

Trends in Cardiac Care in California, 1988 to 2008

Part II: Trends in Heart Attack Hospitalizations



Executive Summary

This report analyzes California hospital patient data reported to the Office of Statewide Health Planning and Development (OSHPD) to track trends in heart attack hospitalization over two decades, from 1988 to 2008. Some of the main findings include:

Case and Rate Trends

- Overall. Between 1988 and 2008 the number of hospitalizations for acute heart attack increased by 15%, while the rate per 1,000 people declined by 15%.
- Race/Ethnicity. The hospitalization* rate for heart attacks declined only among Whites; it increased by 33% to 62% among the other racial or ethnic groups, “catching up” to historically higher rates for Whites.
- Age. The heart attack hospitalization rate declined for people under age 70, but among older people it spiked upward starting in about 1996.
- Gender. Between 1988 and 2008 the number of heart attack hospitalizations increased 27% for females and 7% for males, while the hospitalization rate per 1,000 people actually dropped by 6% for females and 20% for males.
- Patients with Other Medical Conditions. The percentage of heart attack patients reported to also have other conditions such as diabetes or high blood pressure doubled, from 20% to 40%.

Mortality Trends

- The in-hospital mortality rate for heart attack patients was 15% in 1988 and fell to 13% by 2008, while the overall in-hospital mortality rate in California hospitals is about 2%.¹
- The in-hospital mortality rate declined for patients aged 80 and older, but increased for patients in their 60s and younger.

Heart Attack Hospitalization Charges

- The amount that hospitals charged per day for heart attack patient care was more than eight times higher in 2008 than in 1988, for all categories of medical payment.**

Note: A glossary of medical terms and a complete set of data tables are provided in the Appendix.

*In this report, admission to the hospital as an inpatient is referred to as a “hospitalization,” while care in an outpatient setting, such as an emergency department or ambulatory surgery center, is referred to as a “visit.” A patient can have one or more hospitalizations or visits in a given year. (See Technical Notes for details about the data and methods used. Tables showing all the data are in the Appendix.)

** Charges represent the amount billed by the hospital. They do not represent the actual cost of providing care and were not adjusted for inflation.

Background

Nationally, the prevalence of coronary artery disease has been declining over recent decades, as have mortality rates for heart attack, clinically called “acute myocardial infarction.”² About half of the decline may be due to improvements in “revascularization” methods to open blood flow due to a blocked artery and the introduction of new medications to lower blood pressure and cholesterol levels. However, about 40% is due to population-wide decreases in heart attack risk behaviors, such as cigarette smoking. Unfortunately, about half of the benefit seen from the decrease in risk behaviors has been offset by rising rates of risk factors such as obesity and diabetes.^{3,4}

In California between 1995 and 2008, the percentage of the population that smoked daily declined from 13% to 9%, according to the federal government, while the obesity rate increased from 15% to 24%. The percentage of the population diagnosed with diabetes increased from 7% to 9% from 2004 to 2008.⁵ In the California population in 2006, African Americans had the highest rate of coronary artery disease, followed respectively by Whites, Latinos, Native Americans and Asian/Pacific Islanders. In each race/ethnic group, men had higher mortality rates than women.⁶

Hospitalization rates for coronary artery disease in the U.S. began falling in the late 1980s. However, in the mid-1990s the rates increased, possibly because a new diagnostic test (troponin) was introduced that was more sensitive to heart attack damage than the test (creatinine kinase) commonly used previously. The new test meant that people that previously would not have been diagnosed as having an acute heart attack became eligible for treatment.^{7,8}

Number of Heart Attack Hospitalizations in California

The total number of hospitalizations for heart attack in California increased 15% from 1988 to 2008, from about 60,000 to more than 68,000 per year. Initially 66% of these hospital admissions originated in the emergency department; by 2008 74% of patients were admitted to the hospital via this route. (Figure 1, Table 1)

Age and Gender. The number of heart attack hospitalizations per year increased 7% for males, 1988 to 2008 (from 36,678 to 39,328), while for females the number of hospitalizations increased by 27% (from 22,973 to 29,095). The age at which the hospitalizations occurred shifted upward for both genders, peaking for males at 68 years in 1988, and at 76 years in 1998, and by 2008 flattening to a range from 61 to 78 years. For females, the peak age consistently shifted upward, from 75, to 77, to 84 years of age respectively in 1988, 1998, and 2008. (Figure 2)

Population Rates for Heart Attack Hospitalization

The number of hospitalizations for heart attack in California increased 15% between 1988 and 2008, while the state population increased by 35% during this time, and the rate of heart attack hospitalizations per 1,000 people in the state fell by 15%. For every 1,000 persons in the state, there were 2.1 heart attack hospital admissions in 1988; this declined to 1.8 admissions by 2008. These rates varied across age and race/ethnic groups. (Table 2)

Age. In general, the rate of heart attack hospitalization was higher for each added decade of age. Over the twenty years covered by this report, there was a steady downward trend in the age-specific heart attack hospitalization rates per 1,000 people under age 80. However, for patients older than 80 a spike upward started around 1996. For patients older than 90 there was an 87% increase in the heart attack hospitalization rate, from 14 to 27 per 1,000 hospitalizations, 1988 to 2008. (Figure 3, Table 2)

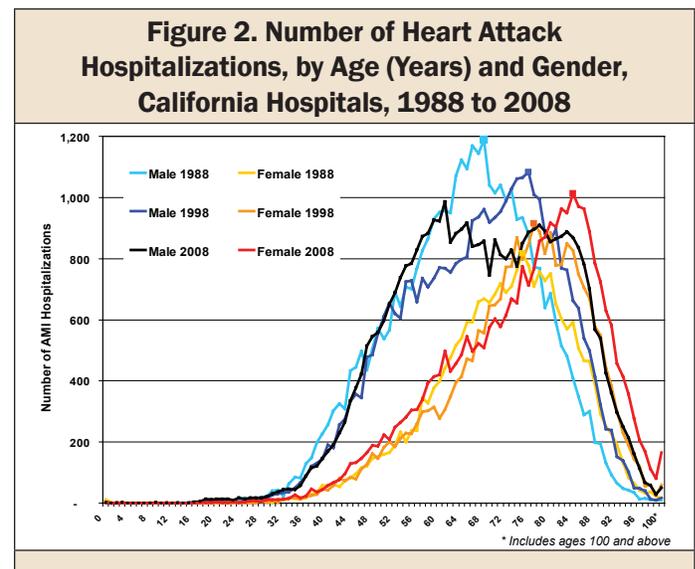
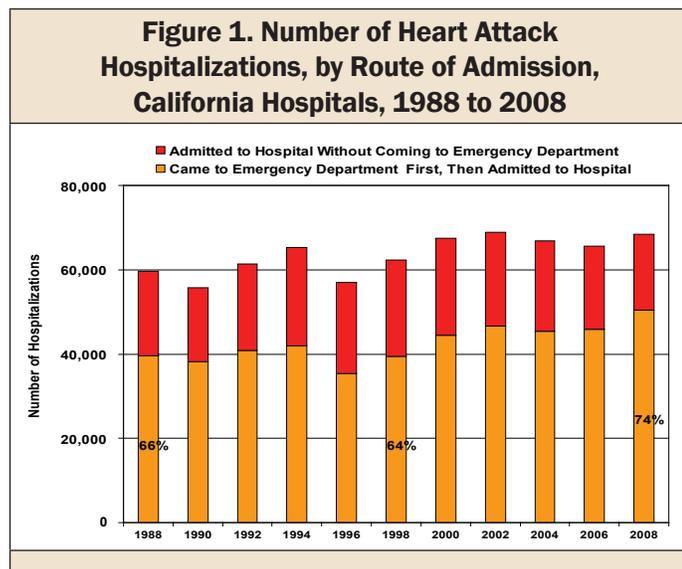
Gender. For men the heart attack hospitalization rate declined 20% from 1988 to 2008, from 2.6 to 2.1 per 1,000 hospitalizations, and for women it declined 6%, from 1.6 to 1.5. (Table 2)

Race/Ethnicity. Across all years heart attack hospitalization rates remained highest for Whites, followed in rank order by African Americans, Asian/Pacific Islanders, Hispanics, and Native Americans.* While the rate per 1,000 people declined 13% for Whites (from 2.9 to 2.5), in all other groups it increased: 62% for Native Americans (from 0.4 to 0.6), 55% for Asian/Pacific Islanders (from 0.9 to 1.4), 34% for Hispanics (from 0.6 to 0.9), and 33% for African Americans (from 1.6 to 2.1). (Figure 4, Table 2)

Risk Factors for Cardiovascular Disease among Heart Attack Hospitalizations

Diabetes Mellitus. Diabetes is increasingly an important risk factor for cardiovascular disease.^{9,10} In 1988 20% of California heart attack hospitalizations also had a diagnosis of diabetes mellitus. By 2008 the percentage had nearly doubled, to 38%. It increased for both men and women and in all age and race/ethnic groups. (See Appendix Table 4a)

Race/Ethnicity. From 1988 to 2008, diabetes rates were generally highest among Hispanic heart attack inpatients, increasing 58% (from 34% to 53% of hospitalizations). Among Asian/Pacific Islanders the rate rose 83% (from 26% to 47% of cases). Whites reported the lowest rates; their percentage rose 78%, from 18% to 32% of heart attack hospitalizations. (Figure 5, Table 4a)



* The number of Native American hospitalizations is small in part because the population is relatively small. In addition, Native American hospitalizations are likely to be undercounted in this report because: (1) OSHPD collects data only from California-licensed facilities and not from facilities operated by federal programs such as Veterans Affairs and Indian Health Services. Consequently, medical care obtained through the Indian Health Services is not included; (2) many people reported as having Native American race are also reported as having Hispanic ethnicity. Standard coding practice and California population estimates count these patients as Hispanic rather than as Native American. The race category "Asian/Pacific Islander" includes a large number of population groups with a wide range of income levels and very different dietary and other health-related practices. Grouping these patients into a single category is likely to obscure important differences in their patterns of diagnosis, medical treatment, and outcome. It would require a change in data collection rules to obtain more detailed information about patients in this group.

Age. By 2008 the percentage of heart attack hospital inpatients with diabetes, among all age groups, was highest for ages 60 to 80 years, at 45%. For patients under 40 or over 90 years it remained lowest, about 20%. (Table 4a)

Hypertension. High blood pressure (also known as hypertension) is another important risk factor for cardiovascular disease.¹¹ The percentage of heart attack hospitalizations that also had a diagnosis of high blood pressure more than doubled, from 24% in 1988 to 51% in 2004, dropping to 47% in 2008. This rise in rates until 2004, followed by a decline, occurred in both men and women and across all race/ethnic groups. (Table 4b)

Race/Ethnicity. From 1988 to 2008, the percentage of heart attack hospitalizations with a diagnosis of high blood pressure was

highest for African Americans, rising from 36% in 1988 to 54% in 2004, and then declining to 44% in 2008. It was lowest for Native Americans, although their rates varied from year to year because of the smaller number of cases. By 2008 the hypertension rates were similar across all race/ethnic groups. (Figure 6, Table 4b)

Age. Initially, from 1988 to 2004, diagnosis rates for high blood pressure were higher for patients between 60 and 79 years, with the peak percentage rising from 27% to 54%. After 2004 the peak ages shifted lower, to 50 to 69 years and the peak declined to 51%. Furthermore, among the youngest patients (ages 59 and below) the percentage with a diagnosis of high blood pressure did not drop, but instead continued to rise (from 18% to 32% for ages 0-39, from 21% to 47% for ages 40-49, and from 24% to 51% for ages 50-59). (Table 4b)

Figure 3. Population Rate (per 1,000) for Heart Attack Hospitalizations, by Age Group, California, 1988 to 2008

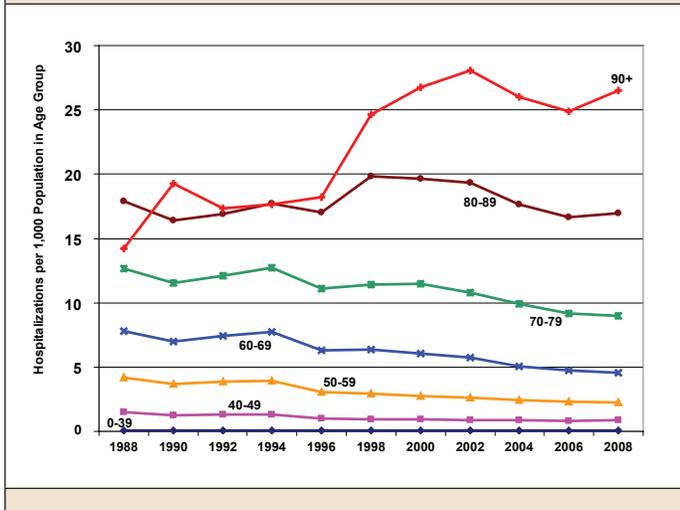


Figure 4. Population Rate (per 1,000) for Heart Attack Hospitalizations, by Race/Ethnic Group, California, 1988 to 2008

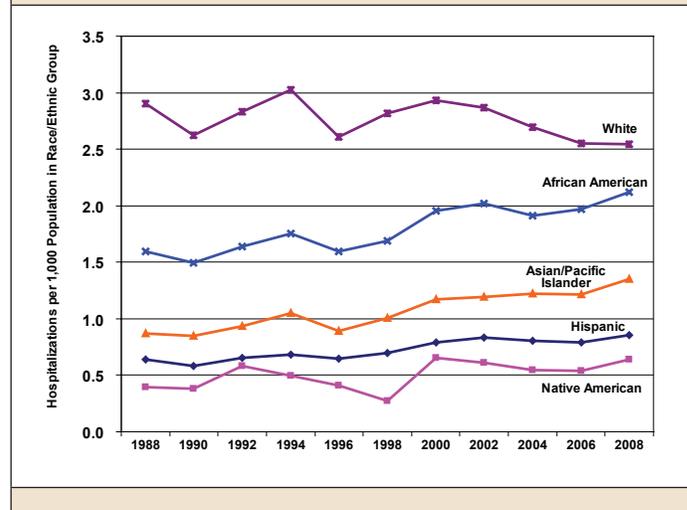


Figure 5. Percentage of Heart Attack Hospitalizations with Additional Diagnosis of Diabetes, by Race/Ethnicity, California, 1988 to 2008

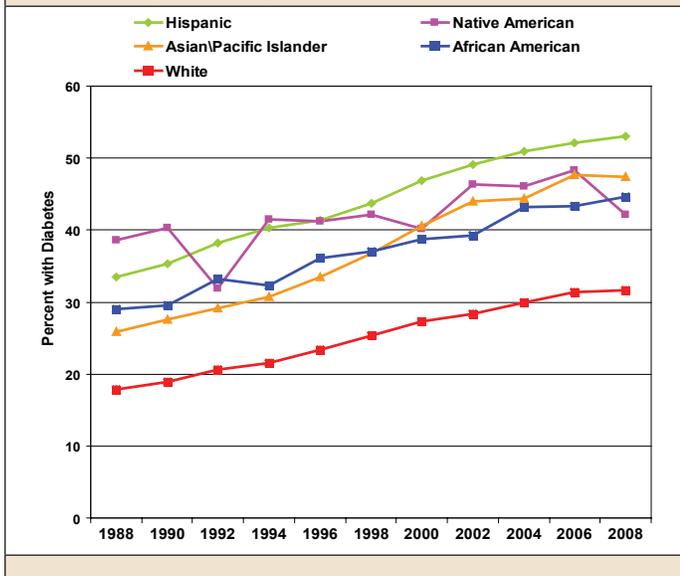
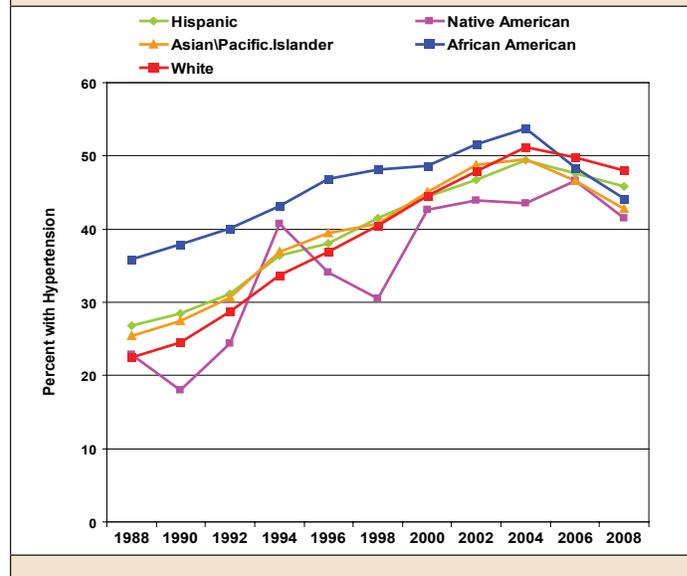


Figure 6. Percentage of Heart Attack Hospitalizations with Additional Diagnosis of Hypertension, by Race/Ethnicity, California, 1988 to 2008



Length of Stay and Charges for Heart Attack Hospitalizations

Length of Stay. The average number of days that heart attack patients remained in the hospital (length of stay) decreased for all medical insurance payer types and for those paying for care out-of-pocket. Patients with the longest length of stay, 1988 to 2008, were consistently those covered by Medi-Cal. This group also had the greatest decrease in the average number of days in the hospital, a 37% drop, from 18 to 11 days.

Average Daily Charges. Average daily charges for hospitalizations related to heart attack increased by 740% to as much as 1,220% over the 20 year period from 1988 to 2008, depending on payer source.

That equates to an average annual increase of between 11.2 to 13.8 percent per year compared to U.S. Medical Cost Inflation* which ranged between 2.8% and 9.0% during the same period.

Average daily charges in 2008 for Medicare and Medi-Cal patients were approximately \$13,800 and for private insurance and self-pay they were upwards of \$19,500. (Figure 8, Table 5)

In-Hospital Mortality for Heart Attack Hospitalizations

For patients with heart attack, the in-hospital mortality rate in California decreased from 15% in 1988 to 13% in 2008. In comparison, the overall in-hospital mortality rate in the state dropped from 2.7% in 1988 to 2.1% by 2008.¹² (Table 6)

Figure 7. Average Length of Stay (Days) for Heart Attack Hospitalizations, by Payer, California Hospitals, 1988 to 2008

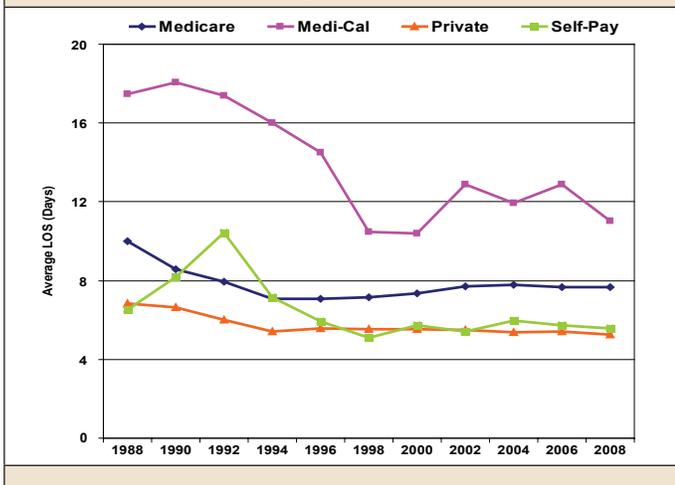


Figure 8. Average Daily Charges (Dollars) for Heart Attack Hospitalizations, by Payer, California Hospitals, 1988 to 2008

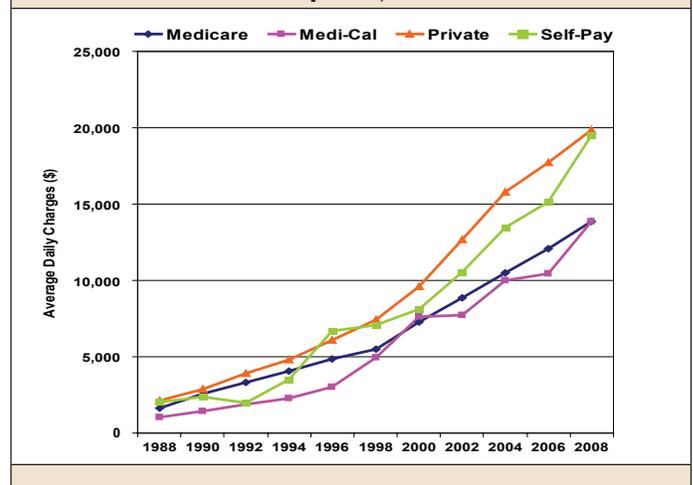


Figure 9. In-Hospital Mortality Rate for Heart Attack Hospitalizations, by Age Group, California Hospitals, 1988 to 2008

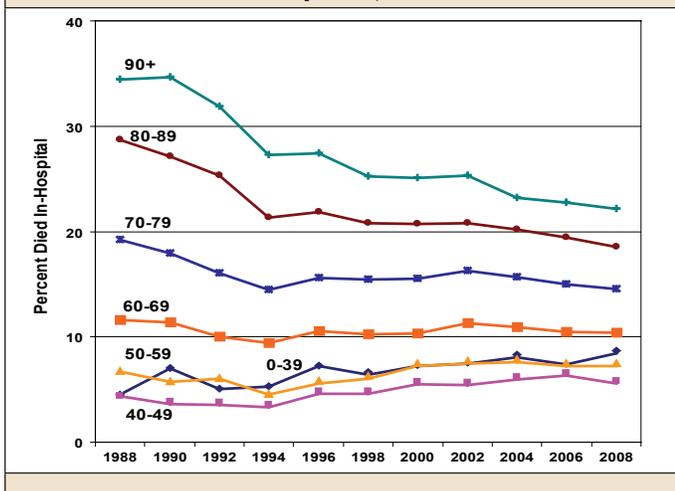
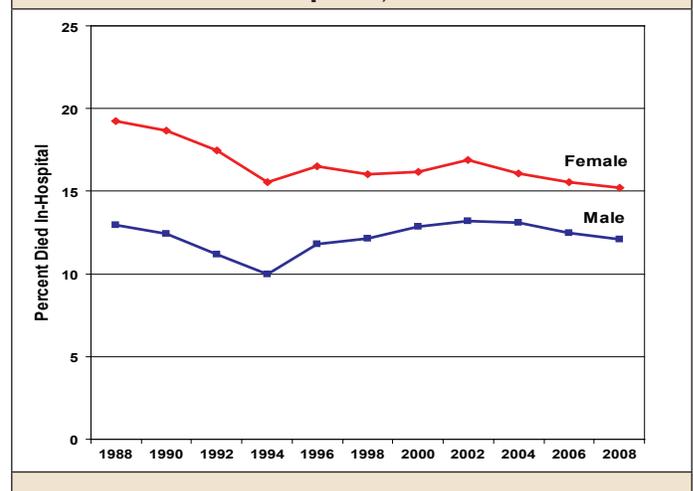


Figure 10. In-Hospital Mortality Rate for Heart Attack Hospitalizations, by Gender, California Hospitals, 1988 to 2008



* Source: U.S. Bureau of Labor Statistics (<http://data.bls.gov/pdq/SurveyOutputServlet>).

Age. For the twenty years covered by this report, the in-hospital mortality rate nearly doubled (from 4.6 to 8.4 per 100 cases) for those under age 40. In contrast, for patients aged 80 and older the mortality rate dropped by more than 35%. By 2008 the in-hospital mortality rate remained highest (22%) for patients age 90 and older, and decreased for each younger age group, reaching 6% for patients in their 40s. For those under age 40 the mortality rate was 8%. (Figure 9, Table 6)

Race/Ethnicity. In-hospital mortality rates for heart attack hospitalizations were similar and declined across all race/ethnic groups, except “other/multi-racial” which increased slightly. The rates were consistently slightly higher for Asian/Pacific Islanders, Native Americans, and Whites (averaging 15.7%, 14.5%, 14.0%, respectively), compared with Hispanics and African Americans (averaging 13.8% and 13.3%, respectively). (Table 6)

Gender. The in-hospital mortality rate was about 50% higher for women than for men in 1988, but only 25% higher by 2008. The narrowing of the gender gap was due to a steeper decline (21%) in the percentage of women dying in-hospital, from 19% to 15% compared with mortality for men, which dropped 7%, from 13% to 12%. (Figure 10, Table 6)

Summary

From 1988 to 2008 the number of heart attack hospitalizations in California increased about 15%, though the state population rate dropped by about 15%. Throughout this period the population rates for heart attack hospitalization remained highest for Whites, males, and with one exception, for each added decade of age.

Improvements in heart attack hospitalization rates were uneven. The decline in the population rate for heart attack hospitalization occurred in some groups, but not others.

- There was a decline in the heart attack hospitalization rate for Whites, but not for any other race/ethnic groups, which appear to be “catching up” to the higher heart attack rates of Whites.
- There was a 20% decline in heart attack hospitalization rates for males, but only 6% for females, so the genders are becoming more similar in heart attack hospitalization.
- There was a decline in the heart attack hospitalization rate for younger age groups. In contrast, there was virtually no change in the rate for patients in their 80s, and for patients in their 90s the rate almost doubled during the 20 years covered by this report. This may be related to changes in how heart attack is diagnosed.

Rising rates for risk factors. The prevalence of diabetes and high blood pressure among people hospitalized with heart attacks doubled, from about 20% to about 40% for each of them. The percentage of cases with these risk factors was higher in the population groups that also had rising—not falling—heart attack hospitalization rates (that is, Hispanics, Asian/Pacific Islanders, African Americans, and Native Americans). Diabetes rates were highest for Hispanics and lowest for Whites. High blood pressure rates were highest for African Americans.

Mortality increased for the younger patients and dropped for the oldest. The in-hospital mortality rate for heart attack hospitalizations increased for patients younger than 60 years old. However, for patients ages 80 and older, the in-hospital mortality rates dropped.

The older age groups also experienced spikes in their heart attack hospitalization rates in the late 1990s. Possibly, the oldest patients were increasingly hospitalized with less severe disease due to expanded use of treatments such as percutaneous transluminal coronary angioplasty in these elderly patients, or to the introduction of a more sensitive diagnostic test for heart attack in the mid-1990s.

Females had an in-hospital mortality rate that was about 50% higher than the male rate in 1988. However, due to the steeper decline in mortality in women than in men, this gender gap narrowed to about 25% by the end of the period of this report.

Steep increases in charges for heart attack care in the hospital. The number of days that heart attack patients remained in the hospital declined during these years, especially among those covered by Medi-Cal. In contrast, both the total amount charged by the hospitals and the daily charges increased steeply across all types of payer.

Technical Notes

Data Sources. The analyses were carried out using data from the following sources:

1. Hospital Patient Discharge Data (PDD) for even-numbered years, 1988 to 2008, collected by the Office of Statewide Health Planning and Development.
2. California population estimates for even-numbered years, 1988 to 2008, published by the California Department of Finance, Demographic Unit. Available online at: <http://www.dof.ca.gov/research/demographic/reports/view.php#objCollapsiblePanelEstimatesAnchor>.

The hospital inpatient data have been collected by the California Office of Statewide Health Planning and Development (OSHPD) since 1983. These are administrative abstracts of patient medical records reported by the hospital for each hospital discharge.

In 2005, OSHPD began collecting patient data from outpatient settings: emergency departments (EDs) and ambulatory surgery centers (ASCs). The ED files include cases that are “visits only,” while patients that come to an emergency department and then are admitted to the hospital are reported in the PDD.

Some patients have more than one hospitalization in a given year. In this report we show trends and rates for the numbers of hospitalizations, rather than for numbers of individual patients. We used this approach because: (1) the patient identifiers needed to link up multiple hospitalizations for individual patients only became available in 1994 and (2) upon analysis there was very little difference in average number of admissions per year between males and females

or between different age and race/ethnic groups. On average, heart attack patients had 1.15 hospitalizations per year, varying between 1.11-1.29 during the years 1994 and 2008, depending on age, gender, or population group. (Table 3)

The charges for hospital care reported in the patient record represent the amount billed by the hospital to the insurance company or other expected payer. It does not represent the actual cost of providing care and does not include the additional charges that might occur, such as services of a surgeon. In this report the amount of the charge is shown as reported by the hospital, unadjusted.

Cases of heart attack were identified by the following ICD-9 diagnosis codes for acute myocardial infarction in the principal or any secondary diagnosis field:

- For 1988 data: 410.1, 410.2, 410.3, 410.4, 410.5, 410.6, 410.7, 410.8, 410.9
- For 1990 to 2008 data: 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91

All analyses were completed using SAS version 9.2.

Glossary

Definitions of terms related to heart disease (from Mosby's Medical Dictionary, 4th Ed., Ed. KN Anderson. Mosby, St. Louis, 1994).

Atherosclerosis

Build up of plaques of cholesterol or other debris in the inner layers of the walls of large and medium-sized arteries. The vessel walls become thick, fibrotic, and calcified and the lumen [inside opening] narrows.

Cardiomyopathy

Any disease that affects the structure and function of the heart.

Congestive heart failure (CHF)

In congestive heart failure the basic disorder is usually ventricular dysfunction [failure of contracting heart chamber]. It often produces symptoms and signs such as difficulty breathing and edema [accumulation of fluid in the body tissues].

Coronary artery disease (CAD)

Any one of the abnormal conditions that may affect the arteries of the heart and produce various pathologic effects, especially the reduced flow of oxygen and nutrients to the myocardium [heart muscle]. Any of the coronary artery diseases, such as coronary atherosclerosis or coronary arteritis may produce the symptom of angina pectoris [chest pain]. The most common kind of coronary artery disease is coronary atherosclerosis.

Diabetes mellitus (diabetes)

A chronic disorder of impaired metabolism of carbohydrates, proteins, and fats. This is due to either (a) too little insulin secreted by the pancreas (Type 1 diabetes) or resistance to insulin by the muscle and other tissues (Type 2 diabetes). Both types are associated with disease of small and large blood vessels. Type 2, which is the most common and is related to obesity, is classically accompanied by premature atherosclerosis, which in turn can lead to myocardial infarction or stroke.

Embolus

A "plug" that circulates in the bloodstream until it becomes lodged in a vessel. It can be an air or gas bubble, bit of tissue or tumor, a thrombus, or a foreign object.

Heart failure

A condition in which the heart cannot pump enough blood to meet the metabolic requirements of body tissues.

Ischemic heart disease

A pathologic condition of myocardium [heart muscle] caused by lack of oxygen reaching the heart muscle cells. [See coronary artery disease]

Myocardial infarction (MI) and Acute myocardial infarction (AMI)

A heart attack. Necrosis [death] of a portion of cardiac muscle caused by obstruction in a coronary artery from either atherosclerosis or an embolus.

Acute myocardial infarction (AMI) is the early, critical stage of an MI.

Obesity

Abnormal increase in the number of fat cells in the body or increase in the size of the fat cells. [Commonly defined as Body Mass Index (BMI) above 30. BMI = (Body weight [lb.] * 703) / (Height [in.] squared)]



APPENDIX

Table 1. Number of Heart Attack Hospitalizations in California, 1988 to 2008

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Total AMIs		59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Age	0-39	1,450	1,267	1,465	1,447	1,064	1,050	1,107	1,293	1,237	1,165	1,232	-15.0
	40-49	5,039	4,570	5,389	5,599	4,505	4,418	4,580	4,822	4,785	4,660	4,857	-3.6
	50-59	9,707	8,740	9,719	10,353	8,502	9,192	9,757	10,125	10,216	10,498	10,725	10.5
	60-69	16,235	14,808	15,558	15,695	12,574	12,869	13,047	13,086	12,638	12,674	13,683	-15.7
	70-79	16,348	15,805	17,434	18,873	16,884	17,995	19,398	18,318	16,888	15,642	15,603	-4.6
	80-89	9,302	8,965	10,072	11,180	11,222	13,727	15,588	16,719	16,398	16,108	16,853	81.2
	90+	1,574	1,610	1,760	2,084	2,310	3,065	3,949	4,538	4,716	4,806	5,471	247.6
	Total	59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Race/ Ethnicity	Hispanic	4,531	4,503	5,575	6,227	6,214	7,160	8,722	9,878	10,099	10,486	11,854	161.6
	Native American	70	72	135	135	126	95	122	123	115	118	147	110.0
	Asian/Pacific Isl.	2,125	2,324	2,842	3,470	3,166	3,876	4,550	4,938	5,306	5,434	6,285	195.8
	African American	3,232	3,146	3,566	3,853	3,526	3,829	4,331	4,536	4,322	4,442	4,822	49.2
	White	48,435	44,697	48,169	50,475	42,451	45,352	47,345	46,749	44,166	41,836	41,745	-13.8
	Other/Multi-racial	770	557	688	728	964	1,228	1,505	1,927	1,892	2,210	2,430	215.6
	Unknown/Missing	492	466	422	343	614	776	851	750	978	1,027	1,141	131.9
	Total	59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Gender	Female	22,973	21,165	22,943	24,751	22,453	25,409	28,154	29,362	28,450	27,693	29,095	26.6
	Male	36,678	34,600	38,454	40,479	34,607	36,906	39,269	39,535	38,427	37,859	39,328	7.2
	Total	59,651	55,765	61,397	65,230	57,060	62,315	67,423	68,897	66,877	65,552	68,423	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Payer	Medicare	33,243	30,516	32,694	33,756	31,934	36,249	41,669	42,834	41,750	40,025	41,878	26.0
	Medi-Cal	2,876	3,051	3,703	4,271	4,132	3,911	4,693	5,351	5,509	5,465	6,001	108.7
	Private	19,215	18,423	20,945	23,121	15,659	18,906	17,349	16,919	15,651	15,888	15,794	-17.8
	Self-Pay	2,405	2,307	2,293	2,325	1,593	1,511	1,573	1,742	1,901	2,068	2,377	-1.2
	Other Government	1,501	1,217	1,563	1,582	1,371	1,536	1,569	1,492	1,507	1,682	1,802	20.1
	Other Source	415	251	199	176	2,372	203	573	563	560	425	572	37.8
	Total	59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Region	Bay Area	13,599	12,360	13,391	14,406	12,419	13,569	13,973	14,512	15,025	14,319	13,899	2.2
	Inland Empire	15,662	15,383	17,494	18,808	16,754	18,322	19,556	20,156	19,484	18,616	20,445	30.5
	Los Angeles	17,672	15,672	16,516	17,523	15,429	16,760	18,772	18,971	17,812	17,808	19,035	7.7
	San Joaquin Valley	6,576	6,037	6,915	7,314	6,776	7,655	8,274	8,557	7,901	8,007	8,327	26.6
	Mountains	2,448	2,429	2,443	2,472	1,906	2,193	2,118	1,974	1,755	1,853	1,952	-20.3
	Sacramento Area	3,698	3,884	4,638	4,708	3,777	3,817	4,733	4,731	4,901	4,950	4,766	28.9
	Total	59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Mortality	Died	9,172	8,257	8,311	7,893	7,792	8,549	9,609	10,182	9,593	9,037	9,173	0.0
	Survival	50,483	47,508	53,086	57,338	49,269	53,767	57,817	58,719	57,285	56,516	59,251	17.4
	Total	59,655	55,765	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Route of Admission	ED to Hospital	39,594	38,163	40,845	42,031	35,333	39,413	44,454	46,677	45,420	45,885	50,380	27.2
	Directly to Hospital	20,059	17,601	20,552	23,200	21,728	22,903	22,972	22,224	21,458	19,668	18,044	-10.0
	Total	59,653	55,764	61,397	65,231	57,061	62,316	67,426	68,901	66,878	65,553	68,424	14.7

Table 2. Heart Attack Hospitalizations per 1000 People in California, 1988 to 2008

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Total AMIs		2.10	1.87	1.98	2.07	1.79	1.90	1.98	1.95	1.83	1.75	1.79	-14.85
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Age	0-39	0.08	0.06	0.07	0.07	0.05	0.05	0.05	0.06	0.06	0.05	0.06	-26.96
	40-49	1.51	1.22	1.33	1.31	0.99	0.93	0.91	0.90	0.85	0.82	0.85	-43.59
	50-59	4.21	3.65	3.89	3.92	3.06	2.95	2.77	2.60	2.41	2.30	2.23	-46.93
	60-69	7.77	7.00	7.45	7.74	6.29	6.33	6.07	5.72	5.08	4.72	4.55	-41.38
	70-79	12.63	11.56	12.07	12.71	11.09	11.39	11.48	10.77	9.92	9.16	8.97	-28.94
	80-89	17.90	16.38	16.88	17.70	17.04	19.85	19.62	19.30	17.66	16.63	16.94	-5.36
	90+	14.21	19.25	17.31	17.68	18.21	24.66	26.73	28.06	26.03	24.89	26.52	86.68
	Total	2.10	1.87	1.98	2.07	1.79	1.90	1.98	1.95	1.83	1.75	1.79	-14.85
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Race/ Ethnicity	Hispanic	0.64	0.58	0.66	0.69	0.65	0.70	0.79	0.84	0.80	0.79	0.86	33.61
	Native American	0.39	0.38	0.58	0.50	0.41	0.27	0.66	0.61	0.54	0.54	0.64	62.33
	Asian/Pacific Isl.	0.87	0.85	0.93	1.05	0.89	1.01	1.17	1.19	1.22	1.21	1.35	54.89
	African American	1.60	1.49	1.64	1.75	1.59	1.69	1.95	2.02	1.91	1.97	2.12	33.00
	White	2.90	2.63	2.83	3.03	2.61	2.81	2.93	2.87	2.69	2.55	2.54	-12.52
	Other/Multi-racial*							2.36	2.77	2.51	2.83	3.03	
	Unknown/Missing*												
	Total	2.10	1.87	1.98	2.07	1.79	1.90	1.98	1.95	1.83	1.75	1.79	-14.85
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Gender	Female	1.62	1.42	1.48	1.57	1.40	1.54	1.65	1.66	1.55	1.48	1.52	-6.06
	Male	2.59	2.32	2.49	2.57	2.17	2.25	2.31	2.24	2.11	2.03	2.06	-20.33
	Total	2.10	1.87	1.98	2.07	1.79	1.90	1.98	1.95	1.83	1.75	1.79	-14.85

*Population data for this category not available for several years.

Table 3. Hospitalizations per Patient with Diagnosis of Heart Attack, 1994 to 2008*

		1994	1996	1998	2000	2002	2004	2006	2008	% Change
Age	0-39	1.34	1.15	1.15	1.15	1.15	1.17	1.18	1.24	-7.9
	40-49	1.37	1.13	1.13	1.12	1.12	1.13	1.15	1.19	-12.8
	50-59	1.36	1.14	1.14	1.12	1.11	1.11	1.14	1.18	-13.1
	60-69	1.30	1.12	1.13	1.13	1.11	1.11	1.13	1.16	-11.0
	70-79	1.26	1.14	1.14	1.13	1.11	1.11	1.11	1.13	-10.2
	80-89	1.20	1.16	1.16	1.14	1.12	1.11	1.11	1.12	-6.3
	90+	1.18	1.17	1.18	1.15	1.13	1.11	1.11	1.12	-5.1
	Total	1.28	1.14	1.14	1.13	1.12	1.11	1.12	1.15	-10.5
		1994	1996	1998	2000	2002	2004	2006	2008	% Change
Race/ Ethnicity	Hispanic	1.32	1.17	1.17	1.18	1.17	1.18	1.19	1.20	-8.7
	Native American	1.21	1.14	1.16	1.12	1.07	1.07	1.09	1.17	-3.2
	Asian/Pacific Isl.	1.31	1.15	1.15	1.15	1.14	1.15	1.14	1.18	-9.9
	African American	1.25	1.16	1.15	1.13	1.12	1.13	1.12	1.15	-7.7
	White	1.27	1.13	1.14	1.12	1.10	1.09	1.10	1.12	-12.5
	Other/Multi-racial	1.38	1.19	1.19	1.18	1.16	1.14	1.21	1.22	-11.5
	Unknown/Missing	1.46	1.17	1.16	1.19	1.13	1.12	1.21	1.44	-1.0
	Total	1.28	1.14	1.14	1.13	1.12	1.11	1.12	1.15	-10.5
		1994	1996	1998	2000	2002	2004	2006	2008	% Change
Gender	Female	1.27	1.16	1.16	1.14	1.13	1.12	1.12	1.14	-9.5
	Male	1.29	1.13	1.13	1.13	1.11	1.10	1.12	1.15	-11.0
	Total	1.28	1.14	1.14	1.13	1.12	1.11	1.12	1.15	-10.5

*Prior to 1994 the data lacked Social Security Numbers necessary for identifying individuals.

Table 4. Prevalence of Heart Attack Risk Factors, 1988 to 2008

4a. Percent of Heart Attack Hospitalizations that also had Diagnosis of Diabetes

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Age	0-39	11.5	13.5	12.7	13.8	15.1	16.2	16.9	18.6	20.0	22.0	19.6	69.8
	40-49	13.6	14.6	16.2	17.4	19.7	22.0	23.8	26.5	27.9	28.8	31.3	130.9
	50-59	19.6	20.3	23.5	23.2	26.7	28.3	32.1	32.6	36.0	35.7	37.0	88.2
	60-69	23.2	25.3	28.1	29.6	32.0	35.4	38.0	40.0	41.8	43.9	45.0	94.0
	70-79	22.4	23.0	26.2	27.5	30.4	33.4	36.8	39.5	41.8	44.0	44.8	99.9
	80-89	16.8	18.6	18.7	21.1	22.8	24.3	26.8	29.3	31.4	34.1	35.3	109.7
	90+	9.6	11.1	11.2	12.9	12.3	14.2	16.1	18.7	19.8	22.5	22.6	135.5
	Total	19.9	21.2	23.4	24.6	26.9	29.0	31.6	33.4	35.4	37.2	38.1	90.9
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Race/ Ethnicity	Hispanic	33.5	35.3	38.2	40.3	41.4	43.7	46.9	49.0	50.9	52.2	53.0	58.1
	Native American	38.6	40.3	31.9	41.5	41.3	42.1	40.2	46.3	46.1	48.3	42.2	9.3
	Asian/Pacific Isl.	25.9	27.5	29.1	30.7	33.5	36.7	40.6	44.0	44.4	47.7	47.4	82.8
	African American	29.0	29.6	33.3	32.3	36.1	37.0	38.7	39.2	43.2	43.3	44.7	54.2
	White	17.8	18.8	20.6	21.6	23.4	25.3	27.3	28.4	30.0	31.4	31.7	77.9
	Other/Multi-racial	21.0	24.1	25.9	28.7	28.5	34.4	35.3	36.8	39.2	39.7	40.8	94.0
	Unknown/Missing	17.1	17.6	19.4	17.8	25.4	24.9	24.8	27.3	30.4	30.7	32.1	87.9
	Total	19.9	21.2	23.4	24.6	26.9	29.0	31.6	33.4	35.4	37.2	38.1	90.9
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Gender	Female	24.7	25.9	27.6	29.1	30.4	31.6	34.0	35.8	37.1	39.5	39.9	61.4
	Male	17.0	18.4	20.9	21.8	24.5	27.2	29.9	31.7	34.2	35.5	36.7	116.7
	Total	19.9	21.2	23.4	24.6	26.9	29.0	31.6	33.4	35.4	37.2	38.1	90.9

4b. Percent of Heart Attack Hospitalizations that also had Diagnosis of Hypertension

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change 1988 to 2004	% Change 2004 to 2008
Age	0-39	18.1	17.7	19.9	21.3	21.7	21.5	23.8	23.3	28.9	30.6	31.5	59.7	9.1
	40-49	20.9	24.2	26.2	29.7	31.9	33.3	35.6	39.4	41.8	44.7	47.1	100.1	12.6
	50-59	24.2	27.3	30.8	35.2	38.1	39.7	43.0	46.3	49.2	50.4	50.9	103.5	3.5
	60-69	26.5	28.2	31.9	37.3	39.6	43.3	47.4	49.4	52.7	52.2	49.7	99.2	-5.8
	70-79	24.8	26.0	31.6	36.0	40.3	43.8	47.8	50.8	53.5	50.1	47.1	115.9	-12.0
	80-89	20.0	22.6	26.9	33.5	36.4	41.1	45.0	49.8	52.8	48.7	44.8	163.7	-15.2
	90+	16.2	18.0	21.8	29.5	32.0	37.4	41.5	46.4	50.9	46.3	42.1	214.1	-17.2
	Total	23.7	25.7	29.7	34.7	37.7	41.1	44.8	48.0	51.1	49.2	47.0	115.5	-8.0
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change 1988 to 2004	% Change 2004 to 2008
Race/ Ethnicity	Hispanic	26.9	28.5	31.1	36.4	38.0	41.5	44.4	46.7	49.4	47.6	45.8	83.9	-7.2
	Native American	22.9	18.1	24.4	40.7	34.1	30.5	42.6	43.9	43.5	46.6	41.5	90.2	-4.6
	Asian/Pacific Isl.	25.4	27.5	30.6	36.9	39.5	40.8	45.1	48.7	49.6	46.6	42.8	95.1	-13.7
	African American	35.9	37.9	40.1	43.1	46.8	48.1	48.6	51.6	53.7	48.4	44.2	49.6	-17.7
	White	22.4	24.5	28.8	33.7	36.9	40.5	44.6	47.8	51.2	49.8	48.0	128.3	-6.1
	Other/Multi-racial	28.2	26.9	31.3	32.4	36.4	39.0	41.1	49.9	54.6	51.5	47.3	93.7	-13.4
	Unknown/Missing	25.4	22.3	28.4	31.5	36.0	40.9	46.8	48.3	54.0	53.9	53.9	112.5	-0.2
	Total	23.7	25.7	29.7	34.7	37.7	41.1	44.8	48.0	51.1	49.2	47.0	115.5	-8.0
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change 1988 to 2004	% Change 2004 to 2008
Gender	Female	26.7	28.6	33.0	38.8	41.6	45.1	48.7	51.2	54.8	52.2	49.5	105.1	-9.8
	Male	21.8	23.9	27.8	32.2	35.2	38.2	42.0	45.7	48.3	47.0	45.1	121.6	-6.6
	Total	23.7	25.7	29.7	34.7	37.7	41.1	44.8	48.0	51.1	49.2	47.0	115.5	-8.0

Table 5. Average Length of Stay and Charges for Heart Attack Hospitalizations, 1988 to 2008

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Length of Stay (Days)	Medicare	10.0	8.6	7.9	7.1	7.1	7.1	7.3	7.7	7.8	7.7	7.7	-23.0
	Medi-Cal	17.5	18.1	17.4	16.0	14.5	10.5	10.4	12.9	12.0	12.9	11.0	-36.8
	Private	6.8	6.7	6.0	5.4	5.6	5.5	5.5	5.5	5.4	5.4	5.3	-23.0
	Self-Pay	6.5	8.2	10.5	7.1	5.9	5.1	5.7	5.4	6.0	5.7	5.6	-14.9
	Other Government	7.3	7.0	6.7	6.3	6.0	5.8	6.2	6.3	6.1	6.1	5.7	-21.2
	Other Source	9.0	7.8	5.3	6.2	6.5	5.3	5.7	6.4	6.2	9.6	5.4	-40.0
Total Charges (\$)													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Total Charges (\$)	Medicare	16,491	21,977	26,526	28,768	34,452	39,117	53,295	68,607	81,731	92,715	106,736	547.2
	Medi-Cal	18,334	25,590	32,602	36,429	43,606	52,048	79,104	99,388	119,653	134,919	153,019	734.6
	Private	14,562	19,223	23,367	25,976	34,066	41,042	52,993	69,687	84,996	96,075	104,705	619.0
	Self-Pay	13,362	19,306	20,531	24,969	39,717	35,902	46,318	57,286	80,349	86,805	108,462	711.7
	Other Government	15,474	20,168	27,488	33,177	38,218	46,717	66,351	81,212	91,145	108,898	117,398	658.7
	Other Source	21,255	24,566	22,721	27,623	34,140	37,688	49,515	92,698	104,039	121,661	116,410	447.7
Daily Charges (\$)													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Daily Charges (\$)	Medicare	1,652	2,567	3,337	4,073	4,856	5,481	7,258	8,885	10,482	12,092	13,885	740.5
	Medi-Cal	1,050	1,418	1,875	2,276	3,005	4,972	7,607	7,702	10,008	10,458	13,856	1,219.6
	Private	2,127	2,889	3,896	4,807	6,096	7,432	9,588	12,657	15,786	17,744	19,873	834.1
	Self-Pay	2,045	2,360	1,964	3,493	6,704	7,065	8,109	10,543	13,465	15,126	19,502	853.4
	Other Government	2,125	2,899	4,089	5,292	6,399	7,997	10,696	12,930	14,940	17,880	20,452	862.6
	Other Source	2,374	3,152	4,327	4,440	5,249	7,117	8,676	14,397	16,742	12,739	21,682	813.2

Table 6. Deaths per 100 Heart Attack Hospitalizations, 1988 to 2008

		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Age	0-39	4.55	7.02	5.05	5.25	7.24	6.38	7.23	7.42	8.08	7.38	8.44	85.5
	40-49	4.41	3.61	3.51	3.29	4.59	4.62	5.52	5.45	5.98	6.33	5.58	26.6
	50-59	6.71	5.76	6.06	4.52	5.55	6.04	7.19	7.45	7.62	7.24	7.21	7.5
	60-69	11.62	11.35	9.99	9.42	10.55	10.23	10.33	11.27	10.93	10.49	10.43	-10.2
	70-79	19.20	17.91	16.04	14.47	15.56	15.45	15.48	16.24	15.67	15.01	14.50	-24.4
	80-89	28.67	27.13	25.28	21.35	21.83	20.78	20.74	20.76	20.17	19.41	18.54	-35.3
	90+	34.43	34.66	31.88	27.30	27.40	25.22	25.07	25.32	23.20	22.72	22.12	-35.8
	Total	15.38	14.81	13.54	12.10	13.66	13.72	14.25	14.78	14.34	13.79	13.41	-12.8
Race/Ethnicity													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Race/Ethnicity	Hispanic	15.93	15.23	12.91	11.48	13.84	14.33	14.16	13.90	13.71	13.40	13.17	-17.4
	Native American	12.86	13.89	14.07	14.07	15.08	11.58	15.57	17.07	16.52	19.49	8.84	-31.2
	Asian/Pacific Isl.	16.85	16.35	14.81	13.49	15.54	15.30	16.29	17.03	15.23	15.97	15.32	-9.1
	African American	13.46	12.91	13.10	10.82	11.57	13.71	13.78	15.65	15.71	14.25	11.74	-12.8
	White	15.48	14.85	13.67	12.19	13.75	13.60	14.20	14.78	14.40	13.73	13.57	-12.3
	Other/Multi-racial	11.95	13.46	9.59	10.85	12.03	13.11	12.56	11.47	12.05	11.04	12.47	4.4
	Unknown/Missing	12.20	13.09	8.06	12.54	10.10	8.38	12.22	14.13	11.76	11.68	9.03	-26.0
	Total	15.38	14.81	13.54	12.10	13.66	13.72	14.25	14.78	14.34	13.79	13.41	-12.8
Gender													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Gender	Female	19.26	18.67	17.48	15.53	16.51	16.01	16.16	16.88	16.05	15.56	15.19	-21.1
	Male	12.94	12.45	11.18	10.00	11.81	12.14	12.88	13.22	13.08	12.49	12.09	-6.6
	Total	15.37	14.81	13.54	12.10	13.66	13.72	14.25	14.78	14.34	13.79	13.41	-12.8
Payer													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
Payer	Medicare	20.83	19.85	18.26	16.12	16.99	17.02	17.27	18.10	17.62	16.92	16.31	-21.7
	Medi-Cal	16.24	15.01	12.37	11.54	14.01	13.37	14.32	14.76	14.74	14.31	14.00	-13.8
	Private	6.98	7.46	7.18	7.16	8.33	8.41	7.96	7.71	7.10	7.21	7.26	3.9
	Self-Pay	11.73	12.22	10.95	9.25	11.49	11.38	12.71	10.79	9.10	9.86	9.34	-20.3
	Other Government	7.33	5.51	6.59	4.11	5.11	4.95	6.05	5.16	5.97	5.71	4.27	-41.7
	Other Source	11.57	7.97	12.56	11.93	9.70	9.36	11.17	11.90	9.11	8.71	9.97	-13.8
	Total	15.38	14.81	13.54	12.10	13.66	13.72	14.25	14.78	14.34	13.79	13.41	-12.8
End-of-Life Preference*													
		1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
End-of-Life Preference*	Both DNR and Palliative							72.14	67.44	68.62	68.10	65.31	-9.5
	DNR only							39.15	39.37	35.67	34.41	30.36	-22.4
	Palliative only							67.26	74.14	74.69	72.50	68.25	1.5
	Neither							11.32	11.62	10.79	9.87	9.45	-16.5

*DNR = "Do Not Resuscitate" order in the patient's medical record.

*Palliative = Special diagnosis code in patient's record indicating hospital admission "for palliative care only" (ICD-9 code V66.7).

Table 7. Place of Occurrence of all Heart Attack Deaths in California, 1988 to 2008

	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	% Change
All Heart Attack Deaths in California *												
Percent Died in a Hospital/ER		68.15	67.25	62.13	60.68	61.02	61.49	60.38	57.89	56.08	56.31	-17.4
Percent of Hospitalizations Died In-Hospital **	15.4	14.8	13.5	12.1	13.7	13.7	14.3	14.8	14.3	13.8	13.4	12.8
ED-to-Inpatient Admissions	16.6	15.5	14.6	13.0	15.7	15.9	16.2	16.9	16.4	15.9	15.0	9.9
Direct Inpatient Admissions	13.0	13.2	11.5	10.4	10.3	9.9	10.4	10.3	9.9	8.9	9.1	30.0
In ED without Admission										32.6	30.4	--

* Source of data: Public Use Death Files, California Department of Public Health, 1988 - 2008.
 ** Source of data: Patient Discharge Data, Office of Statewide Health Planning and Development, 1988 - 2008.

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