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Macro determinants of Iranian provincial healthcare expenditures from 2006 to 2013: evidence from panel data

Satar Rezaei[1], Razieh Fallah[2], Khalil Moradi[3], Somayeh Delavari[4], Siavash Doost Moradi[5], Behzad Karami Matin[6]

[1] Ph.D. Student of Health Economics, Research Center for Environmental Determinants of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[2] M.Sc. of Health Care Management, Amol Imam Reza Hospital, Mazandaran University of Medical Sciences, Sari, Iran
[3] M.Sc. of Nursing, Imam Reza Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran
[4] Student of Medical Education, Department of Medical Education, School of Medicine And Center for Educational Research in Medical Sciences, Iran University of Medical Sciences, Tehran, Iran
[5] M.Sc. of Health Care Management, Imam Reza Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran
[6] Ph.D. of Health Care Management, Associate Professor, Research Center for Environmental Determinants of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

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Abstract

Introduction: During the last few decades, healthcare expenditures (HCEs) have increased significantly in Iran and throughout the world. Understanding the determinants of such increases is essential to health policymakers in finding the best policies to manage healthcare costs. This study aimed to determine the impact of some of the key explanatory variables on household healthcare expenditures across the provinces of Iran.

Methods: A panel data econometric model was used to determine the main factors that affected household healthcare expenditures (HHCEs) across the provinces of Iran from March 21, 2006 to February 19, 2013. The data on household healthcare expenditures per capita, number of physicians per 10,000 population, the degree of urbanization, the proportion of the population that was 65 or older, household income per capita, and literacy rate were obtained from the Household Expenditure and Income Survey (HEIS) data in the Statistical Center of Iran. F-Limer and Hausman tests were used to choose the panel data, and Stata V.12 was used to analyze the data.

Results: Our findings indicated that income per capita, physicians per 10,000 population, and the degree of urbanization had significant impacts on healthcare expenditures. Also, the results of the study showed the elasticity of income, physicians, urbanization, proportion of the population 65 or older, and the literacy rate were 0.25 ($p < 0.002$), 0.37 ($p < 0.001$), 5.01 ($p < 0.001$), -0.1 ($p < 0.73$), and -1.02 ($p < 0.082$), respectively.

Conclusion: The results of the study indicated that the income elasticity of healthcare expenditures was less than 1; health expenditures were considered to be a "necessity good" across the provinces of Iran during the period that was studied. In addition, there were some other factors that affected healthcare expenditures that were not considered in the study, such as the advancement of new technology and the costs of dying. However, it is recommended that future research examine the effect of these factors on HCEs in Iran.

Keywords: healthcare expenditures, panel data estimation, income elasticity, Iran

Corresponding author:
Associate Professor Dr. Behzad Karami Matin, Research Center for Environmental Determinants of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.
Tel: +98.8338262005, Fax: +98.8338263048, Email: bkmatin1344@gmail.com
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1. Introduction

Health is one of the main factors that affect development in every country, and it one of the important determinants of economic activity. Determining the amount of resources that are allocated to the health sector is a main concern of health policymakers throughout the world, and they are interested in identifying the main factors that affect healthcare expenditures (1-3). Understanding these factors is essential if health policymakers are to identify the best policies to manage and control healthcare costs in any country. Several studies have examined the main factors that affect healthcare expenditures throughout the world (1, 3-6). These studies have highlighted the impact of various factors on healthcare expenditures in different countries, such as income per capita, degree of urbanization, proportion of the population that is 15 or younger, proportion of population that is 65 or older, the number of physicians or hospital beds per 10,000 population, and the healthcare inflation rate. The first study that considered the main determinants of healthcare expenditures was conducted by Newhouse in 1977 (7). That study showed that income was one of the most important factors that affected healthcare expenditures. Generally, the factors that affect healthcare expenditures are divided into three categories, i.e., 1) economic variables, such as income, consumer price index in the health sector, and foreign aid (3, 8); 2) demographic variables, such as age, structure, growth rate of the population and the degree of urbanization (1, 3); 3) the delivery of healthcare services, such as the number of beds and the number of physicians per 10,000 population (1, 6). In the model used in our study included income per capita, the degree of urbanization, the number of physicians per 10,000 population, the proportion of population 65 or older, and the literacy rate. Healthcare expenditures vary significantly between developed and developing countries. Per capita healthcare expenditures vary from $3,000 in high-income countries to $30 in low-income countries. Some of the developing countries allocated less than 3% of their gross domestic product (GDP) to health, but it exceeded 12% in some of the developed countries (9). In Iran, health expenditures as percentage of GDP increased from 4.7% in 1995 to 6.5% in 2010. Other data indicated that health expenditures per capita in Iran increased from $117 in 2004 to $346 in 2012. Thus, there was more than fourfold increase in per capita healthcare expenditures from 2004 to 2012 (10). So, in this study, we attempted to examine the effects of some of the key explanatory factors of household healthcare expenditures (HHCEs) among Iran's provinces from March 21, 2006 to February 19, 2013. The results of the study should provide a holistic view that health policymakers can use to gain a better understanding of the main factors that affect household healthcare expenditures in Iran.

2. Material and Methods

A panel data econometric model was used to determine the main factors that affect HHCEs in Iran's provinces from March 21, 2006 to February 19, 2013. The data on per capita HHCEs, number of physicians per 10,000 population, degree of urbanization, proportion of the population 65 or older, per capita income, and literacy rate were obtained from the Household Expenditure and Income Survey (HEIS), an annual survey that is conducted by the Statistical Center of Iran (SCI). These explanatory variables were selected based on literature review and their availability in the HEIS (1, 4, 5, 11). The following primary model was used in the study:

HHCE= F (income, Pop65, physician, urbanization degree, literacy rate)

Where:

- HHCE = Household healthcare expenditure per capita
- Income = Household income per capita
- Pop 65 = Proportion of the population 65 or older
- Physician = Number of physicians per 10,000 population
- Urbanization degree = Percentage of the total population that lived in urban areas
- Literacy rate = Percentage of population older than 6 who can read and write

Based on previous studies (1, 2, 4, 5, 12, 13), we considered the following econometric model in the study:

$LHHCE_{it} = \beta_0 + \beta_1 \text{ Lincomeit} + \beta_2 \text{ LPop65}_{it} + \beta_3 \text{ LPhysician}_{it} + \beta_4 \text{ Lurbanization}_{it} + \beta 5 \text{ Lliteracy}_{it} + \boldsymbol{\nu}_{it}$

Where:

- L denotes the natural logarithm
- i shows the cross section (provinces in the study)
- t shows the time period
- β_1 to β_5 indicate the elasticity of healthcare expenditures with regard to the explanatory variables

If the β_1 coefficient were greater than 1, healthcare was considered to be a luxury, and if it were less than 1, the healthcare was considered to be necessary goods. In addition, we used a log-log model so that the results could be interpreted more easily. In this model, the coefficient shows how the percentages of healthcare expenditures changed

per 1% change in the explanatory variables. To obtain the final estimate using the model, we performed the following steps: First, the F-Limer was used to choose the panel or pool data. If the calculated F is significant, the null hypothesis is rejected, and the panel data are appropriate. Second, in the panel data, the Hausman test was used to determine whether to choose random-effects or fixed-effects models for analysis. The fixed effect estimator is preferred if the null hypothesis is rejected. The data analyses were conducted by Stata V.12 and p-values less than 0.05 were considered as significant. Also, at the time of this study (2006-2013), the $1 was equal to 25,000 Iranian Rials (IRR).

3. Results

The descriptive statistics of the variables included in the study are shown in Table 1. Among the provinces in Iran (for 2006-2013), the mean of HHCE was 7,010,519 Iranian Rials (IRR) with a standard deviation of 1,819,122 IRRs and ranging from 11,134,098 to 2,607,271. There were substantial differences across the country concerning HHCE. The Fars and South Khorasan Provinces had the highest and lowest mean of HHCE, respectively, during the period of the study (11,134,098 IRR for Fars and 2,607,271 for South Khorasan). The mean of household income per capita was 66,627,917 IRR with a standard deviation of 14,584,998 (range from 94,439,880 to 20,607,853 IRR). The mean of degree of urbanization was 64.7% and the maximum and minimum of the ratio were 95% and 49%, respectively. In addition, the mean of the proportion of the population with ages of 65 and above was 5.7%, and it ranged from 4% to 10%. Our analysis of the trend of HHCE per capita across the provinces of Iran indicated that the average increased from 2006 to 2013.

Table 1. Descriptive statistics of the variables used in the study (2006-2013)

Variables	Mean	Standard deviation	Maximum	Minimum
HHCE per capita	7,010,519	1,819,122	11,134,098	2,607,271
Income per capita	66,627,917	14,584,998	94,439,880	20,607,853
Literacy rate, %	82.5	4.05	91	72
Number of physicians per 10,000 population	1086.4	1004	4300	159
Degree of Urbanization , %	64.7	12.3	95	49
Percent of population 65 and older , %	5.7	1.19	10	4

The results of the F-Limer test verified that the panel data were preferred (13.04, $p < 0.001$). In addition, based on the Hausman test (45, $p < 0.001$), the parameters were estimated by the fixed-effect model. The estimated results provided by the model are shown in Table 2. The study indicated that the per capita income had a significant positive impact on HHCE. The coefficient of this variable was 0.25, indicating that, for each 1% increase in income, HCE increased by 0.25%. Also, there was a significant positive relationship between the number of physicians per 10,000 population and HHCE. The coefficient of the number of physicians per 10,000 population was 0.37, which indicated that a 1% increase in the number of physicians will lead to an increase 0.37% in health expenditures. The coefficient of the degree of urbanization was 5.01, and it was significant. It showed that an average increase of 1% in the degree of urbanization would increase the average HCE by about 5%. Also, the literacy rate and the proportion of the population that is 65 and older had a negative impact on HCE, but it was not significant. The overall F-statistic of the estimated model was 56.6, and it was significant. Also, the model's adjusted R2 was 82%, which indicated that about 85% of the variation in the HHCE can be explained by the variables included in this model.

Table 2. Fixed-effect estimates of household health expenditures across the provinces of Iran (2006-2013)

Variables	Coefficient	t	p-value
Constant	-19.87	-3.06	<0.001
Logarithm income per capita	0.25	3.3	<0.002
Logarithm percent of population 65 and older	-0.1	-0.59	0.73
Logarithm number of physicians per 10,000 population	0.37	4.49	<0.001
Logarithm literacy rate	-1.02	-1.86	0.082
Logarithm degree of urbanization	5.01	6.43	<0.001

n: 210; F: 56.6; R2 (adjusted): 0.82

4. Discussion

Healthcare costs have been increasing in Iran and in many other countries over the last few decades. These increases have become a persistent concern of health researchers, planners, governmental officials, and patients throughout the world (3, 16). In Iran, health costs as a percentage of GDP has increased from 4.7% in 1995 to 6.5% in 2010. Also, from 2006 to 2013, there was a 250% increase in household health expenditures per capita across the provinces of Iran, going from 3,967,358 to 9,321,432 IRR, respectively. During this same time period, the income per capita increased by only 190%. Iranian households allocated about 8% of their income to healthcare in 2006 and 10% in 2013. One of the key steps for controlling and managing healthcare costs is to identify the factors that cause such a drastic increase in health spending. However, this study attempted to examine the main explanatory variables that affect HHCE across the provinces of Iran between 2006 and 2013.

Our empirical results indicated that there was a significant positive relationship between income per capita and HCE. Generally, households with higher incomes receive health services from the private sector where the quality of care is better, e.g., shorter waiting times and clean facilities, and the prices are higher. Thus, it is to be expected that higher incomes lead to higher HCE (14). We found that healthcare is a "necessity good" across the county (based on the coefficient of income per capita, which is less than one in Table 2). This finding was consistent with the results of other studies in Economic Cooperation Organization (ECO) countries (5), Spain (6), and Pakistan (13). The first study concerning the determinants of HCE was conducted by Newhouse in 1977, and he concluded that that was more than 90% of the variation in healthcare costs can be explained by income per capita (7). Costa-Font and Pons-Novell (2007) found that the elasticity of healthcare was less than one and that healthcare is one of the necessary goods. They also concluded that private and public health expenditures have an impact on the elasticity of healthcare (15). Khan and Mahumud conducted an investigation to determine whether healthcare was a 'luxury' or a 'necessity' for Southeast Asian countries from 1995 to 2010 (14). They concluded that the elasticity of healthcare may differ based on whether healthcare is a public service of a private service. If healthcare is delivered by the public sector, it is considered to be a necessary good, but when it is delivered by the private sector, it becomes a luxury (14).

Similar to the results of other studies (1, 12), our results indicated the coefficient of degree of urbanization was positive and significant. In other words, we found that an increase in percentage of population who live in urban areas leads to an increase in HHCE. This can be explained by the fact that there is greater accessibility to health services in the urban area than in rural areas. Magazzino and Mele found that there was a significant positive association between the degree of urbanization and HCE in the regions of Italy. The coefficient of this variable in their study was 0.45 (1). Samadi and Homaie Rad found that the degree of urbanization had a positive impact on HCE in ECO countries, and its coefficient was 0.74 (5). The estimated coefficient of physicians per 10,000 population was positive and statistically significant, which was consistent with the results of previous studies (5, 16, 17). This finding can be explained by the fact that increasing the number of physician leads to improved accessibility to the health services, thereby increasing the utilization of those services. It is expected that more access to the health services leads to higher health expenditures. Our results were in agreement with the findings of studies conducted in Italy (1) and Nigeria (18) in which it was reported increasing the ratio of the number of physicians to the number of population in the population had a significant positive impact on HCE.

Our results indicated that association between the proportion of the population that was 65 and older and HHCE was negative and not statistically significant. Although ageing is known as one of the factors that cause significant increases in HCE, several studies, including ours, have indicated that age as a demographic factor has little impact on increasing HCE. Studies conducted by Martins et al. (19), Getzen (20), and Samadi and Homaie Rad (5) found that there was not a beneficial relationship between ageing and HCE. In the "red herring" hypothesis advanced by Zweifel et al. (21), it was highlighted that ageing had an ambiguous impact on HCE. In other words, based on the literature, the specific impact of ageing on healthcare expenditures is unclear. The literacy rate also was considered, and it had a negative and statistically insignificant impact on HCE. Higher literacy rates have different short-term and long-term impacts on HCE. There was a positive, short-term correlation between literacy and HCE. There is some evidence that educated people have higher healthcare costs because they use health services more often than uneducated people (22). In the long-term scenario, there is an inverse association between education and healthcare cost, suggesting that a higher literacy rate might decrease healthcare costs (1). People who have more education tend to choose more healthy lifestyles, and they tend to seek treatment during the early stages of their health problems, which is less expensive and more effective.

This study had several limitations. First, we used household healthcare expenditure per capita across the provinces of Iran as dependent variable and it was different from the per capita healthcare expenditure. The latter includes the sum of private and public healthcare expenditures, while HHCE is part of the private healthcare expenditure; approximately 88% of private healthcare expenditure based on World Bank database in 2013. Second, there are some other factors that affect healthcare expenditures, such as the advancement of new technologies and the costs of dying, neither of which was considered in this study.

5. Conclusions

The main explanatory factors that affected HHCE across the provinces of Iran from March 21, 2006 to February 19, 2013 were per capita income, number of physicians per 10,000 population, and the degree of urbanization. In addition, there are some other factors that affect healthcare expenditures, such as the advancement of new technology and the costs of dying, neither of which was considered in this study. Thus, it is recommended that future research examine the effect of these factors on HHCE in Iran. In addition, we found that health spending in Iran was viewed as a "necessary good." This implies that expenditures for healthcare should be provided from public funding and government intervention.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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