



Investigating the Determinants of Healthcare Expenditures in Different Healthcare Systems

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Abstract

Background: The rapid growth of health expenditures is a great concern for governments at present.

Objectives: The present study aimed to determine the main factors affecting health care expenditures in countries with different types of the healthcare system.

Methods: We studied 25 countries with different types of healthcare systems, including national health insurance, traditional sickness insurance, national health services, and mixed systems. Health expenditure per capita was estimated as a function of health care price, out-of-pocket health expenditure, income, and other exogenous factors. A random-effects model was selected instead of a fixed-effects model based on the Hausman test to assess the effect of different factors on health expenditures.

Results: Income and health care price had the greatest impacts on health expenditures in countries with national health insurance and countries with mixed health care systems, respectively. Among the variables, mortality and life expectancy had the greatest impacts on health expenditure in all types of the healthcare system. The out-of-pocket health expenditure had the most and least impacts on health expenditures in countries with mixed health care systems and countries with national health insurance systems, respectively.

Conclusions: The study showed that health condition and out-of-pocket health expenditure are the most important determinants of health expenditures in all health care systems, especially the mixed health care system.

Keywords: Health Expenditures, Healthcare System, Health Care Price, Panel Data Method

1. Background

Investigating the determinants of health expenditure is a critical issue in health economics research and literature (1). In spite of the positive effects of spending on healthcare, such as its impacts on economic growth through investment in health (2), less developed and developing countries have not enough financial resources for health sectors due to the low-income level. This leads governments to transfer financial resources from other sectors to the health sector and that is why the production level may decrease, especially in less developed and developing countries (3). Unfortunately, the growth rate of healthcare spending is higher than the growth of gross domestic product (GDP) per capita for both developing and developed nations (1).

Previous studies investigated different factors affect-

ing health expenditures both in micro and macro levels, and showed that income is a very important factor that explains the level and growth of health expenditures among different nations (1). Prior research, predominantly in Organization for Economic Co-operation and Development (OECD) countries, reported that income elasticity was significantly above unity (1, 2, 4). In developing nations, most studies show that this elasticity was below the unity and therefore, concluded that health is a necessary good (1, 3).

The population age structure and epidemiological needs are other important factors that have been studied in the health expenditure literature (5, 6). Prior research assessed the share of young and old people over the active or total population. Various variables, such as HIV prevalence and maternal mortality, are also included in health expenditure research to study the impacts of epidemiolog-

ical needs (6).

“Also, the primary investigation conducted by Newhouse has shown that the technology advancement is a driving factor for Increasing healthcare expenditures (7)”. For a long time, adoption and diffusion of new healthcare technologies were accounted as the primary determinants of healthcare expenditure growth (4, 8). Different studies with different methods used several variables to study the impacts of advancing in medical technologies on healthcare spending growth. For example, surgical procedures and the number of specific medical equipment were assessed in cross-sectional studies (9). On the other hand, time or time-specific intercepts were used in time-series models to probe medical technology adaptation and diffusion on healthcare expenditures (10, 11).

The characteristics of the health system comprise another determining factor of healthcare expenditure that was studied in prior research (12, 13). This means that different health systems provide and finance healthcare services with different approaches and diverse provider payment mechanisms, which could have some effects on healthcare spending level and its growth between different nations. Because of this matter, this study investigated the macro determinants of healthcare expenditure in different types of the health system in the world. By doing this, we could compare the main determinants of medical spending between such health systems and provide health system authorities with some information for implication and policymaking.

2. Methods

There are various types of health care system classification in the world, including classification based on the type of financing, health care system functions, and geographic/political criteria.

In this study, we used the classification of health care based on the type of financing, which classifies the health care system into four main groups: National health insurance, traditional sickness insurance, national health services, and mixed systems.

Since there is no clear classification for countries based on the type of financing, we followed other studies such as Raeesi et al. (14) and Senaratne (15) to select and classify countries based on the type of health care system. In these studies, 25 countries were clearly classified based on the type of health care system and we could not find any other country to put in these classes.

The selected countries for this investigation along with the type of their health care system is presented in Table 1. The data were collected from these 25 countries over 16 years (2000 - 2016).

We used the basic econometric model developed by Kraipornsak because this model constitutes some variables at a macro level, such as economic variable (GDP per capita), health economics variable (health care price), health variables (mortality and life expectancy), and social variable (aging population) (16). Therefore, this is a comprehensive model that includes three dimensions of health, economics, and demographic structure of countries. The model is valid because it was used by other investigators in their studies. The model is presented as follows:

$$\begin{aligned} \ln(THE_{it}) = & \beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 POP65_{it} \\ & + \beta_4 OOP_{it} + \beta_5 MOR_{it} \\ & + \beta_6 LE_{it} + \beta_7 HP_{it} + \epsilon_{it} \end{aligned} \quad (1)$$

In this model, THE_{it} and OOP_{it} represent the total and out-of-pocket health expenditures per capita in constant 2011 prices, respectively, HP_{it} represents the health care price (as measured by health expenditure per capita in current prices divided by health expenditure per capita in constant 2011 prices), GDP_{it} represents the GDP in constant 2011 prices (in dollars) based on PPP, the POP represents the proportion of the population aged 65 years or over, MOR_{it} and LE_{it} represent the mortality rate and life expectancy at birth, respectively, i represents countries in the sample, and t represents the year of observation from 2000 to 2016.

To assess the relationship between health expenditure and its determinants, we started our research with a descriptive analysis of variables in each of the healthcare systems. In the first step of the analysis, we performed stationary tests. In the second step, we used the ordinary least squares (OLS) and generalized least squares (GLS) methods. We tried the fixed and random effects for modeling.

In this study, we gathered health expenditure, mortality rate, and life expectancy data from the World Health Organization (WHO) database and the percentage of the population over 65 years of age and GDP per capita were taken from the World Bank database (17, 18). All analyses were performed using STATA 12 software.

3. Results

The health expenditure models were developed for four groups of countries using a panel of estimation method. Summary statistics for variables in each group are provided in Table 2. According to Table 2 for the investigation period of 2000 - 2016, the average total health expenditures ranged from 4,120 \$ to 3,144 \$. The maximum and minimum averages of total health expenditures belonged to the groups of countries with national health services and mixed healthcare systems, respectively. The maximum and minimum averages of OOP belonged to countries with

Table 1. Classification of Countries by the Type of Healthcare Systems

Health Care System	Countries
National Health Insurance System	Canada, Finland, Norway, Spain, Sweden
Traditional Sickness Insurance	Austria, Belgium, France, Luxembourg, the Netherlands, Germany
National Health Services	United Kingdom, Denmark, Greece, Italy, New Zealand, Portugal, Turkey
Mixed systems	Australia, Iceland, Ireland, Japan, Iran, Switzerland, United States of America

mixed healthcare systems (620 \$) and countries with national health services (501\$), respectively. Countries with national health services had the maximum average of LE and the minimum average of MOR. The highest average of GDP belonged to countries with a traditional sickness insurance system. The average health care prices were the same (0.96) in all health care systems, except for the mixed health care system (1.04).

To examine the determinants of health expenditure, we applied the standard panel data econometric methods. To prevent spurious regression, Im-Pesaran-Shin stationary tests were conducted separately for each group. The findings of these tests rejected the null hypothesis that the panel contained a unit root; thus, all variables were stationary at the 5% significance level. Moreover, the findings of the tests for cross-sectional dependence and serial correlation rejected the null hypothesis of no cross-sectional independence and serial correlation. Finally, we used the F-Limer test to determine the Pool or Panel of the model, followed by the Hausman test to determine the fixed effects or random effects. The results of F-Limer test rejected the null hypothesis while Hausman test accepted the null hypothesis. Therefore, a random-effects model was preferred to the fixed-effects model in all the groups. The regression results for each group of countries are shown in [Table 3](#).

3.1. Modeling in Countries with National Health Insurance

Using a random-effects model in countries with national health insurance system in [Table 3](#), it is shown that each percent increase in people income leads to a 0.98 percent increase in health expenditures per capita on average. Income has the largest effect on health expenditure in this group of countries. One unit increase in out-of-pocket health expenditure, life expectancy, mortality rate, and population over 65 years lead to 6.12, 70, 98, and 40 units increases in health expenditures, respectively. Moreover, each unit increase in health care price leads to a 0.5 unit decrease in health expenditures.

The results show that the model is statistically significant, as the F value (20.01) is significant at a 5% level. This indicates that all variables identified as the determinants of health expenditures as used in the model jointly have sig-

nificant effects on health expenditures during the period of the study.

Besides, our results show that the value of the coefficient of determination (R^2) is greater than 0.9. These findings strongly support the selection of the variables used in the model. The Durbin-Watson (D-W) value is near 2, which shows that the model is not affected by the problem of autocorrelation.

3.2. Modeling in Countries with Traditional Sickness Insurance

Model 1 in countries with traditional sickness insurance system shows that one unit increase in health status variables including mortality rate and life expectancy leads to 80 and 81 units increases in health expenditures, respectively. Other variables such as population over 65 years and out-of-pocket health expenditure have positive impacts on health expenditures so that one unit increase in these variables leads to 28 and 6.12 units increases in total health expenditures. Moreover, health care price has a negative impact (-0.52) on total health expenditures. One percent increase in people income leads to a 0.79 percent increase in total health expenditures.

As shown in [Table 3](#), the F-value, R^2 , and D-W values for model 1 were 25.01, 0.92, and 1.8, respectively, in countries with traditional sickness insurance.

3.3. Modeling in Countries with National Health Services

The findings show that a one percent increase in people income leads to a 0.84 percent increase in health expenditures per capita on average. Moreover, health status variables including mortality rate and life expectancy have the largest impacts (99.31 and 82.5, respectively) on health expenditures among other variables in this health care system.

Each unit increase in out-of-pocket health expenditure and population over 65 years leads to 4.2 and 32.2 units increases in health expenditures, respectively. Moreover, each unit increase in health care price leads to a 0.4 units decrease in health expenditures.

Additionally, the F-value indicating the significance of regression shows an overall high significance of regression (< 0.01); the F-value and R^2 were 23.14 and 0.9, respectively,

Table 2. Summary Statistics of the Variables Considered in the Study for Four Groups of Countries with Different Types of Healthcare Systems from 2000 to 2016

Variable	NHIS			TSIS			NHS			MHS		
	Mean ± SD	Max	Min	Mean ± SD	Max	Min	Mean ± SD	Max	Min	Mean ± SD	Max	Min
THE	3393 ± 1123	6221	1470	4019 ± 1053	6463	2221	4120 ± 1521	7102	3022	3144 ± 2350	9535	223
OOP	600 ± 141	888	314	550 ± 191	920	182	501 ± 187	650	140	620 ± 283	1056	41
GDP	36671 ± 21354	110002	7001	49764 ± 20364	97864	30880	48001 ± 20012	87145	35547	36684 ± 20122	101255	20881
LE	78 ± 2.08	83.5	70	78 ± 2.04	84	69.9	78.1 ± 2	85	69.9	77.9 ± 2.2	84.9	68.7
MOR	3.4 ± 0.95	5.3	2	3.5 ± 0.64	4.9	2.1	3.4 ± 0.9	5.2	1.9	17.6 ± 24.13	79.7	1.7
POP	13.8 ± 1.13	16.14	12.57	11 ± 9	15.8	13.01	11.9 ± 1.01	16	12	12.9 ± 1	17	11
HP	0.96 ± 0.02	1.03	0.9	0.96 ± 0.01	0.99	0.94	0.96 ± 0.02	1.02	0.91	1.04 ± 0.3	1.12	0.95

Abbreviations: GDP, gross domestic product; MHS, countries with mixed healthcare system; NHIS, countries with national health insurance system; NHS, countries with national health services system; TSIS, countries with traditional sickness insurance system.

Table 3. Estimated Statistics for Four Groups of Countries with Different Health Care Systems^a

Variable	Total Health Expenditures			
	NHIS	TSIS	NHS	MHS
C	32.58 (0.01) ^a	40.2 (0.03)	30.44 (0.02)	31.03 (0.01)
Log(GDP)	0.98 (0.04)	0.79 (0.03)	0.84 (0.04)	0.88 (0.00)
Out-of-pocket	6.12 (0.00)	6.38 (0.05)	4.02 (0.00)	9.7 (0.02)
Health care price	-0.5 (0.06)	-0.52 (0.07)	-0.4 (0.02)	-0.71 (0.01)
Life expectancy	70 (0.004)	82 (0.004)	82.5 (0.004)	80.5 (0.004)
Mortality	98 (0.02)	80 (0.022)	99.31 (0.01)	98 (0.03)
Population aged 65	40 (0.01)	28 (0.01)	32.2 (0.05)	30 (0.03)
R-square (R ²)	0.9	0.92	0.9	0.94
DW statistics	1.69	1.8	1.73	2.09
F statistics	20.1 (0.021)	25.01 (0.00)	23.14 (0.01)	24.04 (0.001)
Number of countries	5	6	7	7

Abbreviations: GDP, gross domestic product; MHS, countries with mixed healthcare system; NHIS, countries with national health insurance system; NHS, countries with national health services system; TSIS, countries with traditional sickness insurance system.

^aP values denoted in parentheses.

indicating that the model has a relatively high explanatory power.

3.4. Modeling in Countries with Mixed Health Care Systems

According to Table 3, per-capita income has a statistically significant impact on total health expenditures such that each percent increase in income leads to a 0.88 percent increase in health expenditures. Out-of-pocket health expenditure and health care price have the largest impacts on total health expenditures in this health care system among other health care systems such that each unit increase in these variables leads to a 9.7 units increase and a 0.71 units decrease in health expenditures, respectively. Moreover, each unit increase in mortality, life expectancy, and population over 65 years lead to 98, 80.5, and 30 units increases in total health expenditures, respectively. Finally, the F-value and R² were 24.04 and 0.94, respectively.

4. Discussion

The findings of the present study indicated that the GDP per capita and out-of-pocket health expenditure were the influential factors of health expenditures in all types of health care systems. The two variables had a positive relationship with health expenditures. Our findings in this study are consistent with the findings of previous research (3, 10, 12, 16-18).

Furthermore, mortality and life expectancy as the indicators of health status had the maximum positive association with health expenditure in all types of health care system; these results are supported by the findings from the study by Kea et al. and other studies (12, 19, 20). As people live longer, they will tend to need more health care and rehabilitation services.

Another widely perceived determinant of health expenditure was the health care price. Health care price had a negative impact on the level of health expenditures and

this variable was most effective in the mixed health care system. A study by Kraipornsak showed that an increase in health care prices led to a decrease in health expenditure (16). Based on theoretical principles, the increased price of health care may reduce the demand for health care services and cause a decrease in health expenditures imposed on society (21).

The findings of the present study showed that aging population in all health care systems had a positive effect on health expenditures; that is, as the population gets older, the health capital in society decreases and subsequently, health care resources consumption increases (5, 22).

Comparing countries with different types of health-care systems showed that for countries with mixed health care systems, out-of-pocket health expenditure had the highest impact on health expenditures. In countries with mixed health care system, due to the lack of an integrated insurance system, the government has less responsibility than the private sector in health and less social protection for health imposes a high level of out-of-pocket health expenditures (23).

Moreover, health care price had the highest impact on health expenditure in countries with mixed health care systems among countries with other types of health care systems. Health care price can be, in part, a determinant increasing health care expenditure. Due to the important role of the private sector in the health section and due to the type of health financing, countries with mixed health care systems have a high level of health care prices (24).

The mortality and life expectancy effects were found to be positively related to health expenditures in a statistically significant manner. Every percent increase in these variables could moderately raise health expenditures in countries with different types of the health care system.

The findings of this study showed that mortality and life expectancy had the highest impacts on health expenditures in countries with national health services; these findings were consistent with the findings from other studies (12, 21). This may be due to the full government incumbency in the health sector. Government participation in the health sector, especially in prevention and long-term care, has been increasing over time in a large number of countries with the national health care system.

Concerning the per-capita income in four groups of countries with different types of the health care system, the findings showed that income as an important determinant of health expenditure had the highest impact in countries with national health insurance system. In this health care system, People are less likely to face the catastrophic costs. So they have more disposable income to spend on health, which in turn leads to higher health costs

growth; thus, income has a pivotal role in financing; these findings are also consistent with the existing literature of health expenditure growth (16, 19).

4.1. Conclusions

The findings presented in this paper provide empirical evidence that per-capita GDP, aging population, health care price, and health status indicators (life expectancy and mortality rate) play various key roles in explaining the health expenditures in countries with different health care systems.

We observed different impacts of health care price, out-of-pocket health expenditure, and health status indicators on health expenditures in every health care system. Health care price and out-of-pocket health expenditure were more important factors in increasing health expenditures in countries with mixed health care system than in countries with other health care systems. Therefore, monitoring health care price and out-of-pocket health expenditure has a major role in controlling health expenditure growth in countries with the mixed health care system. Hence, in any health care system, identifying factors that mostly affect healthcare expenditures can be critical for policymakers for better planning in the future.

Footnotes

Authors' Contribution: Pouran Raeissi as the main supervisor conceptualized the study and helped in writing and editing the manuscript. Sajad Vahedi and Abdoreza Mousavi acquired the data, cleaned the data, analyzed the data, and prepared the initial draft. Touraj Harati Khalilabad supervised the data analysis, provided statistical consultation, and edited the final manuscript. Mohammad Reza Rajabi provided edited the final manuscript. Touraj Harati Khalilabad provided scientific and methodologic consultation and edited the final manuscript. All authors read and approved the final manuscript.

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