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Decomposition of Health Inequality Determinants in Shiraz, South-west Iran

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ABSTRACT

Background: Despite the enhancement in health outcomes worldwide, health inequity and inequality is one of the most relevant topics both for health policy and public health. This research was designed to decompose the health inequality of people living in Shiraz, south-west Iran.

Methods: Data were obtained from a multistage-sample survey conducted in Shiraz from April to May 2012, to find determinants of health related quality of life (HRQoL). General health (GH) and mental health (MH) were used as health status. As a measure of socioeconomic inequality, a concentration index of GH and MH was used and decomposed into its determinants.

Results: The overall concentration indices of MH and GH in Shiraz were 0.023 (95% CI: 0.015, 0.031) and 0.016 (95% CI: 0.009, 0.022), respectively. Decomposition of the concentration indices indicated that income made the largest contribution (39.92% for GH and 39.82% for MH) to income-related health inequality. Education (about 25% for GH and 34% for MH), insurance (about 14% for GH and 11% for MH), and occupation (about 12% for GH and 11% for MH) also proved important contributors to the health inequality in Shiraz.

Conclusions: There exist MH and GH inequalities in Shiraz. Apart from insurance, most of the health inequalities in Shiraz can be explained through factors beyond the health sector. Hence, implementing redistributive policies and education expansion programs as well as providing an insurance scheme and secure career conditions could decrease these unethical health inequalities.

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Introduction

Despite the global enhancement in health facilities and outcomes, health inequity and inequality is one of the most relevant topics both for health policy and public health[1-3]. Although some of these inequalities which result from demographic characteristics such as age, gender, and genes might seem unavoidable, there seems to be broad agreement that many of them are associated with socioeconomic features potentially amenable to policy interventions and could be considered as avoidable[1,4-6].

Measurement of inequalities between disadvantaged and better-off groups after initiative works of Kakwani et al.[7] has been a popular topic among health economic researchers. Recently, the explanation of inequity and inequality through decomposition methods has been more practical[8].

Although the health system of Iran has succeeded in improving health outcomes[9], it seems that the country suffers from some disparities among different groups[2,10]. Hence, special attention has been paid to health equity within the fourth 5-year economic plan in Iran. Accordingly, government of Iran should devise a strategic plan to decrease the number of poor people and to reduce the social and economic disparities in the country[4].

The present study was designed to decomposition the health inequality of people living in Shiraz, a well-known metropolitan and the capital of Fars Province, south-west of Iran. Because of the vast socioeconomic diversity that may exist among its population, investigation of health inequality in Shiraz is of special interest. This study focused on income-related inequality in general health (GH) and mental health (MH) and quantified the contributions of the potential determinants of these health outcomes to this inequality. Hence, our main purpose in this study was to measure and explain health inequality in Shiraz and bring some evidence for local and national authorities. By quantifying the contribution of each determinant to potential health

inequality, we hope to determine more susceptible groups as the target ones for effective allocation of resources to reduce this inequality.

Methods

Source of data and study setting

In this cross-sectional household survey, data were obtained from a multistage-sample survey, conducted in Shiraz from April to May 2012 to find determinants of HRQoL. The target population included all adults aged 18 yr or above who were dwelling in Shiraz.

The sample size using formula was determined at 784. Where d=0.14, σ=2 and 95% confidence interval were considered. Since the cluster sampling was used in the second step of the sampling, the sample size was determined 2*784=1568. Assuming that about 2.5% of the non-response or incomplete responses have final sample was increased to 1610.

In this survey, sampling was performed in four stages. First, Shiraz's 9 districts were defined as strata and the sample size was determined proportionate to each stratum's population. Through random sampling in the next stage, each of the areas was divided into ten residential blocks. Afterwards, the households were selected by the systematic sampling and finally the subjects were picked out through Kish method[11].

In this study, we used the 36-item Short Form Health Survey (SF-36), which is frequently used in health surveys to monitor health outcome as HRQoL, and health inequalities researches [6,12]. SF-36 will give a broader and more detailed image of health differences, rather than the simple measure of Self Rated Health (SRH). SRH is a single measure of health status measured on a likert scale and there are methodological problems with using an ordinal health outcome in concentration indices[13]. This instrument has been translated and adapted for use in Persian[14]. Two scales of SF-36 were used in this paper: GH and MH. A single general health score was summarized and then transformed to a 0–100 scale using a transformation formula. The MH score combines four domains: Vitality, Social functioning, Role Emotional and Mental Health. This is also known as the Mental Component Score and ranges from 0 to 100[12]. The advantage of using these scales in the SF-36, rather than one-dimensional measures of health status, is that they measure different aspects of health by using multiple domains and lead to greater variations of health among different groups[12].

The data were collected on age (18-40, 41-60, >61), sex, education status (Primary and under primary, Secondary and High School, University), marital status (married, single, widow or divorced), medical insurance (Are you have any insurance?), physical activity (Are you exercise three times a week?), smoking (Are you smoking now?) and monthly income (How much is your monthly income?) by a check list. Monthly income, as the economic status, has some abnormality in its distribution; hence, the log transformation of it used in the analysis.

Statistical Analysis

According to Wagstaff et.al.[15] we assume that we have a linear regression model linking our health variables of interest y_i (GH and MH) to a set of k explanatory variables. This regression equation is:

$$y_i = \alpha + \sum_k \beta_k X_k + \varepsilon_i \qquad (1)$$

where (i) means the interested health outcomes, X_k is the explanatory variables, and ε is the error term. After finding the regression coefficients, the concentration index (C) for y can be written as follows:

$$C_i = \sum_k \left(\frac{\beta_k \bar{X}_k}{\mu}\right) C_k + \frac{GC_\varepsilon}{\mu} \qquad (2)$$

where β_k is the regression coefficient, $\bar{X}_k$ is the mean of the explanatory variable k, μ is the mean of the health variable, and C_k is the C of the variable k. The second component of the Eq. (2) Formula, $\frac{GC_\varepsilon}{\mu}$, is the generalized C for the disturbance term. This residual reflects the income-related inequality in health that is not explained by systematic variation in the regressors and, thus, cannot be calculated. Hence, overall inequality in health has an explained as well as an unexplained component. Under this situation, C reduces to the first component of Eq. (2) and can be estimated using the following equation:

$$C = \sum_k \left(\frac{\beta_k \bar{X}_k}{\mu}\right) C_k \qquad (3)$$

In Eq. (3), the value of $E = \frac{\beta_k \bar{X}_k}{\mu}$ is defined as the elasticity of the determinant k. Also, C_k in this equation can be calculated by using the covariance formula C[15]:

$$C_k = \frac{2cov(x_k, r)}{\bar{X}_k} \qquad (4)$$

in which $cov(x_k, r)$ is the covariance between the explanatory variables and the fractional rank of the variable x_k.

Therefore, for decomposition analysis, the mean and the coefficient of the k independent variables were estimated through regression model, and the elasticity was obtained. Furthermore, C_k was calculated for any related variable by using Eq. (4). Next, the contribution of each regressor to C was computed by multiplying the elasticity by C_k. Finally, the relative contribution of each determinant to the total value of C was obtained by dividing the contribution of C into the total value of C for each dependent variable. All analyses were performed in Stata software version 11/SE.

Results

The response rate for this study was 0.97%. Table 1 shows descriptive statistics for the studied subjects. The average age of the respondents was 36.88 (SD=15.41), ranging from 18 to 88. Among all subjects who filled the questionnaire, 852 were men, with a mean age of 36.92 (SD=15.63) and 716 were women with a mean age of 41.9 (SD=15.15). Most of the respondents were married (n=924), employed (n=571), and belonged to the age group of 18-40 years (n=987); the majority of studied subjects were under health insurance coverage (n=1354), >12 years of education (n=701), physically inactive (n=1033) and nonsmoker (n=1324). Furthermore, since the values of GH and MH

ranged from 0 to 100, the results show that the subjects not only were reported to be higher levels of health, but they also showed higher levels of mental health compared to general health. Although the distributions of MH and GH were slightly skewed negatively, they were all found to be satisfactory.

Table 2 presents the results of the ordinary least square (OLS) models for GH and MH. Compared to men, women reported bad GH in terms of the GH equations. Aging was significantly accompanied by bad GH. Regarding occupation status, housewives and unemployed people showed lower GH. The log of personal income in this estimation showed a positive relationship with GH. In terms of education status, less educated samples reported reduced GH. Moreover, smoking, lack of medical insurance and physical inactivity had statistically significant negative associations with GH.

The OLS regression for MH showed a similar pattern to GH, but the R-squared for the MH regressions were smaller. In general, log of personal income showed a positive effect on GH, while reduced MH is associated with unemployment, being a woman, oldster, physical inactivity, smoking, lower education and lack of medical insurance.

Table 3 shows the concentration indices for studied health measures. They are all significantly larger than zero. As Table 3 shows, GH inequality was greater than MH inequality.

Table 1: Description of sample characteristics

Variables	N (%)	Mean	SD
General health (GH)	-	66.57	18.54
Mental health (MH)	-	71.00	15.92
Log of personal income (R)	-	13.31	0.53
Age (yr)			
18-40	987 (62.9)	0.63	0.48
41-60	456 (29.8)	0.29	0.45
>61	125 (7.9)	0.08	0.27
Gender			
Male	852 (54.3)	0.54	0.49
Female	716 (45.6)	0.46	0.49
Marital status			
Married	924 (58.9)	0.59	0.49
Single	517 (32.9)	0.33	0.47
Widow/Divorce	127 (8.1)	0.08	0.27
Occupation status			
Employed	571 (36.4)	0.36	0.48
Housewife	393 (25.1)	0.25	0.43
Student	362 (23.1)	0.23	0.42
Unemployed	242 (15.4)	0.16	0.36
Education Status			
Primary school or illiterate	197 (12.5)	0.12	0.33
Secondary or High School	670 (42.7)	0.43	0.49
Academic	701 (44.7)	0.45	0.49
Physical exercise			
Yes	535 (34.1)	0.34	0.47
No	1033 (65.8)	0.66	0.47
Smoking			
Yes	223 (14.2)	0.14	0.34
No	1324 (85.7)	0.86	0.47
Insurance			
Yes	1354 (86.3)	0.86	0.35
No	214 (13.6)	0.14	0.34

Table 2: Results of ordinary least square regression

	General Health			Mental Health		
Variables	Coefficient	SE	*P* value	Coefficient	SE	*P* value
Sex						
Man	1.00			1.00		
Woman	-2.39	1.16	0.040	-3.57	0.99	0.001
Age (yr)						
18-40	1.00			1.00		
41-60	-4.69	1.20	0.001	-4.64	1.06	0.001
>61	-5.01	1.89	0.008	-6.73	1.80	0.001
Marital status						
Married	1.00			1.00		
Single	-0.74	1.47	0.087	-0.54	1.51	0.335
Widow or divorced	2.3	1.36	0.316	-1.09	1.13	0.720
Educational status						
Academic	1.00			1.00		
Primary school or illiterate	-8.12	1.73	0.001	-8.52	1.56	0.001
Secondary or high school	-1.96	1.01	0.053	-2.11	0.89	0.018
Log of personal income	2.23	0.87	0.011	1.64	0.75	0.030
Occupational status						
Employed	1.00			1.00		
Homemaker	-3.73	1.60	0.020	-2.23	1.38	0.106
Student	-.57	1.42	0.686	-0.75	1.22	0.535
Unemployed	-6.04	1.44	0.001	-3.87	1.33	0.003
Medical insurance						
Yes	1.00			1.00		
No	-4.74	1.24	0.001	-2.77	1.15	0.016
Physical activity						
Yes	1.00			1.00		
No	-3.06	1.00	0.002	-1.66	0.84	0.050
Smoking habit						
Nonsmoker	1.00			1.00		
Smoker	-2.80	1.36	0.040	-4.53	1.18	0.001
Constant	45.55	12.05		54.81	10.19	
R^2	0.15			0.14		
F	24.78			20.57		
P>F	0.00			0.00		

Table 3: Concentration index

Health measures	C	Robust SE	95% CI	*P* value
General Health	0.023	0.004	0.015, 0.031	0.001
Mental Health	0.016	0.003	0.009, 0.022	0.001

Tables 4 and 5 show the decomposition results for GH and MH. The findings of this study represent a same set of contributors to GH and MH. First of all, income itself accounts for a remarkable contribution both for GH and MH (around 40%). Besides education and lack of medical insurance are respectively the second and third contributors of income-related inequality both for GH and MH. However, there are differences in contribution percentages of these factors to GH and MH inequality; while education contributed around 25% to GH inequality, this contribution for MH was 34%. This difference was also seen with regard to medical insurance; lack of medical insurance mostly induced GH disparities among the subjects. Accordingly, as depicted in Figure 1, income, education, insurance and occupation could be accounted as major determinants of health inequality in Shiraz.

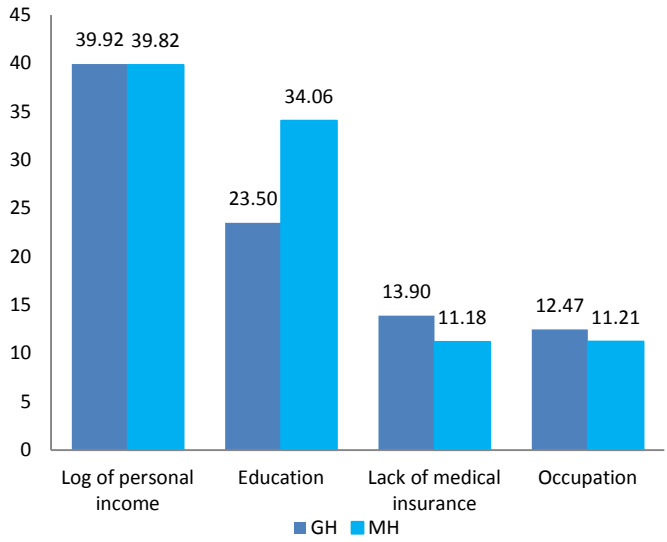

Figure 1: Major contributors of health inequality in Shiraz, south west Iran

Table 4: Decomposition of general health inequality

Variables	Elasticity	C_k	Contribution to CI	Contribution (%)	Per category (%)
Log of personal income	0.446	0.020	0.009	39.9	39.9
Sex					2.0
Male	1.000				
Woman	-0.016	-0.029	0.000	2.0	
Age group (yr)					1.2
18-40	1.000				
41-60	-0.020	0.002	-0.000	-0.2	
>61	-0.006	-0.051	0.000	1.4	
Marital status					
married	1.000				1.7
Single	-0.048	-0.000	-0.000	0.5	
Widow or divorced	-0.001	-0.171	0.000	1.2	
Educational status					23.5
Academic	1.000				
Primary and under primary	-0.015	-0.283	0.004	19.7	
Secondary and High School	-0.012	-0.081	0.001	3.8	
Occupational status					12.4
Employed	1.000				
Homemaker	-0.013	-0.113	0.001	6.8	
Student	-0.001	-0.076	0.000	0.6	
Unemployed	-0.015	-0.083	0.001	5	
Insurance					13.9
Having medical insurance	1.000				
Lack of medical insurance	-0.010	-0.325	0.003	13.9	
Physical inactivity					4.7
Yes	1.000				
No	-0.030	-0.037	0.001	4.7	
Having smoking habit					0.1
Nonsmoker	1.000				
Smoker	-0.006	-0.005	0.000	0.1	
Residual					0.6

Discussion

Our main purpose in this research was the decomposition of income-related health inequalities in Shiraz by applying a methodology developed by[7,15]. Using SF-36 as a health measure, the present study provided new evidence on individual health disparities by income in Iran. We found evidence of avoidable inequalities in both general and mental health in favor of the rich. Meanwhile, the degree of inequality in general health was greater than its counterpart (mental health). Compared to studies conducted in Taiwan and Denmark [6,12], it seems that these inequalities in Shiraz were greater. Previous studies that tried to investigate the existence of health inequalities in Iran, mostly carried out in Tehran, reported that poor SRH and mental disorders were mostly concentrated among poor individuals [4,16].

We showed that income was the most important but not the only factor contributed to the health inequality in Shiraz. Distribution of education, medical insurance, and occupation also has positive contribution on GH and MH inequalities. This means that the combined effects of marginal effects of the desired determinants and theirs distribution based on the economic status increase income-related inequality in health

status. In comparison to other determinants, income is the most important contributor to income-related inequality of GH and MH in both remote and non-remote areas in Taiwan [12]. Other studies, both nationally and internationally, also reported the same result regarding the contribution of income (or economic status) to health inequality[4,6,17-20].

Table 5: Decomposition of mental health inequality

Variables	Elasticity	C_k	Contribution to CI	Contribution (%)	Per category (%)
Log of personal income	0.309	0.020	0.006	39.8	39.8
Sex					4.2
Men	1.000				
Women	-0.022	-0.029	0.000	4.2	
Age group (yr)					2.2
18-40	1.000				
41-60	-0.019	0.002	-0.000	0.3	
>61	-0.007	-0.051	0.000	2.5	
Marital status					2.1
Married	1.000				
Single	-0.005	-0.048	0.000	1.5	
Widow or divorced	-0.000	-0.171	0.000	0.6	
Educational status					34.0
Academic	1.000				
Primary and under primary	-0.015	-0.283	0.004	27.6	
Secondary and High School	-0.012	-0.081	0.001	6.4	
Occupational status					11.2
Employed	1.000				
Housewife	-0.113	-0.113	0.000	5.5	
Student	-0.002	-0.076	0.000	1.2	
Unemployed	-0.009	-0.083	0.000	4.5	
Insurance					11.1
Having medical insurance	1.000				
Lack of medical insurance	-0.005	-0.325	0.001	11.1	
Physical activity					3.5
Yes					
No	-0.015	-0.037	0.000	3.5	
Smoking habit					0.2
Nonsmoker	1.000				
Smoker	-0.009	-0.005	0.000	0.2	
Residual					-8.3

At the individual level income is often a significant predictor of health and it is completely evident that income inequality is an important risk factor that could decrease health outcomes[21,22]. Hence, according to our results, by applying redistributive policies that decrease income inequalities in societies, we could eliminate a number of inequalities not only in health outcomes, but also in other social outcomes. Nevertheless, it must be kept in mind that a tradeoff relationship has been existed between equity and efficiency[23]; hence, ineffective implementation of the redistributive policies could function as a two-edged sword, and while fulfilling the equity objectives, the efficiency goals may go far from access, or both distributive and efficiencies issues may face with disturbances. Unfortunately , it seems that in Iran the implementation of redistributive policies under the name of targeted subsidies plan[24] (hadafmandie yaraneha in Persian) could not reach to the desired goals in its first phase, and income inequality, unemployment and inflation [25] as well as out of pocket health expenditure rose simultaneously in the country. However, in the second phase of this program, especial attention was given to health issues and brought this hope that health outcomes would refer to their positive trends.

Based on our findings, education, as a second contributor of health inequality, accounted for 25% and 34% of inequality in GH and MH, respectively. Regarding the fact that low education levels were more concentrated among the poor ($C_{0\text{-}5}$ = -0.2832 – $C_{6\text{-}12}$ = -0.0818), this finding seems rational. Low education is in line with more health inequality. Khedmati Morasae et al.[17] found that poor education contributed to 13% of inequalities in mental disorders in Tehran. Education is one of the dominant contributors to health inequality[4]. Education is likely to be correlated to socioeconomic indicators such as economic status, occupation and lifestyle. Individuals with a high level of education are more aware of their health conditions and have better access to health care services. Hence, low education has a remarkable effect on inequalities in health amongst different socioeconomic subgroups of the population[26]. Therefore, education expansion policies could remove much of health inequalities in Shiraz and perhaps other regions in Iran.

The findings also showed that lack of insurance contributed 13.9% and 11.18% to income-related inequalities in GH and MH, respectively. In Iran, before and especially after the Islamic Revolution, numerous attempts had been done to put all Iranians under insurance coverage. Nonetheless, evidences showed that insurance schemes in this country could not cover all Iranian population and also the benefit package of insured populating seemed to work ineffectively; contrary to developed nations' reimbursement pattern, insurance organizations in Iran only reimbursed 30% of the health expenditures of their clients[27]. In Tehran, lack of insurance contributed to mental health inequality about 3%[17]. McGrail et al.[5] reported that lack of insurance contributed to 6% of health inequality in USA. According to the findings of our study, prefect consideration must be given to insurance issues in Iran.

Alongside the mentioned factors, occupation status contributed to GH and MH disparity about 12% and 11%. Regarding occupation status, unemployment and being homemaker mostly affect health inequality. In Japan the contribution of unemployment on health during 1986 to 2007 had increased [28]. The positive contribution of unemployment was also found in Australia and New Zealand[20]. Fars province has the highest rate of unemployment (20.5%) in Iran[29]. During unemployment, the mean incomes tend to decrease. If we accept that income has a negative impact on health outcomes with an increase in unemployment, health outcomes should be expected to fall down[21]. To decrease this contribution, providing secure occupation opportunity, especially for the increasing number of well-educated people, seems urgent.

Decomposition analysis revealed that physical inactivity, being female and age were the factors with comparatively minor positive contributions to inequality. By establishing the strategies that promote physical activities and enhance the health status of females and elderly, the positive contribution on inequality of these factors will decrease.

The data and methods used in our study had some important limitations. First, the sample size of this study was relatively small and presumably the results could not be generalized to the whole individuals living in Shiraz and other people living in other regions of Iran. In addition, the results of the decomposition analysis cannot be given a causal interpretation. They are only useful in revealing the partial relationship between the dependent and independent variables. Moreover, we do not measure economic status according to household assets which may pose some defects on our analysis.

It seems that future studies are required on other health status such as children mortality and malnutrition and utilization of health care services in Shiraz and other regions of Iran to fill research gaps and provide more policy implications. Regardless of these limitations, our analysis bring most important implication to national and local policy makers and clarifies routes to decrease health inequality and to increase health outcomes more equitably.

Conclusions

Inequity in mental health was greater than general health. In addition, Decomposition analysis of health inequality determinants provided valuable information and demonstrated more important contributors of health inequality which could be helpful for health policy makers. By applying socioeconomic and effective redistributive policies that are in line with health policies, education expansion programs, providing secure career opportunities and preparing effective insurance plans, these avoidable and unethical health disparities between advantaged and disadvantaged groups could be taken away. Furthermore, this must be kept in mind that decreasing inequalities in health requires the endeavors of health system and other relevant sectors as well.

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Conflict of interest statement

The authors declare that they have no competing interests.

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