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Socioeconomic Inequalities in Iran Health Sector

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Abstract: Socioeconomic inequalities in health is defined as differences in the incidence or prevalence of health problems among the individuals in high and low socioeconomic status. Also, the impact of these catastrophic health expenditures is the most important indicators in the health sector. In this paper, we wish to report the cost-income data of households, estimate the effects of socioeconomic inequalities on the incidence of Catastrophic Health Expenditures during 2009-2011. With using two states estimate and analysis of the marginal effects of Logistic estimates, variables of residence, head of household employment, number of family members, per capita house area, adjusted household size, Marital status of household head, size-adjusted expenditures of household, Employment status and gender of household head affects catastrophic health expenditures, but age of household head and education status of household head has no impact on catastrophic health expenditures. The main reason for this result, is a large proportion of Iranian households out-of-pocket payments for health and medical.

Key words: Socioeconomic inequalities · Catastrophic Health Expenditures · Logit model

INTRODUCTION

When there is a significant difference between income and social groups of the society, public welfare will be damaged and Pareto optimized will be unstable. According to the broad researches, socioeconomic inequalities are seriously harmful for health and their different indexes. On the other side, inequalities of health sector play significant role in socioeconomic inequalities of the entire society and possibly increase the severity and depth of it. If we accept that socioeconomic inequalities may even indirectly affect the health of the people, then it should be said that financial and economic policies can significantly contribute to this effect; but this issue is omitted by economists.

Theoretically, socioeconomic inequalities in health are defined as difference in the incidence of health problems among population at lower and upper socioeconomic level. Epidemiologic studies indicate that poor countries have more improper health outcomes than wealthy countries. Indeed, there is bidirectional causation between improper socioeconomic situation (poverty) and health: lower socioeconomic condition because improper health and improper health also cause to fix poverty and on the other hand, improper socioeconomic situation. From the view of inequality, socioeconomic inequalities of entire society damage health and its indexes and socioeconomic inequalities of health sector can deepen poverty and inequality of entire society.

One of challenges against all social and economic systems is reaching to justice of participation in financial costs and protection from financial losses; and it is very important in health systems due to the tragic and unpredictable nature of most of the costs. On the other side, if we want to improve equality and poverty indexes in macroeconomic, we must study economic infrastructures in which health is the most important subset affecting this indexes and make policies along with equality and decrease of poverty which requires accurate studies and presenting practical and appropriate solution.

Health is by self a component of welfare. Thus, if we accept that health is influenced by socioeconomic inequalities, then taxation tools, subsidy and transmitting policies affect on income distribution, will be effective. Even if these inequalities do not have direct impact on health, redistribution of income for poorer persons will

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promote average rate of health rather than wealthy persons. Seeing welfare such that considers inequalities and health will indicate more extended differences between poor and wealthy.

Literature Review: Most of differences in health of individuals depend on their biological characteristics. Difference in the health of elder and youth, male and female, etc is influenced by their biological nature. For example, older people are exposed more to the diseases; but none of these differences are considered as unfair differences. Most of differences in the health level of the people are determined between different social groups (cultural, political, economic community and social classes) which are called inequality and so this inequality can be considered unfair for the health induced by socioeconomic factors.

Grossman [1] for the first time entered health capital in utility functions; indeed, he considered health as a capital good generate healthy time for the person and emphasized that individual's health plays important role for determining the time which can be spent by the person for income and production. What is important here is financing health sector.

Factors and determinants of inequality in health are numerous. WHO has emphasized on social determinants of health that main factor of fatality and diseases in high income and middle income countries is related to malnutrition, obesity, smoking, alcohol consumption, risky, high blood pressure, sexual behavior- totally related to a socioeconomic situation [2].

Literature of measuring health distribution can be divided into two groups: first group are form the researches related to income inequalities and only how the variables of health conditions are distribute among the population. Income inequality measurement has found its place in health inequality measures. Second group do not measure health inequality, but also try to combine socioeconomic aspects in their assessments. Particularly, they are looking for a scale that shows them to what extent present inequalities of health sector are related to socioeconomic situations. Therefore, most of standard measures of income inequality can not reflect these considerations properly and possibly health distribution measure can be completely different from income distribution measure.

Contoyannis and Froster [3] have developed an economic model based on the relationship between income and health, in which the effect of a specific change in income on health cannot be similar for all social groups. The model shows that under conditions of health behavior improvement, appropriate income growth or income redistribution can be effective on the health of the society and inequalities related to income. The model also present a conceptual framework for some of empirical studies of health inequalities related to income.

Some other studies assess the effects of economic situations on health separately. Several studies have been done about the relationship of income and health. Preston [4] extract an important graph shows the relationship between life expectancy and national income according to the purchase power and dollar by using international data for 1930, 1960 and 1975, that indicate direct relationship of these two variables. Correlation coefficient between natural Logarithm and life expectancy in 1930 was 0.885 and 0.880 in 1960. Wilkinson and Picket [5] also determined the positions of the countries in a graph with axis of per capita national income and life expectancy and conclude direct relationship between these variables.

Deaton [6] presented this graph as wealth is health. Prichette [7] considered some evident that growth rate reduces the fatality of infants. But the relationship between wealth and health should be examined in social groups of a country during a period of time.

Some of studies have examined the impacts of socioeconomic inequalities on fatality or diseases. Smits *et al*. [8] investigated the impacts of socioeconomic situations on fatality of 15.8 millions in Holland in 1999. The results showed that people live in poorer districts are exposed more to the fatality.

Some studies in this field are international and have used international data to examine the subject. Professor Mackenbach *et al*. [9] has investigated economic outcomes of socioeconomic inequalities in health of Europe union. In the framework of this study, health is considered as a proper good (one obtain utility from) and also as a good capital (reinforce human capital). Meant that, by using these two approaches, a monetary value has been calculated for inequalities related to health of the people. This study has showed that damages to the health of the society are related to the calculation of disease frequency in the population of low level of education, lower job class and low income level. Number of fatalities related to the health inequality of Europe union has been approximately 707,000 per year and lost years induced by it has been 11.4 millions. The number of patients can be attributed to the health inequality is over 33 million which has been effective and reduce about 1.8 years on average life expectancy of men and women. Impact of health inequality on average healthy life expectancy has been 5.14 years.

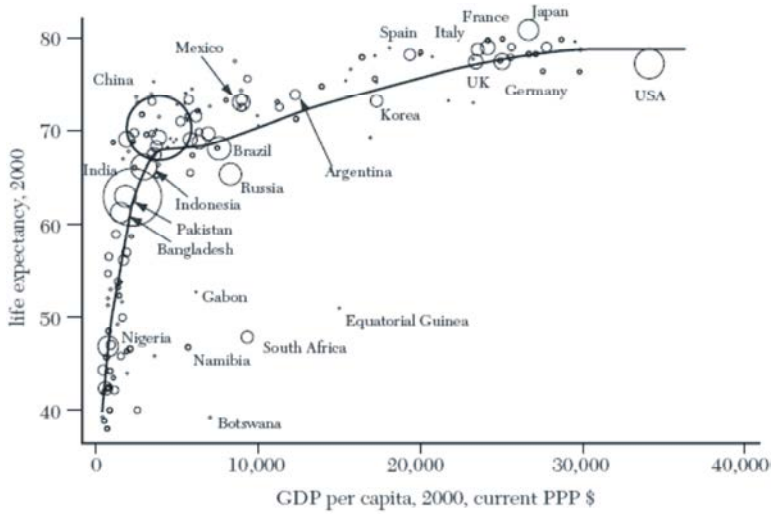

Fig. 1: Perston Cave, the average life expectancy against income
Source: Reproduced from Deaton (2003)[4]

Epstein *et al.* [10] has discussed economically the policies of British government which was effective on health inequalities in an article entitled an economic framework for social determinants of health and inequalities of health. Indeed, he assesses some of the government policies for decrease or increase of inequalities in health sector.

Jones and Nicolas [11] propose a method to compare inequality indexes in health and treatment based on long-term and short-term measures of health and income using time series data. They used general health questionnaire for their article and showed for net health inequality (measuring with Gini coefficient) and income inequality related to health (measuring with concentration index) that how time series data are related to Gini coefficient discrete data and concentration index. The results showed that absolute concentration index GHQ increases income, in average 1.7 or 1.5% for men per year and 5 or 6% for women per year.

A part of performed studies introduce new indexes of measuring socioeconomic inequalities in health sector. In a study performed by Pandey and Nathwani [12], socioeconomic inequalities are measured by quality of life index. This study proposes a new method to measure socioeconomic inequalities by using income inequality index and also standard fatality index. It has utilized from 2 main elements of development index, i.e. real gross domestic production per capita and life expectancy at birth. Income inequality and life expectancy have been used in a quality adjusted income to measure observed differences in quality of life of various quintile of population. Distribution Gini coefficient of QAI is introduced and calculated as a measure of socioeconomic inequality.

In another study, Zheng [13] introduces a new approach to measure socioeconomic of health. Among new features of the approach is the use of health-income matrix associated with socioeconomic class which includes health possibility distribution situation. According to the uniformity assumption of income-health matrix, which is direct interpretation of popular assumption of socioeconomic slope in health outputs, a set of welfare dominancy conditions and inequality dominancy for rating health distribution are presented. Since proposed method do not need any cardinal measure of health rating data, it accounted for strong measure.

A group of other study investigates existing factors in health sector on socioeconomic factors. For example, Walsh and Brenden *et al.* [14] have studied the role of private health insurance on socioeconomic inequalities to absorb cancer screening of Ireland. This showed that significant difference in socioeconomic situations to absorb cancer screening and main determinants of beast cancer; colorectal cancer screening and prostate have been related to private insurance.

Of course, impacts of social positions of the people on their health have been investigated which is one of basic studies about Wilkinson [15] work; he has investigated the impact of social class of people on children fatality and compared it for Sweden and England. The results have been presented below.

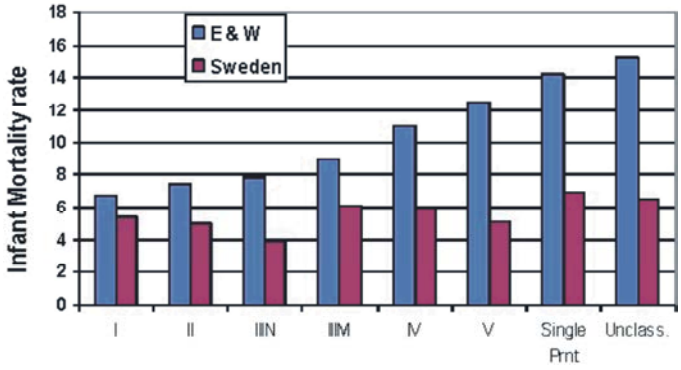

Fig. 2: The impact of social class on the health of people in Britain and Sweden
Source: Leon DA, Vagero D, Olausson PO. BMJ 1992 [16]

There are other interesting studies predict the health of social groups using the impacts of socioeconomic inequalities on health (or fatality). One of these studies is Mete [17], who has predicted the rate of elder fatality according to socioeconomic positions.

MATERIALS AND METHODS

Direct and Indirect Impacts of Income Inequality on Health: Among socioeconomic positions affecting inequality of health sector, income is the most important variable of these positions which is focused by economists. Average income and income inequality is an appropriate criterion to investigate the severity and dependence of heath to the mentioned factors. Per capita income impacts are reflected in individual income, so the rich is the country, these impacts will be more important. Income inequality cause positive impacts of poverty on health to be important issue even in rich countries.

Absolute income hypothesis or poverty hypothesis suggest that in poor countries, mean income is the factor affect on the health of population, but income inequality factor is less effective. While in wealthy countries, mean income is less important in comparison to income inequality factor; so income inequality is considered more important. It should be said according to accepted assumptions that income inequality impact has grown more than mean income. When a country becomes rich, the impacts of this factor grow simultaneously. Therefore, applications of absolute income hypothesis are important because various impacts of mean income and income inequality on health vary with economic development of the countries.

Assume that person i lives in country s and his health H_{is} is a quadratic function of his family income y_{is}; so, if, for better understanding the concepts, we assume that income factor cause to promote health and health in rich countries is less influenced rather than poor countries, then we have:

$$h_{is} - \bar{h} = \alpha + \beta x(y_{is} - \bar{y})^2 - \theta_{vs} \quad (1)$$

It is assumed that this equation is true for poor and rich countries. In rich countries, income inequality is more important in comparison to poor countries; so, both parameters of β and γ are positive and income inequality factor is introduced by income variance v_s. if we assume θ is zero, then impacts of nonlinearity of the equation are the same congestion impacts induced by polynomial equation.

If we average above relation, according to any person lives in any country, we reach to a domestic equation which can be applied in entire the country:

$$h_s - \bar{h} = \alpha + \beta(y_s - \bar{y}) + \gamma(y_s - \bar{y})^2 - (\gamma + \theta)_{vs} \quad (2)$$

In this equation, explanatory variables are represented by index. Even if θ is zero in this equation, variance will appear as summation. Parameter y_s has direct impact on health.

Main idea that income causes health was first proposed by Preston [18]. On the other side, health cause to increase income and wealth. Therefore, policies affecting on health are also effective in income inequalities. In many countries, health treatment expenditures are largely related to individual income and wealth. In many areas of the world, poorest people are often people who are not able to work due to disease or body deficiency. Policies supporting health expenditures of the families such as insurance covers are factors not only promote the health of the society, but also improve income distribution. Income and health equations can be explained as follow:

$$h_t = \alpha_1 + \beta_1 h_{t-1} + \gamma_1 y_t + \varepsilon_{1t} \quad (3)$$

$$y_t = \alpha_2 + \beta_2 h_t + \varepsilon_{2t} \quad (4)$$

ε_{2t} and ε_{1t} are random shocks with mean of zero and variances of δ_{11} and δ_{22} and covariance of δ_{12}. It is assumed for stability of the process that $0<\beta<1$. Environment health variance or health conditions are decreased by activities like eradication of chronic disease or vaccination and cleaning environment. β_1 is non-negative, which shows the speed of treatment trend when the health is at risk. Parameter β_2 is positive, which shows the impact of health on income and if net income is from health sector expenditure, then this coefficient reflects treatment expenditures and factors such as health insurance can reduce it better. Parameter γ_1 also control the relative relationship between income and health and it should be assumed zero to reach the goals so that we can explain the impacts of health on income inequalities with the absence of any relative relation of income with health. Variances and covariance at above equation are calculated as follow:

$$Var(y) = \delta_{22} + \frac{\beta_2^2 \delta_{11}}{1-\beta_1^2} \quad (5)$$

A reduction of health variances such as health insurance promotion leads to the reduction of income inequality. With the lack of relative relationship of income on health, regression coefficient of health will be still positive:

$$b = \frac{cov(hy)}{var(y)} = \frac{\beta_2 \delta_{11}}{\beta_2^2 \delta_{11} - \delta_{22}(1-\beta_1^2)} \quad (6)$$

As the health shock variance is larger than income shock variance, this slope will be larger. As the health insurance system is more efficient, the value of b is less. Since in most of the countries, health of the people is different, this difference in income can be reflected.

Model and Data: To estimate the impacts of socioeconomic positions of families, we used the incidence of poverty expenditures from cost-income data in 2009 to 2011. In econometrics, when dependant variable and explanatory variables of the model are qualitative and two or more alternatives, we use Logit and Probit model. Regarding to the huge volume of cost-income data within 3 years, the results of second model will be the same. Linear probability model, whose dependant variable has two modes of 0 and 1 nature, is defined as follow [19]:

$$P_i = E(Y = 1 \vdots X_i)\ \alpha + \beta X_i \quad (7)$$

If instead of the above model, this model will have to replace:

$$P_i = E(Y = 1 \vdots X_i) = \frac{1}{1 + e^{-(\alpha + \beta x_i)}} \quad (8)$$

where e is based on natural logarithm. This model is known as logistic distribution function. Assume that $z_i=\alpha+\beta x_i$ when z_i varies between negative and positive extremes, then p_i will vary between 0 and 1. Therefore, $1-P_i$ can be defined as follow:

$$1 - P_i = \frac{1}{1 + e^{-z_i}} \quad (9)$$

$$\frac{P_i}{1-P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} \quad (10)$$

If we take the natural logarithm of this equation, we have:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta X_i \quad (11)$$

where L is relative preference logarithm between 2 mdoes, which is linear with respect to X and parameters; this L is referred as Logit. Thus, limitations of LPM models have been overcome in this model and linear feature is still remained. Regarding to the nature of Logit models and data used for this article, final model can be defined as follow:

$Pov_i=\beta_1+\beta_2\ r\_u_i+\beta_3\ job\_h_i+\beta_4 education_i+\beta_5\ employ\_num_i+\beta_6\ age_i+\beta_7 marrige_i+\beta_8\ size_i+\beta_9\ perarea_i+\beta_{10}\ exp_i+e_i$

In this equation, Pov_i is dependent variable of expenditures of family i^{th} which include health expenditures with more than 30 percent of total costs. r_u_i for urban or rural, job_h_i for employed or unemployed households, $education_i$ for education of households, $employ\_num_i$ for number of employed members in the household, age_i for age of householder, $marrige_i$ for Single or married households, $size_i$ for household members, $perarea_i$ for level residential area of the household (based on square meter) and exp_i for showing household spending. All of these variables indicate socioeconomic status which can be effective on incidence of health costs of families.

Another important note which should be investigated here is marginal effect. Mean that the effect of changing variable X, holding other variables constant, on the

probability of incidence of each dependant variable's alternatives should be measured. Thus, in this model, final effects should be surveyed and estimated.

RESULTS AND DISCUSSION

In the present article, factors affecting expenditures within 2007 to 2008 and 2009 has been estimated according to Logit method. To obtain factors affecting expenditures, they have been modeled and calculated in a 2 step model. In the first estimation which is named first correction, ʻsex ʻjob_h ʻeducation ʻemploy_num ʻage ʻmarriage ʻsize ʻperarea ʻexp variables have been estimated by dependant variable of health expenditures. In the second correction, education and age of household have been omitted due to meaningless. Since in Logit methods, explanatory variables' sign and type of effecting can be obtained from the first board of estimation results, in the second step, the effect of each variable on expenditures has been estimated regarding to the final effects test. It is notable that tensile analysis of these variables has been highlighted in final effects method. As it can be seen in Table 1, except education and age of household, all other variables was significant by 5%.

Marginal effects of the model are listed in Table 2. Results show that the household size, level of residential households, head of household gender and employment, have greatest impact on their catastrophic health expenditures.

The effect of each of the independent variables (socioeconomic characteristics of households) on increase or decrease of probability to exposure in catastrophic expenditures region can be explained as follows:

Location: Households living in urban areas affect on expenditures with a negative coefficient and reduce its chances of dealing with it. The factor is -0.19 at first correction and -1.97 at second correction in terms of size. The greatest effect on the explanatory variables is on expenditures.

Householder Education: Although possibility of dealing with health expenditures is less for educated households, this coefficient is not significant statistically.

Householder Age: Being elder or young of the householder doesn't have significant effect on possibility of dealing with health expenditures, although its value is positive.

Householder Employment: Unemployment of householder increases the possibility of dealing with health expenditures at the first correction by 3.17%. at the second correction this index is 3.15. Numerical value of this coefficient (after urban and rural variables) is high. So, employment of householder is important for the health of households.

Employed Members of Household: The more is employed members of a household, possibility of dealing with health expenditures increases by 2.56% at the first correction. Effectiveness of this variable at the second correction is 2.52%. Numerical value of this coefficient (after urban and rural variables) is higher than other sample coefficients.

Per Capita Residential Area of the Household: The less is Per capita residential area of a household, possibility of dealing with health expenditures increases. For example, if Per capita residential area of the household increases to 100 m^2, possibility of dealing with health expenditures reduces by -4.42 at the first correction. Effectiveness of this variable at the second correction is -4.45%.

Modified Dimension of Household: The more is Modified dimension of household, possibility of dealing with health expenditures increases. By the increase of each person to the family members, possibility of dealing with health expenditures increases by 5.9% at the first correction. Effectiveness of this variable at the second correction is 5.72%.

Per Capita Modified Cost: The more is Per capita modified cost, possibility of dealing with health expenditures increases. By the increase of costs, the possibility of dealing with health expenditures increases by 2.52% at the first correction. Effectiveness of this variable at the second correction is 2.52%.

Single Householder: Being single increases the possibility of dealing with health expenditures by 0.3% at the first correction. Effectiveness of this variable at the second correction is 2.59%.

Sex of Householder: Female householder increases the possibility of dealing with health expenditures. The possibility of dealing with health expenditures increases by 3.87% at the first correction. Effectiveness of this variable at the second correction is 4.05%.

Estimation of model according to Logit method and also final effects are presented in Table 3 and 4.

Table 1: Estimates based on panel logit model (first order correction)

Cata	Coef.	Std. Err.	z	P>z	[95% Conf.
r_u	-3.61	0.062	-57.39	0	-3.736
sex	0.30	0.057	5.2	0	0.413
job_h	0.300	0.060	4.92	0	0.419
education	-0.066	0.053	-1.24	0.214	-0.171
employ_num	0.159	0.028	5.62	0	0.103
age	0.001	0.001	1.36	0.173	0.004
marrige	0.031	0.001	-25.69	0	0.033
size	0.104	0.012	8.53	0	0.0807
perarea	-0.004	0.000	-6.78	0	-0.002
exp	7.62	1.02	75.03	0	7.42
_cons	-3.771	0.152	-24.68	0	-4.07

Table 2: Effects of the model (first order correction)

Variable	ey/ex	Std. Err.	z	P>z	[95%
r_u	-0. 199	0	-3.71	0	-3
sex	3.87	0	2.96	0.003	6.40
job_h	3.17	0	3.03	0.002	5.20
Educat_n	-1.07	0	-1.18	0.236	-2.80
Employ_m	2.56	0	3.05	0.002	9.20
age	1.12	0	1.27	0.203	2.80
marrige	2.98	0	3.69	0	4.60
size	5.90	0	3.26	0.001	2.40
perarea	-4.42	0	-3.12	0.002	-1.60
exp	0. 252	0	3.74	0	1.2

Table 3: Estimates based on a panel logit model (second-order correction)

Cata	Coef.	Std. Err.	z	P>z	[95% Conf.
r_u	-3.60	0.062	-57.49	0	-3.73
sex	3.16	0.056	5.62	0	4.27
job_h	3.00	0.060	4.93	0	4.20
employ_num	1.58	0.028	5.58	0	1.03
marrige	3.14	0.001	25.72	0	3.38
size	1.03	0.012	8.44	0	7.88
perarea	-4.15	-0.0005	6.93	0	-2.97
exp	7.63	1.01	75.31	0	7.43
_cons	-3.81	0.149	-25.52	0	-4.104

Table 4: Effects of the model (second-order correction)

Variable	ey/ex	Std. Err.	z	P>z	[95%
r_u	-1.97	0	-7.13	0	-2.50
sex	4.05	0	4.33	0	5.90
job_h	3.15	0	4.18	0	4.60
Employ_m	2.52	0	4.36	0	1.40
marriage	2.95	0	6.94	0	3.80
size	5.72	0	5.18	0	3.60
perarea	-4.45	0	-4.73	0	-2.60
exp	2.50	0	7.22	0	1.80

The greatest impacts on costs in terms of absolute value are by the variables Size, perarea, sex, job_h, marrige, Employ_m, exp, r_u.

CONCLUSION

Most of differences in health of individuals depend on their biological characteristics. Difference in the health of elder and youth, male and female, etc is influenced by their biological nature. For example, older people are exposed more to the diseases; but none of these differences are considered as unfair differences. Most of differences in the health level of the people are determined between different social groups (cultural, political, economic community and social classes) which are called inequality and so this inequality can be considered unfair for the health induced by socioeconomic factors. Socioeconomic inequalities of health are defined as a difference of incidence of health problems between populations in higher or lower socioeconomic positions.

Whatever variables indicating socioeconomic position of people in a society like rural or urban residence, employment or unemployment of householder, householder education, employed member of household, householder age, single or married householder, dimension of household, level of residence under household and expenditures are effective on costs of families, unfairness of financing sector and payment system will be evident. According to the results of this article, location, employment or unemployment of householder, employed member of household, single or married householder, modified dimension of household, level of residence under household and per capita modified expenditures of household, sex of householder are effective variables on expenditures during 2007 to 2009, but householder age and education are not effective on these expenditures.

Two points can be received from these results; one, most of variables indicating socioeconomic position is effective on expenditures. This result shows high out of pocket payments of Iranian families for health payments, this indicates unfairness of health sector. On the other side, comparison of present study and previous study shows that householder age and education were not effective on these expenditures in recent years. And it shows that other variables are determinants of expenditures and income of households. It can be a concern that whether effort and knowledge of householders has been replaced by other variables? It requires further studies in this field.

Political recommendation of this study is that the presence of high out of pocket expenditures in Iranian families leads to the incidence of unfairness and consequently inefficiency of financing system of health

sector in Iran, which cause health challenges for people. So, existence and reform of complete insurance system and public health insurance system can reduce payment costs of families and prevent from incidence of expenditures which is an important index to show unfairness of health system.

Regarding to the fact that, dimension of household, level of residence under household, sex of householder, employment or unemployment of householder have the most impacts on the incidence of expenditures, there are special challenges in the way of government. First, the government should follow low population policy or provide appropriate insurance plan to prevent the incidence of expenditures, if it thinks about increase of population. Second, sex differences on the incidence of such expenditures are alarms for sex unfairness in society that can create socioeconomic problems. Employment planning and solving residence problem of society should be placed in high priority.

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