An Examination
of
The Implications of Excess Hospital Bed Capacity

By

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Dedication

I dedicate this thesis to a number of people who have helped me along the road to a lifelong goal . . .

To my children Jason and Jill *to serve as inspiration that it is never too late to achieve your goals in life.*

To my supportive familty and friends *who have tolerated my neglect when the college work had to come first, especially this last month.*

And

To John *for all your encouragement, care and guidance.*

I love you all.

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INTRODUCTION

The United States has excess hospital bed capacity. For many years, health care experts have suggested the "overbedding" of the American hospital system has been one of the key drivers of high medical costs. Dating back to 1959, when Milton Roemer, MD, proclaimed "A built bed is a filled bed," there is evidence that the availability of hospital beds creates the demand for hospital services. In turn, overuse of hospitalization, the most expensive mode of medical care, propels overall health care costs.

For the period 1960 to 1980, the number of hospital beds in the United States rose 55 percent while population increased only 26 percent. Medical care prices were also skyrocketing. For the period 1974 to 1982, the medical care services CPI (consumer price index), a measure of price inflation, was increasing dramatically each year. The average annual rate of increase for the period was 10.59 percent. In 1983, the annual increases in medical CPI began to slow with the average annual rate of increase dropping to 8.66 percent. The trend is continuing with the annual increases for 1994 and 1995 being only 5.2 percent and 5.1 percent respectively.

There are a number of factors that may be influencing the slowing of the rate of medical inflation (CPI). The number of hospital beds in the country is decreasing, a trend that began in 1983 and continues. Hospital occupancy rates now hover around 63 percent compared to 75 percent in the mid-seventies. Concurrently, and perhaps as an outgrowth of the decline in inpatient occupancy, hospital outpatient visits have increased over 40 percent since 1983. Health maintenance organizations (HMO) have increased in their penetration, particularly in certain regions of the country. HMOs emphasize outpatient care and reduce hospitalization.

Several questions come to mind. Is there an explanation as to why medical inflation is rising at a slower rate than previous decades? Does the closure of unnecessary hospital beds have an effect on inflationary trends? How far will managed care expand hospital excess capacity? Will less hospital beds equate to less cost and less inflation?

What are the other factors that may come into play? Is the problem addressed differently in different regions of the country?

For the twenty-year period 1975 to 1994, this paper will examine a possible relationship between the annual percentage change of medical CPI and the percentage rate of reduction of hospital beds per thousand population. Since national HMO information is only available since 1976, it will also explore a possible correlation between HMO penetration and the reduction in the number of hospital beds from 1976 to 1994. A subsequent analysis will address the relationship between HMO penetration and hospital beds regionally for the period 1983 to 1994.

The research includes an examination of the literature to provide background information on the subject.

BACKGROUND

National Expenditures

In 1993, this country spent almost $900 billion for health care, up 7.8 percent from 1992. Although growth in overall health spending slowed, health care as a share of Gross Domestic Product (GDP) rose to 13.9 percent. Hospital care spending growth slowed to 6.7 percent in 1993 for the same period, down from increases of over 10 percent in 1990. Although length of stay in the hospital also fell for the period, hospital care expenditures still accounted for $326.6 billion or 41.7 percent of personal health care expenditures (Levit, et al, 1994). The Consumer Price Index (CPI), which measures inflationary annual increases in prices, includes a category "Medical Care Services," representing physician and hospital components. For the study period 1974 to1994, the Medical Care Services CPI rose an average of approximately 6.8 percent a year. This represented a tremendous "slowing" from the previous 10 years which rose at an annual at 10.59 percent.

According to Feldstein (1988), the phenomenon of rapidly rising hospital costs has been around since the 1950s when hospital costs rose six to nine percent annually.

Hospital rates have generally risen at rates greater than the general CPI (Feldstein, 1988). A definition of medical CPI appears later in this paper.

There are a number of potential reasons that hospital care expenditures continue to climb. New technology allows more advanced services to be done both in the hospital and on an outpatient basis. Some of this technology decreases length of stay, leaving empty hospital beds. The hospital must account for the fixed cost, or overhead, attributable to empty beds. The cost burden must be transferred to other hospital services or beds which are being utilized. Above all, the demand for hospital care is "provider-induced" generally by a physician who stands to gain financially. Hospitals also induce their own patient demand through discharge referrals to vertically-integrated home health care, laboratory, durable medical equipment, and other agencies. All of these keep hospital costs climbing.

For many years, hospitals have expanded capacity in order to capitalize on the luxury of third party payment for growth in revenue. There are several events that encouraged hospitals to expand their number of hospital beds. The Hill Burton Act of 1946 provided federal funds for hospital construction, primarily in the rural areas. Blue Cross and other medical insurance to employees became commonplace during and after World War II to attract employees. With a third party now paying the bill, demand shifted because patients were able to afford care in a hospital. Coupled with the physician-induced demand, the situation provided the perfect recipe for overbedding.

Finally, and probably the most noteworthy event, the introduction of Medicare and Medicaid in 1965 provided millions of United States citizens access to medical care with little or no out-of-pocket cost.

As "a built bed is a filled bed" (Feldstein on Roemer, 1988), hospitals with the cooperation of physicians, took advantage of a profit-making opportunity to fill beds with Medicare, Medicaid, and private insurance patients. Further, for several years the Medicare and Medicaid programs paid participating hospitals on a "cost-plus" basis,

thereby insuring profit on each and every admission. Private insurers paid full charges until recently (Feldstein, 1988).

In addition to too many hospital beds, America also has too many physicians. For the period 1970 to 1980, the number of medical students grew 66 percent creating an oversupply of physicians. In 1970, the physician to population ratio was 159 to 100,000. In 1989, the figure was 237 to 100,000 and still climbing. In a supplier-induced environment such as health care, an excess supply of physicians logically creates an excess demand for hospital services. However, current controls on admissions through utilization management programs employed by managed care companies and even traditional insurers are deterring hospital admissions. Physicians no longer admit every patient they wish. They must now get permission from a third party. Many times the answer is "no", leaving more hospital beds empty. Even without the new restrictions, overcapacity is so great that physicians would be hard pressed to fill all the beds.

Government Intervention

The federal government has tried to harness rising health costs over the years. The Economic Stability Program of 1971 slowed increases in hospital costs during 1972 to 1974. The United States government removed controls for the health industry in 1974, two years after the rest of the economy. After removal of the controls, health expenditures immediately rose very rapidly to their post-1966 rates of increase (Feldstein, 1988).

In 1975, Congress enacted the National Health Planning and Resources Development Act to address the high costs associated with hospital expansion. The act designated Health Service Areas and established a national certificate-of-need program (CON). States also enacted their own CON programs, some before this time. There appears to be some doubt, however, as to whether the programs lowered or raised hospital beds and hospital plant assets prior to 1980 (Lefkowitz, 1983).

One of the most significant events in controlling rising health care expenditures took place in 1982. Under President Reagan, the federal government began paying hospitals for Medicare (and later Medicaid) patients on a per-case, prospectively determined payment methodology, known as Diagnostic Related Groupings (DRGs). The new methodology caused a tremendous shift in how hospitals treated Medicare patients. For the first time, hospitals had to improve their efficiencies to discharge patients appropriately. There was no incentive to keep them.

Excess Capacity

In the 1970s, it was estimated that the United States had an excess of 60,000 to 100,00 hospital beds (Feldstein, 1988). In 1994, although the country had already begun to see a decline in hospitals beds, there was an estimated excess of 450,000 beds (Soparivala, 1997).

Excess hospital bed capacity carries a substantial cost inasmuch as the fixed costs for the unused beds must be spread across the prices charged for utilized bed, thus driving consumer costs even higher (Soparivala, 1997). To be efficient, hospitals should run at an 85 percent occupancy rate with 4.0 beds per 1000 population (Feldstein, 1988; McClure, 1976). As of 1994, the average hospital occupancy rate in the United States was 62.9 percent. Three of the four census regions of the United States had occupancy below 60 percent. Hospitals are closing or reducing bed size, albeit not at a rapid enough pace (Feldstein, 1988). As of 1994, the country has 3.4 beds per 1000 population; however, with an occupancy rate well below the ideal 85 percent, it appears that there is still substantial excess bed capacity.

Hospital closure is not easy. There are significant social problems inherent to closing down a hospital. In a *Business & Health* article "Patients, profits and health system change," Wall Street experts acknowledge the substantial political role of a hospital in a community makes closure extremely difficult. The hospital is generally one of the largest employers in the area. It also brings a level of prestige and convenience to

those in the community. The hospital industry is close to $400 billion in the U.S. Even with excess capacity, hospitals are still very profitable and not very eager to close or give up beds. (Ginsburg & Grossman, et al, 1997)

The Role of Managed Care

For purposes of this paper, the term "managed care" is defined as care received/provided by health maintenance organizations (HMOs). An HMO is defined as a "closed (physician/hospital) panel prepaid care plan." The concept originated with the Kaiser Permanente Corporation in the 1940s. Kaiser hired physicians and purchased hospitals for the sole purpose of providing health care benefits to its employees in Portland, Oregon, Honolulu, and Los Angeles. The HMO concept integrates insurance coverage and the delivery of health care into a single organization. The Kaiser Permanente HMO represents what is known as a "staff" model. Newer forms of HMOs have since developed whereby groups of individual physicians and hospital contract with an organization. Known as "group" models or "Individual Practice Associations" (IPAs), groups of physicians in practice together or separately are brought together via contract to provide health benefits to a defined population. Generally payment is on a capitated, or per-head amount prepaid to the provider. In any of the HMO forms, the key idea is that the providers of care have no financial incentive to provide unnecessary care because the HMO, hospital, and physicians all share common financial interests (Phelps, 1997). HMO patients usually choose a primary care physician who must direct all care in order for it to be paid for by the plan.

The Nixon administration found HMOs to effectively reduce health care expenditures escalating at a rapid pace since the passage of Medicare and Medicaid in 1965. During his presidency, Congress passed The HMO Act of 1973. Designed to spur competition, the Act required employers of 25 or more employees to include an offering of a federally-qualified HMO in their health benefits package. Under the law, the

employer contribution had to equal that of the largest amount contributed to its non-HMO plans.

HMOs began to flourish in throughout the 1980s and 1990s. Because the HMO philosophy is one of preventive care provided on an outpatient basis, hospitals have lost significant patient volumes. HMOs currently enroll more than 51 million people as of 1994, or 19.4 percent of the population (HMO Survey, 1994). In the Western region, HMO penetration exceeds 31 percent and HMOs have been credited for closure of six percent of the hospital beds in California (Robinson, 1991).

Summary

In summary, there are many events in history of health care that have driven hospitals to the current state of excess capacity. In many instances, the calculations for building hospital bed capacity were originally faulty. In others, hospitals have created the capacity to drive revenues from willing third party payers. Physicians have played a role by admitting patients for their own financial gain.

In any event, hospitals have now realized the situation and the dim future for inpatient beds. They have begun to consolidate, close some beds and/or shut down completely, in response to managed care and other market forces.

Additionally, we have begun to see a slowing of medical inflation or CPI in recent years. Research on this issue will determine if the reductions in hospital bed capacity or the proliferation of managed care, or a combination of both, is making the difference.

LITERATURE REVIEW

There are a number of studies addressing hospital capacity, the costs related to excess capacity, issues relating to closure, and the effects of HMO penetration on hospital utilization.

Hospital Capacity/Demand for Services

According to the American Hospital Association, 33.2 million people were admitted to hospitals in 1993, the lowest number in 20 years. At their peak in 1982, hospital admissions totaled more than 39 million. In 1994, the supply of hospital beds exceeded the demand by almost two to one, with predictions calling for a three-to-one ratio by 1999 if the trend towards managed care continues (Tokarski, 1996).

Probably the most prophetic statement about hospital capacity and its ability to drive demand come from Milton Roemer, M.D. Roemer and Shain (1959) found "the more beds there are, the more they are going to be used. So cost control comes back to control of the number of beds." Their study found there is a high correlation between bed supply and hospital utilization. Further, 70 percent of the differences in hospital utilization by state and by county are associated with differences in bed supply. Studying 17 years from 1940 to 1957, Roemer and Shain (1959) found the same relationship between the bed supply of the states and the number of hospital days per 1000 population. By increasing the bed supply to approximately four per 100,000 residents, doctors would admit patients to the hospital for treatment usually handled in the doctors' office. The rise in hospital insurance encourages this type of practice (Roemer and Shain, 1959).

In a subsequent study, Roemer (1961) proved that, given widespread health insurance in an area, greater hospital capacity equaled greater utilization and higher lengths of stay. Testing hospital utilization between 1957 and 1959 when bed expansion occurred in 1958, Roemer found the number of patient days had risen by 20 percent. Roemer stated physician influence and insurance caused the increase. Physicians like the

added beds to increase their personal wealth and prestige. Since insurance was becoming more prevalent and a third party was paying the bill, the physician, not the patient, was controlling the utilization (Roemer, 1961). Rice (1966) also found the physician is key to the medical care framework. He stated the private practice physician, in principle, is a general contractor to produce health care for his patients. The hospital, in the scenario, is a subcontractor to the physician (Rice, 1966).

Roemer examined Blue Cross patient days between 1957 and 1959. He found hospital days to increase 38 percent in an area where bed capacity rose 42 percent for the same period, noting the closeness of the two figures. He also found hospital occupancy in areas with low bed supplies did not have higher occupancy levels as one might think. In fact, Roemer found the percentage of vacant beds is about the same in those areas, with the percentage of vacant beds being greatest in states with low insurance levels (Roemer, 1961).

Lefkowitz (1983) noted "Roemer's law flew in the face of general economic theory." She cited Martin Feldstein's contention that perhaps reduced insurance coverage, as opposed to limits on supply, would result in lower costs. She also cites Havinghurst (in 1974) and Enthoven (in 1976) who believed that competing economic units, such as HMOs, would more effectively contain costs than regulation. Regulating supply limits might "preclude the entry of more efficient providers into the marketplace" (Lefkowitz, 1983).

Leaders of this country have long recognized that excess hospital capacity, which includes not only beds but labor, equipment and plant assets, increases health cost. In a study completed in 1976 for the Department of Health, Education and Welfare, McClure (1976) found "substantial evidence of excess hospital capacity which contributes significantly to medical cost escalation with little or no benefit to health." He estimated hospital capacity in the United States could be reduced by at least 20 percent or more without harm to the American public. At that time, occupancy rates averaged 75 percent

nationally with 4.4 beds per thousand. He warned, however, savings from hospital reduction would be eroded unless hospitals were restrained from excessively increasing labor and capital dedicated to the remaining beds. McClure noted more savings could be achieved by closing entire hospitals rather than beds for this reason (McClure, 1976).

Cerne and Montague (1994) examined the "capacity crisis," stating the disequilibrium between supply and demand for hospital beds is shifting the leverage to commercial payers negotiating managed care contracts. The situation is draining capital for other community services, such as health promotion, primary care and disease prevention programs. Some suggest a reverse Hill Burton Act which would provide some government assistance to help close hospitals, although some would be skeptical about the taxpayer's role in bailing out hospitals (Cerne and Montague, 1994).

Effects of Physician Supply on Hospital Costs

Physicians play a key role in controlling hospitals as far as cost and capacity. Roemer (1959) saw physicians as a "filler" of hospital beds. Since the physician decides if a patient should be hospitalized, he/she acts as a contractor, providing patients to the hospital, while maximizing profit for himself/herself. In this model, the physician's interest are best served by an increase in hospital capacity, which, in turn, increases the physician's personal productivity. Increases in personal productivity translate to greater income. Particularly when physicians have staff appointments at only one hospital, they would favor "slack" or excessive capacity or duplicative services because is enables them to economize on their own time. In the physician-control model, physicians would favor hospital costs to be lower in order to maximize their own billing capability; however, with the widespread availability of hospital insurance, the physician has no objection to the hospital maximizing profit as well (Feldstein, 1988).

Lewin & Associates (1979) stated the relationship between hospital demand and supply is not direct. Additional factors include the number and type of physicians in a given area, socioeconomic status of the population, and general characteristics of the

delivery system. For example, the study found as the number of General Practitioner rises for a given physician/population ratio, the number of beds in a community falls, generally due to lower admission rates. In areas where there is a shortage of General Practitioners, ambulatory care is replaced by hospital care. The higher the overall physician to population rate, the greater demand for hospital services, particularly the number of surgeons. Chiswick (1976) also found the presence of non-surgical physicians not related to hospital admissions.

The Lewin study concluded as the average size of hospitals in an area increases, the ratio of beds to population increases a well, sometimes due to an increased number of specialists or the greater demand usually evident in large, teaching institutions.

Excessive bed construction might be attributed to lag times between the decision to build and the time the facilities open, service goals of hospitals and cost-based reimbursement. Cost based reimbursement, particularly from health insurance and Medicare/Medicaid, has been an inherent driver in the overbuilding of capacity (Lewin & Associates, 1979).

The Lewin study also pointed out the tremendous physician influence on trying to correct the excess capacity issue. Hospital policy may hinge on trying to please the medical staff inasmuch as closure of hospital beds may result in decreased income for the physicians. Physicians can easily switch loyalties and take the patients to another facility (Lewin and Associates, 1979).

Joskow (1980) considered the number of physicians per hospital in his consideration of the "supply creates demand" comments in his study on the marginal reservation quality to be considered when lowering excess bed capacity. Contrary to other experts, he concluded the supply of physicians in the area had virtually no effect on the qualitative results of his study (Joskow, 1980).

Specific Market/Regional Conditions

Robinson and Luft (1987) found costs were substantially higher in hospitals operating in more competitive environments, with costs per admission being 26 percent higher in hospitals in the most competitive markets, after case mix and other adjustments. Average costs per patient day were found to be 15 percent higher in the most competitive markets than in those with no "neighbors." Taking out the adjustments, the costs were as much as 35 percent higher. The study pointed to the need for hospitals in these markets to provide more services (such as personal amenities) as well as pay additional attention to the community-based physicians who could have divided "loyalties" to more than one hospital in these markets (Robinson & Luft, 1987).

Robinson and Luft (1985) had many of the same conclusions for many of the same reasons in their study that included regional differences. Compared to the southeast, average costs were found to be significantly higher in the north central, northeast and western regions, although the authors stated that the west was understated for its particularly low lengths of stay. The study overall concluded that greater competition is associated with higher, not lower, hospital costs. The authors suggested, however, that regulatory intervention might be counterproductive. In a subsequent study, Robinson and Luft (1988) cited the California experience in which the government invested in procompetitive and market-oriented strategies, such a selective contracting rather than price control legislation. They found California hospitals experienced rates of inflation in average costs per admission 10.1 percent lower than the control group, which included states with all-payer rate regulation (Robinson and Luft, 1988).

Melnick and Zwanziger (1995) also concluded a competitive approach versus a regulatory approach could play a significant role in controlling health expenditures in the United States. The authors cited the California law which allows health plans to selectively contract with providers. They found per capita expenditures for hospital services were half the national growth rate in California for the period 1980 to 1991 (27 percent for California versus 54 percent for the United States). They measured the policy approach of competition-based managed care and state government rate regulation. They found a reversal of the high cost in highly competitive areas within six to seven years after the introduction of price competition (Melnick and Zwanziger, 1995)

Schwartz and Mendelson (1991) examined the reduction in the number of inpatient days between 1981 and 1988. They noted the annual reduction was the greatest in 1984 and 1985 and became progressively smaller in subsequent years. By 1988, there was virtually no further reduction in the number of inpatient days. The authors suggested the slowing of the increase in costs during the mid-80s can be attributed to the reduction to inpatient days. However, some of the savings were offset by increased outpatient costs. The authors further stated the "era of reductions is virtually over" and that "real hospital costs can be expected to rise unless other effective measures to contain costs are implemented." (Schwartz and Mendelson, 1991)

Flood, et al (1984) concluded greater size is consistent with better outcomes; therefore, the authors promoted the regionalization of services to reduce duplication while providing better quality (Flood, et al, 1984).

Levit, et al (1995) reported in 1993, regional hospital spending per capita varied significantly across the country. Spending per capita in New England and Mideast (known as the Northeast region for purposes of this paper) averaged 15 and 21 percent more than the U.S. per capita respectively. The Great Lakes, Plains, and Southeast regions (North Central and South in this paper) had per capita spending levels approximately equal to the U.S. average. The Southeast and Far West, however, had

dramatic changes since 1980. Spending in the Southeast in 1980 was 13 percent below the U.S. average; and by 1993, spending had moved within three percentage points of the average. In the Far West, hospital spending per capita had gone from the U.S. average in 1980 to 13 percent below the U.S. average in 1995. The authors pointed out this region maintains the highest penetration of HMOs (Levit, et al, 1995).

The Dartmouth Atlas of Health Care study of 1996 found residents in regions with the least number of hospital beds per person averaged about 1.6 days in a hospital each year, while persons in regions with the greatest number averaged approximately 2.6 days each year. The study found significant area differences in hospital usage based on number of beds. In 1989, Boston had 4.3 hospital beds per 1000 residents compared to New Haven with 2.3 beds per 1000 residents. The study found Bostonians were more likely to be hospitalized for common conditions like pneumonia and gastroenteritis where people in the New Haven area would be treated outside of the hospital for similar conditions. There were 11 acute care hospitals in Boston and only two in New Haven. In 1989, the per capita expenditure for acute hospital care in Boston was $1,524. For New Haven residents, it was $777. The study found striking regional differences in hospital beds per thousand in 1993, varying by a factor of 2.8 from fewer than 2 beds per thousand residents in Mesa, Arizona to 5.3 beds per 1000 in Monroe, Louisiana. The study found greater hospital bed capacity per thousand residents of the hospital referral region is associated with higher per capita expenditures. In 33 regions with fewer than 2.5 beds per 1000, per capita expenditure was $831. In the 21 regions with more than 4.5 beds per 1000, the average per capita expenditure was $1,389, or 67 percent higher (Wennberg, 1996). Clearly, the Dartmouth findings support Roemer's law that given added beds, there will be additional patients in the hospital.

The literature supports there are regional differences in cost and use of hospital care. In some instances, there are even differences within a region as evidenced by the New Haven/Boston study results.

The cost of excess hospital capacity

Hospitals and health care systems are faced with decisions on excess capacity, either to close down inpatient facilities or fill beds by reducing prices for inpatient care (Sopariwala, 1997). He warned, however, the decision to reduce prices is sometimes based on flawed methodology, which Sopariwala terms as "expected usage" calculation. When expected usage declines, the fixed cost per patient-day increases. He suggested hospitals use maximum feasible patient-days for more accuracy. In an example provided, excess capacity could add as much as 50-60 percent to inpatient fixed costs per day (Sopariwals, 1997).

Schwartz and Joskow (1980) conducted a study on savings that could be realized by consolidating duplicative services, including general hospital beds, could potentially save about $1 billion per year. However, the authors state the resulting indirect costs, such as moving patients from one facility to another, would reduce that amount significantly or even eradicate the gain. Using Health and Human Service goals for hospital efficiency, they concluded that only reducing the demand for services would truly produce substantial savings. In the study, the authors commented on the definition of excess beds being cited repeatedly as a major source of escalating hospital costs. According to Schwartz and Joskow (1980), approximately 5 to 10 percent (60,000 to 100,000) of the short-term hospital beds have been considered unnecessary. They said a desirable maximum ratio is four beds per 1000 population and an ideal occupancy rate is about 80 to 85 percent. The authors stated 80,000 beds or 10 percent are never used. Keeping in mind that a reserve is necessary, Schwartz and Joskow conclude a that a single large hospital can serve a population, rather than a number of small ones, with more efficient handling of reserve capacity. The authors suggested 75,000 beds need to be closed at a savings of approximately $52,000 per bed per year. With an estimation for marginal cost, overall savings were predicted at approximately $800 million per year. While the figures represent only one percent savings of total hospital expenditure for a

closure of seven percent of all hospital beds, the authors indicated that the patients still have to receive necessary services, albeit at other facilities. However, the cost of regulation in certificate of need programs may negate the savings altogether (Schwartz and Joskow, 1980).

Issues in reducing excess bed capacity

In another study, Joskow (1980) looked at the issue of hospital bed supply decisions based on demand uncertainty, non-price competition among hospitals, and hospital regulation. To the issue of "costly excess bed" perceived in the country, Joskow (1980) warned that beds are not perfect substitutions for each other. He promoted a formula that considers the "reservation quality of the system" and examined the marginal cost associated with turning a patient away. Joskow (1980) argued that we cannot apply the same occupancy criteria to small hospitals as we do to larger ones. Joskow's formula used average daily census in a calculation to determine how many beds were really on hand. The greater the number means there is excess capacity; the smaller the number represents a possibility of patients being turned away. He also indicated that hospitals in areas with high HMO penetration would have a larger average reserve margin since HMOs tend to hospitalize less (Joskow, 1991).

Studying regional differences in the utilization of short-term hospitals in Standard Metropolitan Statistical Areas (SMSAs) in 1967, Chiswick (1976) noted hospital occupancy rate and the bed rate are based on the short-term variations in the demand for hospital services. While costs are incurred for maintaining excess capacity, there are also costs of a different nature when a bed is not available for a patient due to the variation in demand. These include greater pain and suffering, increased probability of death or greater costs in curing the patient by delayed treatment. Another basic issue is that hospital beds in different hospitals are not perfect replacements for each other; e.g. a general medicine bed cannot serve as an obstetrical bed (Chiswick, 1976).

Robinson (1996) stated the number of staffed beds declined much more slowly than the number of inpatient days, financially weakening the major nonprofit hospital systems as the excess beds are supported. He noted for-profit hospitals exercise a strength in reducing number of beds at a more effective rate than non-profits (Robinson, 1996).

Evidence of the long-time problem, the Federal government commissioned the Interstudy organization over 20 years ago to address excess hospital bed capacity. In the study, McClure (1976) concluded reducing hospital bed capacity is more "a socio-political problem than a technical problem." While the technical tools to identify and reduce excess capacity were crude, they were sufficient to begin the process. The "chief barrier to reduction is the absence of public support." McClure stated Americans are unaware of what they are paying for the excess and look more to the convenience, employment and prestige a hospital brings to a community (McClure, 1976).

The effects of HMOs on hospital costs

According to Phelps (1997), extensive studies of HMOs show their lower use of hospitalization, a very costly activity controlled by the physician and/or the HMO plan. A key study, known as the RAND Health Insurance Study, concluded there were no differences in the health outcomes of people who received care from an HMO in Seattle versus those who received care in a full coverage, fee-for-service plan (Phelps, 1997).

In an article in *HealthCare Financial Management*, KPMG Peat Marwick LLP assessed the impact of managed care on hospitals in the 50 largest cities in the US. The 50 cities were categories as having high managed care penetration (above 30 percent of the population enrolled); medium (15 to 30 percent), or low (below 15 percent). The study found hospital costs in cities with high managed care penetration were about 11 percent below national average hospital costs and 19 percent below hospital costs in markets with low managed care penetration. Hospital length of stay in high managed

care markets were 6 percent lower than the national average. The authors found these areas to have no higher mortality or complication rates (Hern, 1996).

Luft (1978) examined how HMOs achieve their savings. He found total costs for enrollees, including premium and out-of-pocket, were 10 percent to 40 percent lower than those for comparable persons with traditional health insurance. He found most of the cost difference, about 30 percent, was attributable to lower hospitalization rates for the HMO members. Luft stated the lower hospitalization rates were "across the board" with no evidence of reductions in discretionary or unnecessary categories of admissions. He concluded the key to lower costs in the HMO appeared to be the lower hospital utilization rate. At the time of this study, Luft found no consistent differences in the average length of stay, although hospital days were 25 percent to 45 percent lower in prepaid group practices and 0 to 25 percent lower in individual practice associations (IPAs).

Miller and Luft (1994) conducted a literature analysis to review managed care performance since 1980. They said physician practice is what is "managed" in managed care. Since there were no studies in the literature available on point-of-service or limited performance results for preferred provider organizations (PPOs), Miller and Luft (1994) concentrated their analysis on HMOs (Miller and Luft, 1994). *Note: A point-of-service plan provides some coverage outside of the HMO. A preferred provider organization is a fee-for-service arrangement with providers of health care. Patients in a PPO can self-direct themselves to providers in the plan.*

In the study, Miller and Luft (1994) reported HMOs had lower admission rates than indemnity plans, although some of the differences were small in the studies they analyzed. In the strongest statistically significant study, however, HMO admission rates were 26 percent to 37 percent lower than indemnity. Further, they found HMO plans had shorter hospital lengths of stay, from one percent to 20 percent shorter than indemnity plans. The statistically strongest study reported a 14 percent shorter length of stay. According to Miller and Luft (1994), hospital charges per stay for HMO patients were

slightly lower than indemnity; however, they felt that the usefulness of the data was questionable inasmuch as some measured charges vs. price paid by the HMO (Miller and Luft, 1994).

Miller and Luft (1994) found no studies which "estimated the impact of managed care plans on national or regional health care expenditures, although some studies estimated the impact on hospital expenditures." They reported studies using data prior to 1985 found no statistically significant relationship between HMO market share and hospital expenses per capita or per admission. Miller and Luft pointed to the Robinson California study (noted later in this discussion) which concluded 10 percent increase in HMO market penetration led to 9.4 percent lower increase in hospital costs per admission for the period they studied (Miller & Luft, 1994).

Miller and Luft (1994) also commented "compared with indemnity plans, HMOs appear to have lower bed use because they can implement a much wider array of methods of affecting physician practice..." (Miller and Luft, 1994)

Contrary to most theorists on the subject, McLaughlin (1987) found that lower hospital costs lead to increased HMO enrollment, not vice versa. McLaughlin measured the effects of prepaid group practices (PGP), i.e. HMOs, on hospital expenses and use for 25 SMSAs from 1972 to 1982. McLaughlin found that an increase in PGPs in an area resulted in reduced numbers of hospital admissions and length-of-stay. However, overall hospital costs were higher in areas with high HMO penetration (McLaughlin, 1987).

McLaughlin (1987) noted the higher costs could be attributed to the HMO's inherent philosophy to admit only the most severe cases to the hospital. Thus, the services are more costly, even though the number of admissions and length of stay are lower.

McLaughlin (1987) also contended that most of the studies conducted on the relationship between HMOs and hospital costs are "unidirectional" with hospital costs

and utilization modeled as a function of HMO enrollment. McLaughlin's study tested HMO enrollment as a function of hospital costs and utilization.

McLaughlin (1987) pointed to a number of variations in similar studies, both in areas studied (SMSA versus federally designated Health Service Areas) as well as findings. In 1978, Hay and Leahy, as noted by McLaughlin, found HMO penetration has a negative, insignificant effect on admission rates and average length of stay. McLaughlin (1976) stated that Goldberg and Greenberg investigated the impact of hospital expenses on HMO penetration at the state level. Like McLaughlin, they found a positive relationship between HMO penetration and higher hospital costs for the period 1966 to 1976 (McLaughlin, 1976).

McLaughlin (1976) suggested HMOs may develop and prosper in areas of high hospital costs because they present themselves as a viable, cost-saving alternative (McLaughlin, 1976).

The MEDSTAT Group, a health care information service firm, found "for hospital care overall, high managed care penetration (defined as greater than 25 percent) was associated with a statistically significant decrease in average length of stay in large and small metropolitan areas, but not in medium-size metropolitan areas. Like McLaughlin, the MEDSTAT report showed areas with high managed care penetration had significantly higher hospital charges than their counterparts with less managed care, despite shorter stays (Carleton, 1997)

Robinson (1991), like Goldberg and Greenberg, found a spillover effect with similar reductions in hospital costs for non-HMO patients. He concluded hospitals operating in markets with high HMO penetration experienced rates of growth at about 9.4 percent less than the average cost per admission rise of 74.5 percent for the period of 1982 to 1988. While the impact was modest compared to the high rate of increase, it represents a slowing nonetheless. Robinson (1991) also reported findings higher levels of HMOs resulted in lower admission rates and lengths of stay (Robinson, 1991).

In a later study, Robinson (1996) measured the HMO impact on California hospital capacity, utilization and expenditures for the period 1983 and 1993. He concluded for the period, hospital expenditures grew 44 percent less rapidly in areas with high HMO penetration vs. those with low HMO penetration (Robinson, 1996).

Robinson (1996) claimed that of the 44 percent reduction, 28 percent was due to reduction in services, ***six percent was due to the reduction in hospital bed capacity***, and the other 10 percent reflected a change in the intensity of services.

The Robinson (1996) study noted hospitals have been the center of the health care delivery system. Hospitals have shifted the focus from inpatient to costly outpatient services such as ambulatory care, laboratory, etc. HMOs are combating that shift by contracting with less costly replacement entities, such as independent medical groups and freestanding sites (Robinson, 1996).

With their rapid growth, HMOs are asserting influence on physician costs as well as hospital costs. HMOs control costs by negotiating favorable payment rates with providers, reducing hospital costs and limiting access to specialized care. In 1988, 61 percent of physicians in private practice had a managed care contract. By 1993, the figure had grown to 75 percent (Levit, et al, 1995).

Cutlerland and Sheiner (1997) also found increased managed care enrollment significantly reduces the growth of hospital expenditures, primarily by reducing length of stay. They found managed care also slows the adoption of new technology, suggesting a "long-term moderating effect on the growth of medical expenditures." The authors found, although every 10 percentage point increase in HMO enrollment reduced the growth of per capita hospital expenditures by 0.5 of a percentage point, it increased physician spending by 0.7 of a percentage point (Cutlerland and Sheiner, 1997).

Public Policy and Managed Care

In another study, however, McLaughlin (1987) pointed out, based on her findings, public policy that promotes the use of HMOs to reduce costs is perhaps flawed. She

stated programs which regulate hospital pricing and/or influence the supply of physicians would be more effective in reducing hospital expenses per capita (McLaughlin, 1987).

Cerne and Montague (1994) cited Massachusetts as an example. With 33 percent of its insureds in HMOs, hospitals have undergone a wave of consolidations. In 1993 and 1994, three were six acute care facility closures, two mergers and several acquisitions. With the managed care penetration on the rise, another 30 percent to 40 percent drop is expected.

Robinson (1991) found legislative barriers may be the detriment of the opportunity HMOs afford to reducing hospital costs in an area. In California, HMO coverage grew from 8.3 percent of all admissions in the local hospital market to 17 percent of all admissions in 1988. Robinson found the average rate of growth in hospital costs between 1982 and 1988 was 9.4 percent lower in markets with high HMO penetration compared with markets with low HMO penetration (Robinson, 1991).

Robinson (1991) contended that removal of legal restrictions for contracting between HMOs and hospitals (e.g. any willing provider, price regulations, etc.) results in hospitals being able to focus on price competition vs. non-price competition such as reputation, level of service, etc. Without the ability to selectively contract with hospitals based on price, HMOs cannot effect hospital costs in a given area (Robinson, 1991).

Beginning in 1983, fee-for-service insurance plans in California were permitted to contract selectively with health care providers, opening the door for price competitiveness. HMOs began to grow rapidly under the scenario (Robinson, 1991).

Robinson noted although deregulation and HMO growth have stimulated price competition in California, hospitals used non-price strategies to attract physicians as an indirect means to obtain more patients. As hospital care is a physician-induced demand, these strategies assure the hospital more admissions by the affiliated physicians (Robinson, 1991).

Angus, et al (1996) examined the effect of managed care on intensive care lengths of stay in Massachusetts, particularly the implications for the Medicare program. They found there appeared to be a 35 percent decrease in resource consumption; however, this was attributed to case mix factors since HMOs have predominantly included younger patients. The authors commented, as HMOs begin to enroll more Medicare patients, thus shifting the case mix to "include sicker and older patients, the initial advantages of reduced resource consumption will diminish" (Angus, et al, 1996)

RESEARCH QUESTION

Beginning in 1974, the Consumer Price Index (CPI) for health care began to rise at runaway levels. For the period 1974 to 1984, the average rate of inflation for the category of Medical Care Services increased at an average of 10.38 percent per year, with some years in the 11 to 12 percent range. For the Hospital Room component, this figure increased at an average of 13 percent for the same period.

In the next ten years (1985-1994), however, the rate of increase in the Medical Care Services CPI began to slow. (See Appendix I)

What caused the dramatic change? There were a number of events happening in the health care arena. Medicare and Medicaid moved to a prospective payment system for hospital care in 1982. Health maintenance organizations (HMOs) began to flourish in the 1980s driving hospital admissions down. Hospitals, which already had excess capacity from overbuilding in the 1960's and 1970's, saw occupancy rates on a steep decline. Some hospitals consolidated, some closed totally, and yet others simply removed a quantity of licensed beds. Many hospitals became for-profit or were purchased by for-profit entities.

Some key questions remain. Is there a relationship between the slowing of the Medical Care Services CPI and the reduction in hospital beds? Can the phenomena be narrowed to hospital actions and reactions to the marketplace? What role does the growth of HMOs play in the reduction in hospital beds?

My research will attempt to answer some of these questions.

Hypotheses & Definitions

Hypothesis #1

Ho For the period 1975 to 1994, there is no relationship between the percentage rate of change of hospital beds per 1000 population and the Medical Care Services Consumer Price Index (CPI-U).

Independent Variable: Annual percentage rate of change in the number of hospital beds/1000 population.

Dependent Variable: Annual percentage rate of increase in medical CPI.

Hypothesis #2

Ho For the period 1976 – 1994, there is no relationship between the annual percentage change (increase) in HMO penetration and the annual percentage change in the number of hospital beds per 1000 population.

Independent Variable: Annual percentage change of managed care (HMO) penetration.

Dependent Variable: Annual percentage change in number of hospital beds per 1000 population.

Hypothesis #3

Ho For the period 1984 – 1994, there is no relationship between the managed care (HMO) penetration rate and the number of hospital beds per 1000 population by region.

Independent Variable: HMO penetration by region.

Dependent Variable: Number of hospital beds per thousand population by region.

Definitions

Consumer Price Index (CPI) – A measure of the average change in prices over time in a fixed market basket of goods and services. Published by the United States Bureau of Labor Statistics (BLS), the CPI is based on prices of a number of items such as food, clothing, physician, hospital, and other services people buy for day-to-day living. The BLS publishes CPI for two population groups: (1) a CPI for All Urban Consumers (CPI-U) which covers approximately 80 percent of the total population; and (2) a CPI for Urban Wage Earners and Clerical Workers (CPI-W) which covers 32 percent of the population. The CPI-U, which will be utilized for this study, includes, in addition to wage earners and clerical workers, groups such as professional, managerial, and technical workers, the self-employed, short-term workers, the unemployed and retirees and others not in the workforce.

Medical Care Services CPI – The Medical Care Services category of the CPI-U includes hospital, professional and other medical services. It represents an average relative importance to the overall CPI of approximately five percent of the overall CPI-U. Hospital room, included in Medical Care Services, is an average of .6 percent of the medical care CPI-U. This study will use Medical Care Services CPI as the measurement because the data is continuous, that is calculated annually and quarterly, and is readily available by region (Relative Importance of Components in the Consumer Price Indexes, 1991; Bureau of Labor Statistics on-line). (Appendix I)

Regions – Regions of the country as defined by the Bureau of the Census: Northeast, North Central, South, West. A full listing of states contained in each region is included in Appendix IV.

Hospital Beds - For purposes of this study, hospital beds are defined as non-federally owned, short-term hospital beds; i.e. those having an average stay of less than 30 days as

defined by the American Hospital Association in its Hospital Statistics, published annually. Also referred to as Community Hospital in 1985 statistics (Source: Statistical Abstract of the United States).

Hospital Beds Per 1000 Population - Short-term hospital beds per 1000 population by states as published annually in the American Hospital Association's Hospital Statistics (Source: Statistical Abstract of the United States).

Percentage Rate of Change of Hospital Beds/1000 Population - Percentage change in the number of short-term beds per 1000 population calculated as a change from the prior year (Source: Statistical Abstract of the United States).

Managed Care - For purposes of this study, managed care will refer to health maintenance organizations (HMOs) only. A full definition of HMOs is included within the body of this paper. The study will not segregate health maintenance organization by type, e.g. IPA, staff model, etc.

Managed Care Penetration - Number of persons enrolled in health maintenance organizations by region divided by the total state population (Sources: GHAA's National Directory of HMOs database & the Statistical Abstract of the United States).

DATA AND METHODS

Data

Data on hospital beds, occupancy rates, outpatient visits, physician supply and population were collected from the Statistical Abstract of the United States, editions 1976 through 1995. The data for 1989 hospital beds, occupancy rates, and outpatient visits was obtained directly from the 1990 Annual Survey of Hospitals conducted and published by the American Hospital Association. The survey is the source for the information contained in the Statistical Abstract of the United States. Information was gathered on a state basis and converted, when necessary, to the four major regions of the country as defined by the Bureau of the Census. The number of beds per thousand were calculated using the population figures obtained from the Statistical Abstract of the United States.

Information on health maintenance organization enrollment was collected from three sources. Figures for 1988 to 1994 were obtained from the American Association of Health Plans, formerly known as the Group Health Association of America. The 1988 to 1994 figures represent enrollment on December 31 of each year. Enrollment for 1983 to 1987 came from an InterStudy publication, *Managed Care: A Decade in Review 1980-1990* (1990). Figures for the period 1983 to 1987 represent enrollment as of June 30 of each year. Both sources provided the information based on the census regions. National enrollment was obtained from the *Statistical Abstract of the United States 1990* for the period 1976 through 1979. Regional figures were not available for this period.

HMO enrollment was divided by population to obtain managed care penetration rates. Annual percentage change differences were then calculated.

National CPI-U Medical Care Services figures (1974 to 1994) were obtained from the *Statistical Abstract of the United States* (various years). Regional CPI-U and percentage change data were obtained from the *CPI Detailed Reports*, January issues for the years 1984 to 1995. Other CPI information came from the 1984 – 1995 editions of the publication *Relative Importance of Components in the Consumer Price Indexes.*

Some general information was obtained from the Bureau of Labor Statistics Internet Web Site.

Table 1 includes the variables and descriptive statistics.

Table 1 – Descriptive Statistics

	Mean	SD
1975-1994		
Hospital beds/1000 (national) (1)		
Annual % change	-0.011	0.012
Medical Care Services CPI-U (national) (1)		
Annual % change	8.600	2.078
1976-1994		
HMO Penetration Rate (national) (1)		
Annual % change	0.115	0.072
1984-1994		
HMO Penetration Rate (2)		
-Northeast Region	0.134	0.060
-North Central Region	0.121	0.039
-Southern Region	0.067	0.033
-Western Region	0.223	0.057
Hospital Beds (1)		
-Northeast Region	206.225	7.528
-North Central Region	254.167	35.552
-Southern Region	337.392	9.775
-Western Region	148.467	3.977

Source: (1) Statistical Abstract of the United States (various years); (2) 1988 to 1994 figures are December 31 as obtained from the American Association of Health Plans; 1983 to 1987 are June 30 enrollment rom Managed Care: A decade in review; population for penetration rate calculation from the Statistical Abstract of the United States (various years).

STATISTICAL METHODS

Hypothesis #1

An ordinary least squares regression model run on SPSS was used to test the hypothesis that the change in hospital beds per 1000 population influenced Medical Care Services CPI-U for the period 1975 to 1994. Variables for 1974 were used to determine the percentage annual change for the beginning of the period. Annual percentage changes were used for both statistics to accommodate the change in CPI base rate in 1977 and 1982-84.

Standard F and t tests using 18 degrees of freedom and a confidence level of .95 were utilized. A Durbin-Watson model was employed to test for autocorrelation, or serial correlation, inherent in time-series data. Autocorrelation is the possibility of the statistical dependence of errors on preceding errors (Wesolowsky, 1976) or a tendency for effects to persist over time even when independent variables change (Vogt, 1993). A residual scatter plot was generated to examine the hypothesis.

Hypothesis #2

A regression analysis using the Excel Data Analysis tool was used to measure the hypothesis that the annual percentage changes in managed care penetration 1975 to 1994 influences the annual percentage change in the number of hospital beds per 1000. F and t tests, with .95 confidence level, were performed to determine any relationship between the two variables.

Hypothesis #3

For the period 1983 to 1994, separate linear regression models were run by region using *actual* number of hospital beds and HMO penetration rate; i.e. not the annual percentage rate of change. Since HMO penetration is greater in some regions of the United States, the analyses was designed to measure if the reduction in bed supply due to HMO penetration was a regional phenomena. Standard F and t tests were performed.

using 10 degrees of freedom and a .95 confidence level. A Durbin-Watson analysis was run for each of the four regions.

As the Durbin-Watson analysis for three of the four regions indicated autocorrelation, an Autoregressive Integrated Moving Average (ARIMA) model was performed. The ARIMA method is a complex statistical tool that combines autoregressive analysis procedures with those of moving averages. With the ARIMA model, one is able to account for both systematic error (autocorrelation) and unsystematic (random) error. ARIMA methods are employed in reporting findings for seasonally adjusted prices (Vogt, 1993).

RESULTS

Hypothesis #1 - The effect of hospital bed change on CPI

The regression analysis yielded significant results for the t-test (t=5.616) and F test (F=31.358), p<.001. The Durbin-Watson statistic (1.570) indicates no autocorrelation in the result. The unstandardized coefficient (135.397) denotes that every 1.35 percent change in the increase in hospital beds per thousand population will yield one unit of increase in the annual CPI. Therefore, we *reject* the null hypothesis. The adjusted R square of .616 represents that the independent variable accounts for 62 percent of the change in the dependent variable. See Table 2.

Hypothesis #2 – The effect of national HMO penetration on hospital bed change

The regression analysis failed to produce significant F (F=0.969) or t-tests (t= -0.984), p<001. The results indicated no relationship between the annual percentage change (increase) of HMO enrollment and annual percentage of change of hospital beds per 1000 population. The coefficient (-0.037) and R Square (0.061) are not significant. The results indicate we must *fail to reject* the null hypothesis. See Table 3.

Hypothesis #3 – The regional influence of HMO penetration on hospital bed change

Except for the North Central region, the original regression analysis for this hypothesis produced biased results due to autocorrelation indicated by low Durbin-Watson scores. (See Appendix V.) For the North Central region, the model produced significant F and t-tests (F=8.238, t=-2.870, p<.05). The adjusted R-Square (.397) indicates that the independent variable accounts for approximately 40 percent of the change in the dependent variable. See Table 4.

Autoregressive Integrated Moving Averages (ARIMA) analyses was performed on each set of variables to adjust for the autocorrelation. The ARIMA model produced the following results by region.

Northeast

For the Northeast region, the ARIMA model generated a significant t-test of -3.286, $p<.01$. The unstandardized coefficient (-107.097) indicates that every 1.07 percent change in HMO penetration will yield a reduction of one unit of hospital beds.

South

For the Southern region, the ARIMA model rendered a significant t-test (-6.165), $p<.001$. The adjusted coefficient (-250.529) indicates that every 2.50 percent change in HMO penetration will yield a reduction of one unit of hospital beds.

West

The ARIMA produced a significant t-test of –9.943, $p<.001$ for the Western region. The adjusted coefficient is –63.649 meaning a .63 percent change in HMO penetration will yield a reduction of one unit of hospital beds.

See Tables 4 & 5.

Table 2 – Regression results for the effect of the annual rate of change of hospital beds/1000 on the annual rate of change of Medical Care Services CPI-U

Variable	df	Unstandardized Coefficient	Standard Error	t	F	Significance
Annual % change In beds/1000	18	135.397	.397	5.616	31.58	<.001
CONSTANT		10.136	24.110			
N=20		Adjusted R-Square = 0.616		SD = 0.0122		

Source: Regression model run on SPSS. For data source, see Table 1.

Table 3 – Regression results for the effect of the annual rate of change of the national HMO penetration rate on the annual Rate of change of hospital beds/1000.

Variable	df	Coefficient	Standard Error	t	F	Significant
Annual % change HMO penetration	15	-0.012	0.005	-2.251	0.969	<.05
CONSTANT		-0.037	0.038			
N=17		Adjusted R-Square = -0.00195		SD = 0.011		

Source: Regression model run on Excel Analysis Tool. For data source, see Table 1.

Table 4 – Regression results of regional HMO penetration rate effect on number of hospital beds 1984 – 1994 – North Central region.

Variable	df	Unstandardized Coefficient	Standard Error	t	F	Significance
North Central HMO penetration	10	-620.472	216.179	-2.870	8.238	<.05
CONSTANT		329.493	27.428			
N=12		Adjusted R-Square = 0.397		SD = 0.039		

Table 5 – ARIMA results of regional HMO penetration rate effect on number of hospital beds 1984 – 1994 – Northeast, South and West regions.

Variable	df	Unstandardized Coefficient	Standard Error	t	Significance
Northeast					
HMO Penetration	9	-107.097	32.597	-3.285	<.01
CONSTANT		221.547	5.186		
N=12		Log likelihood = -29.525		Std Error = 3.136	
South					
HMO penetration	9	-250.529	40.639	-6.165	<.001
CONSTANT		354.836	3.336		
N=12		Log likelihood = -25.741		Std Error = 2.290	
West					
HMO penetration	9	-63.649	6.401	-9.943	<.001
CONSTANT		162.488	1.503		
N=12		Log likelihood = -10.265		Std Error = 0.6336	

Source: ARIMA model run on SPSS. For initial data, see Table 1.

DISCUSSION

Hospital Bed Change on CPI

The results are consistent with health care experts' claims that excess hospital bed capacity drives medical costs up. As medical costs rise, generally prices rise. Inasmuch as CPI measures the increase in prices, or inflation, it is logical that as excess beds are cut from the system, inflation should slow as costs are cut. The significant F and t-tests and R squared give us some assurance that further reduction in beds will continue to positively affect (lower) the rate of Medical Care Services CPI-U.

While the results indicate there is a clear relationship between the reduction in hospital beds over time, there are a number of factors that may act in conjunction with the hospital bed reduction in slowing Medical Care Services CPI. Although not analyzed here, consideration should be also given to the increase in outpatient visits for the population. New technology is increasingly shifting patients from the inpatient to the outpatient setting. Consistent with the transfer to more outpatient services, occupancy rates have been decreasing significantly over the period. A future analysis might include these variables to explore whether the movement of services to the outpatient setting has a negative or positive effect on the Medical Care Services inflation rate (CPI-U).

Other factors that may be influencing the reduction in bed supply and/or the reduction in the annual rate of increase of CPI are physician supply, high-cost technology and third party payers in the form of health insurance, and government spending for Medicare and Medicaid benefits. The health care market does not operate like other free markets and, therefore, price inflation may not be the best measure of the implications of reducing hospital bed size. In most instances, a third party is paying the price of hospital care and, therefore, it is price inelastic. Managed care may be able to change that philosophy by negotiating with selected hospitals to pay amounts significantly less than billed charges. This may explain some of the regional HMOs differences discussed later.

A limitation in the study data may exist in that number of hospital beds is derived from the American Hospital Association annual survey as published in the Statistical Abstract of the United States. Response to the survey is estimated to be high (~85% in 1995); however, the number of beds reported only includes those responding to the survey.

Another limitation may be related to the concepts and components of the medical care CPI. The CPI is considered a rate, and, as such, may cause complexities when interpreting the results.

Further, according to Peden and Lee (1991), personal consumption of medical care experienced output and price average rates above the general economy during the period 1965 to 1990. The extraordinary increases were the result of expanded government (e.g. Medicare and Medicaid) and third-party payment by insurers. The higher relative prices did not recede as prices in other markets indicative of the provider-induced demand for medical care (Peden and Lee, 1991). An alternative measure for the cost of medical care in relation to beds may be personal consumption or average hospital daily cost. At this point, however, there is not enough reported annual data available to measure the year-to-year impact that the reduction in hospital beds may have. More data time points are also needed to fully study the issue.

National HMO penetration effect on hospital bed supply

One might explain the failure to find a relationship between the percentage change in the national HMO penetration rate and the annual change in the percentage of hospital beds per 1000 by looking at the HMOs strong growth rates. Inasmuch as HMOs are virtually a new mode of health care, the percentage rates of growth are extremely high. Beds, while decreasing, are moving at a much slower rate. As HMOs began to take hold, their growth rates in the early 1980s were in the 15 to 20 percent range, partly a function of the low enrollment at that time. The use of HMOs is increasing and there is significant

literature regarding their ability to keep patients out of the hospital. Perhaps as the HMO industry grows in age, additional data will be more conclusive.

Regional HMO penetration influences the number of hospital beds

Using actual numbers for HMO penetration and hospital beds produced a significant negative relationship between the two variables. In other words, the greater the HMO penetration, the less hospital beds are present in a region. As noted in the literature review section, there is substantial evidence in the literature that HMOs reduce hospitalization. It is a well-known fact that the West has been the pioneer and leading growth area for HMO enrollment. An examination of the means for HMO penetration (23 percent) and hospital beds (148.467) clearly demonstrates this phenomena. The Western region has the least number of beds in the country and the highest HMO enrollment. The region represents 22 percent of total population of the country. Population is relative with at least two of the other U. S. regions. The 1994 HMO penetration rate in the West region is 31 percent. Its hospital beds per 1000 population are only 2.5 compared with an average for the United States of 3.4 per 1000 population. Appendix II and Appendix III provide the regional data used in the study.

While HMOs do not utilize as many hospitals, however, there is no indication that costs for those areas are lower. In many instances, HMOs are located in densely populated areas with high medical costs. This study did not address regional costs and/or major urban areas where most HMOs operate.

CONCLUSIONS

The country is reducing the number of hospital beds, albeit at a slow rate. Data from the Statistical Abstract of the United States (various years) show that the rate of reduction is actually declining in more recent years, having reached a peak decrease of three percent in 1985 and tapering off to figures between one and two percent in 1993 and 1994. There are a number of factors that deter interest in closing beds, particularly social issues.

For a long time, hospitals have had opportunities to shift the cost of unused beds to commercial insurance payers and government programs. The growth of managed care with its selectivity of providers and emphasis on patient care outside the hospital will put yet more pressure on hospitals to reduce excess bed capacity. Federal and state governments are embracing managed care as a cost-saving alternative for the Medicare and Medicaid programs. Hospital occupancy rates are well below recommended rates (63 percent versus 85 percent). As the HMO programs encompass more and more of the "insured" population, hospital occupancy will drop even more.

The growth of managed care in general, including PPO and other managed plans, will also impact as traditional indemnity insurance goes by the wayside as a mode of health insurance. No longer can Roemer's "built bed be a filled bed." There are too many other forces at work now. Hospitals will have to effectively face the issue or suffer unplanned closures and bankruptcies.

IMPLICATIONS FOR FUTURE RESEARCH

Now that HMOs are established and growing, additional years of their existence will enhance analyses of their effects on the decrease in hospital beds and medical costs in general. What is needed is a clear measure of the cost of each excess hospital bed. American citizens are unknowingly bearing the burden of the excess bed cost in higher insurance costs, higher taxes, and overall medical expenditures. This may become even

more important in view of recent public policy to move Medicare and Medicaid patients into HMOs.

Hospital occupancy rates continue to shrink, but there is still much unknown information on how that impacts overall cost and medical inflation. In some instances, patients may not be be receiving care as an inpatient; however, expensive technology or cost-shifting to the outpatient arena may not "net" the expected savings to the health care system.

Additionally, the current oversupply of doctors should be researched to determine the cost. While we as a country need to be sure we will not incur a physician shortage at some time in the future, we need to know just how much each additional physician costs the system. Future time studies may measure an effect of recent government policy to reduce training of new physicians, particularly specialists. Moreover, other measurements, such as personal health expenditures, may provide a clearer picture of the true effects on cost of the reduction of hospital beds. Improved data availability for consecutive time periods will greatly enhance capability to measure the effects of the variables in the ever-changing health care marketplace. There appear to be regional differences in health care. Careful analysis of cost efficiency may provide a "model" to other regions of the country.

Experts have claimed for more than 20 years the country had too many hospital beds. America's bed supply is twice what it needs to be. However, researchers will require more data across a greater span of time to make the case that hospitals and/or hospital beds should be closed. Managed care is fairly "young" with penetration rates reaching 10 percent in 1987, just ten years ago. The significant movement of patients to outpatient surgical settings is in its infant stages, and there is minimal documented proof that outpatient versus inpatient care truly saves costs.

Researchers need additional pertinent data with more time points and improved methodology to calculate and show the financial impact of excess hospital capacity. With

additional valid information on cost savings, the public may be more willing to accept the local challenges of closing hospitals and/or reducing the number of beds.

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APPENDIX I - DATA

	Annual % change Med Care Svcs CPI-U (national)	Annual % change Hospital Beds/1000 (national)	Annual % change HMO Penetration (national)
1974	12.6	0.007	
1975	10.1	0.005	
1976	9.9	0.003	
1977	8.6	-0.005	0.168
1978	9.7	-0.029	0.089
1979	11.3	-0.007	0.090
1980	10.7	0.005	0.117
1981	11.9	-0.001	0.045
1982	8.7	-0.030	0.145
1983	6.2	-0.010	0.198
1984	6.3	-0.031	0.238
1985	7.5	-0.029	0.244
1986	6.8	-0.028	0.196
1987	6.5	-0.023	0.013
1988	7.7	-0.022	0.054
1989	9.3	-0.015	0.038
1990	8.9	-0.016	0.048
1991	7.6	-0.013	0.062
1992	6.5	-0.016	0.079
1993	5.2	-0.013	0.126

Source: Statistical Abstract of the United States; GHAA's National Directory of HMO's Database; Managed Care: A Decade in Review 1980-1990

APPENDIX II - DATA

Year	Beds (000) Northeast	Beds (000) North Central	Beds (000) South	Beds (000) West
1983	218.7	297.1	352.4	152.9
1984	219.9	291.7	354.2	153.7
1985	214.4	280.3	348.6	153.2
1986	209.3	272.5	343.3	151.7
1987	203.5	265.7	338.3	150.6
1988	201.4	260.6	333.7	148.9
1989	200.1	254.3	330.7	147.8
1990	200.4	250.0	330.8	146.8
1991	200.1	246.7	331.2	145.7
1992	203.2	244.0	329.6	144.5
1993	204.8	238.8	329.1	143.5
1994	198.9	234.1	326.8	142.3

Source: Statistical Abstract of the United States.

APPENDIX III - DATA

Year	HMO Penetration Northeast	HMO Penetration North Central	HMO Penetratior South	HMO Penetration West
1983	.05	.05	.01	.14
1984	.06	.06	.02	.15
1985	.07	.08	.03	.16
1986	.09	.11	.05	.18
1987	.11	.13	.07	.20
1988	.14	.14	.07	.22
1989	.14	.14	.07	.24
1990	.16	.14	.08	.26
1991	.17	.14	.08	.26
1992	.18	.15	.09	.27
1993	.21	.15	.10	.28
1994	.23	.17	.12	.31

Source: Statistical Abstract of the United States: GHAA's National Directory of HMO's Database; Managed Care: A Decade in Review 1980-1990

APPENDIX IV

State Listing for the United States Census Regions

NORTHEAST
Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut
New York
New Jersey
Pennsylvania

NORTH CENTRAL

Ohio
Indiana
Ilinois
Michigan
Wisconsin
Minnesota
Iowa
Missouri
North Dakota
South Dakota
Nebraska
Kansas

SOUTH
Delaware
Maryland
District of Columbia
Virginia
West Virginia
North Carolina
South Carolina
Georgia
Florida

WEST

Montana
Idaho
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Washington
Oregon
California
Alaska
Hawaii

Source: Statistical Abstract of the United States

Appendix V – Biased regression results of regional HMO penetration rate effect on number of hospital beds 1984 – 1994 – Northeast, South and West regions.

Variable	df	Unstandardized Coefficient	Standard Error	t	F	Significance
Northeast						
HMO Penetration	10	104.520	22.193	-4.710	22.180	<.001
CONSTANT		220.241	3.236			
N=12		Adjusted R-Square = -0.658		SD = 0.060		
South						
HMO penetration	10	-284.306	26.391	-10.773	116.052	<.001
CONSTANT		356.330	1.946			
N=12		Adjusted R-Square = 0.913		SD = 0.033		
West						
HMO penetration	10	-68.756	3.786	-18.162	329.853	<.001
CONSTANT		163.818	0.870			
N=12		Adjusted R-Square = -0.968		SD = 0.057		

Source: Regression model run on SPSS. For data source, see Table 1.