Original Article

The Inequity of Expenditure Ratios on Health and Food among Different Deciles of Iranian Households

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Abstract

Background and purpose: Utilization of health care services and food influence the health status. The food and health care expenditure ratios determine the importance level of them in household's consumption expenditures. We aimed to investigate the Iranian rural and urban food and health expenditure ratios inequality during 1998 to 2012.

Materials and Methods: This is a descriptive longitudinal study, which was conducted based on Iranian Statistics Centre and Central Bank annual surveys. Firstly we calculated the households food and health expenditure ratios. Then we calculated the Gini coefficients and Atkinson index by using STATA version 12.

Results: The mean of rural households food and health expenditure ratios were 0.53 and 0.37 respectively. Also these were 0.53 and 0.22 for urban households. All above inequality levels are based on Gini coefficients.

Conclusion: There is a high level of inequality between Iranian rural and urban income deciles for health expenditure ratio, but the food expenditure ratio inequality were less and lower.

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1. *Introduction*

Equity is an essential aspect of human life and it is more considerable if the fundamental concepts of individual and households are investigated (1). The education and health are two fundamental concepts in any individual and households life cycles and the inequality about them has been made a challenging issue for policy makers. Reviewing the literatures present that there are at least three aspects about the health inequality. O'Donnell and et al provided four main kinds of inequality about health services:

1- Health outcomes

2- Health care utilization

3- Subsidies received through the use of services

4- Payments people make for health care (directly through out-of-pocket payments as well as indirectly through insurance premiums, social insurance contributions, and taxes) (2).

Regarding to this, each typically inequality in health services has related concepts, quantitative and measuring methods and tools and policy making issues. But the fourth category that refer to payments people make for health care, implies on the distribution of health care expenditures that paid by individual and households to utilizing the health care services. The health care payments shape the health care financing methods in any health systems including:

Out-of-Pocket payments, Social and Private health insurance and tax based funds (3).

The health systems thinkers say the health care financing levels and distribution are very important for any health systems. In fact we should consider the both health expenditures quantity and distribution (equity) together (4). In addition, today there is no any doubt that Out-of-Pocket payment is not an effective and fair health financing method. Nevertheless we observe Out-of-Pocket yet and then the equity consequences related to it is a concerning challenges (5). The main part of this financing mechanism paid through individual and households' income and the share of this determines the distribution of health care and services distribution between different socio- economic groups.   There are many studies which concluded that the poor- or low income group- paid a more share (ratio) of their income to health care than rich –high income group-. The ratio (share) of individual or households that paid to health care services implies the importance degree of these services in that individual or households consumption basket (6). The main problem for investigating the distribution of individual and households health care expenditures ratio related to estimating and then categorizing of their income.

Therefore most studies substituted the individual and households consumption expenditure instead of income. This is true because:

1. Consumption expenditures in general and consumption expenditures for health in particular are more realistic and objective indicators to reflect ability (capacity) of individuals and households to pay.

2. Calculating or estimating expenditures is easier than calculating income, and this is especially true for developing countries, which have largely informal economy and people are less likely to declare their real income levels (7).

Furthermore, we should note that the health in addition to income ratio (share) on health services depend on other factors that food security is one of them. Food security refers to availability and accessibility to food and nutrition in an equal way to promote the individual and households health status. The studies present a significant relationship between the ratio (share) of households' income paid to food and their health status (8 and 9). Regarding to these, we aimed to investigate the inequality of Iranian rural and urban households' ratio (share) of income paid to food and health services between 1998 to 2012.

2. Materials and Methods

This is a descriptive retrospective study which has applicable results to Iranian health policy makers. All of Iranian rural and urban households shaped the population. The sample has been selected according to Iranian Statistics Centre that conducted a national survey on about 375432 rural and urban households on average during the 1998 to 2012. Iranian Statistics Centre designs a three stages randomized clustering sampling and completes a questionnaire through interviewing with household's head. This questionnaire including all essential data about the demographic, socio-economic situation over the recent year (10). There are many data in each Iranian Statistics Centre annual surveys, so we only extracted our required data through the Internet searching the Iranian Statistics Centre web site, these data collected for variables: total consumption expenditures of households, food expenditures of households, non-food expenditures of households, health expenditures of households, for each income deciles. The data were analyzed in two stages: Firstly, we calculated the ratio (share) of food and health expenditures from rural and urban household's income. This calculation has been done for each income deciles. Following formula used to this calculation:

$$\text{Household's Food \& Health Ration} = \frac{\text{The Level of Payments for Food \& Health Expenditures over the Recent Year}}{\text{The Income Level of each Deciles over Recent Year}}$$

Following this, we measured the inequality level of rural and urban households food and health expenditures ratios among income deciles. We used the Gini coefficient and Atkinson index as the food and health expenditures inequality measurer because of their popularity in inequality literature. Also we presented a brief description about these measurers below:

Gini index: The most common index to measure inequality in the literature. This index is derived from the Lorenz curve. Lorenz curve has two orthogonal axes. The horizontal axis indicates cumulative frequency of population and the vertical axis shows cumulative frequency of income (wealth, consumption expenditures, etc.). A line passes from origin of the coordinate with a 45 degrees angle relative to the axes, which is called perfect equality line. If any distribution of income (wealth or consumption expenditures) places on this line, it is quite fair andGini coefficient is zero, however, if there is a gap between its distribution and this line, the inequality will increase. In such a case, the inequality is equivalent to the area between the perfect equality line and the Lorenz curve, which is distanced from this line. The maximum value of the Gini coefficient is equal to one. The general shape of the Lorenz curve and also the way of calculating Gini coefficient is given below:
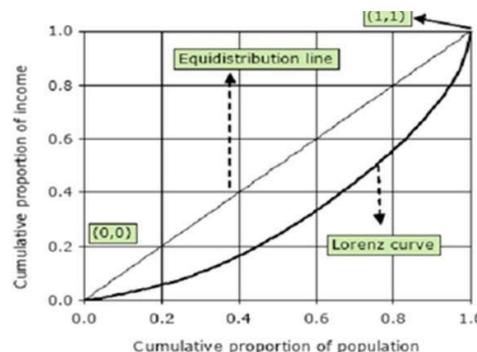
Figure 1. A Schematic Lorenz curve

In its simplest form, the Gini coefficient is calculated using the following formula:

$$Gini = 2\frac{Cov(f_i y_i)}{\frac{1}{N}\Sigma_{i=1}^{N} y_i}$$

Where yi is cumulative proportion of the distributing variable (here, food and health expenditures) in the ith household; Xi is cumulative proportion of the variable in the ith household and n is the total number of households (2).

Atkinson Index: This index is based on social welfare function and is a measure of inequality related to social classes. The Atkinson index is defined as:

$$A_\varepsilon(y_1,\ldots,y_N) = \begin{cases} 1 - \frac{1}{\mu}\left(\frac{1}{N}\sum_{i=1}^{N} y_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)} & \text{for } \varepsilon \in [0,1) \cup (1,+\infty) \\ 1 - \frac{1}{\mu}\left(\prod_{i=1}^{N} y_i\right)^{1/N} & \text{for } \varepsilon = 1, \end{cases}$$

In above formula, y_i is person's or household's income (i= 1,2,…,N), also the μ is the mean of income levels.

Also the ε indicates the inequality aversion level amongst persons and households, this parameter take several values in dependency of social contexts. Usually economic researchers the 0, 25, 0.5 and 0.75 as the values. In most developing countries this value is 0.5, so in this study we considered the 0.5 as inequality aversion parameter (11).

3. Results

We presented the results for rural and urban households' food and health services expenditures ratios inequality in 2 tables and 8 Lorenz curves. Firstly we presented the urban households health and food expenditures ratios inequality. Then we illustrated the rural and urban food and health expenditure ratios inequality through the Lorenz curves for 1998 and 2012.

Table1. The inequality levels for food and health expenditures ratios among rural and urban households

Inequality Level		Gini Coefficients for both Expenditures		Atkinson Index (Parameter Epsilon: 0.5) for both Expenditures	
Years		eExpenditures on Food	eExpenditures on Health	eExpenditures on Food	eExpenditures on Health
1998	Urban	0.13(0.01-0.35)	0.54(0.36- 0.71)	0.065(0.013-0.12)	0.23(0.08-0.39)
	Rural	0.35(0.2-0.51)	0.56(0.36-0.76)	0.1(0.02-0.2)	0.23(0.08-0.4)
1999	Urban	0.15(0.01-0.31)	0.62(0.46- 0.87)	0.08(0.02-0.14)	0.32(0.14-0.5)
	Rural	0.38(0.22-0.54)	0.5(0.32-0.68)	0.11(0.02-0.21)	0.32(0.13-0.51)
2000	Urban	0.31(0.02-0.73)	0.62(0.46-0.78)	0.06(0.01-0.12)	0.32(0.14- 0.5)
	Rural	0.37(0.21-0.54)	0.64(0.46-0.81)	0.11(0.02-0.2)	0.32(0.14-0.5)
2001	Urban	0.15(0.01-0.35)	0.59(0.44-0.75)	0.08(0.02-0.14)	0.29(0.12-0.46)
	Rural	0.37(0.2-0.53)	0.56(0.4-0.74)	0.11(0.02-0.2)	0.3(0.12-0.46)
2002	Urban	0.14(0.01-0.34)	0.56(0.39-0.74)	0.07(0.02-0.11)	0.26(0.09-0.43)
	Rural	0.35(0.2-0.5)	0.51(0.025-0.63)	0.1(0.02-0.18)	0.26(0.09-0.43)
2003	Urban	0.15(0.01-0.4)	0.49(0.31-0.68)	0.07(0.02-0.12)	0.2(0.05-0.35)
	Rural	0.36(0.21-0.52)	0.53(0.34-0.72)	0.1(0.02-0.2)	0.2(0.05-0.35)
2004	Urban	0.16(0.01-0.55)	0.52(0.36-0.7)	0.085(0.03-0.14)	0.22(0.07-0.37)
	Rural	0.35(0.21-0.5)	0.52(0.31-0.73)	0.11(0.02-0.18)	0.22(0.07-0.37)
2005	Urban	0.14(0.01-0.48)	0.54(0.37-0.71)	0.07(0.02-0.11)	0.24(0.08-0.4)
	Rural	0.31(0.19-0.43)	0.56(0.39-0.73)	0.08(0.02-0.14)	0.24(0.08-0.4)
2006	Urban	0.25(0.05-0.41)	0.5(0.31-0.68)	0.2(0.05-0.35)	0.11(0.03-0.19)
	Rural	0.33(0.2-0.46)	0.53(0.36-0.7)	0.11(0.03-0.2)	0.2(0.05-0.35)
2007	Urban	0.26(0.04-0.45)	0.51(0.29-0.72)	0.11(0.03-0.2)	0.22(0.045-0.39)
	Rural	0.38(0.24-0.53)	0.54(0.36-0.72)	0.11(0.031-0.2)	0.22(0.045-0.4)
2008	Urban	0.25(0.04-0.43)	0.5(0.3-0.7)	0.1(0.03-0.2)	0.21(0.05-0.37)
	Rural	0.38(0.24-0.52)	0.51(0.32-0.7)	0.13(0.041-0.23)	0.21(0.05-0.37)
2009	Urban	0.28(0.04-0.51)	0.48(0.32-0.65)	0.12(0.04-0.25)	0.22(0.05-0.39)
	Rural	0.41(0.27-0.56)	0.5(0.3-0.65)	0.12(0.04-0.25)	0.22(0.04-0.4)
2010	Urban	0.3(0.06-0.54)	0.49(0.3-0.68)	0.13(0.04-0.26)	0.23(0.055-0.41)
	Rural	0.42(0.27-0.59)	0.52(0.34-0.72)	0.15(0.03-0.27)	0.23(0.05-0.45)
2011	Urban	0.3(0.05-0.76)	0.5(0.32-0.71)	0.14(0.04-0.27)	0.25(0.06-0.45)
	Rural	0.42(0.26-0.61)	0.51(0.32-0.68)	0.14(0.03-0.3)	0.24(0.04-0.5)
2012	Urban	0.31(0.05-0.8)	0.51(0.35-0.75)	0.15(0.04-0.28)	0.26(0.06-0.48)
	Rural	0.25(0.04-0.53)	0.53(0.3-0.73)	0.43(0.0.27-0.63)	0.15(0.02-0.32)
Mean	Urban	0.22	0.53	0.096	0.24
	Rural	0.25	0.53	0.37	0.11

The table (1) presents a notable inequality in urban food and health expenditure ratios inequality. Also this is true about the inequality in food and health expenditure ratios for Iranian rural households. There is no any ordered decreasing or increasing pattern in the rural or urban food and health expenditures ratios inequality among deciles over the past 16 years. In fact we observe the inequality among income deciles in some years has decreased and in other years has increased. Also in comparing the food and health expenditures ratios inequality between rural and urban regions, we observe that the health expenditures ratios inequality in rural areas is more than urban areas based on Gini coefficients but based on Atkinson Index there is no any substantial different between mentioned areas. In the other hand the food expenditures ratios inequality is more in rural areas than urban areas based on both Gini and Atkinson Indices. Following the illustration form for Iranian rural and urban household's food and health expenditure ratios for 1998 and 2012 have been presented. First, we presented the rural and urban food expenditures ratios inequality for both rural and urban households.
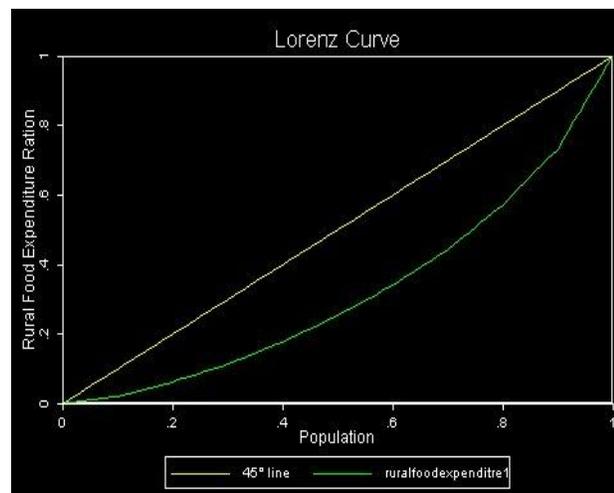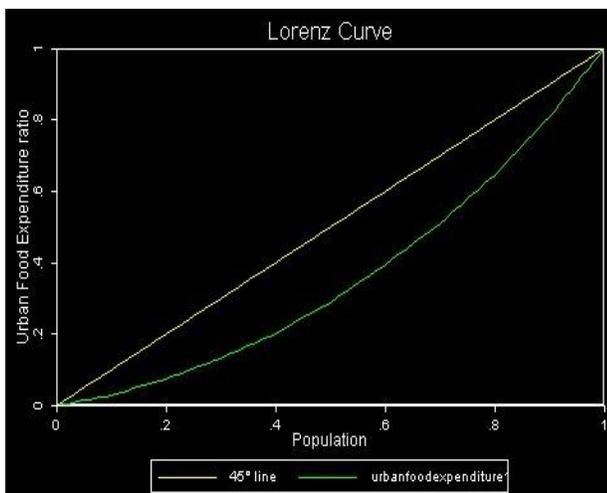
Fig1. The urban food expenditure's Lorenz Curve (1998)

Fig2. The rural food expenditure's Lorenz Curve (1998)
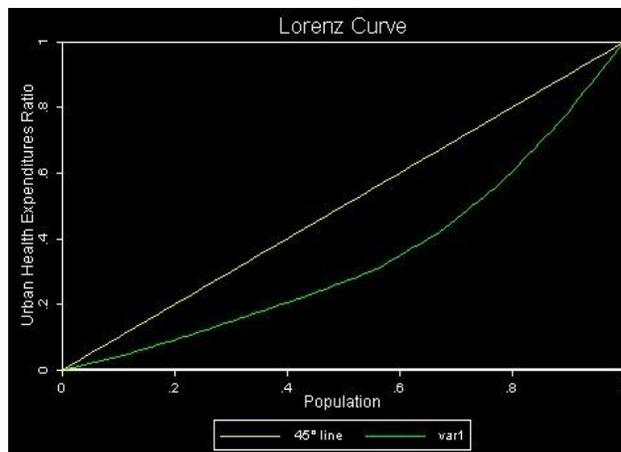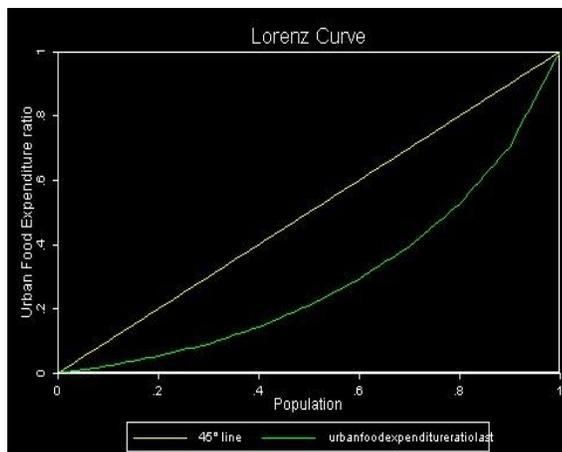
Fig 3. The urban food expenditure's Lorenz Curve (2012)   **Fig4.** The rural food expenditure's Lorenz Curve (2012)

In figure 1 and 2, we observe rural food expenditures ratios inequality is more than urban health expenditure ratios inequality at the beginning of study, but at the end of study this became reverse. After this, we presented the Lorenz curves for rural and urban health expenditures ratios for the beginning and the end of period study:
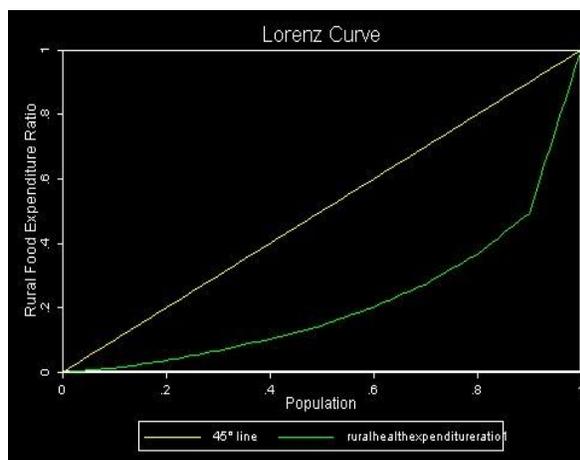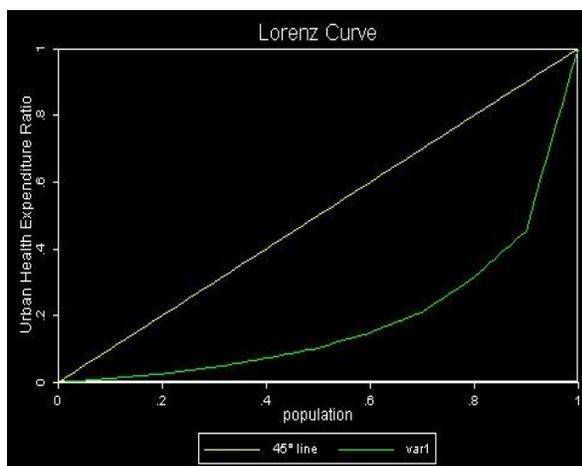
Fig 5. The urban health expenditure's Lorenz Curve (1998)   **Fig 6.** The rural health expenditure's Lorenz Curve (1998)
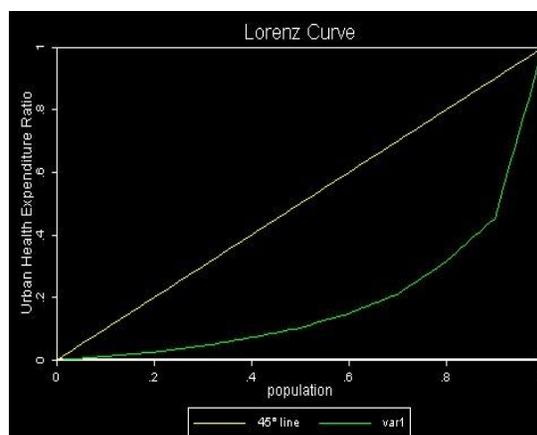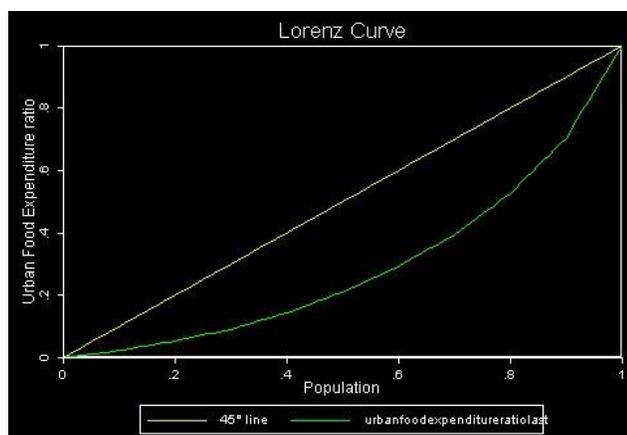
Fig 7. The urban health expenditure's Lorenz Curve (2012) **Fig 8.** The rural health expenditure's Lorenz Curve (2012)

The figures 5 to 8 imply considerable inequality expenditures ratios for both rural and urban households' deciles. But at the beginning of the study the urban health expenditures ratios inequality is more than urban areas, and at the end of the study this is reverse.

4. Discussion

The overall health expenditures ratios inequality is relative high for both rural and urban income deciles over the past 16 years. The mean of Gini coefficient is 0.53 for both of them. But this is less about urban and rural households' food expenditures ratios inequality and the mean of Gini coefficients are 0.22 and 0.25 respectively. Although we reach to these results but we should note that, food is a substantial item in Iranian households and the rich and poor considered this good as a vital and important, although it seems that Iranian poor households spent more ratio to this part of expenditure more than the ratio which has been spent by rich households. There are several studies about the food and health expenditures inequality among Iranian rural and urban households and

they concluded relatively similar results. A study from 1989 to 2007 reported inequality in healthcare for households of Tehran to be significant and with a range from 0.6 to 0.8 based on Gini coefficient (12). Also a study on food expenditure inequality for rural and urban Kerman province in Iran presented the average of Gini coefficients 0.37 and 0.36 respectively, over the 1989 to 2005 (13). Finally, the results of another study indicated that inequality of health expenditure for Iranian rural households based on Gini coefficient from 1995 to 2005 was about 0.4 in average and based on concentration index it's about 0.5. These indices have been calculated for urban areas about 0.38 and 0.5 respectively based on Gini coefficient and concentration index respectively (14). Exception of food expenditures ratio in our study which we found a relatively lower Gini coefficients, the results for health ratio inequality the results are similar and presented a high levels of inequality. We investigated the inequality between health and food expenditures ratios and not the health and food expenditures, and this may cause of our study different with other previous studies.

In international scale there are several studies about health and food inequality, we presented their results below:

In a Chinese province the results of a research present the low income households in both rural and urban regions have undertaken a larger share of the health care financing burden and the Kakwani index for general taxation was negative, for public health insurance there was a little positive figure (0.07) in urban and negative in rural regions, but the O.O.P was negative and regressive for both of them (15). In Tanzania a research reported 0.34 for concentration index and -0.08 for Kakwani index, also about national health insurance the results present -0.07 and -0.49 for concentration and Kakwaniindeicis respectively which imply a regressive burden on poor (16). Also in Hungary a research presents highly regressive out-of-pocket payments on health care with a kakwani index of -0.22 (17). Health is a substantial need for any person and household, several factors determine the health status. Food and health services accessibility are influential factors on health. Regarding to this, the food and health expenditures ratio from income levels present the importance of these goods and services amongst any person or household. It appears that there is substantial inequality in health care expenditure ratio between Iranian income deciles and this is less about food expenditure ratio inequality. Attending to the Iranian household's welfare and designing and implementing effective protective financial schemes are very important in Iran. Regarding the period of this study, the information about South, Razavi, and North Khorasan provinces has been considered as one province, which is Khorasan. On the other hand, data associated with some provinces in some years was not available, so the researchers have estimated probable data according to time trend of variables.

Acknowledgments

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