



Investigating the Factors Affecting Hospital Expenditures of Iranian Urban Households: Emphasis on Maternal Education

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Abstract

Introduction: Considering the high proportion of hospital expenditures in out-of-pocket payments and the importance of controlling and managing hospital expenditures to prevent catastrophic costs, the main purpose of this study was to investigate the factors affecting the hospital expenditures of Iranian urban household with emphasis on maternal education.

Methods: The present study is a descriptive-analytical and applied research conducted at national level using econometrics Heckman two-step model. The sample size included 15740 urban households of Iranian provinces in 2017 that was selected according to Cochran formula and three-stage sampling by the Statistical Centre of Iran. The data were also extracted from different sections of the standard questionnaire “Urban Household Cost-Income” of the Statistical Centre of Iran and processed in Stata 10 software.

Results: Higher education and employment of mothers have led to a decrease in the probability of household facing hospital expenditures, by 0.002% and 0.9%, respectively. Mother’s employment, having supplementary health insurance, and bachelor’s or higher education of mother resulted in a decrease in per capita hospital expenditures of households by 2058123, 1361437 and 3647518 Rials, respectively. An increase in household size, having children under the age of seven and elderly persons over sixty years old, and mothers with elementary education led to an increase in household hospital expenditures by 1347241, 4406778, 1602637 and 1674286 Rials, respectively.

Conclusion: Regarding the greater impact of aging of mothers, compared to fathers, and having children and elderly persons in the household and increased hospital expenditures, protection and support of such households is necessary to achieve better health status and reduce household hospital expenditures, which can be achieved through improving and discounting insurance coverage and preventive health care. Also, investing in education to provide an appropriate condition for education of most people in the community, as well as enhancing parental health literacy through health education, is recommended.

Keywords: Inpatient hospital expenditures, Education, Heckman model

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Introduction

Iran’s Healthcare System is faced with a sharp increase in health expenditures in which a large proportion of costs is financed out of pocket (1-5). This proportion is usually over 50%, which is considered as a serious barrier to fair access of health services (3). High proportion of out-of-pocket payments for reaching health services can threaten the standard of living in the short and long run. In the short run, households should ignore the current consumption of other commodities, and in the long run, it will lead to the decreased savings and sale of the assets (6). Therefore, identifying the factors that have the most impact on out-of-pocket payments is crucial for health system policy makers and planners because it can be useful and effective in determining the best policies for control and management of

health expenditures (2-7).

On the other hand, the cost of hospital services has the highest proportion of health expenditures and out-of-pocket payments to households, especially those who are faced with the catastrophic health expenditures (8-10). Studies showed that catastrophic health expenditures were mainly imposed on households using hospital inpatient services (6, 9, 11). Also, there is a high level of catastrophic medical payments in hospitalized patients. The weakness of economic status of households and poor-designed prepayment schemes, on the other hand, may lead to this (9, 12). Therefore, hospital services are one of the most important factors in the incidence of catastrophic health expenditures. Hence, identifying the factors affecting household hospital expenditures is crucial to support those dealing with catastrophic

health expenditures. Several factors affect health expenditures and consequently household hospital expenditures.

In general, the main effective factors were classified into three categories: economic, social, and demographic. Economic factors included income, wealth and employment, and social factors consisted of education, tobacco and education expenditures; also, demographic factors were age structure and household size. (3, 7). Of course, all types of insurance coverage and systemic hospital reform also reduce hospital expenditures (8, 13, 14). Hajizadeh and Nghiem (8), Yang et al. (15) and Ghiasvand et al. (12) showed age, length of stay, lower household wealth index and education level, and admission to a private hospital were the major factors contributing to the increase in the probability of hospital catastrophic expenditures. Yazdi-Feyzabadi et al. (1) showed that rural settlement, higher income, delivery of inpatient and outpatient services, and existence of elderly people in the household led to an increase in catastrophic expenditures prevalence. Also, Alipour et al. (16) investigated the effect of aging on inpatient hospital expenditures, and Bernal-Delgado et al. (10) showed that hospital expenditure was inelastic to quasi-prices and to the economic cycle fluctuations as a strong inducer of the hospital expenditure in Spain.

One of the most important factors affecting health and health expenditures includes education, and literacy levels of household members (8, 12); given the parents' decision-making role in household health, parental literacy level, especially that of mothers, is a crucial constituent in household health expenditures. Education can have a positive and negative impact on the health expenditures of the household. As education level increases, people become more aware of their health requirements and use preventive health services when needed, in order to reduce their need for costly health services in the future. Therefore, according to this approach, the higher level of education leads to an increase in the health expenditures in the short run and a decrease in the health expenditures in the long run (2, 17, 18). Moreover, mothers with higher education level have higher levels of benefit from health services, nutrition, and hygiene (19, 20).

Therefore, given the high proportion of hospital expenditures in out-of-pocket payments and the importance of controlling and managing hospital expenditures to prevent catastrophic health expenditures, it is crucial to evaluate the factors affecting household hospital expenditures. Accordingly, the main purpose of this study was

to investigate the factors affecting the hospital expenditures of Iranian urban households with emphasis on maternal education and to answer these questions: which factors affect the hospital expenditures of Iranian urban household?, how much does mothers' education impact the hospital expenditure?, and how much does parental education prevent the household from facing hospital expenditures?

Many studies have assessed the factors affecting health expenditures at the macroeconomic level (2), but at the microeconomic level, there are relatively few studies, and this study is also at the microeconomic level. More microeconomic studies have focused on household health expenditures in general, and limited studies have examined the factors influencing household hospital expenditures separately. Therefore, the present study is different from other studies in terms of the topic, which focuses on household hospital expenditures and the impact of maternal literacy on it. Another distinctive aspect of the present research is the statistical population of the study including all cities in Iran, which is more general, and also the method used in study is the Heckman two-step selection model which is more appropriate for subject assessment.

Methods

The present study is a descriptive-analytical and applied research conducted at national level using Heckman two-step selection model. The statistical population included the total urban households of the Iranian provinces in 2017, and the sample size included the number of households selected according to Cochran formula and three-stage sampling by the Statistical Centre of Iran. Of this sample size, only those households whose parents were alive and the information needed for the study also existed were selected. Thus, 15740 households were selected as the sample size. The data required for this study were also extracted from the raw data related to different sections of the standard questionnaire "Urban Household Cost-Income" of the Iranian Statistical Center and processed in Stata 10 software.

Of the total households sampled, 85.81% had no hospital expenditures, so hospital expenditure, as a dependent variable, was not normal and had a right-skewed distribution. In this case, ordinary least squares regressions have no longer efficient estimates (13). Therefore, in order to prevent the elimination of households with zero hospital expenditures, the use of econometric sample selection models is necessary. In this study, Heckman two-step model was applied (3).

Heckman two-step model consists of two equations of selection and decision. Concerning the study subject, the selection equation expresses the household's willingness to pay for hospital expenditures, and the decision equation expresses the factors affecting household hospital expenditures. These equations are as follows (21, 22):

$$y_{2i} = \begin{cases} 1 & \text{if } y_{2i}^* > 0 \\ 0 & \text{if } y_{2i}^* \leq 0 \end{cases} ; y_{2i}^* = x_{2i}\beta_2 + \varepsilon_{2i} \quad \text{selection Equation}$$

$$y_{1i} = \begin{cases} y_{1i}^* & \text{if } y_{2i}^* > 0 \\ - & \text{if } y_{2i}^* \leq 0 \end{cases} ; y_{1i}^* = x_{1i}\beta_1 + \varepsilon_{1i} \quad \text{Decision Equation}$$

In the selection equation, y_{2i} is a binary variable with values of one and zero representing the payment and nonpayment of hospital expenditures, respectively and y_{2i}^* is the latent variable indicating the household's willingness to pay for hospital expenditures. Therefore, while providing positive willingness of households [$y_{2i}^* > 0$], there will be payments for hospital expenditures [$y_{2i} = 1$]; otherwise, the payment for hospital expenditures will be zero. In the decision equation, y_{1i} and y_{1i}^* represent the amount of household hospital expenditures and the optimal amounts of hospital expenditures, respectively. The latter is visible if the household has paid for hospital expenditures. x_{2i} and x_{1i} indicate the vector of independent variables affecting the household's willingness to pay and hospital expenditures, respectively. β_2 and β_1 are vector coefficients and ε_{2i} and ε_{1i} are the error terms in the selection and decision equations, respectively.

According to Heckman two-stage model, the above equations are estimated in two stages. In the first step (selection equation), using Probit Analysis, the factors affecting the probability of payment for hospital expenditures are estimated and then using the estimated results, a new variable called the inverse Mills ratio is calculated and entered into the second step. In the second step (decision equation), the factors affecting household hospital expenditures are estimated by linear regression and ordinary least squares method with inverse Mills ratio. To investigate the sample selection bias and the use of Heckman two-step model, we evaluated the significance level of the inverse Mills ratio. If the coefficient of inverse Mills ratio is statistically significant from zero, there will be sample selection bias and using the Heckman two-step model is necessary. According to theoretical foundations and empirical studies, the factors affecting household hospital expenditures include economic, social and demographic ones; the independent variables of the study are described in Table 1. The dependent variable of the model is also

household hospital expenditures which involves all expenditures of hospital services, including hospitals of medical sciences and other centers and hospitals, excluding the costs of visits and cosmetic surgeries and private nursing.

Results

The total sample size was 15740 households, out of which 12883 households (85.81% of the sample) had no hospital expenditures in the last 12 months and 2857 of them (17.15% of the sample) had hospital expenditures; the average per capita hospital expenditure of the sample households was 1170230 ± 77061 Rials. Households in which the mother's education level was a high school diploma or lower, higher than a high school diploma, and a bachelor's degree and higher comprised 85.82%, 14.28% and 10.43% of the sample, respectively. The other descriptive statistics of the model variables are expressed in Table 1.

As mentioned above, Heckman's two-step model was used to investigate the factors affecting household hospital expenditures. In the first step, known as selection step, households with hospital expenditures were selected compared to other households and the factors affecting the probability of payment for hospital expenditures were evaluated. Regarding the nature of dependent variable, the Probit method was used in this step. Since the coefficients of the Probit model cannot be interpreted [9, 13, 19], the marginal effects of the variables were also estimated to investigate their effect on the dependent variable. The results are presented in Table 2. In the second step, the factors affecting the amount of payments for household hospital expenditures were estimated using the linear least squares method. The results are also presented in Table 2. The coefficient of Mills variable was calculated 7425169, which had a significant difference from zero at 5% significance level. Therefore, there was a sample selection bias and the use of Heckman two-step method was necessary. Also, the coefficient of Wald Statistics at the 1% significance level was 286; that is, all the explanatory variables included in the model had a significant difference from zero simultaneously and were capable of explaining the dependent variable.

The results of the selection equation showed that an increase in the father's age, household size, having children under the age of seven, and elderly persons over sixty years old led to an increased probability of household exposure to hospital expenditures by 0.1, 0.4, 9 and 5 percent, respectively. Being employed and improved educational level of mother decreased the

Table 1: Independent variables and coding

Abbreviation	Variables	Coding	Mean (Std. Dev.)
Fage	Father's age	Continuous variable, Year	48.38 (14.2)
Fedu	Father's education status	Discrete variable, 0: Illiterate, 1: Literate, 2: Elementary education, 3: Middle education, 4: High education, 5: Diploma and collage, 6: Associate degree, 7: Bachelor's degree, 8: Master's degree, 9: Doctoral degree	2.79 (2.15)
Size	Number of household	Discrete variable, Person	3.77 (1.28)
Child	Households with Child	Dummy variable, Households with members under 7 years old = 1, otherwise 0	0.33(0.47)
Aging	Household with an elderly person	Dummy variable, Households with members over 60 years old = 1, otherwise 0	0.45(0.49)
Sinsur	Supplementary health insurance	Dummy variable, Having supplementary health insurance = 1, otherwise 0	0.30(0.45)
Hinsur	Health insurance	Dummy variable, Having health insurance = 1, otherwise 0	0.83 (0.37)
Home	private home	Dummy variable, Owning a private home = 1, otherwise 0	0.69(0.46)
Smoking	Household with smoking member	Dummy variable, Household with smoking member = 1, otherwise 0	0.18 (0.38)
Nemp	Number of employed persons in household	Discrete variable, persons	0.99 (0.68)
Eedu	Per capita education expenditures	Continuous variable, Year, Rials	992177.9 (2970028)
Income	Per capita income	Continuous variable, Year, Rials	6.24×10 ⁷ (5.37×10 ⁶)
Medu	Mother's education status	Discrete variable, 0: Illiterate, 1: Literate, 2: Elementary education, 3: Middle education, 4: High education, 5: Diploma and collage, 6: Associate degree, 7: Bachelor's degree, 8: Master's degree, 9: Doctoral degree	3.14 (2.28)
Mage	Mother's age	Continuous variable, Year	42.97 (13.09)
Memp	Mother's employment status	Dummy variable, Employed mother = 1, otherwise 0	
Hdeg	Highest household degree	Discrete variable, the coding is the same as father's education	4.30 (1.93)
Mbach	Mother with a bachelor's degree and higher	Dummy variable, Mother with a bachelor's degree and higher = 1, otherwise 0	0.10 (0.30)
Melement	Mother with an elementary education	Dummy variable, Mother with an elementary education = 1, otherwise 0	0.27 (0.44)
Mdiploma	Mother with a diploma degree	Dummy variable, Mother with a diploma degree = 1, otherwise 0	0.24 (0.43)
Mills	Inverse Mills ratio	Calculated in selection equation (first step)	

exposure level of household to hospital expenditures by 0.002% and 0.9%, respectively. Also, having health insurance and supplementary health insurance increased the probability of household exposure to hospital expenditures. Owning a private home as well as an increase in the number of employed persons in the household reduced the probability of exposure to hospital expenses, up to 0.4% and 1%, respectively. The mother's increased age, smoking by each household member, as well as an increased income of the household, led to an enhanced likelihood of household exposure to hospital expenditures.

The results of the decision equation related to the factors affecting the payment of Iranian urban households for hospital expenditures are presented

in Table 2. An increased parental age had a positive impact on household hospital expenditures. If the age of father and mother increase for one year, the per capita hospital expenditures will increase by 61353 and 129483 Rials, respectively. The coefficient of the highest educational qualification of household members had a negative effect on the hospital expenditures (20733 Rials), which means that if the most advanced educational qualification of the household is enhanced, the household hospital expenditures will be reduced by 20733 Rials.

In the case of mother, having bachelor's degree or higher and being employed had negative impacts on household hospital expenditures, so that mother's employment and bachelor's degree or higher caused

Table 2: Estimation of selection and decision equations

Independent variables	Selection equation		Decision equation
	Coefficients	Marginal effects	Coefficients
Fage	0.0037*	0.0010***	61353.8
Fedu	-0.0108*	-0.0028***	119017.4
Size	0.0166*	0.0043***	1347241***
Child	0.3584**	0.0982*	4406778**
Aging	0.1961**	0.0514**	1602637
Sinsur	0.0335	0.0088***	-1361437*
Hinsur	0.1116***	0.0280***	
Home	-0.0169	-0.0044***	-90909.7
Smoking	0.0827***	0.0220***	
Nemp	-0.0500***	-0.0130**	
Eedu	0.0000	0.0000	-0.09138
Income	-1.8×10 ⁻¹⁰	-4.3×10 ⁻¹¹ ***	0.089184***
Medu	-0.0001	-0.00002***	621825.3**
Mage	0.0020	0.0005***	129483.4**
Memp	-0.0367	-0.0094**	-2058123
Hdeg			-20733.6
Mbach			-3647518**
Melement			1674286**
Mdiploma			125120.7
Cons	-1.4740***	0	2.76E+07**
Mills	-1.60e+07**	0.031	7425169

Source: Authors' findings

a decrease in per capita hospital expenditures by 2058123 and 3647518 Rials, respectively. Mothers' elementary education had a positive effect on the per capita hospital expenditures (1674286 Rials). It means that the households in which mothers have elementary education pay for higher hospital expenditures, compared to those with more educated mothers (higher than elementary). However, the education of father and mother had overall positive effects on the amount of household hospital expenditures (119017 and 621825 Rials, respectively).

Supplementary health insurance negatively affected household payment for hospital expenditures, so that a household with supplementary health insurance pays 1361437 Rials less than other households for per capita hospital expenditures. The increased size of household, having children under the age of seven and elderly persons over sixty years old increased the household hospital expenditures, so that these variables led to an increase in per capita hospital expenditures by 1347241, 4406778 and 1602637 Rials, respectively. Although household spending on education of children and owning a private home were not statistically significant, both had negative impacts on household hospital expenditures.

Discussion

The results showed that an increase in paternal age,

maternal age, and household size increased the probability of household's hospital expenditures. These findings are consistent with many theoretical bases and studies (3-5, 8, 15, 23). Increasing maternal age had a greater impact on household hospital expenditures than the father. That is, with increasing age, the mother is more exposed to diseases and health care services than the father of family. In addition to the parents' age, the two age groups of children under seven and elderly persons over sixty years old were included in the model to evaluate the effect of age on hospital expenditures. The results showed that both age groups increased the hospital expenditures as well as the probability of household's hospital expenditures. However, among these two age groups, households with children under the age of seven were more likely to have hospital expenditures and pay for higher hospital expenditures.

Alipour et al. (16) showed that the inpatient hospital expenditures growth rate of the two age groups (older than 60 and under 60 years old) was the same. Previous results have shown that older people have more per capita health care spending than younger age groups (1, 8, 24, 25) and the reasons are high mortality, the epidemic of chronic disease, comorbidity, disabling conditions, and overall reduction in health states (16). Also, Su et al. (26), Shahraki and Ghaderi (13), and Xu et al. (27)

reported that people over the age of 60 and children under the age of 5 were more likely to be exposed to health expenditures.

The increased education of father and mother reduces the probability of household exposure to hospital expenditures. That is, households with more educated father, mother or any other member (the highest household qualification also had a negative impact on hospital expenditures) are less likely to have hospital expenditures, compared with other households. Ghiasvand et al. (12) showed with increasing educational level, the likelihood of hospital catastrophic expenditure decreased substantially and household with the lowest educational level had 1.6 times higher chances of facing such expenditures compared with the highest educational group. Also, Hajizadeh and Nghiem (8) state that the increase in the level of education has led to not only a decrease in hospital catastrophic expenditure, but also to an increase in hospital expenditure. This may be reflected in preventive health care and services (3, 17) where more educated parents who benefit from more health literacy provide more preventive health care to family members, leading to avoidance of costly and catastrophic hospital services in the future. These services can be in the field of lifestyle, nutrition, exercise, and education.

Households whose parents were more educated and faced with hospital expenditures had higher hospital expenditures than the others. For further investigation, to study the effect of maternal education on household hospital expenditures, in addition to maternal education variable, we considered the variables of mothers with elementary education and mothers with bachelor's degree and higher in the model. The results showed that elementary education of mothers had a positive effect and, on the contrary, bachelor's degree and higher had a negative effect on hospital expenditures. In other words, the higher the educational level of the household, the lower their hospital spending. However, parental education had a positive effect on hospital expenditures in general. Studies have also shown that increasing parental education has not only led to an increase in household health expenditures, even in child working households (3, 7, 8, 28), but has also led to an increase in hospital spending (8, 12). This increase in health expenditures is probably aligned with the increase in household health status because people with higher education lead to an improved health status through affecting employment and income (19), choosing the right combination of time and consumption, increasing productivity, and affecting mental and

personality traits (29-31).

Furthermore, the reason for the positive impact of parent education on hospital expenditures may be that the educational level of many parents in sample households is a high school diploma or lower. Since parents with elementary education and lower had a positive effect on household hospital expenditures, the variable of parental education had an overall positive effect on household hospital expenditures. Another reason includes an increase in educational level and health literacy of parents to prevent chronic and communicable diseases for household members in the future. Therefore, parents with higher education behave rationally and pay the costs of hospital services in the short run to avoid too high and overwhelming costs in the long run. On the other hand, the existence of some health insurance and supplementary health insurance that cover all or part of the hospital costs has further increased the household's motivation to undertake hospital services.

Having health insurance and supplementary health insurance increased the probability of household exposure to hospital expenses. This means that households with health insurance or supplementary health insurance are more likely to use hospital care, compared to other households. Because knowing that insurances, especially supplementary health insurance, can reduce hospital costs, or some types of health insurance can cause all hospitalization costs to be free, households apply more for hospitalization and the use of hospital services for complete recovery. Therefore, they are more likely to be exposed to hospital expenditures. The positive correlation between having insurance and health spending has also been suggested by other studies (3, 4, 15). Also, having supplementary health insurance resulted in reduction in household hospital expenses. This result is consistent with the function of supplementary health insurance that should cover part of the health costs, and is in the same line with Panahi et al.'s results (23) on the medical costs of patients hospitalized in Tabriz hospitals.

Hajizadeh and Nghiem (8) declared that low-income households are still faced with higher hospital expenditures than other households, even with health insurance, and health insurance system in Iran does not provide equal protection against hospital expenditures. Also, Shahraki and Ghaderi (13) stated that among all types of health insurance, households with insurances of specific institutions and organizations had lower out-of-pocket payments, compared to households with health and social security insurances; also, Rezaei and Hajizadeh (11) showed that Catastrophic Healthcare

Expenditures are disproportionately concentrated among poor households in Iran. Also, there is inequality in hospital expenditures and out-of-pocket payments in Iran, and socioeconomic factors have contributed to this inequality (11, 32). Therefore, the same insurance coverage that protects all members of society against Catastrophic Healthcare Expenditures is necessary. This study had some limitations. First, the survey data were collected by questionnaire based on the head of household's statements; thus, the information may be untrue or inaccurate. Second, some of the variables affecting household hospital expenditures were not statistically significant and were excluded from the model.

Conclusion

According to the results, increasing parental age, having children under the age of seven and elderly persons over sixty years old, household size, having health insurance, and smoking lead to an increased probability of household's hospital expenditures as well as increased household hospital expenditures. Since with aging, the mother is more exposed to disease and health care, compared to the father, protection of mothers is necessary to achieve better health status and reduce household hospital expenditures. It is also essential to support families with children or elderly person to avoid hospital expenses or to pay less for hospital expenses; this can be achieved through improving insurance coverage and preventive health care. Especially the elderly, due to aging and reduced income, are more prone to medical interventions and catastrophic health expenditures. Therefore, the development of supplementary health insurance is also recommended to reduce the hospital expenditures and risk of catastrophic health expenditures. Also, parental education, especially for mothers, is an important factor in reducing household hospital expenditures. Hence, investing in education is essential to provide an appropriate condition for education of most people in the community who will be future parents. Also, improving the health literacy of household, especially parents, is recommended through health education which can be provided for parents continuously from birth to maturity of children, through hospitals, health centers, or any other center.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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