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Household Health Expenditure in Iran: A Cross-National Survey

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Abstract

Household health expenses (HHE) are an important problem in any area. This national study aimed to investigate the determinants of HHE using quantile regression methodology. This cross-sectional national survey data was collected through the Iranian households' income and expenditure survey, administered by the Statistical Centre of Iran (SCI) in 2014. In total, 38299 households were selected by a three-stage stratified cluster sampling method. The data were collected using a standard SCI-made Household Income and Expenditure questionnaire. A quantile regression (QR) approach was employed to determine the key predictor variables of HHE. R programming language (ver. 3.3.0) was used for data analysis. The findings indicated that the median annual medical expenses per capita was 1020000 Rls (= 48.02 USD) for Iranian households. The results of QR modeling revealed that age, income, region, gender, literacy, and occupational status had significant effect on HHE. Among households with moderate HHE, families with older-female-higher income heads experienced more HHE, while among high HHE households, families with older-rural-higher income heads spent more on HHE. Since inequality at HHE was revealed by age, income, region, gender, literacy, and occupational status among Iranian households, more attention will be needed from policymakers and health sectors on population subgroups of Iran.

Keywords: Health expenses, Household, Quantile regression

Introduction

Health is one of the key components of the country's economic progress [1]. A healthy population probably brings higher economic value added [2]. Universal health coverage means that all the persons get the health services they require without risking financial privation [3, 4]. Poor households are remarkably at risk of high health expenditures and deal with trouble while facing increasing health services payments [5-11].

In practice, HHE data often do not meet the assumptions needed for most statistical techniques. Paying no attention to these assumptions might lower the efficiency of the statistical hypotheses tests [12]. Quantile regression (QR) modeling is a powerful method for analyzing such data. It models the relationship between independent variables and different quantiles of response [13]. To our knowledge, few studies can be found in the literature that evaluate the determinants of HHE in low- and middle-income countries using the QR approach. This methodology has been employed in many research areas such as quality of schooling [14], demographics' impact on infant birth weight [15], malnutrition [16], growth curves [17], Genetics [18], public health [19], environmental sciences [20], ophthalmology [21], and health economics [22-25].

The present study aimed to investigate the predictors of HHE using the quantile regression method in a national study of Iranian households.

Methods

The data were collected through the Iranian Households' Income and Expenditure Survey (HIES), a cross-sectional national survey, administered by the Statistical Center of Iran from 20 March 2013 to 21 March 2014. The objective was to achieve optimum estimation for the average expenditure and income for households at the province and country levels [22].

The population of HIES was all private settled and collective households. A multistage sampling technique was performed in the survey. The census areas, the urban and rural blocks, and the households were categorized and randomly selected in the first, second, and third steps, respectively. A sample of 38299 households was selected to estimate the average yearly income and expenses of a family. For precise estimations, the sampled households were selected from all months of the year. All selected households were covered in the survey unless the household did not participate for any reason mainly, unsatisfactory, mental disabilities, absence of the household during sampling time (after three times of follow-ups), and houses with no resident inside. Hence, substitutions were used for households that did not cooperate in the survey [22].

The questionnaire consisted of distinct parts including demographic properties, marital status, education, access to facilities, housing, food and non-food expenses, and family's annual income. The health expenditure part included questions about expenses on treatment, medicines, laboratory tests and diagnostics, hospitalization, remedial equipment, health-care products, visits to traditional healers, outpatient services, surgical operations and tools, addiction therapy, dentistry, and other health-related expenses for all family members. To compute the total annual income of the family, the income of all family members was added. The out-of-pocket health expenditure was the attention of the present research. Governmental financial support and insurance premiums on HHE were disregarded. All information was collected through a face-to-face interview by educated and trained persons. Also, a well-informed member of the family responded to the questions. For more details about HIES see (22). Based on the purchasing power parity (PPP), one U.S. dollar was equal to an average of 22370 Rls (Iranian currency) in the data-gathering period [23].

The dependent variable, HHE, was computed as the sum of all expenses for healthcare, treatment, and medical equipment of all household members in the past 12 months before the interview. Predictor variables of this study were 1) Household head characteristics: gender (male/female), age, education level, and activity status, and 2) Household characteristics: yearly income, living area, and size of the family.

The logarithmic transformations of HHE per capita and income per capita were used in the analyses for modeling objectives. Qualitative variables were summarized as frequency and percent. For quantitative characteristics, mean ± standard deviation (SD), and/or quartiles were reported. Note that the analyses were based on sampling weights. QR method was employed for modeling the relationship between response and predictors. This approach has some advantages over traditional regression models where the outcome is not normally distributed and/or when the modeling of lower and upper percentiles of the outcome is of interest.

The package quantreg of the statistical programming environment R [26] was employed for model fitting. Finally, we compared the results with linear traditional regression model findings. Note that, according to Akaike's and Bayesian information criterion (AIC and BIC), the best model was chosen and reported .

Results

Summary statistics

Household characteristics are reported in Table 1. About 27% of households were living in rural areas. A considerable proportion of household heads (11.9%) were female. The mean ± SD of heads' age was 48.43 ± 15.38 years old. 20.8% of the household's heads were illiterate. The illiteracy proportion in female-headed households was estimated at 67.7% .

The results indicated that the yearly median of HHE and income per capita were $US 45.60 (Q1=0; Q3=162.27) and 1987.48 (Q1=1287.44 and Q3=3055.07) $US, respectively. A substantial proportion (32%) of the sample reported no out-of-pocket HHE. Summary characteristics of HHE and income per capita by expenditure deciles are represented in Table 2. The findings indicated that the proportion of yearly income per capita spending on HHE was increased with expenditure deciles.

Results of QR analysis

Table 3 shows the results of linear quantile and ordinary regression models. The quantile model estimated different coefficients as quantile changes. It means that independent characteristics had distinct effects on families with low-, medium-, and high-health expenses (Table3 and Figure 1). On the other hand, ordinary regression showed fixed effects for each predictor. The reason is that this model only focuses on the average HHE not families with low or high HHE. The exponentials of regression coefficients (e^{β}) were also reported for interpretation goals. For example, for a specified household with HHE about median (1'020'000 Rls), female-headed families spent 1.06 times (6%) more than their male-headed counterparts. Likewise, families with illiterate heads spent 27% less than literate-headed households. These findings differ for slightly and highly health expenditure families. This property is one of the advantages of the quantile model. Since a high proportion of families have not reported any out-of-pocket expenses on health, estimations for lower quantiles could not be computed.

Predictors of HHE

In this section, we report the factors that determine HHE using a quantile regression model. The analysis showed quite surprising results in comparison with the classical regression model. As shown in Table 3, the age of the family head and household income had a substantial effect on annual Iranian health expenses. These positive effects were kept in all quantiles of interest and in classical regression. Being rural and illiterate had a decreasing effect on HHE. Gender and activity status of household head played different roles across quantiles.

Table 1. Descriptive statistics of the households by gender of household head

	Man	Woman	Total
Location			
Rural	16885 (23.2)	2538 (3.3)	19423 (26.5)
Urban	16767 (64.9)	2109 (8.6)	18876 (73.5)
Literacy of household head			
Literate	26296 (73.9)	1500 (5.2)	27796 (79.2)
Illiterate	7356 (14.2)	3147 (6.6)	10503 (20.8)
Activity status of household head			
With income	32269 (84.8)	4093 (10.3)	36362 (95.1)
Without income	1383 (3.4)	554 (1.6)	1937 (4.9)
HHE per capita (1000 Rls)	984 ± 3480	1500 ± 5400	1020 ± 3630
Income per capita (1000 Rls)	44299 ± 37345	47244 ± 65493	44460 ± 39542
Age of household head (year)	47.04 ± 14.89	58.72 ± 15.03	48.43 ± 15.38

Categorical variables: Freq. (%); Household health expenses& income: median ± IQR (= Q3-Q1); age: Mean ± SD

Table 2. Summary characteristics for HHE and income per capita (1000 Rls) by total expenditure decile

expenditure decile	income	HHE	%(HHE/income)
1	34775 (34976)	1558 (3118)	6
2	41219 (29896)	1736 (3826)	5
3	42798 (29710)	1916 (3981)	5
4	44996 (27476)	2307 (5288)	6
5	49587 (33097)	2488 (4707)	6
6	52817 (38466)	2860 (5452)	7
7	58055 (37653)	3943 (8414)	8
8	66743 (48291)	5111 (9958)	13
9	79757 (59907)	6673 (12873)	11
10	112239 (106563)	13717 (33795)	18
Total	**58292 (54609)**	**4230 (13118)**	**8**

The process figure for activity status shows that the slope parameter changes from negative to positive at about the 58th percentile. The 95% confidence bands showed that the relationship

Table 3. Comparisons of linear quantile and classical regression findings

	Linear quantile regression model								classical regression model	
Percentiles	**40**		**50**		**75**		**90**			
Predictors	**β(SE)**	**e^{β}**	**β(SE)**	**e^{β}**	**β(SE)**	**e^{β}**	**β(SE)**	**e^{β}**	**β(SE)**	**e^{β}**
Intercept	-1.16(0.23)***	0.31	-0.45(0.16)**	0.63	0.18(0.13)	1.20	0.31(0.16)	1.36	-0.67(0.15)***	0.51
Age (years)	0.01(0.001)***	1.01	0.01(0.001)***	1.01	0.01(0.001)***	1.01	0.005(0.0007)***	1.01	0.01(0.001)***	1.01
Log.Income (1000 rials)	0.70(0.05)***	2.01	0.67(0.04)***	1.96	0.66(0.03)***	1.94	0.73(0.03)***	2.08	0.53(0.03)***	1.69
Sex (Female)	-0.79(0.36)*	0.45	0.06(0.03)*	1.06	0.04(0.02)*	1.04	0.03(0.03)	1.03	-0.35(0.10)***	0.70
Region (Rural)	-0.05(0.03)	0.95	-0.02(0.02)	0.98	-0.03(0.01)*	0.97	-0.03(0.02)*	0.97	-0.04(0.02)	0.96
Literacy (Illiterate)	-0.09(0.04)*	0.91	-0.32(0.09)***	0.73	-0.25(0.07)***	0.78	-0.02(0.02)	0.98	-0.12(0.03)***	0.89
Occupation (Without income)	-0.09(0.09)	0.91	-0.02(0.05)	0.98	0.15(0.03)***	1.16	0.09(0.03)**	1.09	0.11(0.05)*	1.12
Sex*Age	0.01(0.005)***	1.01	-	-	-	-	-	-	0.01(0.002)***	1.01
Literacy* Occupation	-	-	-	-	-0.12(0.05)*	0.88	-	-	-0.32(0.08)***	0.73
Age* Literacy	-	-	0.005(0.001)***	1.01	0.004(0.001)***	1.004	-	-	-	-

*, **, *** indicate significance at 5%, 1%, and 0.01% levels, respectively. SE: standard error

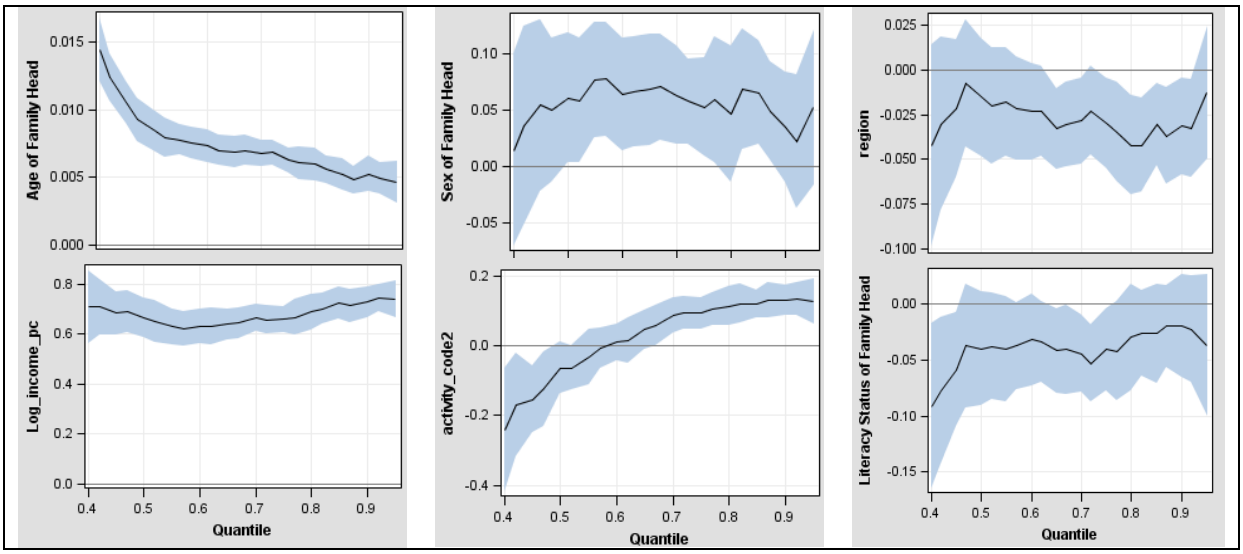

Figure 1. Regression coefficients estimations and their 95% confidence intervals at different quantiles and predictors

between HHE and activity status (expressed by the slope) was not significant from about 48th to 67th percentiles. Income and age indicated substantial positive effects in the whole range of percentiles. On the other hand, gender was not significant in some quantiles. Figure 1 also illustrates the negative effect of literacy level and residential area by fluctuations in regression coefficients.

Discussion

This paper propounds a robust modeling methodology of a nationally-representative household survey for analyzing health expenses in Iran. This method, which is referred to as quantile model, fits different models for each response percentile and reveals more details of the relationships between variables missed by other regression models [27]. According to the 50th percentile, we found that age, income, gender, and literacy level had a statistically significant effect on HHE. These effects were different in direction and size for different percentiles. This is one of the important properties of the QR technique since it seems households with low-, middle-, and high-health expenses follow distinct patterns from each other.

The current study indicated that on average, health expenditure per capita accounts for about 8% of annual income per capita. Moreover, households spent more portion of their income per capita on HHE while their total expenses increased .

Age indicated a quite uniform effect on health expenditure which concurs with other studies [28, 29]. Although the model coefficient for age was small, it was significant. It means that HHE increases about 11% for each decade of age increase of household head. It means that elderly populations need more health services which would result in higher health expenses [30].

Related research has shown that the effect of income is under question. The present study indicated that income has a substantial positive effect on HHE which is in good agreement with other studies [24, 25, 30, 31]. The descriptive analysis also revealed that low HHE was observed in low-income families. Thus, policymakers should increase health services equipment and insurance in such households.

Recessions and economic instability have a potentially adverse effect on health.

This study also examined the effect of family head gender. The findings of household head gender on HHE indicated that HHE for female-headed households were more (about 6%) than male counterparts annually. The possible reason might be an unhealthy lifestyle resulting from illiteracy and poverty of female-headed households. Furthermore, our study showed that households with illiterate heads spent less (about 27%) on HHE. The reason might be that literate and educated persons tend to follow a healthy lifestyle [32] and spend more on their health [1, 28]. Although the findings revealed that urbanization made individuals spend more on HHE, it was not statistically significant. It seems that the difficulties in accessing health services by rural residents were solved during the time [33]. The examination of the activity status of family heads represented that with-income heads spent less on HHE than without-income counterparts at the interval (0.4, 0.6) but these two groups behaved inversely at quantiles upper than 0.6. Based on the descriptive findings of the current study, the most likely explanation might be the poverty of lower expenditure deciles. As we mentioned in previous sections, households in lower expenditure deciles had less income too. Thus, they spent more on essential needs like food, clothing, and so on rather than health.

There were quite prevalent households with zero HHE in the present research. It might be because of governmental supportive policies and insurance coverage in deprived areas. One limitation of the current research was that even though the HIES questionnaires were filled in by educated individuals and implemented exactly with ISC, the income and expenses data were self-reported for a year before the interview. Hence, recall bias could happen in such information, especially, in expenses.

Conclusion

Summing up the results, differences in HHE among age groups, income, region, gender, literacy, and occupational status were detected among Iranian household heads. More concentration on HHE is necessary for researchers and politicians as it is a major issue in developing countries and deprived regions. We also emphasize that efficient methods for data analysis can give researchers a more comprehensive picture of current issues among distinct groups and/or subgroups.

Ethical approval

The protocol of this study was assessed and approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (SBMU), Tehran, Iran (Code: SBMU.REC.1393.146).

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Conflict of Interest

All authors have no conflicts of interest to disclose.

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