table 15). The odds ratios are 1.98 (95 % CI, 1.53-2.52) for Medicaid, 1.45 (95 % CI, 1.27-1.64) for Medicare, 1.35 (95% CI, 1.14-1.61) for Self-pay/other and 0.86 (95 % CI, 0.64-1.16) for HMO.

Among the racial/ethnic groups, the odds ratios are 1.11(95 % CI, 0.97-1.27) for Hispanics, 1.08 (95 % CI, 0.96-1.20) for African-Americans, and 0.98 (95 % CI, 0.82-1.18) for other racial groups.

The odds ratio for females is 0.85 (95% CI, 0.80-0.92). The odds ratio for patients aged 64 and above is 2.84 (95% CI, 2.45-3.23).

After controlling for potential confounding factors like age, gender, the odds ratio for patients dying after admission were calculated. The race/ethnic group variable was not included in the Table 16 because it did not add to the model.

Table 15

Odds Ratios Obtained from Modeling Status of the Patients

By Race, Age, Source of Payment, and Gender

		95% CI	
	Odds Ratio	Lower	Upper
Self-pay/other	1.35	1.14	1.61
HMO	0.86	0.64	1.16
Medicare	1.45	1.27	1.64
Medicaid	1.98	1.53	2.52
Age>64	2.84	2.45	3.23
African-American	1.08	0.96	1.20
Hispanic	1.11	0.97	1.27
Other	0.98	0.82	1.18
Female	0.85	0.80	0.92
Commercial*	1.00	-	-
White*	1.00	-	-
Age 35-64*	1.00	-	-
Male*	1.00	-	-

* Reference Group

Table 16

Odds Ratios Obtained from Modeling Status of the Patients

By Age, Source of Payment, Gender

	Odds Ratio	95% CI Lower	95% CI Upper
Self-pay/other	1.37	1.15	1.63
HMO	0.87	0.64	1.15
Medicare	1.45	1.28	1.65
Medicaid	2.01	1.57	2.58
Age>64	2.82	2.48	3.21
Female	0.85	0.78	0.92
Commercial*	1.00	-	-
Age 35-64*	1.00	-	-
Male*	1.00	-	-

* Reference

After stratifying the age variable into five groups, odds ratios were obtained. The findings are reported in Table 17. For patients aged 85 and above the odds ratio is 7.74 (95 % CI, 6.38-9.40). For patient's aged 75-84 the odds ratio is 4.95 (95 % CI, 4.11-5.94). The odds ratios were observed to increase with the age but there was no effect on the odds ratio of Medicare and Medicaid compared to the model in which age was dichotomized.

Table 17

Odds Ratio Obtained from Modeling Status of the Patients

Source of Payment, Gender, and Stratifying Age

		95% CI	
	Odds Ratio	Lower	Upper
Self-pay/other	1.37	1.15	1.63
HMO	0.87	0.64	1.15
Medicare	1.31	1.16	1.50
Medicaid	2.00	1.57	2.56
Age 55-64	1.93	1.62	2.30
Age 65-74	3.06	2.55	3.68
Age 75-84	4.95	4.11	5.94
Age 85 +	7.74	6.38	9.40
Female	0.94	0.87	1.02
Commercial *	1.00	-	-
Male*	1.00	-	-
Age 35-54*	1.00	-	-

* Reference Group

The odds ratio of the patients based on gender and race are reported in Table18. White male and White female were used as the reference group. The odds ratios are 1.01 (95 % CI, 0.88-1.17) for Hispanic males, 0.99 (95 % CI, 0.81-1.21) for African-American males, and 0.89 (95 % CI, 0.70-1.12) for other males.

Table 18

Logistic Regression Model of Vital Status by the Race/Ethnic Groups

	Male	95% CI		Female	95% CI	
	Odds Ratio	Lower	Upper	Odds Ratio	Lower	Upper
African-American	0.99	0.81	1.21	1.00	0.84	1.20
Hispanic	1.01	0.88	1.17	1.06	0.92	1.23
Other	0.89	0.70	1.12	1.00	0.78	1.30
White*	1.00	-	-	1.00	-	-

The odds ratio for African-American females were 1.00 (95% CI, 0.84-1.20), 1.06 (95 % CI, .92-1.23) for Hispanic females and 1.00 (95% CI, .78-1.30) for other females.

The mean length of hospital stay for the age group 35-54 was 4.78 days (95% CI, 4.66-4.90) and for age group 85+ the mean length was 6.40 days (95% CI, 6.21-6.58) as reported in Table 19. The mean length of hospital stay for Whites was 6.02 days (95% CI, 5.75-6.29), 6.23 days (95% CI, 65.76-6.70) for African-Americans and 6.76 days (95% CI, 6.44-7.08) for Hispanics.

The mean length of hospital stay for females was 6.50 days (95% CI, 6.15-6.83) and 6.62 days (95% CI, 6.35-6.88) for males.

Table 19

Crude Mean Length of Hospital Stay (in days) by Race, Age, and Gender

Type of Insurance	Mean	95% Confidence Interval Lower	Upper
Male	6.62	6.35	6.88
Female	6.50	6.15	6.83
African- American	6.23	5.76	6.70
Hispanic	6.76	6.44	7.08
White	6.02	5.75	6.29
Other	7.12	6.60	7.78
Age 35-54	4.78	4.66	4.90
Age 55-64	5.63	5.51	5.75
Age 65-74	6.50	6.38	6.61
Age 75-84	6.72	6.60	6.84
Age 85+	6.40	6.21	6.58

Table 20

Test of Between-Subjects Effects

Source	Mean Square	F	Sig
Race	994.54	32.71	<0.01
Gender	3342.76	109.98	<0.01
Age	4976.36	166.21	<0.01

After controlling for potential confounding variables like race, age, gender the mean length of hospital stay are reported in Table 21.

Table 21

Mean Length of Hospital (in Days) Obtained from Modeling Length of Hospital Stay by Race, Age, Gender, Type of Insurance.

Type of Insurance		95% Confidence Interval	
	Mean	Lower	Upper
Self-pay/other	6.16	5.81	6.52
HMO	5.86	5.10	6.62
Medicare	6.75	6.52	6.95
Medicaid	8.53	7.93	9.14
Commercial	5.58	5.37	5.79

Patients enrolled in Medicaid had a mean length of hospital stay of 8.53 days (95% CI, 7.39-8.79), followed by patients enrolled in Medicare, 6.75 days (95% CI, 6.52-6.95).

Table 22

Test of Between-Subjects Effects

Source	Mean Square	F	Sig
Type of insurance	795.93	26.82	<0.01

Patients enrolled in Self-pay had a mean length of 6.16 days (95% CI, 5.59-6.60), 5.86 days (95% CI, 4.97-6.71) in HMOs, and patients enrolled in commercial insurance programs had a mean length of 5.58 days (95% CI, 5.37-5.79). Patients enrolled in commercial insurance groups had the lowest mean length of hospital stay whereas patients enrolled in Medicaid had a mean length of hospital stay that was higher than all the other insurance groups.

CHAPTER 5

DISCUSSION

It has been suggested that age, race, gender, insurance status, and income may be associated with unequal access to diagnostic procedures and medical care. Few studies (Ella, 1999; Li, 2000; Canto et al., 2002; Canto, Rogers, et al, 2000) that have examined these associations have found differences in hospital mortality or length of hospital stay according to type of medical insurance coverage.

Sada, et al., (1998) reported that Medicaid patients with AMI undergo fewer invasive cardiac procedures than do patients with HMO or private insurance. Every, et al., (1993) had reported that use of early diagnostic procedures results in a shorter hospital stay, and Medicaid patients were least likely to undergo such procedures. These investigators also reported higher in-hospital mortality in the Medicaid cohort. The Epidemiology and Biometry Program, National Heart, Lung, and Blood Institute (Canto, et al., 2000) conducted a cohort study using a national survey data containing information on social, economic, and demographic factors and health insurance with deaths identified through matching to the National Death Index resulting in a mortality follow-up period of five years. The study concluded that mortality was lowest in employed persons with employer-provided health insurance and highest among Medicare and Medicaid enrollments. Carlise, and colleagues (1997) examined whether disparities in the use of cardiovascular existed among different racial groups within the health insurance categories. After adjusting for confounders, lower odds of procedure use were found for African-American and Hispanic patients for most types of insurance, but disparities were absent among the privately insured.

In this study patients enrolled in the commercial insurance group had overall shortest length of hospital stay. Reasons for the shortest hospitalization may be related to reimbursement or hospital policies for these pre-paid health care plans. Another possible explanation may be the pressure applied by these insurers on the health care system for early discharge. The maximum number of patients were enrolled in the Medicare program. Out of the 36,320 subjects, 19,056 (52.5%) subjects were enrolled in the Medicare program. Also patients who were 65 and above were enrolled mostly in the Medicare program. Initial crude logistic regression analysis revealed that the patients enrolled in the Medicare program were 2.93 (95 % CI, 2.64-3.25) times more likely to die after admission with AMI than patients enrolled in the commercial insurance group. Patients enrolled in the Medicaid program were 1.79 (95% CI, 1.40-2.28) times more likely to die than patients enrolled in the commercial insurance group after admission with AMI. After controlling for confounding factors like age, race, and gender the odds ratio for patients dying after admission were calculated. Patients enrolled in Medicare insurance program were 1.45 (95% CI, 1.27-1.64) times more likely to die than patients in the commercial insurance group after admission with AMI. Patients enrolled in the Medicaid program were 1.98 (95% CI, 1.53-2.52) times more likely to die than patients enrolled in the commercial insurance group after admission with AMI.

After controlling for the available confounding factors females were less likely to die after admission with AMI to the hospital than males. This finding is of particular significance, because most of the previous studies reported that women were at a greater risk to die after an admission to the hospital with AMI than men. The odds ratio for women dying after admission was 0.85 (95 % CI, 0.80-0.92). The reason for this particular finding is unclear. Other unaccounted factors might have influenced the odds ratio.

Hellinger (1998) reported that the type of health care that patients receive is influenced by the type of insurance coverage. Gornick, et al. (1996) reported that after adjusting for age, gender, and co-morbid illness, uninsured ethnic minority patients and minorities with Medicare, Medicaid, and HMO insurance were less likely to undergo catheterization, PTCA and CABG than whites within the same insurance class. However no effect of race or ethnicity was found on patients with private insurance. This study found no significant differences among the different racial/ethnic groups, both in respect to the in-hospital mortality as well as length of hospital stay. When compared to Whites, African-Americans were 1.08 (95 %CI, 0.96-1.20) times more likely to die after admission to the hospital with AMI. The odds ratio was obtained after controlling for the available risk factors. Similarly the odds ratio for Hispanics was 1.11(95% CI, 0.97-1.27) and for others the odds ratio was 0.98(95 % CI, 0.82-1.18). The crude mean length of hospital stay in days for Whites was 6.02 (95 % CI, 5.75-6.29), 6.23 (95 % CI, 5.76-6.70) for African-Americans, for Hispanics 6.76 (95 % CI, 6.44-7.08) and 7.12 (95 % CI, 6.60-7.78) for others.

The association between insurance coverage and hospital mortality rate was also reported for other conditions. Roetzheim, et al., (2000) studied the association between health insurance payer and the care and outcomes of patients with colorectal cancer. The study concluded that patients with colorectal cancer who were uninsured or insured by Medicaid or commercial HMOs had higher mortality rat4es than patients with commercial fee-for-service insurance. Li and Davis (2000) conducted a retrospective cohort study of 23,134 trauma patients younger than 15 years who were admitted between 1996 through 1999 to the participating hospitals of the National Pediatric Trauma Registry. The study concluded that uninsured and underinsured pediatric trauma patients were at significantly elevated risk of in-hospital mortality when compared to patients enrolled in commercial insurance. The association between insurance status and the likelihood of survival was independent of injury severity and demographic characteristics. Ella, David, Magid, Ned, (1999) reported that AMI patients with HMO insurance had longer delays in seeking medical care than patients with fee-for-service coverage. However these longer delays were not associated mortality outcomes.

The Medicaid population differs from other insurance groups in terms of demographic characteristics as well as the location of the care. While there were differences in baseline characteristics that might affect in-hospital prognosis in the insured payer groups, control for these factors confirmed the higher, statistically significant, in-hospital death rates and greater length of hospital stay for Medicaid patients. Reasons for increased risk of dying during hospitalization for AMI in Medicaid patients may be caused by a number of factors including, prolonged delay in hospital admission, less aggressive treatment for these patients, and the fact that these patients may present with more severe coronary heart disease at the time of acute clinical event.

Limitations

Patients in the self-pay or other insurance coverage group may differ in their ability to pay for preventive and clinical practices. Patients in the self-pay or other insurance group included those who paid for their hospital-associated expenses out-of-pocket as well as patients with no insurance coverage. There is no further information to further categorize the private or commercial insurance group. But the commercial insurance group included payment provided by non-governmental sources and payments covered under the traditional indemnity plans or a commercial carrier. Differences in the outcome observed according to insurance status may be confounded by socioeconomic characteristics of the payer group, such as income and education that were not accounted for. Information was not collected on other factors that may have affected outcome such as medical history, type of AMI, acute clinical complications or ejection fraction.

Strengths

To evaluate the association between type of insurance coverage and selected outcomes for a highly prevalent condition, the examination was done from a population-based perspective with a validated AMI. The results of this study may be generalized to the U.S. population, particularly Whites and African-Americans given the relative similarity of the socio-demographic characteristics of Texas to those of rest of United States. This study provides information that can enable consumers to have an impact on the cost and quality of health care in Texas. In 1999, Medicare provided insurance to 2.2

million elderly and disabled. In 2002, Texas Medicaid expects to pay about $507 million for Medicare premiums, deductibles, and co-payments. This will account for 4 percent of the Texas Medicaid budget, excluding disproportionate share hospital funds (Texas Medicaid in Perspective, Texas Medicaid Program, July 2, 2002). Such a huge amount of public spending warrants that the quality of health care provided to the individuals enrolled in Medicaid program should be similar to the individuals enrolled in commercial insurance programs. The Medicaid population consists of many people who typically do not have comprehensive health insurance: the aged, disabled and chronically ill. Moreover, Texas Medicaid pays for long-term care and community care services not typically covered by private health insurance. It also pays for comprehensive to children that exceed those offered by most private insurance plans. Given the unique concentration of medically high-risk persons enrolled in the Texas Medicaid program, no commercial insurance program would resemble the Medicaid population. The Texas Health Care Information Council public use data file is under-utilized and further studies need to be done on other prevalent conditions to examine the possible association between medical insurance coverage and quality of the health care.

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