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State Level Comparison of Factors Contributing to Rising Inpatient Hospital Costs

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Abstract:

This paper examines an array of factors that contribute to rising inpatient healthcare costs. The study utilizes existing information from previous studies and applies its methods to a 50-State comparison. Using state-level inpatient costs per day as the dependent variable, an ordinary linear regression (OLS) model has been used to determine which of the independent variables contributes significantly to the rising costs.

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1.0 Introduction

Healthcare expenditures noticed a significant increase over the time period 1998-2001. On average inpatient health costs rose 5.9% per year during this time period, which was twice the average annual rate of inflation of 2.9%. The largest sector of healthcare expenditures is inpatient health costs. Inpatient health costs are those that are incurred while patients are under hospital care. There have been many studies that have analyzed different factors that could lead to the increases in inpatient health costs. There are many different factors such as local area wages, income per capita, and physician market characteristics that have an effect on inpatient costs. The availability of hospital caretakers also contributes to rising costs as well. (Hay, 2002)

This paper takes the research of previous studies and applies the on a 50-State comparison in 2006. Many of the variables are indeterminanible or rather unavailble due to their nature. Such unavailable variables include Treatment Patterns and Technology, Provider Market Structure and individual Demographics. Technology in hospitals can be thought of as new methods for surgeries or new mechanical tools that increase physican efficiency. Since technology varies by state and changes at a rapid rate, a data source for this information is unavaible and highly subjective. Health Insurance Products and Design also vary greatly by state and availability of data is scarce. Many different health insurance plans pay for different types of medical treatment for various diseases. Patients with diseases such as Cancer and Diabetes have intuitvely higher health costs, but certain health plans have different level deductibles on these diseases as well as many other popular ones. This paper provides an emprical assessment of the different factors that are believed to be responsible for abnormal growth in inpatient healthcare costs.

2.0 Trends

The table below, Table 1, denotes the growth in different expenditure sections during the 1998-2001 time period. This table shows that inpatient health costs rose an average of 5.88% per year,

which is the smallest growth compared to that of prescriptions and outpatient services. The research of Joel Hay has shown that inpatient expenditures are the number one component of health expenditures.

Table 1: Expenditure Per Member Growth Rates (%) 1998-2001

Expenditure Category	Minimum	Maximum	Mean	Standard Deviation
Inpatient Services	**.23**	**12.9**	**5.88**	**2.73**
Prescriptions	**7.3**	**14.8**	**11.08**	**1.28**
Outpatient Services	**7.18**	**23.14**	**14.96**	**3.53**

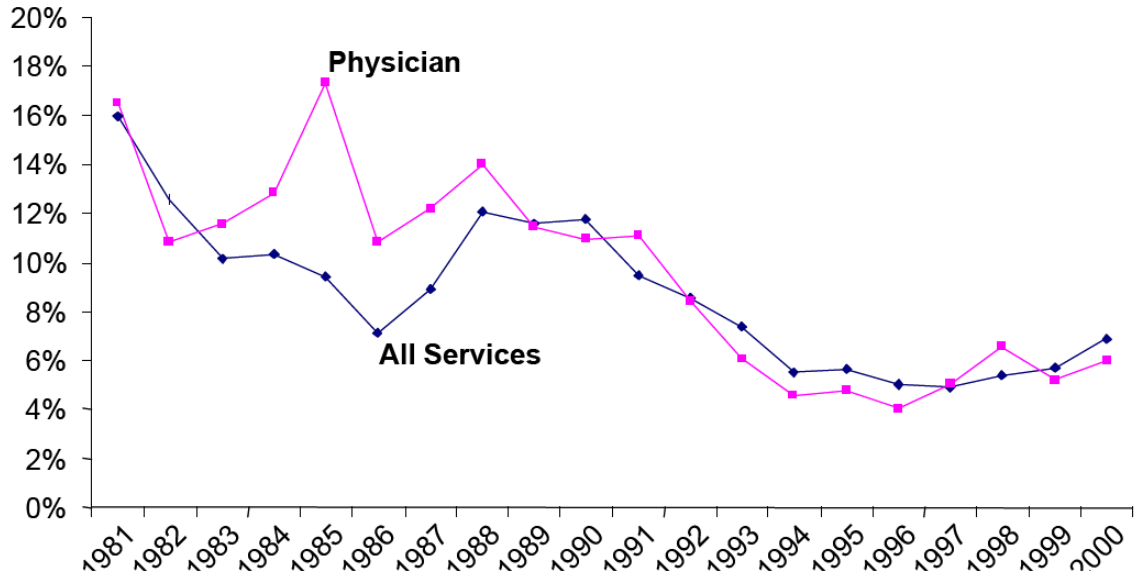
n = 51 for each category.

Total expenditures per member per day include all members, including those who were not hospitalized. The average annual consumer price index inflation rate during this period was 2.9% (http://www.bls.gov). SD indicates standard deviation.

(Hay, 2002)

The figure below, Figure 1, depicts the growth of physician expenditures since the early 1980's. Physician expenditures are positively correlated with inpatient health costs and have significantly contributed to the overall growth in inpatient health costs during this time period. (The Lewin Group, 2002)

Figure 1
Annual Growth in All Healthcare Services and Physician Expenditures, 1981 - 2000



Source: Centers for Medicare & Medicaid Services, Office of the Actuary.

(The Lewin Group, 2002)

Table 2 is consists of high technology drug categories that were selected to explain increases in technology of popular drug categories. The increases in technology of each respective drug category is positively correlated with inpatient health expenditures. It requires large amounts of capital for research in development to develop new technologies for these drugs, and that is reflected by the increase in inpatient healthcare expenditures.

Table 2: New Patient Growth Rates for High-Tech Drug Categories 1998-2001

Drug Category	Growth Rate (%)			
	Minimum	Maximum	Mean	SD
Cardiovascular	5.47	16.57	10.14	2.68
Lipid	10.49	22.79	15.37	3.01
Enbrel	0.00	100.75	35.48	23.58
Immune suppression	−7.33	42.87	16.21	9.56
Multiple sclerosis	−54.93	103.97	32.17	25.78

n = 51 for each category.
SD indicates standard deviation.

(Hay, 2002)

3.0 Literature Review

Hospital inpatient expenditures over the time period of 1998-2001 accounted for over 34.2% of total health care expenditures, making it the highest contributor of health care expenditures. In 2001, per capita inpatient hospital spending increased by over 7%, nearly three times higher than the previous year. Also in 2002, a 6 month study has shown that the growth in total health care expenditures has slowed down from 10% growth to about 8.8%. Even though there is a reduction in growth, it is still significant in this time frame, seeing as how in the 1994-1998 era there were reductions in total health care spending as high as 5.3%. Many different variables have been factored into regression models in order to explain what drives health expenditures. Such variables include: population growth, aging population, disease, trends in private and public health care coverage, percentage of the population uncovered by health insurance, hospital business issues, new technology, labor costs, legislation, geographic variation, and many more. These variables all contribute to total health expenditures, but the task of explaining the significant increase in costs over the 1998-2001 time period still lies at hand. A list of what is believed to be the most significant factors contributing to this increase is as follows; workforce

shortages and costs, new technology costs (including drugs), retreat from tightly managed care, legislation changes to private and public health spending, and shifts in hospital business directions. (Forest, Goetghebeur, & Hay, 2002)

Nurse labor shortages have been thought to contribute a significant amount to inpatient health costs. For every 1% gap between the supply and demand of nurses, in this case shortages, a .5% to 1% increase in hospital inpatient expenditures per capita was noticed. Nurses constitute 44% of total inpatient health costs, so clearly the availability of nurses in the labor pool is significant to this study. A double-log univariate regression was used in 2000 to show that for each 1% shortage of nurses in the labor forced constituted a .96% increase in inpatient expenditures. Over the time period of 2000-2005 the Health Resources and Services Administration (HRSA) has determined that the nurse shortage will increase by 40%, which will lead to further increased inpatient expenditures. Per capita disposable income is also positively correlated with inpatient daily expenditures. For each 1% increase in per capita disposable income, an increase as much as 2% in inpatient expenditures is noticed. This is also the same for hospital and physician office wage levels, meaning that for each 1% increase in this category, an increase as high as 2% in inpatient expenditures is noticed. (Hay, 2002)

The relative importance of cost driver categories can be split into nine different categories. These categories are in order from least to most important are: health care regulation, health status, provider operating costs, physician supply, treatment patterns and technology, provider market structure, general price inflation, demographic and economic conditions. These findings are consistent with the above research. However this research does not account for the relevance of the nursing shortage and how it contributes to health costs. However this research demonstrates how physician supply and costs are more significant to inpatient health costs as compared to those of the nurses. This research has different perspectives on each category. Health status, healthcare regulation, and health insurance product does not appear as significant as expected. (The Lewin Group, 2002)

4.0 Data and Empirical Methodology

4.1 Data

The data that was used in this research came from a variety of sources, both independently obtained and acquired from previous research. This paper is a cross-sectional study of the 50-US States including the District of Columbia. Data acquired regarding per capital income for each individual state was acquired from the Bureau of Economic Analysis (BEA). The US Department of Commerce news release provided per capita income for 2006-2008. The Kaiser website was used for obtaining the bulk of the data used for this research. Kaiser State Health Facts provided information for the following; inpatient daily expenses, birth rate per 1000, total health spending, percentage of health spending on subdivisions of physician services, drugs and other medical nondurables, nursing home care, dental services, home health care, medical durables, and other personal care, percentage of population in different age categories, as well as percentages of the population with different types of healthcare.

4.2 Methodology

In this study an ordinary linear regression model (OLS) was used in order to determine which variables chosen contribute significantly to the daily inpatient health expenditures per state. Multiple regressions were used in this study with different variables added and deleted from each respective model. The primary model uses LOG DAILY INPATIENT EXPENDITURES (LDIE) as the dependent variable. The independent variables in this model are; LOG BIRTH PER 1000 (LBPT), LOG PER CAPITA INCOME (LPCI), TOTAL HEALTH SPENDING (THS), HOSPITAL CARE (HC), PHYSICIAN AND OTHER PROFESSIONAL SERVICES (PPS), DRUGS AND OTHER MEDICAL NONDURABLES (DOMN), NURSING HOME CARE (NHC), DENTAL SERVICES (DS), HOME HEALTH CARE (HHC), MEDICAL DURABLES (MD), OTHER PERSONAL HEALTH CARE (OPHC), CHILDREN 18 AND UNDER (CHILDREN), ADULTS 19-64 (AD19-64), ADULTS 65-74 (AD65-74), ADULTS 75+ (AD75+), EMPLOYER HEALTH INSURANCE (EHI), INDIVIDUAL HEALTH INSURANCE (IHI), MEDICAID (MEDICAID), MEDICARE (MEDICARE), OTHER PUBLIC HEALTH INSURANCE (OPHI), and UNINSURED (UNINSURED).

The original regression equation has the following form:

$$LDIE= - \beta_0(LBPT) + \beta_1(LPCI) - \beta_2THS + \beta_3(HC) + \beta_4(PPS) + \beta_5(DOMN) + \beta_6(NHC) + \beta_7(DS) + \beta_8(HHC) - \beta_9(MD) + \beta_{10}(OPHC) - \beta_{11}(CHILDREN) - \beta_{12}(AD19\text{-}64) - \beta_{13}(AD65\text{-}74) - \beta_{14}(AD75+) + \beta_{15}(IHI) - \beta_{16}(MEDICAID) + \beta_{17}(MEDICARE) - \beta_{18}(OPHI) - \beta_{19}(UNINSURED) - \varepsilon$$

The second regression equation eliminated variables in order to obtain a more effective model. All age groups except Adults over 65 were eliminated from the equation. The log of birth per 1000 , total health spending, dental services, home health care, and other personal health care are eliminated as it is believed they are not significant. The new regression equation is:

$$LDIE= \beta_0(LPCI) - \beta_1(HC) - \beta_2(PPS) - \beta_3(DOMN) - \beta_4(NHC) - \beta_5(MD) - \beta_6(AD65\text{-}74) - \beta_7(AD75+) + \beta_8(IHI) - \beta_9(MEDICAID) + \beta_{10}(MEDICARE) - \beta_{11}(OPHI) - \beta_{12}(UNINSURED) + \varepsilon$$

The third regression equation eliminated per capita income and medical durables to obtain a more effective equation resulting in:

$$LDIE= - \beta_0(HC) - \beta_1(PPS) - \beta_2(DOMN) - \beta_3(NHC) - \beta_4(AD65\text{-}74) - \beta_5(AD75+) + \beta_6(IHI) - \beta_7(MEDICAID) + \beta_8(MEDICARE) - \beta_9(OPHI) - \beta_{10}(UNINSURED) + \varepsilon$$

These regression equations were broken down further into the following three regression equations.

Regression 1

The regression below represents the core regression. Daily expenditures, the dependent variable, is determined from the four variables below.

	COEFFICIENT	P-VALUE
ADULTS 75+	-3.253679**	0.0195
DOMN	0.484132	0.4444
LPCI	0.766672***	0.0004
PPS	0.663805	0.1531

*,**,*** Represents significance at 5% 2% 1% Levels, respectively

Regression 2

This regression has added in the age 65-74 age group as well as the population enrolled in Medicare. Many coefficients came out as expected, however only two variables were significant.

	COEFFICIENT	P-VALUE
ADULTS 65-74	-3.886553	0.0350
ADULTS 75+	-1.859417	0.2192
LPCI	0.654370***	0.0016
PPS	0.353678	0.4336
DOMN	0.687694	0.3041
MEDICARE	2.81E-08	0.1334

*,**,*** Represents significance at 5% 2% 1% Levels, respectively

Regression 3

This regression includes the entire adult age group, as well as the percentage of population enrolled in Medicaid and those Uninusured as well.

	COEFFICIENT	P-VALUE
ADULTS 75+	-1.181944	0.4596
ADULTS 65-74	-3.812058*	0.0461
ADULTS 19-64	0.680594	0.5047
PPS	0.525503	0.2896
DOMN	1.004489	0.1471
LPCI	0.609721***	0.0092
UNINSURED	-3.54E-09	0.8937
MEDICAID	2.06E-08	0.5317

*,**,*** Represents significance at 5% 2% 1% Levels, respectively

5.0 Empirical Results

Abbreviation	Description	Expected Sign
HC	Hospital Care	+
PPS	Physician and other Professional Services	+

DOMN	Drugs and Other Medial Non-Durables	+
NHC	Nursing Home Care	-
AD65-74	Adults 65-74	+
AD75+	Adults 75+	+
LPCI	Log Per Capita Income	+
EHI	Employer Health Insurance	-
IHI	Individual Health Insurance	-
MEDICAID	Medicaid	-
MEDICARE	Medicare	+
OPHI	Other Public Health Insurance	-
UNINSURED	Uninsured	+

Hospital Care represents the proportion of each state's health expenditures spent in hospitals. The expected sign is positive because research has shown that daily hospital costs increase if a state spends a high amount in that sector. Physician and other Professional services represent the proportion of health expenditures spent towards physicians and other professionals. The expected sign is positive, because research has shown that Physician wages are going up significantly during this time period, and an increase in their wages represents a higher cost to patients. Drugs and Other Medical Non-Durables is the total amount spent on drugs. Research has shown that technological advances in drugs significantly increase the cost of these drugs, resulting in higher patient costs. Nursing home care is the amount spent by each state in nursing homes. There is little research on this topic, but the expected sign is negative. The reason for this is intuitive, if senior citizens are in nursing homes which have nurses and

other health professionals on duty, and then their overall inpatient hospital costs should go down as they are not at the hospital. The expected sign of the population age groups of 65-74 and 75+ are both positive. Research has shown that the older population, those over 75, is growing more rapidly than any other age group. As people become older they are more vulnerable to disease and thus need more hospital care, which is why inpatient daily expenses are expected to increase. The log of per capita income was taken and its expected sign is positive. Before the 1998-2001 study, it was believed that as income went up, inpatient health costs would go down, however research has shown that these two variables are positively correlated. The different health insurances represent the number of persons in each state that have each different type of health insurance. Different health insurance plans have many different deductibles for a variety of patient needs. For EHI, IHI, and OPHI the expected sign is negative. Inpatient health costs should decrease if patients have health insurance, not just due to deductibles. For Medicare and Medicaid the expected signs are respectively negative and positive. The reason for this is that Medicare helps senior citizens buy prescription drugs as well as provide them with a certain criteria of health insurance. The reason the expected sign for Medicaid is positive is because if the population of a particular state tends to favor those with lower income, then their health status may be low as well. Those with higher income can afford better health care and thus would have lower health costs, as opposed to the poorer individuals who might tend to have higher inpatient health costs. The uninsured respresents the number of persons in the population without health insurance coverage. The sign is negative seeing as how those who do not have health insurance will incur more inpatient costs as they have no deductible.

6.0 LIMITATIONS

This paper attempted to find a link between hospital costs and different types of insurances. There are many different types of variables that were not available to the author of this paper, such as hospital market structures, physician demands, and supply of labor for hospital care. These variables as well as many others have a significant impact on the empirical research. However due to the availability of this information, this paper took into account only the variables that were attainable through various research methods.

6.1 POLICY RECOMMENDATIONS

The independent research of this paper has suggested that there is a positive correlation between Medicare and inpatient health costs. This correlation infers that perhaps a more detailed healthcare plan should be in place for senior citizens in the recent future. With healthcare expenditures and technologically increasing, the aging population might not be able to afford these increase costs and thus would need a more efficient health plan. If there were a more positive correlation between those Uninsured and the number of citizens enrolled in Medicaid, then recommendations could be properly issued. However the outcome of this paper did not prove a positive correlation. If in the future this expected positive correlation is found, state regulators could pass different legislation and such that would accommodate the poor population in such hard economic times.

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