

## Decomposition of Socioeconomic Inequality in Catastrophic Health Expenditure: An Evidence from Iran



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### ABSTRACT

**Background:** Evidences showed that the incidence of catastrophic health expenditure is unequally distributed among disadvantaged populations. The present study has tried to explain the contributors of this unfair inequality in Hamadan, Iran.

**Methods:** The target population was households that utilized inpatient services in hospitals of Hamadan. A proportional stratified random sampling method was used to determine study sample (N = 770). The associated factors of catastrophic health expenditure were estimated using logistic regression analysis. The inequality of catastrophic health expenditure was measured by concentration index and explained by decomposition analysis. The data were analyzed by using STATA version 12.

**Results:** The key determinants of catastrophic health expenditure were poor economic status, lower household size, lack of supplementary insurance and the number of hospitalizations. The overall concentration index of catastrophic health expenditure in Hamadan was  $-0.163$  (95% CI:  $-0.242$  to  $-0.083$ ). Household economic status (63.60%) and household size (39.90%) were considered as the first and the second largest contributors of catastrophic health expenditure inequality, respectively.

**Conclusion:** It is demonstrated that catastrophic health expenditure inequality in Iran could be explained by the factors beyond the health sector scope. Hence, future policy efforts need to consider both health system factors and the factors beyond the health system to eliminate catastrophic health spending burden and its inequality.

### 1. Introduction

Protecting households from illness-related financial catastrophe alongside increasing health outcomes are increasingly playing more fundamental roles in healthcare system.<sup>1,2</sup> Out-of-pocket (OOP) health expenditure that goes far from certain proportions of a household's financial capacity has been accounted as catastrophic health expenditure.<sup>3,4</sup> Catastrophic health Expenditure (CHE) could severely affect households living conditions and in its higher degree pushing them into poverty.<sup>5</sup> It is reported that 150 million people worldwide suffer from financial catastrophe each year and 100 million are impoverished because of direct payments for health services.<sup>6,7</sup>

Although it is emphasized that a desirable health system need to

ensure that its stakeholders have effective access to required care without suffering from financial hardship,<sup>1,8</sup> evidences showed that the incidence of CHE is unequally distributed among disadvantaged populations.<sup>2,9</sup> Despite the fact that “average” catastrophic health spending could be reduced by policy interventions, inequalities in CHE will not simply be eliminated and inevitably exist across households due to the diverse socioeconomic factors.<sup>10</sup> Hence it is important to measure the inequalities in facing CHE and quantify the determinants of its inequality.<sup>9</sup>

The adverse organization of healthcare financing,<sup>8,11,12</sup> along with diverse socioeconomic factors, could increase the risk of catastrophic health payment. The health system of Iran suffered from high degrees of CHE. The adverse status of these payments has been highlighted in

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different studies, in national<sup>13–15</sup> and subnational level.<sup>16,17</sup> Moreover, previous research revealed that this adverse outcome had been unevenly distributed among poor Iranian households.<sup>9,11</sup> In present study, we investigated the inequality of CHE for households that have used inpatient healthcare services in Hamadan, a less investigated province with regard to catastrophic payments, and analyze the determinants of this inequality to bring some policy implication.

## 2. Materials and methods

### 2.1. Study setting

The required data of this cross-sectional study was obtained from former survey that carried out in 2014 in Hamadan city. The target population in this survey consisted of the households that have member with inpatient services utilization in 8 hospitals of Hamadan. Proportional stratified random sampling method was used for sampling. it was performed in three steps. First, the total number of hospitalized patients in 6 months of 2014 (21 March to 22 September) were found. In the second step, the sampling weight was calculated according to the proportion of hospitalized patients for each hospital. Finally, the sample size for each hospital was obtained by multiplying the sampling weight to the total sample size. The total sample size of the present study was calculated using the Cochran formula in which  $p = 12\%$  (Proportion of the households face with CHE),<sup>9</sup>  $d = 0.0228$ , and  $\alpha = 0.05$  (Type I error). Accordingly, a sample size of 780 households was determined for this study. After data cleaning (i.e. excluding the households with variables missing), the analysis was performed for 770 households. The household-related section of the World Health Survey questionnaire was used in this survey to measure OOP and demographic and socio-economic factors. The validity and reliability of this questionnaire were verified in previous research.<sup>9</sup>

### 2.2. Catastrophic health expenditure and its determinants

The capacity to pay (CTP) approach<sup>18</sup> was followed to measure CHE. According to this approach, CTP was obtained from difference between effective income (measured by total expenditure) and basic subsistence needs. Health care expenditure would be considered ‘catastrophic’ if it was equal to or higher than 40% of the household’s CTP. Based on this approach, a binary variable could be defined to capture catastrophic payment. The logistic regression analysis was used to investigate the impact of the determining variables (supplementary insurance status, sex of household head, household size, having a member over 60 years, having a member below 6 years, having a disabled member, economic status and reporting inpatient service usage) on the CHE.

### 2.3. Catastrophic health expenditure inequality and its determinants

We used concentration index (CI), one of the most widely accepted techniques to identify health inequalities,<sup>19,20</sup> to measure the socio-economic inequality in CHE. To investigate the determinants of CHE inequality, regression-based decomposition was applied.<sup>21,22</sup> The details of this method are explained in previous researches.<sup>2,10</sup> The data were analyzed by using STATA 12 (STATA Corporation, College Station, TX). P values less than .05 were considered statistically significant.

## 3. Results

Table 1 shows the summary statistics for independent variables. Eighty six (11.2%) households had female household heads. The Mean household size was 4.11 (SE = .17), and 69.2% of the households had 3–6 members. A Majority of households reported no supplementary insurance coverage. The incidence of disabled member was 10.6%. Our result revealed that in Hamadan, 160 households (20.8%; 95%

confidence interval (CI): 17.9–26%) experienced CHE.

### 3.1. Determinants of catastrophic health care expenditure

Table 2 shows the logistic regression results of determinant factors of CHE in Hamadan. Except for the second quintile, we observe no significant association between economic status and incurring CHE; this means that the households belonging to this economic quintile have higher probability to pay remarkable proportion of their earnings to use required health care services.

As seen in Table 3, the increase in hospitalization would pose the households in financial hardship. The Absence of supplementary insurance is another significant factor that could increase experiencing CHE; in this regard, households that did not have any type of supplementary health insurance were more likely to confront with financial hardship than those that had advantage of these insurance programs. Besides, the lower household size significantly increased the chance of CHE in comparison to larger ones’. Although it was seen that having disabled member and having member  $\geq 60$  positively related to CHE, this was not significant in this study. Meanwhile, female household heads and having children below 5 years insignificantly decreased the chance of incurring CHE.

### 3.2. Socioeconomic inequality in catastrophic health care expenditure

Fig. 1 shows the concentration curves for catastrophic payment in Hamadan. It was laid above the line of equality, this indicates that the CHE was more concentrated among the disadvantaged households. Testing the concentration curve dominance showed that the concentration curve of CHE significantly located above the line of equality. Moreover, related concentration index for CHE was  $-0.163$  (95% CI:  $-0.242$  to  $-0.083$ ). The negative value of this index indicates that poor households had higher probabilities of facing CHE.

### 3.3. Decomposition of inequality in catastrophic health care expenditure

Table 3 shows the decomposition results for the concentration index of the Ln odds of catastrophic payments in Hamadan. This table represents the concentration index and relative contributions of each determinant of inequality in CHE. Here; the negative value of the concentration index demonstrates that the ‘interest’ variable unevenly concentrated amongst the poor and vice versa. In this regards, variables such as having household members over 65years, having disabled member and female household heads had been distributed in low income households.

The grouped contribution per category variable is shown in last column of Table 3. The Positive value of variable’s contribution indicates that relevant variables increase inequality, and vice versa. The findings revealed that the majority (near 64%) of CHE inequalities could be explained by households’ economic status. Besides, the household size (about 40%) is the second contributor of CHE inequality in Hamadan. moreover, having members aged over 65 years, disabled members, and members younger than 5 years old would increase the inequality. The Number of hospitalization (about  $-14\%$ ), female household heads (3.28%) and the lack of supplementary insurance ( $-1.15\%$ ) negatively contributed to the studied socio-economic inequality.

## 4. Discussion

Present study showed that for more than one fifth of households that used inpatient services, health expenditure levels was more than 40% of their nonfood expenditures. This is higher than the overall CHE incidence assessed by another Iranian study that investigated the determinants of CHE among households that had hospitalized members.<sup>23</sup> While this result is inconsistent with most previous studies that

**Table 1**  
Socioeconomic characteristics of the study population.

Variable	Description	N (%)	Mean (S.D.)
Economic status	Quintile 1 (poorest)	1 if the 20% low income households, 0 otherwise	155 (20.1)
	Quintile 2 (Poor)	1 if the 20% low middle income households, 0 otherwise	152 (19.7)
	Quintile 3 (Middle)	1 if the 20% middle income households, 0 otherwise	155 (20.1)
	Quintile 4 (Rich)	1 if the 20% high middle income households, 0 otherwise	154 (20.0)
	Quintile 5 (Richest)	1 if the 20% high income households, 0 otherwise	154 (20.0)
Disabled member	Have	1 if having household members suffer from disability, 0 otherwise	80 (10.6)
	Not have	1 if no household members suffer from disability, 0 otherwise	690 (89.4)
Household head	Male	1 if the head of household was male, 0 otherwise	684 (88.8)
	Female	1 if the head of household was female, 0 otherwise	86 (11.2)
Household size	1–2 members	1 if household members is 1–2, 0 otherwise	177 (23.0)
	3–6 members	1 if household members is 3–6, 0 otherwise	533 (69.2)
	≥ 7 members	1 if household members is ≥ 7, 0 otherwise	60 (7.8)
Member ≥ 65	Have	1 if household having members over 65 years old, 0 otherwise	347 (45.9)
	Note have	1 if all household members below 65 years old, 0 otherwise	423 (54.1)
Member ≤ 5	Have	1 if household having members below 5 years old, 0 otherwise	184 (23.9)
	Note have	1 if all household members over 5 years old, 0 otherwise	586 (76.1)
Supplementary insurance status	Have	1 if all household members covered by supplementary health insurance, 0 otherwise	184 (23.9)
	Note have	1 if all household members not covered by supplementary health insurance, 0 otherwise	586 (76.1)
Number of hospitalization	Total number of hospitalization for each of household members		2.024 (2.525)

reported CHE incidence in national<sup>11,13–15,24</sup> and subnational<sup>9,16</sup> contexts, as former research in Kermanshah<sup>25</sup> as well as Ferdows<sup>26</sup> reported high degrees of CHE incidence. In the mentioned studies, inpatient service use is one of the major determinants of facing with catastrophic payments. Generally, Inpatient healthcare services consist of very expensive healthcare services. Lack of financial protection can increase vulnerability of households versus CHE.<sup>24</sup> This study also well highlighted that hospitalization costs can increase the incidence of CHE. National and sub-national authorities must listen to ear-splitting alarm of CHE incidence and pay attention to this adverse outcome, especially for households with remarkable inpatient expenditures, which may push the households into poverty.

Although other studies in Iran<sup>9,15,16,27</sup> and other countries<sup>2,28</sup> proved that lower economic status has a remarkable role in incurring CHE, while we only found a significant relationship between CHE and second economic quintile. This means that poorest households, due to inpatient services, may decrease their health care needs. This result is in line with a previous study conducted in China.<sup>10</sup> Former research that conducted in some Asian countries also revealed that wealthier households, compared with disadvantaged ones, devoted a larger proportion of their earnings to healthcare services. This may confirm that the poor households avoid the utilization of healthcare services.<sup>29</sup> This is a drastic problem for the health sector that its clients neglect their health care needs. Hence, required policies must be designed and implemented not only for reduction of catastrophic payments, but also for transformation of slept health-care needs to effective demands.

The findings revealed that lower household size significantly accompanied with higher probability of incurring catastrophic payments.

It is clear that households with lower breadwinners have lower capacity to pay and hence, devote large proportion of their incomes to utilization of health-care services. Previous research in Iran<sup>11,15</sup> and other nations<sup>2,10</sup> also reported the same result. Policy makers must be aware of this issue, and not only improvise an in-depth health insurance program for these households, but also improve business atmosphere for households with lower household size to earn much income. However, other studies<sup>14,30</sup> reported that larger household size would increase the probability of facing with CHE.

Consistent with former researches in Iran<sup>11,16</sup> and other countries,<sup>10,31</sup> our findings demonstrated that the absence of supplementary insurance had raised the risk of CHE in Hamadan. Considering that most of the studied households had been covered by basic health insurance, this finding implicitly highlights the insufficiency of basic insurance plans to protect households from financial hardship in Iran. The failure of a previous intervention,<sup>9</sup> which was designed to increase the effectiveness of health insurance programs in Iran, motivates the policy makers to broaden the coverage of these insurance plans in the framework of recent Iranian healthcare reforms.

Present study showed that CHE was unevenly distributed among disadvantaged households. Former national<sup>11</sup> and regional<sup>9,12,23</sup> studies also confirmed this result. Trying to explain the socioeconomic inequality in catastrophic payments through decomposition analysis we showed that most of this unfair inequality could be explained by household economic status. This finding is in line with a similar research in Tehran, which reported that more than 80% of CHE inequalities might be justified by economic status of the studied households.<sup>9</sup> Former research<sup>22,32</sup> that used decomposition analysis to

**Table 2**  
The relationship between CHE and its determinants.

Variable	β coefficient	P value	95% confidence interval		
Economic status	Quintile 1 (poorest)	0.5088875	0.126	–0.1423959	1.160171
	Quintile 2 (Poor)	0.7483503	0.019	0.1230486	1.373652
	Quintile 3 (Middle)	–0.1365969	0.699	–0.8290423	0.5558485
	Quintile 4 (Rich)	0.0792185	0.818	–0.5943145	0.7527514
Having member disabled	0.3995435	0.176	–0.179234	0.9783211	
Female household head	–0.1302501	0.646	–0.6855178	0.4250176	
Household size	1–2 members	1.097957	0.023	0.1539057	2.042007
	3–6 members	0.340528	0.437	–0.5183425	1.199399
Having member ≥ 60	0.3111722	0.115	–0.0761405	0.6984849	
Having member ≤ 6	–.2712569	0.319	–0.8052417	0.2627279	
Lack of supplementary insurance	.4682577	0.037	0.0289054	0.90761	
Number of hospitalization	.1852697	0.000	0.0981201	0.2724192	

**Table 3**  
Decomposition analysis of concentration index of CHE in Hamadan (2014).

Variable		Coefficient	Mean	Elasticity	Concentration index (CI)	Contribution to CI	Contribution to CI %
Economic status	Quintile 1 (poorest)	0.4042196	0.2012987	-0.05183185	-0.79766806	0.04134461	63.60
	Quintile 2 (Poor)	0.5972205	0.1974026	-0.07509759	-0.39948254	0.03000018	
	Quintile 3 (Middle)	-0.1157077	0.2012987	0.01483685	-0.00129702	-0.00001924	
	Quintile 4 (Rich)	0.0297246	0.2	-0.0037869	0.39948254	-0.0015128	
Having member disabled		0.3730934	0.1038961	-0.02469194	-0.10781489	0.00266216	2.43
Female household head		-0.1576254	0.1116883	0.01121431	-0.32075636	-0.00359706	-3.28
Household size	1-2 members	-0.7238929	0.6922078	0.31918994	-0.352929	0.05167328	39.90
	3-6 members	-1.082268	0.0779221	-0.1118495	0.07253342	-0.00811283	
Having member ≥ 60		0.2607917	0.4506494	-0.14641269	-0.15762732	0.01180056	10.07
Having member ≤ 6		-0.1896802	0.238961	0.02887271	0.0674733	.0674733	0.194
Lack of supplementary insurance		0.3692687	0.761039	-0.17901435	0.00706943	-0.00126553	-1.154
Number of hospitalization		0.1478138	0.2701299	-0.19063775	0.07895523	-0.01505185	-13.73
Ln of odds			-1.569862		0.10828493		
Residual							1.96

quantify contributors of other health inequalities also reported that economic status plays an important role in the inequality between advantaged and disadvantaged Iranian households. Other studies in China,<sup>2,10</sup> accounted the household size as the largest contributor of CHE inequality.

In this study, household size was demonstrated as the second largest (about 40%) contributor of inequality in facing with CHE. This seems logical; as mentioned above, lower household size, that is concentrated among poor households (CI = -0.352929), could increase the chance of incurring CHE. Compared with former research in Tehran,<sup>9</sup> it is demonstrated that in Hamadan household size has larger contribution on CHE inequality. After these dominant contributors, having disabled persons and the members above 60years old has some positive contribution on CHE inequality in Hamadan.

Like other studies<sup>2,9,10</sup> we found negative contribution of health service usages, measured by hospitalization, and CHE inequality. Since higher utilization of health service is concentrated among rich households; if the chance of CHE increases among them, the inequality in the number of households facing catastrophic costs in different socio-economic groups can be reduced. Contrary to expectations, the lack of supplementary insurance negatively contributed to CHE inequality. One possible explanation is that supplementary health insurance has not yet spread among wealthier families.

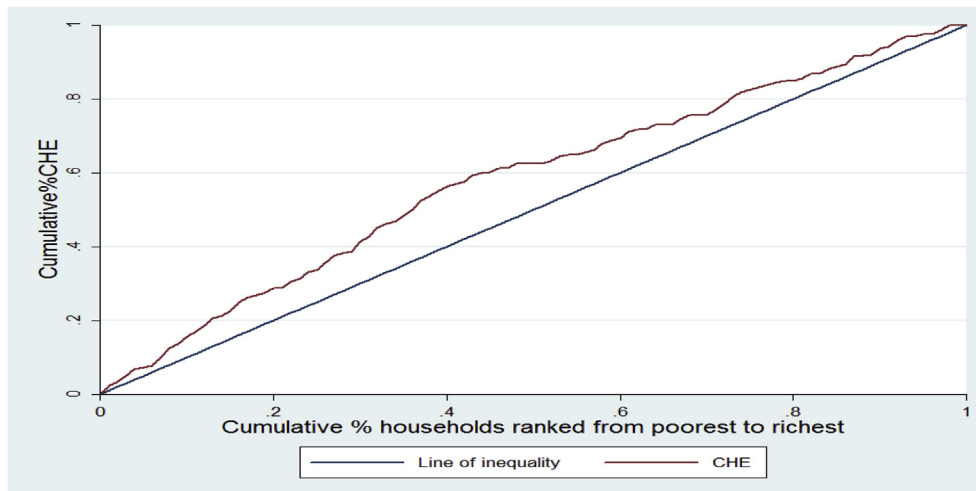
Considering that most of CHE inequalities are explained by factors beyond the health sector, it will be great if policy makers, alongside health financing reforms, try to eliminate socio-economic inequalities among households by distributional policies. However, bad implementation of these policies could leave some side effects on

socioeconomic factors in the society.<sup>22</sup> For example, the well-known substantial distributional policy in Iran, known as Targeted Subsidies, couldn't reach to its desired ideals. It is believed that this policy has some negative effects on health outcomes especially among poor people<sup>33</sup> and probably made them sensitive to CHE.

We have some limitation in our research which must be acknowledged. Decomposition analysis could not show causal relationship between CHE inequality and studied variables; hence the results of this study must be interpreted with caution. Like other studies, relinquishing healthcare needs because of their costs, increase in the capacity to pay by loaning, selling assets and decreasing in other expenditure is not reflected in our research. Hence, CHE incidence may be underestimated in this study.

## 5. Conclusion

The findings showed sever CHE incidence and inequality in Hamadan. Logistic regression showed that the lower socioeconomic status, lower household size, absence of supplementary insurance and increase in hospitalization will increase catastrophic health spending in Hamadan. Besides, decomposition analysis revealed that most of CHE inequalities could be explained by the factors such as economic status and household size that are beyond the health system scope. It is evident that an emphasis on health system intervention couldn't effectively dispel CHE inequality in communities; therefore, it is profoundly suggested that future policy efforts would simultaneously include health system factors and the factors beyond health system to eliminate CHE burden and its inequality, more effectively.



**Fig. 1.** Concentration curve of incurring CHE.

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## Declaration of competing interest

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