
James A. Koziol, PhD, Bruce L. Zuraw, MD, Sandra C. Christiansen, MD

James A. Koziol, PhD, Bruce L. Zuraw, MD, and Sandra C. Christiansen, MD

Purpose: This report examines health care rates, charges, and patterns of consumption from a comprehensive California hospitalization data set covering 1986–1995. An improved understanding of current trends in health care consumption would facilitate the development of future resource allocation models. Design and Methods: We obtained discharge and charge data from all licensed nonfederal hospitals in California between 1986 and 1995 relating to inpatient discharges of individuals aged 55 years and older. We used the direct method of standardization to adjust discharge statistics for differing age and gender case mixes, and we adjusted all charges to 1990 dollars for cost comparisons. Results: Standardized to the 1990 population, annual discharge rates declined between 1986 and 1992, then leveled off to about 227 per 1,000 between 1993 and 1995. Rates of both discharges and charges for men consistently exceeded those for women, there being about a 5-year lag between female and male rates of discharge. The insurance payer mix shifted between 1986 and 1995, with dramatic declines in private insurance mirrored by increases in managed care. Implications: Hospital care consumption among the elderly people in California demonstrates a trend of increasing adjusted total charges despite declining hospitalization rates. Overall, individuals aged 55 years and older comprise 18% of the California population and incur 52% of discounted total charges. Private insurance has virtually disappeared, replaced by HMO/PHP/PPO organizations; still, charges to governmental sources (primarily Medicare and Medi-Cal) account for about 78% of total billings. Absolute numbers of Californians aged 55 and older are projected to increase 54% by 2010 and 226% by 2025 compared with 1995, engendering a dramatic increase in the financial burden of health care to this segment of the population. Key Words: Hospitalization discharges and charges, Case mix, Medicare, Medi-Cal

The combination of rising health care costs, dynamic changes in the health care insurance market, and a recent escalation in physician group bankruptcies has catalyzed interest in health care expenditures in the United States (Bodenheimer, 1999; Glabman, 1998; Kuttner, 1999; Nearly 60 Percent, 1998; “New Jersey Regulators,” 1998; Tokarski, 1998). The introduction of increasingly sophisticated medical technology and expensive new pharmaceutical agents, together with the demographics of a growing and aging population, is creating a staggering public economic burden for the provision of care (Kassirer, 1998). Prompted by the 1997 Balanced Budget Act, public policy makers are exploring schemes for risk adjustment to ensure an equitable allocation of governmental funding for health care while attempting to contain health care costs (Ellis et al., 1996a, 1996b; Iezzoni, Ayanian, & Burstin, 1998; Medicare program: Establishment, 1998; Medicare program: Request, 1998). In this regard, the development of accurate predictive models for apportioning future resource allocations could profitably be based on a comprehensive understanding of current health care expenditure patterns.

The availability of statewide data from California, with its large and diverse population base, presents an excellent opportunity to investigate in detail both rates and costs of hospital care and the patterns of its consumption. In addition, California has experienced a substantial penetration of managed care into the health insurance marketplace over the past 15 years, and the impact of this market shift on health care trends is of considerable interest. We obtained comprehensive discharge and charge data from the...
Methods

Sources of Data

Discharge and charge data were obtained from the California Office of Statewide Health Planning and Development (California Health and Safety Code, undated). The office is mandated by the California Health and Safety Code to collect annual inpatient discharge data from every hospital licensed in the state of California, except for federal hospitals. There are some 3.5 to 3.7 million inpatient discharges annually from nonfederal California hospitals; thus, there are about 3.7 million records in each year’s inpatient discharge database.

Each record in the annual state inpatient discharge database relates to an individual discharge, or hospital stay (of one or more contiguous nights), rather than a unique patient. Hospital inpatient stays are recorded for newborns, as well as for mothers. The databases are compilations of inpatient hospital data, hence conditions treated on an ambulatory basis are not represented therein. Each discharge record includes patient demographics (age, sex, race), admission and discharge status, principal and secondary diagnoses, principal and secondary procedures, total charges, length of stay, hospital identifier, and expected payment source (primary billing source). (Actual payment data are not available.) The age record was used here to limit consideration to patients 55 years of age or older in each annual database.

Charge Data

Total charges include all charges for services rendered during the length of stay for patient care at the facility. Daily hospital services, ancillary services, and other services defined as patient care are included in the total charges. However, the professional component (physician fees related to patient care) is excluded. Kaiser hospitals and Shriner hospitals are exempted by the state from reporting total charges. For purposes of analysis, charges relating to discharges from these facilities were estimated from the same calendar year’s database, using average charges over all other discharges with the same diagnosis from other hospitals. (Percentagewise, the number of discharges from Kaiser and Shriner hospitals among all discharges of individuals aged 55 years and older increased from 7.7% in 1986 to 9.9% in 1992, then decreased to 8.8% in 1995.)

All charges were adjusted to 1990 dollars, using a 4% discount rate (i.e., charges subsequent to 1990 were deflated by 4% annually and charges prior to 1990 were inflated by 4% annually, to adjust all past and future values to 1990 values). In sensitivity analyses, we also examined discount rates of 2%, 3%, and 5%, and found no substantive differences from the findings we present here.

Standardization

We used the direct method of standardization to adjust hospital discharge statistics for differing age and gender structures. Direct standardization applies the observed diagnosis rates for each age–sex group in the study population to the corresponding age–sex group in the reference population so as to derive uniformly weighted summary rates and charge statistics for comparison purposes. For our analyses, we adjusted statistics to the 1990 California population for reference. Annual California population figures (1986–1995) by gender and age were obtained from the California State Department of Finance. The Department of Finance benchmarks the 1980, 1990, and 2000 Census counts as modified by the Bureau of the Census for known misreporting and then uses a baseline cohort-component method for interpolations to noncensus years. Extrapolation of population estimates is done by means of demographic modeling incorporating births, deaths, and migrations.

Results

Rates of Hospital Discharges Fell Between 1986 and 1995

Figure 1A displays the total number of discharges annually from 1986 through 1995. Numbers of discharges tended to increase during this period but remained fairly constant each year at about 24% of that year’s population of Californians aged 55 years and older.

To ensure that rate comparisons over the 10 years depicted were not confounded by different age–sex population mixtures in the different years, the discharge data were standardized to the 1990 California population (Figure 1B). When standardized, hospitalizations decreased at a rate of about −1.8% annually between 1986 and 1992, from an adjusted figure of 1.36 million (254 per 1,000) in 1986 to 1.22 million (228 per 1,000) in 1992. There was then a leveling off to an average of 1.22 million annually (227 per 1,000) between 1993 and 1995.

Figure 2 shows the number of hospitalization discharges and the rates of discharges separately for men and women, after standardization to the 1990 population. Discharges among men declined at about −1.8% annually over this 10-year period, and discharges among women declined at about −1.7% annually until leveling off in 1993. Rates of discharges...
among men declined at about −3.2% annually, from 286 per 1,000 in 1986 to 213 per 1,000 in 1995. Rates of discharges among women declined at about −3.2% annually from 1986 to 1992, from 263 per 1,000 to 214 per 1,000, but have remained relatively constant since then.

Hospital Charges Increased Between 1986 and 1995

Annual total hospital charges (in 1990 dollars) increased substantially between 1986 and 1995, as shown in Figure 3A. Total charges were $12.3 billion in 1986, increased at an annual rate of about 13.1% over the next 6 years to $20.5 billion in 1992, then leveled off in 1993. Per capita charges showed the same pattern (Figure 3B), rising from $2,466 per person in 1986 to $3,682 per person in 1992, an annual increase of about 9.3%, then leveling off in 1993.

Total and per capita charges by sex are shown in Figure 4. Total charges for men increased about 13.7% annually between 1986 and 1992, compared with an annual increase of about 12.6% for women.
Over that same period, per capita charges increased about 9.6% annually for men, compared with 9.0% for women. Total charges are consistently higher for women than for men, but because of the relatively constant 54:46 ratio of women to men aged 55 years and older over the period 1986–1995, per capita charges for men are substantially higher than for women.

**Effects of Age and Sex on Hospital Discharge Rates and Hospital Charges**

We noted that age is a confounding factor both in the observed patterns in the annual rates of discharges over the 1986–1995 period (Figure 1) and in the differential rates of discharges for men and women (Figure 2). We further examined these overall trends in patients stratified into 5-year age intervals starting with 55- to 59-year-olds and found that rates of discharge for men consistently exceeded those for women over the 10-year period under consideration here. Importantly, the crude rates of discharges in Figures 1 and 2 obscure the widely disparate rates evident in the different age groups. In Figure 5, we present rates of discharge for 1986, 1989, 1992, and 1995 by age and sex; patterns are quite similar for the other years not pictured. With the exception of the 90 and older age cohorts in 1986, rates of discharge monotonically increased with age for both sexes in each of these years. Note also that there is about a 5-year lag between men and women: In each year, the discharge rate for men in any particular age cohort [up to 90 and older] was about equal to the discharge rate for women in the next consecutive age cohort.

In Figure 6, we present a composite of discounted annual charges for 1986, 1989, 1992, and 1995 by sex and age. Patterns are relatively unchanged for the different years. It is immediately apparent that total charges tended to peak in the 70–74 age bracket, with total charges higher for men than for women up to around age 74; subsequent to that age, the rate of...
decline in charges for men is much more pronounced than for women.

We explore age–charge differentials further in Figure 7, where we compare population proportions (averaged over the 10 years 1986–1995) in different age brackets with corresponding charges attributable to those age brackets over the same period, relative to the entire California population. Overall, individuals aged 55 years and older comprised 18.2% of the California population (men, 25.3%; women, 10.3%) and incurred 52.1% (men, 25.3%; women, 26.8%) of discounted total charges.

Figure 4. Total charges, A, and average per capita charges, B, relating to all inpatient discharges of individuals aged 55 years and older from all licensed hospitals in the state of California, annually from 1986 to 1995, with the exception of federal facilities, separately by sex, following standardization to the 1990 California state population. Charges are given in 1990 dollars, using a 4% annual discount rate. Yearly per capita charges by sex are relative to the corresponding male or female population of the state of California aged 55 and older in that year. (Between 1986 and 1995, there was about a 9.8% difference annually in numbers of men and women aged 55 and older [54.5% women vs 45.6% men], from the state population figures.)

Figure 5. Rates of inpatient discharges of individuals aged 55 years and over, for 1986, 1989, 1992, and 1995, from all licensed hospitals in the state of California, with the exception of federal facilities, by age and sex.
Private Insurance Payer Mix Has Changed Between 1986 and 1995, But Medicare Is a Constant

In Figure 8, we present graphs relating to the expected source of payment (primary billing source) over the 10 years of the study. Total charges were discounted to 1990 dollars. Figure 8A shows that Medicare was the largest source of payments over this 10-year period. Total charges to Medicare increased 1.7-fold, from $8.8 billion in 1986 to $14.6 billion in 1995. In comparison, total charges to Medi-Cal increased 2.3-fold, from $0.69 billion in 1986 to $1.84 billion in 1995. In the private sector, private insurance (including Blue Cross) dropped dramatically, from $1.62 billion in 1986 to $0.82 billion in 1995, whereas billings to HMO/PHP/PPO organizations increased 5.2-fold, from $0.69 billion in 1986 to $3.6 billion in 1995. Total billings to governmental sources increased from $9.7 billion in 1986 to $16.9 billion in 1995, and total billings to nongovernmental sources increased from $2.7 billion in 1986 to $4.7 billion in 1995.

Figure 8B shows the discounted total charges by payment source as a percentage of the total hospitalization charges. Charges to Medicare modestly declined, from 71.4% of total billings in 1986 to 67.9% in 1995. Medi-Cal billings increased slightly, from 5.6% in 1986 to 8.5% in 1995. Private insurance billings dramatically declined, from 13.1% in 1986 to 3.8% in 1995, whereas HMO/PHP/PPO billings increased from 5.6% in 1986 to 16.6% in 1995. Overall, billings to governmental sources remained relatively constant at about 78% of total charges annually compared with 22% of total charges billed to nongovernmental sources.

Discussion

A comprehensive understanding of current health care consumption patterns can provide a solid foundation for devising future models for health care resource allocation. Although many studies have examined disease-specific costs (Grasso, Weller, Shaffer, Diette, & Anderson, 1998; Hodgson & Co-
hen, 1999; Jollis et al., 1996; Lozano, Sullivan, Smith, & Weiss, 1999; Weiss, Sullivan, & Lyttle, 2000), little data are available regarding comprehensive overall trends. Inpatient hospital care represents the dominant fraction of per capita health care expenditures for national samples and therefore the most important target for decisions regarding future expenditures (Health Care Financing Administration, 1997; U.S. Department of Health & Human Services, 1991, 1992). We have analyzed a complete data set consisting of all licensed hospitals in California (except federal hospitals) to determine hospitalization rates and costs over the period 1986 to 1995 for individuals aged 55 years and older. By collating comprehensive hospitalization data from a large and diverse population over a decade, broad trends in current health care consumption can be discerned and analyzed.

Our analysis of hospitalization discharge rates revealed several interesting trends. Numbers of hospital discharges (Figure 1A) increased from 1.24 million in 1986 to 1.34 million in 1995. When standardized to the 1990 population, however, annual hospital discharges fell substantially between 1986 and 1992 and have remained relatively constant since then. Compared with 1986, the number of population standardized hospital discharges was 10% lower in 1995. There was also a consistent difference in the rates of hospital discharges between women and men (Figure 2), with rates for men being consistently higher than those for women.

In addition to analyzing hospitalization rates, total hospital charges (excluding physicians’ fees) were also examined. Although population-adjusted hospitalization rates fell, total hospital charges increased, even...
after adjusting for inflation. Annual total charges as well as total hospital charges per capita adjusted to 1990 dollars rose rapidly between 1986 ($12.3 billion total charges) and 1993 ($21.1 billion total charges). After 1993, however, total adjusted hospital charges showed little change, at about $21.3 billion annually. When expressed as per capita, hospital charges rose from $2,466 in 1986 to $3,761 in 1993, then leveled off to $3,755 in 1994 and $3,752 in 1995.

When rates of discharges and total hospital charges are examined by gender and age, several interesting patterns emerge. Rate of discharges were consistently higher for men than for women in every age bracket examined (Figure 5), and the distribution of discharge rates seems to be shifted about 5 years earlier in men compared with women. Elderly people are heavy consumers of health care resources: Overall, individuals aged 55 years and older comprise 18% of the entire population of California and incur 52% of discounted total hospitalization charges. The magnitude of the age-related charges emerges when the percentage of total hospital charges in any particular age group is examined within the context of the percentage of that cohort in the total population (Figure 7). The ratio (relative hospital charges/fraction of the total population) monotonically increased in each 5-year age bracket between ages 55–59 and ages 85–89 in both men and women: from 1.6 to 7.0 in men and from 1.3 to 4.8 in women, respectively.

Because California has been a well-publicized arena for the growth of managed care, we were interested in examining the changes in discharge and charge by payer source over time. During the 10 years examined in this study, there was a virtual disappearance of private insurance (36.0% of the discounted total charges in 1986 to 6.0% of the discounted total charges in 1995) with a corresponding increase in the HMO/PPO sector (17.3% of the discounted total charges in 1986 to 34.8% of the discounted total charges in 1995). Medicare billings modestly declined, from 71.4% in 1986 to 67.9% in 1995, whereas Medi-Cal billings increased from 5.6% in 1986 to 8.5% in 1995. Total government coverage increased from 39.5% in 1986 to 55.8% in 1995. Overall, primary billings to governmental sources remained relatively constant over this 10-year period, at about 78% annually.

Analysis of the average hospital charge per discharge revealed modest differences among the various payer types: In 1995, for example, the average charges per discharge were $15,910 for Medicare patients, $18,800 for Medi-Cal patients, $15,470 for HMO/PHP/PPO patients, and $17,130 for patients with private insurance. Direct comparison is difficult, however, given the presumably different case mixes associated with the different payer categories.

The implications of our findings relating to future health care consumption are sobering. The two fundamental factors affecting hospitalization expenditures are the absolute numbers of hospitalizations and costs. We have found that, in the age cohort we have examined here, the overall rate of hospitalizations has bottomed out at about 230 per 1,000 between 1992 and 1995. Even if the rate of hospitalizations remains fairly constant over the next decades, the absolute number of hospitalizations will increase dramatically due to the net rise in population in this age cohort from births and migrations (after allowance for mortality). Indeed, the number of Californians aged 55 and older is projected to rise from 3.7 million in 1995 (17.9% of the total California population) to 8.9 million in 2010 (22.2% of the total population), 13.0 million in 2025 (26.7% of the total population), and 15.2 million in 2040 (25.9% of the total population). The 2010 projection constitutes a 54.3% increase in the absolute number of Californians aged 55 and older compared with 1995; the 2025 projection, a 225.6% increase; and the 2040 projection, a 264.5% increase. Hospitalizations would likely mirror this population increase, as hospitalizations in this age cohort are rarely elective; that is, demand is relatively inelastic. The current inpatient health care delivery system in California is inadequate to meet the logistic requirements engendered by the projected population growth: Occupancy rates cannot simply rise without the need for more facilities. Even in the short term, there are clear limits on the increased numbers of inpatient hospitalizations that can be accommodated without compromising efficiency or quality of care.

Similarly, there is some indication that annual per capita charges leveled out at about $3,750 in 1995. Nevertheless, over the long term, costs will likely increase for a number of reasons. By 1995, managed care had thoroughly penetrated the California market and had achieved major cost savings through negotiated price discounts from physicians and other health care providers. Managed care providers now face the daunting task of wringing any further savings from the health care delivery system in the face of growing disenchantment and discontent from physicians and consumers. The introduction of new and costly technology for diagnostic and therapeutic purposes will also strain cost-containment measures. And if new hospitals are to be constructed, or presently mothballed beds reopened, costs of inpatient hospitalizations will necessarily rise as providers seek to recover these new capital expenditures through amortization or annuitization procedures.

Even in a best-case scenario under which hospitalization costs remain relatively constant, the increased financial burden likely to be incurred by Medicare and Medi-Cal merely by the changing demographics of the population is staggering. The problem is familiar to those who have followed the debate surrounding Social Security’s future financial struggles and raises the profound national issue of how these programs can remain financially solvent. Virtually every retiree is eligible for Medicare. In the year 2000, there were about 5.71 individuals in California aged 21 to 65 (potential contributors to Social Security and Medicare) for each individual aged 65 and older. This ratio drops dramatically from about the year 2011, when the first baby boomers become eligible...
for retirement at age 65. By 2031, when the last boomers turn 65, the ratio of potential workers to retirees in California is only 3:2.7. As with Social Security, one might mitigate the growing burden for taxpayers by raising the age at which persons would become eligible for Medicare or by establishing an annual maximal income for eligibility (i.e., means testing), although both are somewhat politically unpalatable. On the other hand, the introduction of a prescription drug benefit into Medicare will surely lead to a substantial jump in per capita expenditures. Slowing the growth of Medicare spending has been a high priority of federal legislators over the past decade, an attitude at variance with the dramatic increase in costs that would be engendered by a prescription drug benefit.

Clearly, it is in the public interest that strategies be developed for addressing health care inequities, apportioning health care delivery, and controlling health care expenditures. Data such as presented here can inform (although not resolve) debate on constructing rational predictions of the levels of need and expenditures in the elderly segment of our population.

With regard to our methodology, we note that standardization is commonly used to control for possible differences in populations that are due to variations in the distribution of certain underlying characteristics, such as age and sex. In this study, we adjusted for the influence of varying age–sex cohort sizes in the California population between 1986 and 1995 on annual discharges and charges through direct standardization, using the 1990 California population from the U.S. Bureau of the Census as the standard. This population figure should be more accurate than the state population projections for the off-census years provided by the California Department of Finance.

Similarly, we adjusted all monetary charge data to 1990 dollars, thereby ensuring that the maximal period of annualized discounting was 5 years. The year 1990 was thus our standard, in terms of both direct population standardization and monetary discounting. We discounted to allow for the differential timing of costs and consequences (i.e., we discounted future costs to equate them to their 1990 value, reflecting the fact that future dollars are values less high than 1990 dollars; Warner & Luce, 1982.) Our choice of discount rate can be made on the basis of high than 1990 dollars; Warner & Luce, 1982.) Our choice of discount rate of 4% seems appropriate for an economic evaluation such as presented here (Gold, Siegel, Russell, & Weinstein, 1996); from our sensitivity analyses, findings are rather robust to choice of real discount rate (which is more of a value judgment than a technical judgment).

We caution that the charge data available in the California state inpatient discharge database do not necessarily reflect costs or reimbursements (Finkler, 1982). We acknowledge that market prices may not reflect opportunity costs and that market imperfections exist in health care. It might be possible to derive costs by adjusting for hospital-specific cost-to-charge ratios within diagnosis or procedure categories; however, this would be a daunting task, and the derivation would be dependent on the quality of accountancy studies within each licensed hospital in the state. Hence, we do not have a clear and objective way of making adjustments of charges to costs. Moreover, from the viewpoint of the governmental or nongovernmental billing source, that is, the third-party payer, the actual charges are perhaps more relevant than the underlying hospitalization costs, insofar as they reflect diagnoses and procedures. (Again, we acknowledge that reimbursements, i.e., actual transfer payments, may not be the full amount billed.)

The statistics presented here are affected by both sampling error and sources of nonsampling error, such as nonresponse bias and respondent reporting errors. Our data consist of the entire population of all inpatient discharges in every licensed hospital in the state of California with the exception of federal facilities. Licensed hospitals are required by law to report all inpatient discharges to the California Office of Statewide Health Planning and Development (with the hospitals liable for daily fines for nontimely transfer of records). The state database thus contains records representing 98% of all hospitalizations within California over this decade. Hence, nonresponse should be of little concern, and selection bias from exclusion of military and Veterans Administration hospitals should be minimal, with slight underrepresentation of discharges accruing to active military personnel and their dependents, as well as military retirees. Similarly, we are confident that hospital reporting errors should not have much impact in the aggregate on our data summaries. Green and Wintfeld (1993) reported the results of a reabstraction study using records from the California Office of Statewide Health Planning and Development; they found that information on age and sex was quite reliable, with error rates of less than 1%. At the local (hospital) level, required data are typically abstracted from medical records by a coding staff credentialed by the American Health Information Management Association and are transmitted electronically to the state office on a semiannual basis. Policies and procedures are well formulated, with the state office dictating requirements for effective and efficient data management and transfer. The state office in turn screens the data for accuracy and may return certain data to individual hospitals for clarification if the state screening algorithms detect possible error levels exceeding a nominal 1%–5% threshold. Monitoring and improving data quality are ongoing processes with the state office, which works closely in concert with the hospitals to ensure seamless and accurate data acquisition.

This analysis of the California population provides a comprehensive picture of the pattern of hos-
pitalizations and charges between 1986 and 1995 among individuals aged 55 and older. Although federal institutions (military and Veterans Administration hospitals) were not included within the data set, the covered hospitals made up more than 98% of total hospitalizations within California over this decade. Elderly people, especially men, exert a disproportionate impact on the consumption of hospital care and charges. In addition, there is heavy reliance on government funding, in particular Medicare, in this age cohort. As the population ages, these findings have important implications for future allocation of public resources for health care as well as the interpretation of cost-containment measures.

References


Received March 29, 2001
Accepted October 8, 2001
Decision Editor: Laurence G. Branch, PhD

The Gerontologist