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State-Level Variations in Hospital Expenditures: An Application of Spatial Regression

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Abstract

Hospitalizations have resurfaced as one of the primary concern for the United States healthcare system and the health planners due to their increasing share of total medical expenses, illness and mortality problems. Approximately, 30-38% of the total healthcare costs is due to hospitalizations. While there are many reasons for hospitalization, an estimated 25% to 40% of all admissions are for treating alcohol-related complications. Furthermore, it is plausible that the hospital spending in one state can affect the hospital expenditures of the neighboring states. This is because 1) hospital prices, practices and policies of the adjacent states influence the hospital expenditures of one state, and 2) presence of hospital facilities in a Hospital Referral Region (HRR) which serve patients across state lines. Therefore, using a Spatial Durbin Fixed Effect Model, this paper examines the state-level variations in hospital expenditures. This research used panel data from 2000 through 2009, extracted from publicly available data files.

Results highlighted that rate of binge drinking, the total number of hospital beds and hospitals per 1,000 residents, the unemployment rate, the percentage of African-Americans, proportion of active physicians and state gross domestic product (GDP) had positive impacts on its neighboring states' rates of hospital expenses. Moreover, the increasing rate of male population, Hispanic population and the rate of un-insurance of a state had adverse impacts on its own rate of hospital costs but positive effects on its bordering states' rate of hospital spending.

Keywords: hospital expenditures, Spatial Durbin Fixed Effect, state level, binge drinking

JEL code: I100, H750, I180, C23

Introduction

Healthcare spending in the US has increased from $75 billion in 1970 to an estimated $2.9 trillion or $9,255 per person in 2013 (CMS, 2013). The increase in healthcare spending is documented across all services such as inpatient care, physician and clinical services, home health care services, prescription drugs, nursing care, durable medical equipment and others (CMS, 2013). Of all the services, hospital expenditures constituted the significant portion of total healthcare spending. In 2013, 32.3% ($936.9 billion) was spent on hospital care (CMS, 2013).

"In recent years, hospitalizations have reemerged as a priority for the United States healthcare system, policy makers, and research communities, due to their large share of total expenditures and morbidity and mortality burden on patient populations (Wilkins, 2013)." At the national-level, between 1993 and 2009, the number of hospital discharges increased from 34.3 million to 39.4 million (Healthcare Cost and Utilization Project (HCUP), 2009; Wilkins, 2013). In 2009, the average hospital charges were $30,655 (American Health Association (AHA) Resource Center, 2012). The largest component of Medicare expenditures was on inpatient care and totaled $134 billion (Medicare Payment Advisory Commission (MedPac), 2014; Wilkins, 2013). Out of $822.3 billion of private health insurance spending in 2010, 20.4% or $167.7 billion was spent on hospital expenditures (IMShealth, 2012). Additionally, $542.9 billion out of $3390.8 billion of Medicaid funding has been spent on hospital costs in 2014 (Kaiser Family Foundation (KFF), 2014).

Variations in Hospital expenditures at the state level

At the state-level, hospital expenditures are the highest component of total health care costs with significant variations across the states. In 2009, the lowest hospital expenditure was $806.89 million (Wyoming), the median was $5,623.21 million (Arizona), and the highest was $41,567.24 million (California). The share of hospital expenditures to total expenditures was the largest in the District of Columbia (47% between 2000 and 2009), followed by South Dakota, Vermont, and Missouri (45% in 2009), California (33% in 2009), Nevada, Oregon, and Alabama. Tennessee had the lowest share of hospital expenditures to total spending (29% in 2009) (Centers for Medicare and Medicaid Services (CMS), 2011).

Determinants of Hospital expenditures

A study by Gornick (1982) highlighted the presence of a wide range of variation in the rate of hospitalization and length of stay across the regions of the US, thereby causing a substantial variation in the hospital charges and expenses across these regions. Knickman and Foltz (1984) concluded that socio-economic differences (age, race, income, education) among the regions of the U.S. have a higher impact on hospital utilizations and costs than the length of stay. Knickman and Foltz (1985) also reported that population factors and hospital infrastructures, such as the number of hospital beds and physicians, had a major impact on these interregional hospital use variations. For example, female (80 days per 1000 population greater than male), older people (aged 65 years and above had 1947 days per 1000 population) and residents with lower income (individual with income >$15,000 had 0.208 fewer days per year less hospital stay than individual with income <=$5000) had lower rate of hospital stays.

A variety of factors contributed to hospital expenditures. Studies have documented the association between hospital expenditures and demographic characteristics, such as gender (Qureshi et al., 2013), age (Ziaeian et al., 2015), race/ethnicity (CDC, 2013), access to care such as presence of health insurance (Qureshi et al., 2013; CDC, 2013), and health status of individuals (Ziaeian et al., 2015; Qureshi et al., 2013), supply-side factors (Qureshi et al., 2013), and others. One study examined the state-level variations in hospital expenditures (Bopp and Cebula, 2009). This study attributed the variations in inpatient expenditures to state-level variations demographic profiles, socio-economic characteristics, access to healthcare, and healthcare infrastructure.

Using a panel regression analysis, these researchers concluded that health insurance coverage and age-composition of the population were associated hospital expenditures. Higher the rates of health insurance coverage and greater the proportion of elderly in the state, higher were the hospital expenditures (Bopp and Cebula, 2009). Wul et al. (2014) reported that per capita income, unemployment rate, aged population above 65 years and staffing increased hospital expenditures between 2001 and 2007. According to the American Hospital Association (2005), the increasing hospital care spending can be explained by the changing demographics (a growing population of the elderly), costs of hospital supply factors, wages of physicians and improvement in technology.

Binge drinking and its impact on hospital costs

The above mentioned studies highlighted the role of demographic, socio-economic characteristics, healthcare needs, access to care and cost of providing hospital care in influencing hospital expenditures. However, it has been reported that an excessive amount of drinking (binge drinking) can also lead to substantial state-level variations in hospital expenditures. It has been estimated that 20% to 25% of all patients in U.S. general hospital beds (not in maternity or intensive care) were treated for complications of alcohol-related problems (*The Cost of Substance Abuse to America's Health Care System*, 1994). In 2008, 12% of hospital stays among 18-44 years old, 21% of hospital stays among 45-64 years old and 12% of 65-84 years were due to alcohol related disorders (HCUP, 2008).

The estimated costs of excessive drinking were $223.5 billion in 2006 (Bouchery et al., 2011), out of which the cost from binge drinking was about $170.7 billion (Bouchery et al., 2011). The estimated per-capita expenditure of excessive drinking was $746, which included direct medical care costs, lost productivity, and crime (Bouchery et al., 2011). It was also the third leading lifestyle-related cause of death in the United States every year (CDC). In the recent years, excessive alcohol use led to 88,000 deaths and 2.5 million years of potential life lost (YPLL) each year in the United States from 2006 to 2010 (CDC, Alcohol-Related Disease Impact (ARDI), Stahre et al., 2014). Excessive drinking was the third leading preventable cause of death (Bouchery et al., 2011).

Excessive drinking is characterized as binge drinking, heavy drinking and any drinking by pregnant women or people younger than age 21 (CDC website). Binge drinking, in particular, is defined as 5 or more alcoholic beverage drinks for men per occasion and 4 or more drinks for women per occasion, all within a two-hour period (*The Cost of Substance Abuse to America's Health Care System*, 1994). According to the definition of the National Institute on Alcohol Abuse and Alcoholism, "Binge drinking is a pattern of drinking that brings a person's blood alcohol concentration (BAC) to 0.08 grams percent or above." It has been seen that binge drinkers in the

US drink an average of 8 drinks more than four times a month (CDC, Vital Signs, 2012). In the year 2009, the overall prevalence of binge drinking among adults in the 50 states and District of Columbia of the US was an average of 15.2% of the total population (Kanny, 2011). In 2013, 24.6% of the population above 18 years reported binge drinking in the past month (Substance Abuse and Mental Health Services Administration (SAMSHA), 2013). It has also been associated with many health problems, such as unintentional and intentional injuries, alcohol poisoning, high blood pressure, stroke, other cardiovascular diseases, sexually transmitted diseases, etc. (CDC, 2012), leading to an increase in total hospital expenses. Rehm et al. (2009) has recognized alcohol misuse as an important risk factor for chronic diseases and injury and also captured its high social and economic costs on the economy. Hunkeler et al. (2001) compared moderate drinker to non-drinkers and reported that those with a drinking history exhibited significantly higher use of outpatient visits and hospital care than nondrinkers with no drinking history and recent drinkers. Gary et al. (2004) reported an inverse relationship between alcohol uses with the amount of health care utilization.

State-level variations in binge drinking

There are state-level differences in binge drinking, and the rate of binge drinking has been increasing at a fast rate. In 2000, Utah had the lowest binge alcohol usage at 14%, Mississippi and the North Carolina percentages were second lowest at 16.8%, while North Dakota was the highest (29%). In 2009, the number of states with highest binge alcohol use increased to include North Dakota (29.77%), South Dakota (29.71%), District of Columbia (29.63%) and Wisconsin (29.03%) with Pennsylvania (24.07%) and Utah still having the lowest consumption rate at 14.07% (SAMSHA website). It is a problem for every state, as even states that have low binge drinking rates "also suffer as they are binge drinking more often and in higher amounts" (CDC, Vital Signs, 2012).

Purpose of spatial analysis of hospital expenditures

In this context, the proposed study examined the state-level variations in hospital expenditures due to binge drinking and controlling for demographic, socioeconomic characteristics, health care status, and supply-side factors. To understand how binge drinking and other factors affected hospital expenditures, it was important to account for the spatial dependence between states. Often, hospital expenditures of one state may be influenced by hospital prices, practices and policies of the neighboring states.

1) Mobley and colleagues demonstrated that hospital expenditures of a particular region were affected by the prices in the nearby regions (Mobley et al., 2004). Baltagi and Yen (2014) used state-level data for the years 2005 through 2008 and found the existence of spatial dependence of hospital treatment rates among the states. For example, a "1% increase in average treatment rate of heart attack, heart failure, pneumonia in neighboring hospitals is associated with a rise of 0.31%, 0.41%, and 0.46%, respectively, in the hospital's own treatment rate (page 16)."

2) Another reason to focus on spatial dependence is the presence of hospital facilities that serve patients across states. For example, the investigators of the Dartmouth Atlas defined Hospital Referral Regions (HRR) to explain geographical variations in inpatient use and expenditures (Dartmouth Institute for Health Policy and Clinical Practice) as shown in figure 1. HRRs "represent regional health care markets for tertiary medical care that requires the services of a

major referral center. The regions were defined by determining where patients were referred for major cardiovascular surgical procedures and neurosurgery. Each Hospital Service Area (HSA) was examined to determine where most of its residents went for these services. The result was the aggregation of the 3,436 hospital service areas into 306 HRRs (Dartmouth Atlas of Health Care)." An HRR can serve residents of neighboring states. For example, Evansville Hospital referral region comprised of Illinois, Indiana, and Kentucky.

3) Using these HRRs and quality score, Baltagi and Yen (2014), reported that there are geographical clustering and correlation of medical quality of one HRR with neighboring HRR. From their investigation, it was evident that hospital treatments, prices, costs, quality, and patient referrals are not unique to one state but rather they cross boundaries and are influenced by characteristics of the neighboring states. Gilmer and Kronick (2011) demonstrated that there is a presence of positive correlation across the hospital referral regions.

4) Manski (1993) suggested three ways to clarify the reasons for the interaction between the local governments/states supporting the idea of spatial dependence, which were—endogenous effect, exogenous effect and contextual and correlated effect. Endogenous effect proposed that a state is affected by endogenous group (states) behavior. Exogenous effect reports that gains from public expenditures (hospital expenditures) or socio-economic characteristics of one state entered into the welfare function of the adjacent states (Lundberg, 2014; Bose, 2015). The contextual and correlated effect advocated that policy measure (example- health policy) of a state will influence the resources and budget decisions of its adjacent state in a similar way (Lundberg, 2014).

As health policies are determined and enacted at the state level, the presence of spatial dependence of health expenditures across the neighboring states makes it evident that state health policies are dependent on their neighbors (Bose, 2015). They follow or try to compete among each other to attract federal funds, increase profits, improve health care reforms, and balance their cost-benefit situations. Hospital expenditures, being an integral part of the total health expenditure of the States, follow a similar pattern.

Unique Contribution

Therefore, it was necessary to incorporate spatial dependence on understanding variation in hospital expenditures. This study extended the prior literature on the spatial dependence in analyzing hospital expenditures. The unique contribution of the study was examining spatial dependence of state-level hospital expenditures from 2000 to 2009. This model captured the direct and indirect effect estimates (as described below in model) of the factors on hospital expenditures which is not possible in any other regression methods. Thus, this study also analyzed the direct and indirect impact of these variables on state-level hospital expenditures.

Method

Previous studies have used ordinary least squares (OLS), weighted least squares (WLS) or panel regression model (Fixed effect or Random effect) to deduce the prime factors causing variation in the rate of hospital expenses but, these are incorrect estimation procedures because applying these methods will lead to "wrong conclusions concerning the existence of spatial externalities and hence to incorrect model specification (Beer and Reidl, 2010)." This is because hospital costs have geographical variation across the US. These methods lack the ability to capture

the attributes of space or location in the state, county or region data analysis (Anselin, 1988; LeSage and Pace, 2009). Therefore, it can be inferred that spatial econometric model analysis is the correct estimation method for state-level analysis of changes in hospital expenditures.

Moran's I index

Accordingly, the first step of the analysis is to employ Moran's I index (1950), to comprehend if there is a presence of any spatial pattern among the states for hospital spending. This index assumes normality of the error term. If the index is rejected, it indicates that there is a presence of spatial interaction, but it does not specify the exact spatial model that can be employed for analysis. Moran's I is expressed by the formula:

$$\mathrm{I} = \frac{N\sum_i\sum_j w_{ij}(Y_i - Y)(Y_j - Y)}{\sum_i\sum_j w_{ij}\ \sum_i (Y_i - Y)2} \qquad (2)$$

The value of the Moran's I index varies from -1 to +1 displaying if hospital expenses have a clustered, dispersed, or random spatial pattern across the states. Also, Moran's I scatter plot provides a graphical representation of the cluster or dispersion characteristics among the states for a hospital expenditure variable. In the equation (2), Y is the mean value of Y_i (rate of hospital expenditure for state i) and Y_j (the rate of hospital expenditure for state j). It is assumed that w_{ij} is the element of the spatial weight binary contiguity matrix for the i^{th} and j^{th} states (Zhao et al., 2014).

Binary contiguity weight matrix is a matrix that considers regions or states with common borders as neighbors. Therefore, the value of the matrix w_{ij} is one when the two states i and j has a common boundary or are adjoining regions and w_{ij} is zero if i and j have no conjoint boundary. This spatial weight matrix has been row-standardized, which means each of the elements of the weight matrix is created after dividing them by its row sum (which is the sum of the weights of its neighbors$\sum_i\sum_j w_{ij}$ offers the summation of the components of the spatial weight matrix (Zhao et al., 2014).

Spatial Models

With Moran's I index verifying the presence of spatial correlation among the states, spatial regression models are considered for further investigation of the state-level variation in hospital spending. "Spatial dependence refers to the dependence on outcomes at different locations and is often modeled in the form of a lagged dependent variable or in the disturbances (Yadavalli et al., 2013)." Three distinct spatial panel models (spatial lag, spatial error and spatial Durbin) developed by LeSage and Pace (2009), Anselin (2008), and Elhorst (2014) are considered for this study.

In the spatial lag model or the ***Spatial Autoregressive Model (SAR)***, the spatially lagged dependent variable captures the spatial dependence and in the spatial error model or the ***Spatial Error Model (SEM)***, the spatial autocorrelation term captures the spatial dependence (Glass et al., 2012). Both Elhorst (2014) and LeSage and Pace (2009) reported that ***Spatial Durbin panel model (SDM)*** is preferred to the lag model or the error model (Glass et al., 2012) as it allows inclusion of non-spherical disturbances (Beer and Reidl, 2010). "Spatial Durbin Model (SDM) includes a spatial lag on the dependent and independent variables and is thus suitable to capture externalities and spillovers arising from different sources (Beer and Reidl, 2010)." This model

also eliminates biasedness and ignores heterogeneity (Beer and Reidl, 2010). "Spatial Durbin panel model allows exploiting the natural advantages of panel data, including higher sample variability, an increase in the degrees of freedom, more accurate inference and the possibility to control for the impact of time-constant omitted variables (Beer and Reidl, 2010)."

The mathematical form of the ***Spatial Durbin Panel model*** can be expressed as-

$Y_{it} = \phi + \lambda \sum_{j=1}^{N} W_{ij} Y_{jt} + X_{it}\beta + \sum_{j=1}^{N} W_{ij} X_{jt}\theta + \mu_i + \delta_t + \varepsilon_{it}$ (Elhorst, 2014)

Where Y_{it} and Y_{jt} are the rate of hospital expenditures for the states, i and j at time period t. $\sum_{j=1}^{N} W_{ij} Y_{jt}$ is the sum of the interaction effect of Y_{it} with Y_{jt} for N observations with λ being the response parameter of the endogenous interaction effect (Elhorst, 2014) and W_{ij} being the element of the spatial weight matrix W. This is based on contiguity or distance criterion (Yadavalli et al., 2013). W has (NxN) observations with N being the total number of observations and k being the nearest number of neighbors. The value of λ lies between +1 and -1. X_{it} represents (Nxk) matrix of the independent variables for state i at the time period t. β is the vector of coefficients of the non-spatially weighted explanatory variables. ϕ is the constant term, μ_i is the individual state effect or spatial specific effect, δ_t is the time period effect, and ε_{it} is the error term, which is multivariate normal with zero mean and variance σ^2, and it is independently and identically distributed (Elhorst, 2014). θ is the vector of coefficients of the spatial dependence of the independent variables and $\sum_{j=1}^{N} W_{ij} X_{jt}$ provides the sum of the interaction effect of independent variables of state i with that of the neighboring states explanatory variables.

Statistical Analysis

Moran's I index value tells us the presence of spatial cross correlation among the state's rate of hospital expenditures. If the z-statistic of Moran's I index is significant, it confirms the existence of spatial autocorrelation or spatial association among the hospital spending rates of the states over the years. If the index value is positive, the hospital expenditure rate of state i has a positive autocorrelation with its neighbors, while if it is negative, it has a negative autocorrelation.

Moran's I scatter plot displays the relation between the hospital expenditure (horizontal axis) for the period of 2000 to 2009 with the spatial lags of the hospital expenditure (vertical axis). The spatial lag of hospital spending is generated from the product of the spatial weight matrix Wij with the hospital expenditure rate of the neighboring states. There are four quadrants in the scatter plot. The points in the upper right (or high-high) and lower left (or low-low) quadrants indicate a positive spatial association of values. The lower right (or high-low) and upper left (or low-high) quadrants include observations that exhibit negative spatial association (SAS/STAT 9.3 User's Guide).

After confirming the presence of spatial spillover, the study follows specification tests as mentioned by Elhorst (2014) to determine which one of the three spatial panel models is the most appropriate one for the study. This is because Moran's I "does not provide much help regarding which alternative model would be most appropriate (Anselin, 2003)." To verify if the Spatial Durbin model (SAR) is the preferred model in comparison to the Spatial Autoregressive (SAR) or Spatial Error model (SEM) (Elhorst, 2014), ***Wald test*** and ***Likelihood ratio (LR)*** test are applied (Elhorst, 2014).

Secondly, the ***Hausman specification test*** (Elhorst, 2014) helps to differentiate between the spatial panel random effects model and the spatial panel fixed effects model. The spatial panel random effects model is considered as the null hypothesis in this specification test. If the null hypothesis gets rejected, then the spatial panel fixed effect model is counted as the structural one for the study.

The last step is to evaluate the direct and indirect effects (LeSage and Pace, 2009) of the independent variables. The ***direct effect*** is the impact on the rate of hospital spending of a state i by a unit amount of changes in state i's explanatory variables. This direct effect also incorporates feedback effect, which is the effect of state i's independent variables on its dependent variable that passes on to the neighboring states and comes back to state i. The ***indirect effect*** constitutes the variations in the hospital costs of the neighboring states produced by the changes in the independent variables of state i. This is a cumulative effect value, as it includes the effect of all of the neighbors of state i. The ***total effect*** is the sum of the indirect and direct effects.

Types and Sources of Data

The data used for this study are extracted from four different sources. The first data source is ***Centers for Medicare and Medicaid Services*** (CMS, Health Expenditures by the State of Residence). From this resource, data on the following variables has been obtained, namely total hospital spending and total health care spending by states for the years 2000 to 2009. The percentage of hospital expenses for each state for each year has been calculated by dividing hospital spending to total health care spending. This has been treated as the dependent variable for the study.

The rest of the variables mentioned below are considered independent variables in the analysis. The second data source is the ***Substance Abuse and Mental Health Services Administration (SAMHSA)***, Center for Behavioral Health Statistics and Quality (formerly known as the Office of Applied Studies). From this source, data on the percentage of people with binge alcohol use has been collected (National Survey on Drug Use and Health, State Estimates of Substance Use and Mental Disorder). This used the criteria of men having five or more drinks and women having four or more drinks in a two-hour time period.

The third source used to obtain data on variables related to the demand for health care is the ***United States Census Bureau***. This Census report contains data on variables such as: state shape files, Federal Information Processing Standard (FIPS) code for the states, Gross Domestic Product of each state, the percentage of the population above age 65 and below age 17, number of active physicians per 100,000 civilian population, poverty rate, HMO, the percentage of Medicaid expenditure, the uninsured rate of people, the unemployment rate, gender, and race. All of the afore-mentioned variables have been used for the analysis. The state-level shape data file, acquired from the U.S. Census Bureau (Topologically Integrated Geographic Encoding and Referencing (TIGER) report, gives the latitudinal and longitudinal value of each state, providing information on the geographic area of each state (Bose, 2015). The latitudinal and longitudinal values of the states have been used to determine the contiguity weight matrix used for the spatial analysis model (Bose, 2015).

Last, but not the least; the fourth source is the ***State Health Facts*** (Henry J. Kaiser Family Foundation, 2000–2009). Statistics on the hospital beds per 1,000 population and the total number of community hospitals are obtained from here. The interaction of these two variables has been used in the analysis due to their high correlation value (0.77). All the variables are considered from the year 2000 to 2009 and for 48 states and Washington, DC. Alaska and Hawaii are not included in the analysis because states with no neighbors will lead to inefficient estimates for the spatial dependence model (Bose, 2015). MATLAB 12 software has been used to obtain the results of the spatial panel analysis.

Independent Variables

Table 1 identified the variables used for the analysis. All of the socio-economic, demographic and health supply variables as mentioned are assumed to have significant contribution in explaining the changes in the percentage of U.S. state-level hospital expenses. Hispanics are a healthy group of a population when compared with any other races. Therefore, it is predicted for the study that increases in the Hispanic population of a state will have a negative impact on the state's hospital costs. The African-American community, in general, suffers from major chronic diseases such as heart disease, stroke, cancer, etc. 14.6% of the African-American population is estimated to have been suffering from ill health (CDC, 2012). It can be hypothesized that they are sicker than other racial groups. Alongside, as they are also the less insured population (21%) in comparison to the whites, the African-American population is unable to pay for the hospital charges incurred, leading to the rising costs of the hospitals from the outstanding share of the service charges. It is evident from previous literature that the female population uses more hospital services and health care utilization than male (Cameron et al., 2010; CDC, 2001) leading to rise in the total hospital charges. Therefore, a rise in percentage of the male population will lead to a decline in total hospital expenditure.

With increasing Medicaid expenditure and managed care by the federal and state governments jointly, it can be assumed that the hospital charges and expenses will be under control and hence will have an inverse relation (Dartmouth Atlas of Health Care in the United States). The total health care expenditures of a state increase with increasing Medicaid expenditures, but the rising Medicaid expenditures help in managing the costs incurred by the hospitals. It is also seen that the average population below age 17 is the healthiest population. As a result, it is hypothesized in this study that state hospital expenditures have a negative relation with an increase in the percentage of the younger generation of the population (Cuckler et al., 2011).

The percentage of the population above sixty-five can act in either way. They might have a negative or positive relation with hospital costs. This is the population that has the poorest health and hence is in need of constant care. They are usually long-term care patients and are taken care of—at homes, nonprofit organizations or nursing homes after initial treatment. Therefore, their impact is considered to be ambiguous.

With the rise in the percentage of uninsured people, it is expected that they will access fewer medical services as they are unable to afford the high charges without insurance coverage (Martin et al., 2002; Cuckler et al., 2011). The poverty rate and the unemployment rate will also increase the total cost of the hospitals. These sections of people suffer from illness more than others do due to the deficiency in a proper diet, poor hygiene, and a lack of sanitation, and they are more likely to be admitted to emergency rooms and intensive care units, thereby driving the costs

up as they are unable to pay for the high charges. They are also mostly treated for very small charges or for free, and this causes to form an additional burden on the hospital service costs and hence total hospital expenses.

The increase in state GDP will initiate investment in every aspect of the state economy. Health infrastructure, being an important factor for the improved and reformed economy, will also witness a rise in total expenditure in the form of new staff, supports, supplies, better equipment, etc., which will add to the total hospital costs. It is also seen that positive changes in health supply factors, such as the number of hospitals, active physicians, and hospital beds per 1,000 population, has an upward impact on hospital expenditures. This is because the regions and states that witness a greater influx of physicians and hospital beds also seem to observe a higher number of visits to doctors and higher hospitalization volumes (Bose, 2015; Fisher et al., 2004).

Another important factor that has a major impact on the hospital expenditures is alcohol abuse. Binge drinking or excessive drinking of alcohol leads to many chronic diseases such as heart disease, stroke, liver failure, road accidents, head injuries, high blood pressure, cancer, depression, etc. Therefore, it is very obvious that hospital expenditure will have a positive impact on the rise in the percentage of people involved in excessive drinking.

Descriptive Statistics

The descriptive statistics for the dependent and independent variables used for analysis are summarized in Table 2. The dependent variable is the percentage of hospital expenditure (hospital expenses to the total amount of health care spending). The statistical values indicate that the independent variables vary widely across the states and over the years. The rate of binge drinking use varies from 14.07% to 29.77% across the states (2000-2009). Connecticut has the lowest percentage of hospital care expenses, while Washington, D.C., spending the highest amount. While the unemployment rate is the lowest in Connecticut (2.3%) and highest in Michigan (13.3%), poverty rate varies from 5.3% (New Hampshire) to 21.9% (Mississippi). The African-American population ranges from Maine (0.37%) being the smallest to the District of Columbia's (60.26%) being the largest. The Hispanic population can be seen to be residing mostly in New Mexico (45.56 %), with the lowest percentage in West Virginia (0.67%). Massachusetts has the lowest uninsured rate of 4.4% and reaches maximum for Texas (26.1%).

Results and Discussion

Examining Figure 2, it can be seen that for the year 2009, while South and Pacific West have a lower rate of hospital expenditures, Midwest has a higher rate of hospital expenses. Moran's I index value (0.25) in Figure 3 is significant at the 5% level reporting the presence of positive spatial association of the rate of hospital expenditure for state i with its neighboring states. Hence, the following specification tests necessary to find the appropriate spatial panel model can be performed.

To ascertain that the SDM model cannot be further reduced to either i) the SAR model or ii) the SEM model (Table 3), Wald test and Likelihood ratio tests have been conducted for both the models. Both tests, as seen in Table 4, rejects the null hypothesis of SAR being preferred to SDM (Wald test— χ^2 =107.411, df=14, p-value is 0.000<0.001, and LR test— χ^2 = 91.531, df =14, p-value is 0.000<0.001) and SEM being preferred to SDM (Wald test— χ^2 = 99.036, df= 14, p-value

is 0.000<0.001, and LR test— χ^2 = 84.138, df=14, p-value is 0.000<0.001), ensuring that the spatial Durbin panel model is the relevant model for this analysis (Elhorst, 2014).

Finally, to narrow down as to which one of the two SDM panel models (Spatial Durbin random effect model or fixed effect model) is the most pertinent and robust one, Hausman's (1978) specification test has been applied. Assuming the random effect SDM model as the null hypothesis model for this specification test, rejection of the null hypothesis (84.680 degrees of freedom: 29, significance: 0.000) indicates that the spatial Durbin fixed effect model is the best fit model. The SDM model has two unique advantages—first, it provides unbiased coefficients in comparison to the SAR or SEM model as it incorporates the lags of both the dependent and independent variables in the equation, and second, it enables us to capture the direct (also includes the feedback effect) and indirect effects in a model.

The results in Tables 5 and 6 provide detailed information of the estimated, direct, indirect, and total coefficients for the explanatory variables using the SDM fixed-effect model. The values of direct effect in Table 5 are different from Table 6 because the direct effect values in the latter table also include feedback effects. The magnitude of lambda (the interaction effect of the rate of hospital expenses of state i with state j) is 0.12 and is significant at the 1% level. This means that the increase in the hospital expenditure rate of the neighboring states by 1% leads to an increase of 0.12% of hospital costs of state i. As mentioned earlier, state health care expenditures and health policy decisions depend on their adjacent states; therefore, this positive interaction effect suggests that hospital expenditure follows the same path.

This spillover effect can be described in terms of fiscal competition, exogenous effect, and diffusion policy, as mentioned by Manski (1993). State governments are inclined toward following or adopting policies similar to their adjacent states. There are several reasons for this. First, hospitals in a state usually compete with its neighboring regions to increase their revenue by improving their qualities through improvised technologies, hiring specialized physicians, and increasing the number of hospital beds in order to attract more patients (Baltagi and Yen, 2014). This will increase their investment costs leading to an increase in total hospital expenditures. Secondly, there are no market forces that will force hospitals to lower their rates. This market does not work efficiently as there is no governmental regulation on hospital rates or price ceiling, thereby driving the hospital charges and total costs to soar up (some hospitals charge "markup of more than 1,000 percent for the same medical services" (Anderson and Bai, 2015).

The rate of binge drinking in each state has positive direct, indirect, and total influences on the hospital expenditure rate. The tables indicate that every 10% rise in population with excessive alcohol consumption will cause a total rise of 1.6% (approximately 2%) in the total spending rate, of the hospitals. In comparison to other variables, the rise in rate of hospital expenditures due to the rise in the percentage of the population with binge drinking can be prevented. Therefore, accounting for the amount of healthcare expenses due to binge drinking will provide the policy makers an initiative to create better prevention measures to decrease the rate of binge drinking and thereby controlling the rate of hospital costs.

This estimate includes the effect of both positive significant direct and indirect impact of the percentage change of alcohol abuse. Therefore, the rise in the proportion of people of state i

with excessive alcohol consumption increases not only its own hospital spending rate but also those of its neighboring states. As hospital referral regions (HRR) are cross boundaries; fatalities, road accidents, self-harm, unintentional and intentional injuries and wounds caused during drinking, and chronic diseases caused by alcohol, misuses such as liver cirrhosis, cancer, stroke, and heart problems lead to increase in total expenditures of the hospitals of the state and also of its neighbors.

Concentrating on demographic variables, specifically, the percentage of the Hispanic population and the percentage of the male population, we see that their direct effects in Table 6 are negative and significant at the 1% level. As explained earlier, the Hispanic population is healthier in comparison to that of the non-Hispanic population (Zhang et al., 2012). They also have a higher life expectancy (National Center for Health Statistics, 2013) and suffer less from diseases due to their health habits and hereditary characteristics. Hence, the increase in their population will decrease the rate of hospital expenditures. The male population has a lower rate of medical use (Cameron et al., 2010; CDC, 2001) in comparison to the female population. Hence, the dominance of the male population in a state will drive the hospital costs down due to less use of health services.

The indirect effects of both the Hispanic population and the male population in state i have a positive and significant impact (1%) on its neighboring states, which might have been caused by the migration effect. One of the reasons that the population in state i is increasing might be the relocation from its neighboring regions or states in search of better living conditions, work opportunities, and improved health conditions, thereby escalating the adjacent states' hospital spending as their female and non-Hispanic population increases in comparison to the male and Hispanic population.

The rise in the aged population and the population below age 17 of state i has a negative, significant cumulative indirect impact on its neighboring states' hospital expense rates. The rise in the elderly population and the young population of state i might be due to the migration from its nearby states to access better health facilities or amenities if their own state is lacking in providing them (Glaser and Grundy, 1998). Glaser and Grundy (1998) also specified that "poor health is positively associated with the greater likelihood of changes in both living arrangements and address among people over the age of 65." Thus, a rise in the elderly population in state i lead to a lower hospital expenditure rate of state j. Furthermore, even though the populations of both age groups are increasing, they are the ones who access hospital care the least. This is because the aged population requires long-term care and is usually treated in home health care, adult day care and respite care, nursing homes, government programs, etc., and the younger population is a much healthier population who does not fall sick that often. Therefore, these population groups will have an adverse impact on the rate of hospital expenses.

The percentage of the African-American population has a positive and significant direct, indirect, and overall influence on the state-level hospital expenditure rate. This is because they mostly comprise of the low or middle-income group and majorly suffers from chronic diseases and worse health conditions due to their socio-economic backgrounds and daily lifestyles. They also happen to consist of the larger bracket of the uninsured population. As a result, even if they need more hospital care, they are incapable of paying for expensive inpatient and outpatient service

fees, increasing the costs of the hospitals from the unpaid share of the service charges. The indirect effect being positive and significant illustrates that the rise in the percentage of African-American residents in a state also causes an upsurge in bordering states' rates of hospital spending.

The interaction term of the total number of hospital beds and hospitals per 1,000 residents displayed significant positive direct, indirect, and total effects on the rate of hospital expenditures. Also, the change in the proportion of active physician per 100,000 residents did not have any significant direct impact, but it had a significant indirect and total effect. These supply-side variables will improve the quality of the hospitals and health care provided, but will also increase the total hospital expenses for the state. The neighboring states, competing among themselves and with state i to attract patients and federal funds will also follow a similar pattern of improving their health infrastructures, thereby pushing their expenditures up. This is because Fournier and Mitchell (1992) have reported that the "degree of competition" among hospitals have "cost-increasing effects."

The unemployment rate and poverty rate of a state both have positive direct, indirect (for the unemployment rate only), and total effects that are statistically significant for hospital expense rates. Populations belonging to these groups suffer from sickness and diseases more than other demographics as they do not get proper nutrition and often lack proper cleanliness and hygiene. They are more likely to be admitted to emergency rooms and intensive care units of the hospitals in their own state and also of the nearby bordering states as and when needed (OECD, 2006). Thus, these factors affect the hospital expenditure rates positively. With increases in the rate of unemployed population, migration to the neighboring states tends to grow, in search of a better standard of living or jobs. This leads to an increase in the proportion of unemployed people in the adjacent states too, also leading to a rise in the hospital expenditure rate of the bordering states.

The percentage of Medicaid expenditures as a form of managed care helps in reducing and keeping the total hospital expenses of the state (negative and significant relation) low because these are the funds that are a combined effort of both the state and federal government resources. The more the government supports in sustaining hospitals, the easier it will be for the hospitals to cope up with the rising prices. The increase in the uninsured rate has a significant negative indirect impact on hospital expenses. With rise in the number of uninsured people, the use of health care falls as they cannot afford to pay for the high hospital care charges out of their pockets.

Per capita GDP of state i have a positive significant impact on state j because as the state gross domestic product of state i increase; it invests and improves all sections of the economy. This also includes health care reforms. Neighboring states provide evidence of a spatial interaction pattern in terms of fiscal competition. Hence, they will also increase their investment in improving their quality of health care, causing a rise in their hospital costs. As Morey et al. (1992) explained that improving quality of care of a hospital (reducing death rate) will result in a higher cost burden on the hospital.

Thus, it is evident from this study that past literature was successful in capturing the effect of spatial spillover of the independent variables on the rate of hospital expenditures across the states in the United States for the period of 2000 to 2009. This study is an advanced analysis, which exhibits the presence of positive spatial dependence of hospital spending of a state on its

adjacent regions. Furthermore, this study has highlighted that rate of binge drinking, the total number of hospital beds and hospitals per 1,000 residents, the unemployment rate, the percentage of the African-American population, proportion of active physicians and state gross domestic product have positive impacts on its neighboring states rate of hospital expenses. Moreover, the increasing rate of male population, Hispanic population and the rate of un-insurance of a state have adverse impacts on its own rate of hospital costs but positive effects on its bordering states' rate of hospital spending.

Conclusion and Policy Implications

Summary

This study achieves the goal of examining the state-level variations in hospital expenditures. It highlights the presence of positive spatial dependence of rate of hospital spending across the states. No previous studies have considered or examined the influence of factors on state-level hospital expenditures using a spatial Durbin fixed effect model over an extended time period (2000 to 2009). It is important to understand why these variations are occurring so as to know if this is leading to the absence of equity in health care and status among the population and proper utilization of scarce resources. Finding the reasons behind this variation will not only assist all of the states to control cost growth but also help in providing the population with better health care services, quality, infrastructures, treatments, and health policies.

This is the most recent time period data available for analysis, and it reports the demographic profile, economic factors, supply side variables, and substance abuse factor that are the leading causes of the growing state-level hospital costs. This research does not consider comparative analysis, cross-sectional analysis, or panel analysis as these model analyzes are not only incomplete in providing a comprehensive explanation of the deviation in hospital expenses across the states but also provide biased or inefficient coefficients. None of the analysis methods stated above incorporates location, peculiarity of space or geographical variation while analyzing the state-level variations of the rate of hospital expenses.

The positive spatial correlation of hospital expenditures across the states can be explained by the economic competition (contextual and correlated effect) and the exogenous effect. Hospitals in a referral region (HRR) cross state boundaries. Therefore, patients can be referred to any of the hospitals among any of these states in one HRR based on their medical condition. Further hospitals of neighboring region compete among each other to attract patients, thereby improving the quality of care (technology, specialized physicians, hospital beds, etc.), causing the costs to increase (Baltagi and Yen, 2014; Fournier and Mitchell, 1992; Morey et al., 1992). Along with this positive spatial dependence, an increase in a state's rate of population with binge drinking and increase in socio-economic, demographic, and health infrastructure factors (such as the total number of hospitals and beds per 1,000 residents, unemployment rate, poverty rate , per capita state GDP and percentage of African-American population) increases the rate of hospital expenditure (except GDP) of a state and it also increases the hospital expenditures of the neighboring states (except poverty rate). Alternatively, the percentage of male, Hispanic, and percentage of Medicaid expenses display inverse relation with hospital spending of a state. Further, while a rise in the percentage of male, Hispanic and proportion of active physicians of state i increases the rate of hospital expenses of state j; an increase in the rate of uninsured, aged and population below age17 of state i decrease the rate of hospital expenses of state j.

Increases in the rate of population in state i with binge drinking will increase the rate of population suffering from acute diseases, such as heart attack, liver cirrhosis, cancer, etc., and also suffer from head and body injuries from accidents, rash driving, mental depression, fatalities, etc., who might be referred to a hospital in an adjoining state j as U.S. hospitals are categorized as HRR, which cross state boundaries, incorporating hospitals from multiple states, where the patients can be referred for acute condition treatment. Further, injured patients from road accidents (Interstate, highway) caused by alcohol abuse are also taken to nearby hospitals irrespective of the state in which they reside.

Cost of binge drinking to the government

Despite having a modest effect on the hospital costs directly, excessive alcohol consumption has an additional huge indirect cost effect in the form of loss of work productivity and suffering from chronic and long term illness. It has been reported 16.9% of the total population (312,000,000 in 2010 (WHO, 2014) who are binge drinkers consume 76% of the total alcohol consumed (CDC, 2012). The total consumption of pure alcohol in 2010 was 9.2 liters per capita (aged 15 years and above, a population of 249,600,000(WHO, 2014). This means binge drinkers had about 1.7 billion liters of alcohol in 2010. In other words, a binge drinker has 73.85 drinks per week or 556 drinks per year (Cook, 2007). "Binge drinking cost federal, state, and local governments (health) about 62 cents per drink, while federal and state income from taxes on alcohol totaled only about 12 cents per drink (CDC, Vital Signs, 2012)." Therefore, the total health cost to the government was an estimated $18,176,396,160 or $18 billion and the taxes collected are $3,518,012,160 or $3 billion from binge drinkers. Therefore, this will further increase the total burden on the economy to a larger extent.

Policy Implications

Findings from this study have profound implications for policies regarding substance abuse prevention and treatment and economic and social determinants of health to contain hospital expenditures. Although states generate income from alcohol taxation as stated above alcohol use in the form of binge drinking is responsible for 3.6% of emergency visits and 38.9% of all hospitalizations which means a large amount of hospital expenditures came from binge drinking (NIH, 2013). Therefore it is important to spread awareness among people about the fatality of alcohol consumption (as it leads to over 54 injuries and diseases along with accidents, violence, unplanned pregnancy, fetal alcohol spectrum disorders and sudden infant death syndrome, sexually transmitted diseases, etc.) because the states are indirectly losing huge amount of money by the rise in hospital expenditures and loss in work force and productivity (CDC, Vital Signs, 2012).

Some of the reasons behind this frequent drinking are— cheap alcohol that is becoming much cheaper with time (Office of Justice Programs Office of Juvenile Justice and Delinquency Prevention (OJJDP), 2002), $4 billion of alcohol marketing every year, alcohol being the readily available consumer product, etc. (OJJDP, 2002). Restricting alcohol outlets, strengthening and enforcing minimum purchase age laws, strategies to curb the social availability of alcohol, controlling alcohol advertising and promotion, an increase in alcohol tax to pay for prevention programs are some of the policies that have been useful (OJJDP, 2002). Individual state funded policies to prevent and generate awareness of alcohol abuse include examples of ACT Missouri, DHS Office of Alcohol and Drug Abuse Prevention (OADAP) in Arkansas.

However, there are no joint prevention programs among the states to intervene the growing concern of alcohol abuse on health outcomes. Adjacent states can undertake joint policies to create prevention strategies to promote awareness among the state residents as drinking is not only negatively impacting the state itself but also the neighboring states. The U.S. government can also "collaborate with states and communities to support effective community strategies to prevent binge drinking" and also "control the marketing and sale of alcohol (CDC, Vital Signs, 2012)."

It is important to go beyond healthcare interventions/healthcare sectors and pay attention to the social determinants and economic profile such as unemployment rate, poverty rate, race, gender and ethnicity of the residents. Addressing social determinants of health helps in achieving health equity (CDC website) by "eradicating systematic disparities in health between and within social groups that have different levels of underlying social advantages or disadvantages (Braveman and Gruskin, 2003; page 2139)."

The study findings also confirm that lack of health insurance has a significant effect on state-level variations in hospital expenditures. It has been reported that "people without insurance coverage have worse access to care than people who are insured. Almost a third of uninsured adults in 2013 (30%) went without needed medical care due to cost. Studies repeatedly demonstrate that the uninsured are less likely than those with insurance to receive preventive care and services for major health conditions and chronic diseases (KFF, 2014)." ACA (Affordable Care Act, 2010) have addressed this issue by enhancing access to the uninsured and the individuals below 138% of the federal poverty level to reduce the burden of higher health care expenditures from uninsured individuals suffering from chronic diseases. This has decreased the uninsured rate by 1% (National Center for Health Statistics. 2014).

As ACA expansion was effective from January 2014, currently there are no available data on whether expanding insurance will reduce the hospital expenditures at the state level. Future studies need to examine whether states that have expanded health insurance either through Medicaid or setting up health insurance exchanges have reduced hospital expenditures.

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Abbreviations

CDC: Centers for Disease Control and Prevention, ACA: Affordable Care Act, KFF: Kaiser Family Foundation, OJJDP: Office of Justice Programs Office of Juvenile Justice and Delinquency Prevention, OADAP: Office of Alcohol and Drug Abuse Prevention, DHS: Department of Human Services, NIH: National Institute of Health, OECD: Organization for Economic Co-operation and Development, FIPS: Federal Information Processing Standard, SAMSHA: Substance Abuse and Mental Health Services Administration, SDM :Spatial Durbin Model, SAR: Spatial Autoregressive, SEM: Spatial Error Model, AHA: American Hospital Association, CMS: Centers for Medicare and Medicaid Services, HCUP: Healthcare Costs and Utilization Project, IMS: Institute for Healthcare Informatics, MEDPAC: Medicare Payment Advisory Commission, WHO: World Health Organization.

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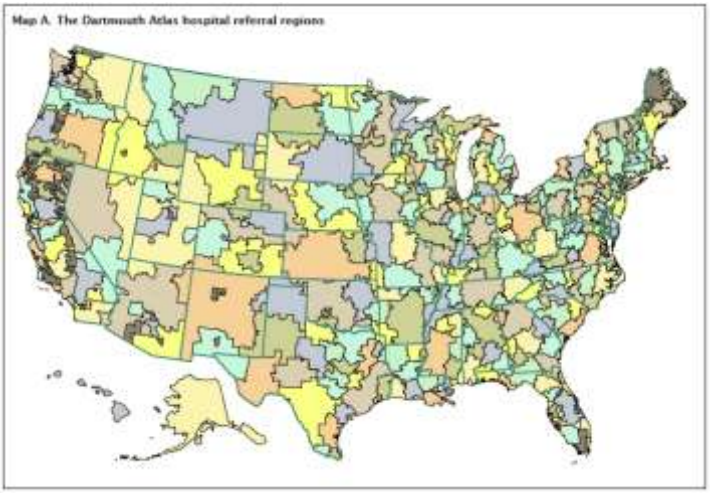

Figure 1: HRR Source: The Dartmouth Institute for Health Policy and Clinical Practice

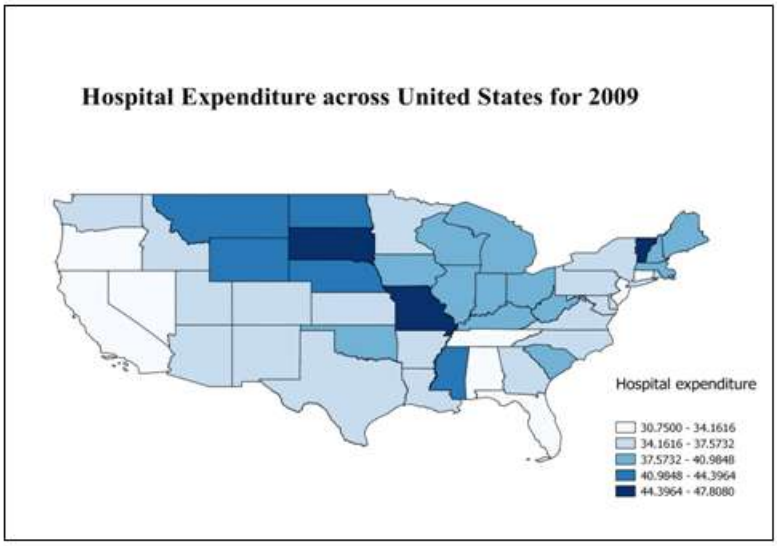

Figure 2: Map depicting variations in hospital expenditure in the U.S. as a percent of total health expenditures, 2009

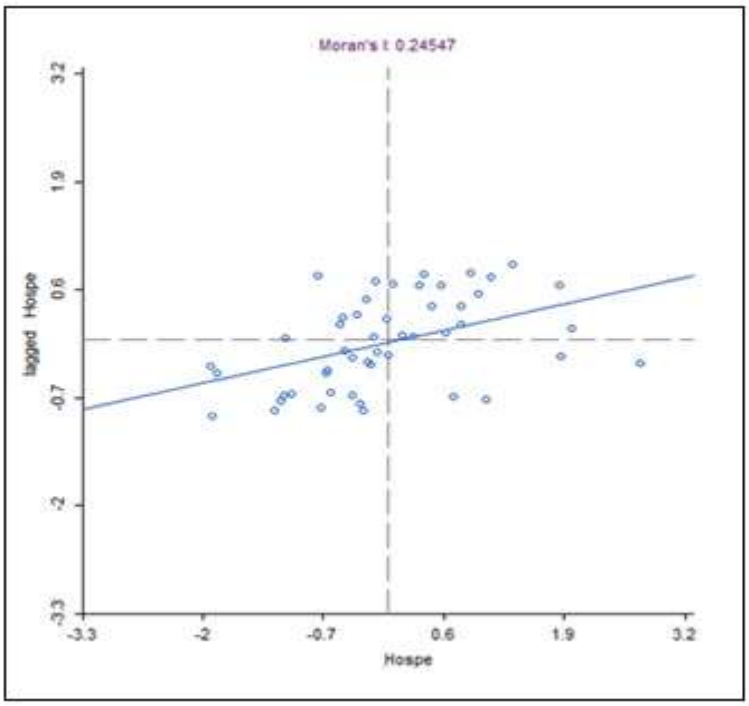

Figure 3: Moran's I scatter plot reporting presence of positive spatial autocorrelation of rate of Hospital Expenditures

Table 1: Definition of Variables

Dependent Variables (Y)	**Definition**	**Expected sign of coefficients**
HOSP EXP	Percentage of Hospital Expenditure to the total health expenditure (state level)	
Independent Variables (X)		
UNINS	The proportion of the population without insurance	+ on own state, - on neighbors
ACTIVE	Number of active physician per 100,000 population	+
HOS	Number of hospitals per 1000 population	+
HMO	Percentage enrolled in Health Maintenance Organization	-
PER CAPITA GDP	Per capita gross domestic product of the state	+
POV	Poverty rate	+
MEDICAID	Percentage of Medicaid Expenditure	-
AGE65	Proportion of the population above age 65	-
AGE17	Proportion of the population below age 17	-
BED	Number of hospital beds per 1000 population	+
AFRICAN-AMERICAN	Percentage of African-American population	+
MALE	Percentage of male population	Ambiguous
UNEMP	Unemployment rate	+
HISPANIC	Percentage of Hispanic population	Ambiguous
BINGE	Percentage of population with binge alcohol use (5 drinks for men and 4 drinks for women within two-hour time period in the past 30 days)	+

Table 2: Summary Statistics for State Level Hospital Expenses 2000-2009 for 48 States and Federal Districts

Variable	Unit	Mean	Standard deviation	Minimum	Maximum
Percentage of Hospital Expenditure	%	36.510	3.453	29.111	49.528
Uninsured rate	%	13.553	3.901	4.400	26.100
Proportion of population below age 17	%	24.591	2.099	18.930	43.757
Proportion of population above age 65	%	12.776	1.538	8.500	17.600
Active physician per 100,000 population	Unit	265.344	95.886	154.000	852.000
Percentage of population enrolled in HMO	%	19.878	12.142	0.100	64.100
Poverty rate	%	12.824	3.193	5.300	21.920
Percentage of Medicaid Expenditure	%	15.060	3.994	7.272	29.977
Total number of community hospitals	Unit	99.794	79.840	5.000	428.000
Unemployment rate	%	5.189	1.665	2.300	13.300
Percentage of African-American population	%	11.639	11.595	0.311	61.106
Percentage of Male population	%	49.207	0.722	47.044	51.013
Percentage of Hispanic population	%	9.089	9.470	0.679	45.566
Percentage of population with Binge alcohol consumption	%	23.319	3.502	13.730	33.820
Hospital bed per 1,000 people	Unit	3.042	1.008	1.700	6.200

Table 3: Estimation Results of Spatial Panel Data Models (SAR and SEM)

	SAR		SEM	
Variable	Coefficient	T statistics	Coefficient	T statistics
Percentage of Hispanic population	-0.475***	-4.504	-0.623***	-5.471
Percentage of Male population	-2.345**	-2.584	-2.553***	-3.043
Percentage of African-American population	0.498***	3.250	0.391***	2.755
Uninsured rate	-0.030	-0.856	-0.013	-0.382
Per capita GDP	0.023	1.070	0.009	0.462
Percentage of Medicaid Expenditure	-0.075**	-2.352	-0.077***	-2.608
Active physician per 100,000 population	0.005	1.136	0.002	0.609
Percentage of population enrolled in HMO	-0.002	-0.233	0.000	-0.023
(Hospital bed *Total number of hospitals) per 1000 people	9.593***	3.833	9.990***	4.363
Poverty rate	0.149**	2.223	0.131**	2.092
Proportion of population above age 65	0.049	0.189	0.080	0.331
Proportion of population below age 17	-0.066	-1.401	-0.040	-0.941
Unemployment rate	0.116*	1.661	0.144**	2.064
Percentage of population with Binge alcohol consumption	0.049***	1.837	0.074***	2.790
λ(Lambda)	0.370***	6.586		
η (eta)			0.396***	6.964
R square	0.9441		0.9387	
Log Likelihood	-601.061		-597.364	
Number of observations	490		490	
*The symbols ***, ** and * represent one, five and ten percent significance level.*				

Table 4: Wald Tests and Likelihood Ratio Tests Results

	Wald Test(SAR vs. SDM)	LR test(SAR vs. SDM)	Wald Test(SEM vs. SDM)	LR test(SAR vs. SDM)
Value	107.411***	91.531***	99.036***	84.138***
Degrees of freedom	14	14	14	14
*The symbols ***, ** and * represent one, five and ten percent significance level.*				

Table 5: Spatial Durbin Fixed Effect Model Results

Variable	Coefficient	T-statistics
Percentage of Hispanic population	-0.657***	-4.671
Percentage of Male population	-2.882***	-3.300
Percentage of African-American population	0.489***	3.252
Uninsured rate	-0.003	-0.075
Per capita GDP	0.012	0.602
Percentage of Medicaid Expenditure	-0.062**	-1.997
Active physician per 100,000 population	0.000	0.020
Percentage of population with Health Maintenance Organization	-0.002	-0.224
Hospital bed per 1,000 people *Total number of hospitals	11.185***	4.753
Poverty rate	0.108*	1.685
Proportion of population above age 65	-0.242	-0.919
Proportion of population below age 17	-0.055	-1.237
Unemployment rate	0.192***	2.592
Percentage of population with Binge alcohol consumption	0.076**	2.901
W*Percentage of Hispanic population	0.984***	3.904
W*Percentage of Male population	4.933**	2.179
W*Percentage of African-American population	0.902**	2.243
W*Uninsured rate	-0.153**	-1.853
W*Per capita GDP	0.084**	1.789
W*Percentage of Medicaid Expenditure	-0.018	-0.221
W*Active physician per 100,000 population	0.015**	1.920
W*Percentage of population with Health Maintenance Organization	-0.031	-1.345
W*Hospital bed per 1,000 people *Total number of hospitals	1.299	0.195
W*Poverty rate	0.168	1.149
W*Proportion of population above age 65	-2.194***	-3.570
W*Proportion of population below age 17	-0.188*	-1.811
W*Unemployment rate	0.223*	1.655
W*Percentage of population with Binge alcohol consumption	-0.001	-0.021
λ(lambda)	0.120**	1.740
R square	0.9526	
Log Likelihood	-555.295	
Number of obs.	490	

*The symbols ***, ** and * represent one, five and ten percent significance level. T-test values are specified in the column after the coefficient values of each model.*

Table 6: Direct, Indirect and Total Effect Results of the Spatial Durbin Fixed Effect Model

Variable	Direct Coefficient	T statistics	Indirect Coefficient	T statistics	Total Coefficient	T statistics
Percentage of Hispanic population	-0.638***	-4.663	1.009***	3.822	0.371	1.666
Percentage of Male population	-2.763***	-3.151	5.151**	2.023	2.388	0.853
Percentage of African-American population	0.516***	3.252	1.089**	2.446	1.605***	3.239
Uninsured rate	-0.006	-0.171	-0.177*	-1.900	-0.182*	-1.796
Per capita GDP	0.015	0.707	0.093**	1.828	0.107**	1.991
Percentage of Medicaid Expenditure	-0.064**	-2.074	-0.031	-0.343	-0.095	-0.962
Active physician per 100,000 population	0.000	0.121	0.017**	1.931	0.017*	1.823
Percentage of population with Health Maintenance Organization	-0.002	-0.249	-0.033	-1.215	-0.036	-1.141
Hospital bed per 1,000 people *Total number of hospitals	11.144***	4.663	2.909*	3.850	14.054*	1.713
Poverty rate	0.110*	1.793	0.204	1.234	0.314*	1.769
Proportion of population above age 65	-0.288	-1.078	-2.517***	-3.587	-2.806***	-3.643
Proportion of population below age 17	-0.056	-1.294	-0.206**	-1.732	-0.263**	-1.995
Unemployment rate	0.197***	2.671	0.274*	1.847	0.470**	3.194
Percentage of population with Binge alcohol consumption	0.076***	2.901	0.079***	3.005	0.155***	2.481
R square	0.9526					
Total number of observations	490					

*The symbols ***, ** and * represent one, five and ten percent significance level. T-test values are specified in the column after the coefficient values of each model.*