

Determinants of household's health expenditures: A population-based study

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ABSTRACT

Studies have shown that the determinants of households' health expenses are in doubt in Iran. Patients deal with pain and trouble while facing increasing health services payments. Thus, their quality of life decreases in all aspects. The objective of this research lies within the analysis of Iranian households' health expenditure (HHE), using multilevel modelling methodology. Data was collected through Household Income and Expenditure Survey by Statistical Center of Iran. A total of 38299 Iranian households were sampled. This nationally-representative cross-sectional survey collected the required information from March 2013 to March 2014, using a three-staged cluster sampling method. Descriptive statistics and multilevel modeling was employed for data analysis. Data analysis was performed using R programming language version 3.3.2 and SPSS version 20. $P < 0.05$ was considered as statistically significant. Our findings indicated that families spent about seven percent of their annual income on HHE. Annual median of medical expenses and income per capita were 1020 and 44460 thousand rials, respectively. Family income, age, and activity status of household head had significant positive effects on annual HHE ($P < 0.05$). Female headed families spent about 10% less health expenses than male headed households annually ($P < 0.001$). Although rural and illiterate heads experienced lower health expenses, their effects were not statistically substantial ($P > 0.05$). More attention on HHE is needed from researchers and politicians, as it has proved to be no easy matter in the low-income and deprived areas.

Key words: Health Expenditure; Household; Multilevel Analysis

INTRODUCTION

Health is one of the crucial factors for country's economic development [1]. A healthy population is likely to bring higher economic value added. Hence, universal health coverage is the goal through which all people obtain the health services they need without risking financial hardship [2-4]. High health expenses can seriously make people deal with pain and trouble and affect the living standards [5-6]. As a consequence, they reduce other essential family expenditure. Poor households are particularly vulnerable to high health expenses [7-9]. Thus, the financing of household health expenditure (HHE) is a major concern in any country. Furthermore, health care expenditure varies substantially over time and across countries, leading to substantial geographical heterogeneity at the

level of expending [10]. In spite of enhancement of HHE as a percentage of gross domestic product (GDP), only a few studies have investigated the average HHE and its predictors in a country level setting especially in developing countries. In addition, when households are nested within provinces (clusters) in a country, there is an intra-cluster correlation among responses that should be taken into account in the analysis of data [11-13]. Moreover, studies have been devoted to the analysis of this issue as Iranian households are rare and descriptive, too [14-19]. Hence, the present study aimed at determining the predictors of Iranian HHE in a nation-wide setting using multilevel modelling perspective. The remainder of the paper is organized as follows: Section two outlines the study settings, empirical methodology, and data

collection. In section three, HHE is analyzed. Section four discusses the results of this work. Finally, the conclusion is reported in Section five.

METHODS

Study design

The data used in this study came from the Households Income and Expenditure Survey (HIES), which was administered by Statistical Center of Iran (SCI). Its general aim was to estimate the average expenditure and income for urban and rural households at country level. This nationally-representative cross-sectional survey collected information from 38299 households from March 2013 to March 2014. The HIES target population includes all private settled and collective households in urban and rural areas. A three-staged stratified cluster sampling method has been used in the Survey. At the first stage, the census areas were classified and selected. At the second stage, the urban and rural blocks have been selected and the selection of sample households has been done at the third stage. The sample size was optimized to estimate the average annual income and expenditure of a household based on the aim of the survey. In order to obtain estimations which are better representative of the whole year, the samples were distributed between the months of the year for the survey. All private settled and collective households that selected as sample were included in the study unless the household didn't cooperate for any reason, mainly unsatisfactory, mental disabilities, absence of the family during sampling period (after three times of referring), and houses with no resident inside. In these situations, next households were chosen. The present research was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (code: SBMU.REC.1393.146).

The HIES questionnaire included different parts and sections that covered demographic characteristics, education, marriage, primary life equipment, access to facilities, housing, monthly and yearly food and non-food expenditure, and yearly income of household. Health expenses section included expenditure questions on treatment, medicines, laboratory tests and diagnostics, hospitalization, health-care products, remedial equipment, outpatient

services, visits to traditional healers, surgical operations and instruments, dentistry, addiction therapy, and other health-related expenditure for all household members. This section divided into two subsections which collect expenses monthly and annually. For monthly-recorded expenditure, a yearly value with the appropriate multiplier pattern was used. For the purpose of analysis Attention was only on out-of-pocket health expenses. Insurance premium and governmental financial supports on HHE were ignored. The earnings of all household members who work for obtaining the household income were also aggregated. According to the purchasing power parity (PPP), in average, one U.S dollar was equal to 22370 rials (Iranian currency) in the period of data collection [20].

HHE as the dependent variable aggregated all expenditures for treatment, health care, and medical equipment of all family members in the past 12 months before the interview. Explanatory variables also were: 1) Household head variables: *Age*, *gender*, *literacy status* (literate / illiterate), and *activity status* (employed / unemployed / unemployed but has income / student / householder / other), 2) Household variables: *living area* (rural / urban), *province of living* (There are 31 provinces in Iran), *income*, *size* (number of household members). For simplicity, household head *activity status* variable re-categorized into two new categories (with income (employed + unemployed but has income) / without income (unemployed+ student + householder + other)). The variable *weight* was used for sample size determination and estimation precision.

STATISTICAL ANALYSIS

The HHE per capita and income per capita were used through analyses. Variables were summarized as mean \pm standard deviation (SD) or median \pm interquartile range (IQR) and categorical data were reported as percentages. Note that the analyses were based on sampling weights. The right-skewed distribution of HHE and *income* suggested logarithmic transformation for modeling purposes. Since households (level 1) were clustered within provinces (level 2), we used multilevel model for the analyses. This model takes into account the dependency of the observations within provinces. Intra-class

correlation coefficient (ICC) as an indication of the dependency of the HHE within provinces was also estimated. All computations were performed using the package *lme* and *lm* for the statistical programming environment R version 3.3.2 and SPSS version 20. $P < 0.05$ was considered as statistically significant.

RESULTS

There were no missing data in the sample. The majority of household's heads (88.1%) were male and about 27% were living in rural areas. The mean heads' age were 48 ± 15 years old. About 21% of the household's heads were illiterate and also, this proportion for female headed households were about 56%. Annual

median of medical expenses and income per capita were 1020 and 44460 thousand rials, respectively. A sizeable proportion (32%) of the reported households had not out-of-pocket spending on health. Table 1 shows the characteristics of the households.

Distribution of household health expenditure

Table 2 presents the Mean \pm SD for HHE and income per capita by weighted income decile. The proportion of annual income per capita spending on health expenses decreases with income decile. It seems that there is a negative correlation between HHE and family income. It also shows that, in total, about seven percent of the annual income is spent on HHE.

Table 1. Summary statistics for households (n = 38299)

Household heads' characteristics		Household characteristics	
Age, years	$48 \pm 15^*$	HHE per capita, 1000 Rials	$1020 \pm 3630^{**}$
Male/female	33652/4647	Income per capita, 1000 Rials	$44460 \pm 39542^{**}$
Rural, n (%)	19423 (26.5)	Size	$3.6 \pm 1.5^*$
Illiterate, n (%)	10503 (20.8)	--	---
Without income, n (%)	1937 (4.9)	---	---

*: Mean \pm SD; **: Median \pm IQR

Table 2. Mean \pm SD for HHE and income per capita (1000 Rials) by total income deciles

Income decile	HHE	Income	%(HHE/income)
1	2850 ± 6463	21434 ± 11972	13
2	2809 ± 7889	29301 ± 17761	10
3	3264 ± 8527	34924 ± 20962	9
4	2955 ± 6963	39847 ± 23856	7
5	3422 ± 9190	43775 ± 25545	8
6	3357 ± 7706	48804 ± 2745	7
7	3591 ± 8507	52597 ± 26633	7
8	4887 ± 13839	61508 ± 33882	8
9	5741 ± 22545	74049 ± 42132	8
10	7188 ± 18942	128109 ± 97922	6
Total	4230 ± 13118	58292 ± 54609	7

Results of multilevel modeling

Table 3 provides the results of fitting multilevel modeling, taking into account the *province* as level two in the model. As mentioned in previous sections, the logarithm of HHE and income were used in model fittings, which is why the exponentials of model coefficients, ($\exp(\beta)$) were reported for interpretations of the results. ICC was calculated as 0.06, indicating provinces were homogeneous and different from each other. Linear standard regression also fitted. The AIC for multilevel model and standard regression were estimated 157283 and 163180 respectively, indicating better fitting of

multilevel perspective than standard regression. The results of multilevel regression

modeling showed that HHE boosts significantly as income of the family increases. This was also confirmed through Table 2.

Although the model coefficient for age is small, it is highly significant and positive. The findings also indicated that female headed families have less medical expenses ($\exp(-0.11) = 0.90$). That is, female headed families had about 10% less health expenses than male headed households annually. The effect of residential area and literacy status of household heads was also

considered. They both have unsubstantial negative effect on HHE. It means that, in average, rural and illiterate heads have had lower health expenditures than their related

counterparts. Inversely, with-income heads families experience significantly less healthcare expenses (about 12%) during the year than without-income heads.

Table 3. Results of Multilevel Regression Model for Sampled Households (n = 38299)

Predictors	β^* (SE ^{**})	Exp (β)	P
Intercept	-0.29 (0.17)	0.75	0.09
Age	0.01 (0.001)	1.01	< 0.001
Log Income	0.48 (0.03)	1.62	< 0.001
Sex (Female)	- 0.11 (0.02)	0.90	< 0.001
Region (Rural)	-0.02 (0.02)	0.98	0.33
Literacy (Illiterate)	- 0.002 (0.02)	0.998	0.93
Activity status (Without income)	0.11 (0.04)	1.12	0.004

*: Estimation of multilevel regression coefficient; **: Standard error of the estimation

DISCUSSION

It was the main purpose of the paper to draw attention to Iranian household health expenses using multilevel modeling prospective which takes into account the correlation among observations. The present study showed that important factors for explaining HHE were: family income, age, gender, and activity status of household's head. Moreover, age of the family head had a positive effect on annual HHE, which is in line with other studies [9, 21]. It is well understood that elderly populations require more health services which would result in higher health expenditure [7]. It is worth noting that income is positively related to health care expenditure in the present study. Although some studies tend to show that income is effective [9, 22], others conclude that it is not [7, 10, 23]. It is therefore an empirical issue. The reason may be due to differences in the inclusion of predictors and methods of analysis. Our descriptive analysis also revealed that the low HHE is a result of low income in Iranian households. Policymakers should enhance health services equipment and insurance in low-income families. Recessions and economic instability have a potentially adverse effect on health [6]. The consequences of household head gender on HHE is also considered. The results showed that average annual HHE for female headed households were less (about 10%) than male counterparts. The poverty of female headed families might be the main reason. Additionally, our findings indicated that region of living and literacy do not markedly effect HHE. Hopefully, it can be claimed that access difficulty to health services

by rural residents [4] and following unhealthy lifestyle by illiterates [24] have descended in recent years in Iran. Some benefits of multilevel models that make researchers more optimistic about findings are: 1) there is no need for the assumption of homogeneity of regression slopes in analysis of covariance 2) there is no need for the assumption of independence unlike many common statistical analysis methods 3) it enables data analysts to obtain efficient and precise estimates of effects statistically 4) by using the clustering information, it provides correct standard errors, confidence intervals and significance tests [11, 25-26]. This research also had a *limitation*. Although the HIES data recorded using educated persons and carried out precisely with ISC, the income and expenditures data is self-reported for the period of last year at the time of the interview. Possible recall bias in reports, especially in expenditures is quite probable. It cannot be ascertained that possible inaccuracies in recall occur similarly for income or expenditures which was not verifiable from other sources.

CONCLUSION

Summing up the results, it can be concluded that more attention on HHE will be needed from researchers and politicians' side, as it has proved to be no easy matter in the low-income and deprived areas. Another focus of the present study has been the analysis of cluster-correlated health expenditure data using a precise modeling method. The proposed method, multilevel modelling, indicated better fitting than standard linear model. Therefore, this technique can be used in medical researches.

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