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Exploring dental and medicine health expenditures in Iran: financial protection and inequality analysis

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Abstract

Background Healthcare systems must not only improve health outcomes but also protect individuals from financial hardship caused by healthcare costs. This study aimed to investigate financial protection and economic inequality in catastrophic dental healthcare expenditure (CDHE) and catastrophic medicine expenditure (CME) among the insured households through the Social Security Organization (SSO) in Iran.

Method This cross-sectional study gathered data from 1679 insured households across 5 provinces, utilizing a multistage sampling approach. The prevalence of CDHE and CME was assessed by determining the proportion of households spending at least 40% of their capacity to pay on dental care and medications. Logistic regression analysis was used to identify the factors contributing to CDHE and CME. The concentration curve (CC) and concentration index (CI) were employed to visualize and quantify the extent of economic inequality in CDHE and CME. The CI was further decomposed to identify the primary factors driving the observed economic inequality in CDHE and CME.

Findings The study found that 6.2% (95% confidence interval CI 5.1 to 7.4%) of households experienced CDHE and 4.9% (95% CI 4.0 to 6.0%) experienced CME. The CI for dental costs and medication costs were 0.248 (95% CI 0.115 to 0.381) and was 0.149 (95%CI 0.087 to 0.211), respectively, indicating that these costs were more concentrated among socioeconomically advantaged households. Conversely, the CI for CDHE and CME were −0.185 (95% CI −0.297 to −0.073) and −0.570 (95% CI −0.692 to −0.448), respectively, suggesting that these outcomes were more prevalent among poorer households. The decomposition analysis highlighted that the household wealth index explained 45.4% and 22.5% of the concentration of CDHE and CME among the poor, respectively.

Conclusion The financial burden imposed by out-of-pocket (OOP) payments for dental care and medication was substantial among households insured by the SSO. Expanding insurance coverage for these services could significantly reduce OOP spending and the likelihood of health expenditures leading to poverty, particularly among lower-income households.

Keywords Catastrophic costs, Dental care, Medication, Out-of-pocket payments, Economic inequality, Decomposition

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Introduction

The goal of health systems extends beyond merely improving the health status of a population. A well-functioning health system is one that can protect people from the financial consequences of using health services, ensuring that individuals do not face impoverishing conditions or fall into poverty due to healthcare utilization [1, 2]. The World Bank report titled "Voices of the Poor," which examined 50 countries, revealed that poor health and illness are major contributors to poverty. In addition, the World Health Organization's 2000 report emphasized financial protection for patients as one of the main objectives of health systems [2]. Similarly, in national development programs in Iran (seventh development plan), two key indicators have consistently been highlighted and set as goals in this regard: Out-of-pocket (OOP) payments for health services (target: less than 30%) and households facing catastrophic health expenditures (target: less than 2%) (Article:68) [3].

Financial protection is a critical aspect of health system performance, as it ensures that individuals and families can access necessary healthcare services without experiencing financial hardship. This protection is particularly important in preventing catastrophic health expenditures, which can push households into poverty or deepen existing poverty [4, 5]. The financial burden of healthcare costs on households is a significant challenge in healthcare systems today. The increasing costs of healthcare services have created financial difficulties for households facing medical expenses. In this context, health financing sources play a crucial role in mitigating these financial burdens. Healthcare financing in Iran is a multi-faceted system, with various sources contributing to the overall funding. The government budget accounts for nearly 20% of total health spending, while public health insurance covers approximately 30% of total health spending. Private health insurance, on the other hand, accounts for less than 10% of total health spending. The majority of healthcare funding, nearly 40%, comes from OOP payments made by individuals [6–11].

Across the world, annually over 150 million people struggle with financial difficulties due to OOP healthcare expenses, and approximately 100 million people fall below the poverty line [12]. In Iran, recent emphasis has been placed on reducing catastrophic healthcare expenditures (CHEs) to below 2% in the fourth, fifth, sixth and seventh development plans. However, the financial protection status against healthcare costs has not been satisfactory, as evidenced by studies reporting CHEs ranging from 8.3% to 14.3% among households [13–17]. This rate was higher among households with a member suffering from cancer, at 72.7% in 2018 [18]. These studies have focused on the prevalence of CHEs for total healthcare expenditures. However, despite the lack of comprehensive insurance coverage for both dental and medication costs, there are few studies on the prevalence of catastrophic expenditures specifically due to dental and medication costs in Iran [19–21]. Despite being insured through the Social Security Organization (SSO), many households in Iran still face significant out-of-pocket expenses related to dental and medical care. This situation raises concerns about financial protection and access to necessary healthcare services, which are critical issues in health economics. The study aims to investigate the prevalence of catastrophic dental health expenditure (CDHE) and catastrophic medicine expenditure (CME) among these households. Understanding the extent of these expenditures is crucial for identifying gaps in the financial protection provided by insurance. Additionally, the analysis of economic-related inequality in these expenditures will shed light on how financial burdens disproportionately affect lower-income households. This aspect is vital for informing policymakers about the need for targeted interventions to improve equity in healthcare financing. Furthermore, there is a notable lack of research focusing specifically on catastrophic expenditures related to dental and medical care among SSO-insured households in Iran. By addressing this gap, our study contributes valuable insights into the broader discourse on health financing and equity.

Methods

Study setting

The study was conducted among households insured by the SSO. The SSO was established in 1975 to provide health insurance coverage and healthcare services to employed individuals. As the second largest healthcare provider in Iran, the SSO operates through two main sectors: direct and indirect. In the direct sector, SSO-owned facilities such as hospitals, clinics, pharmacies, and rehabilitation centers offer somewhat free treatment and medications to patients. In contrast, the indirect sector involves contracts with affiliated hospitals, medical centers, laboratories, and private providers to deliver care to insured patients. Patients often prefer the direct sector due to its free services, but this can result in long wait times. Individuals may opt to use the indirect sector of the Social Security Organization (SSO), which involves out-of-pocket payments, in order to access healthcare services more quickly. The SSO is funded through insurance premiums from members and employers, as well as government subsidies [9, 10, 22].

Sample size, sampling method, and data collection tool

In this cross-sectional study, a total of 1679 individuals who were insured through the SSO health insurance

participated by completing the questionnaire. Multistage sampling method was used to select the samples. Firstly, Iran was divided into five regions, namely north, west, south, east, and center, from which one province was randomly selected for each region. Subsequently, within each selected province (the capital of the province), four SSO agencies were randomly chosen based on their geographical areas to partake in the study. If a province had fewer than four SSO agencies, all available agencies were included. Lastly, within each province, face-to-face interviews were conducted by one or two trained interviewers with SSO insured individuals visiting the designated agencies. The convenience sampling method was employed to include participants in the study within each agency. The five provinces included in this study were Tehran, Kermanshah, Yazd, Sistan-Baluchistan, and Golestan provinces.

To collect data, a self-constructed questionnaire was employed, designed based on the study objectives and the WHO questionnaire. The questionnaire consists of two main parts. The first section focuses on sociodemographic information pertaining to households. It encompasses details such as the age, gender, and educational level of the household head, household size, supplementary health insurance status, presence of members below the age of 5 or over the age of 65, presence of members with chronic diseases, and the living area. The second section gathers data regarding the utilization of dental care and medicine by household members over the past month. Additionally, it captures monthly household expenditures categorized by type, including expenses related to dental care, medicine, total health costs, food costs, overall costs, and total household income. A recall period of one month was utilized to collect information on total household expenditures and health service utilization.

Data analysis

In order to determine the prevalence of catastrophic dental health expenditure (CDHE) and catastrophic medicine expenditure (CME), the WHO's approach was employed, using a threshold of 40% of non-food household spending [23]. According to this approach, if a household allocates 40% or more of their non-food capacity-to-pay (CTP) towards dental care or medicine, they are considered to have experienced CDHE or CME. Other alternative thresholds have been used in some studies to define catastrophic healthcare expenditure. Therefore, we also used thresholds of 30%, 20%, and 10% of the household's non-food spending capacity to estimate the prevalence of CDHE and CME.

The following steps were used to calculate CDHE and CME. First, to determine a household's capacity to pay (CTP), we subtracted food expenditure (considered subsistence spending) from the total monthly household expenditure. The remaining non-food expenditure was considered the CTP. To account for household size variations, we applied the following formula to adjust the CTP value:

$$\text{Eqhsize}_h = \text{size of household}^{\beta}$$

where Eqhsizeh is the equalized household's size, and β is set to 0.56 [23]. Second, the household's share of food expenditure of total household expenditure was used to construct the poverty line (PL) as follows:

$$\text{Eqfood}_h = \frac{\text{Foodexp}_h}{\text{Eqhsize}_h}$$

$$\text{PL} = \frac{\sum W_h{}^{*}\text{Eqfood}_h}{\sum W_h}; \text{food45} < \text{foodexp}_h < \text{food55}$$

Here, Eqfood*h* is the share of spending on food relative to the total household expenditure; W_h is the sampling weight of the households; food_h is the household's food expenditure; and food 45–food55 is the mean food expenditure for sampled households spending 45–55% of their total expenditure on food. Third, the subsistence expenditure for each household was calculated using the following formula:

$$\text{Subsistence expenditure} = \text{PL} \times \text{Eqhsize}_h$$

subsistence expenditure was greater than the food expenditure for the household, we calculated the CTP of the household as follows:

$$\text{CTP}_h = \text{total expenditure}_h - \text{food expenditure}_h$$

If food expenditure was equal to or greater than subsistence expenditure for household h, we calculated the CTP as follows:

$$\text{CTP}_h = \text{total expenditure}_h - \text{subsistence expenditure}_h$$

Fourth, to determine if a household experienced CDHE or CME, the following formula was used:

$$\text{household facing CDHE or CME} = \frac{\text{OOP}_{\text{denatl or medicine}}}{\text{CTP}_h} \geq 0$$

where $\text{OOP}_{\text{denat or medicine}}$ represents out-of-pocket (OOP) payment for dental care or medicine for household h. If the OOP payments for dental care or medicine

equaled or exceeded to 40% of the household CPT, the household was considered to be facing CDHE or CME. By inputting 0.3 into the formula, we can calculate the prevalence of CDHE or CME using the 30% household CTP threshold.

To identify the main factors associated with CDHE or CME at the 40% threshold, two separate multiple logistic regression models were employed. The logistic regression model for CDHE included explanatory variables such as the gender, age, education level of the household head, household economic status, having supplementary health insurance, presence of a household member over 65 years old, living area, and province. The logistic regression model for CME included explanatory variables such as the gender, age, education level of the household head, household economic status, having supplementary health insurance, presence of a household member over 65 years old, presence of household member(s) with chronic disease(s), living area, and province. The economic status of households was determined by assessing their total household costs. We categorized households into five economic groups, namely poorest, poor, middle, rich, and richest, based on their total household costs.

Socioeconomic-related inequality in CDHE, CME and OOP payments for dental care and medicine

We conducted an analysis to assess economic inequality in the prevalence of CDHE and CME, as well as OOP payments for dental care and medicine among the households included in our study. We employed the concentration curve (CC) and the concentration index (CI) to examine this inequality [13, 24]. The CC visually represents the cumulative percentage of households ranked by their wealth score on the x-axis, plotted against the cumulative percentage of households experiencing CDHE, CME, or making OOP payments for dental care or medicine on the y-axis. If the curve lies above (below) the line of equality, it indicates that the outcome of interest is more concentrated among poorer (wealthier) households. The CI quantifies the extent of economic inequality and is calculated as twice the area between the CC and the equality line. The CI ranges from −1 to 1, where a negative (positive) value indicates that CDHE, CME, or OOP payments for dental care or medicine are more concentrated among the poor (rich) households. Since CDHE and CME are binary variables, we normalized the CI by multiplying it by 1/(1-μ) to account for the bounds, following the suggestion by Wagstaff [25].

The decomposition analysis was performed as follow to determine main determinants of the observed economic-related inequality in facing CDHE or CME: If we have the following linear regression model linking our CDHE or CME variable, y, to a set of k explanatory factors,x_k:

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon \tag{1}$$

The CI for CDHE or CME, y, can be decomposed as follows [26]:

$$CI = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k + \frac{GC_\varepsilon}{\mu} \tag{2}$$

where CI shows the CI for CDHE or CME, $\bar{x}_k$ is the mean of explanatory variable x_k, C_k is the CI for x_k, defined analogously to the CI and $\frac{\beta_k \bar{x}_k}{\mu}$ is the elasticity of CDHE or CME with respect to the explanatory variable x_k. The $\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k$ indicates the contribution of explanatory factor x_k to the CI. The last term,$\frac{GC_\varepsilon}{\mu}$, is the residuals component and reflects the socioeconomic-related inequality in health outcome that cannot be explained by systematic variation in x_k across wealth groups [27].

The normalized CI can be decomposed using the following formula:

$$C_n = \frac{CI}{1-\mu} = \frac{\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k}{1-\mu} + \frac{\frac{GC_\varepsilon}{\mu}}{1-\mu} \tag{3}$$

Since CDHE or CME is a binary variable, we used marginal effects obtained from a logit model in the decomposition analysis [27].

All analyses were performed using Excel and Stata 17.0 software (Stata Corporation) and the significance level was set at $p < 0.05$.

Results

Characteristics of households included in the analysis, by catastrophic dental health expenditure (CDHE) and catastrophic medicine health expenditure (CME) at 40% CTP thresholds are reported in Table 1. The mean age of the household head was 44.5 years with a standard deviation of 15.2 years. Approximately 85.3% of the household heads were male, and 92.5% of the households resided in urban areas. Among the households examined, around 1.2% had at least one member over the age of 65, while 4.4% had at least one family member affected by a chronic condition such as high blood pressure, cancer or diabetes and etc. The study also indicated that dental services had been utilized by 19.7% of the households, while medicine services had been used by 59.6% of the households in the past month. The prevalence of catastrophic dental health expenditure (CDHE) in Iran was found to be 6.2% (95% CI 5.1 to 7.4), while the figure for catastrophic medicine expenditure (CME) was 4.9% (95% CI 4.0 to 6.0). Analyzing the data by household characteristics, the rate of CDHE was 6.5% (95% CI 5.4 to 7.9)

Table 1 Catastrophic dental health expenditure and catastrophic medicine health expenditure among households insured by social security organization in Iran

Variables	Mean	Prevalence of catastrophic dental health expenditure (95% CI)	Prevalence of catastrophic medicine expenditure (95% CI)
Age of household head in year	44.5	6.2 (5.1 to 7.4)	4.9 (4.0 to 6.0)
Sex of household head			
Male	0.85	6.5 (5.4 to 7.9)	4.8 (3.8 to 6.1)
Female	0.15	4.1 (2.2 to 7.4)	5.6 (3.4 to 9.4)
Education status of the household head			
Illiterate	0.07	3.2 (1.2 to 8.4)	3.2 (1.2 to 8.4)
Less than diploma	0.28	4.2 (2.7 to 6.5)	5.9 (4.1 to 8.4)
Diploma to bachelor	0.52	6.6 (5.1 to 8.4)	4.9 (3.7 to 6.6)
Master to Ph.D	0.13	10.2 (6.8 to 14.9)	3.6 (1.8 to 6.9)
Living area			
Urban	0.93	6.6 (5.5 to 7.9)	5.0 (4.0 to 6.2)
Rural	0.07	0.8 (0.1 to 5.5)	4.0 (1.6 to 9.3)
Having supplementary health insurance			
Yes	0.53	7.8 (6.2 to 9.8)	5.4 (4.0 to 7.2)
No	0.47	4.5 (3.2 to 6.2)	4.6 (3.4 to 6.2)
Household having member over 65 years old			
Yes	0.84	9.6 (6.6 to 13.8)	8.6 (5.7 to 12.5)
No	0.16	5.5 (4.4 to 6.8)	4.2 (3.3 to 5.4)
Household having member(s) with chronic disease (s)			
Yes	0.60	–	6.8 (5.1 to 8.9)
No	0.40	–	3.7 (2.7 to 5.1)
Economic status of household			
Poorest	0.20	9.9 (7.1 to 13.7)	16.8 (13.2 to 21.3)
Poor	0.20	5.8 (3.8 to 8.9)	3.2 (1.8 to 5.7)
Middle	0.22	6.9 (4.7 to 9.9)	2.9 (1.6 to 5.2)
Rich	0.19	3.8 (2.2 to 6.6)	–
Richest	0.19	4.1 (2.4 to 6.9)	1.5 (0.6 to 3.7)
Province			
Golestan	0.13	10.2 (6.7 to 14.9)	5.5 (3.1 to 9.5)
Kermanshah	0.26	1.5 (0.7 to 3.3)	1.1 (0.4 to 2.7)
Tehran	0.19	7.8 (5.3 to 11.3)	3.7 (2.1 to 6.5)
Yazd	0.24	3.9 (2.4 to 6.3)	2.9 (1.7 to 5.1)
Sistan and Baluchestan	0.18	11.5 (8.3 to 15.7)	14.2 (10.6 to 18.7)

CI is the confidence interval

for male-headed households, and the rate of CME was 4.8% (95% CI 3.8 to 6.1) for the same group. Additionally, the study revealed disparities in the prevalence of CDHE based on other factors. Households with supplementary health insurance had a higher prevalence of CDHE at 7.8% (95% CI 6.2–9.8), compared to those without such coverage. Urban resident households also experienced a higher rate of CDHE at 6.6% (95% CI 5.5–7.9), compared to their rural counterparts.

Figure 1 illustrates the prevalence of CDHE and CME at different levels of capacity to pay (CTP) thresholds. The data shows an inverse relationship between the CTP threshold and the prevalence of CDHE and CME. As the CTP threshold increased, the prevalence of both types of catastrophic expenditures decreased. Specifically, at a CTP threshold of 10%, the prevalence of CDHE was 16.2% and the prevalence of CME was 32.0%. However, when the CTP threshold was raised to 30%, the prevalence of CDHE dropped to 11.3% and the prevalence of CME decreased to 10.8%.

The regression analysis identified the factors significantly associated with CDHE and CME (Table 2). For

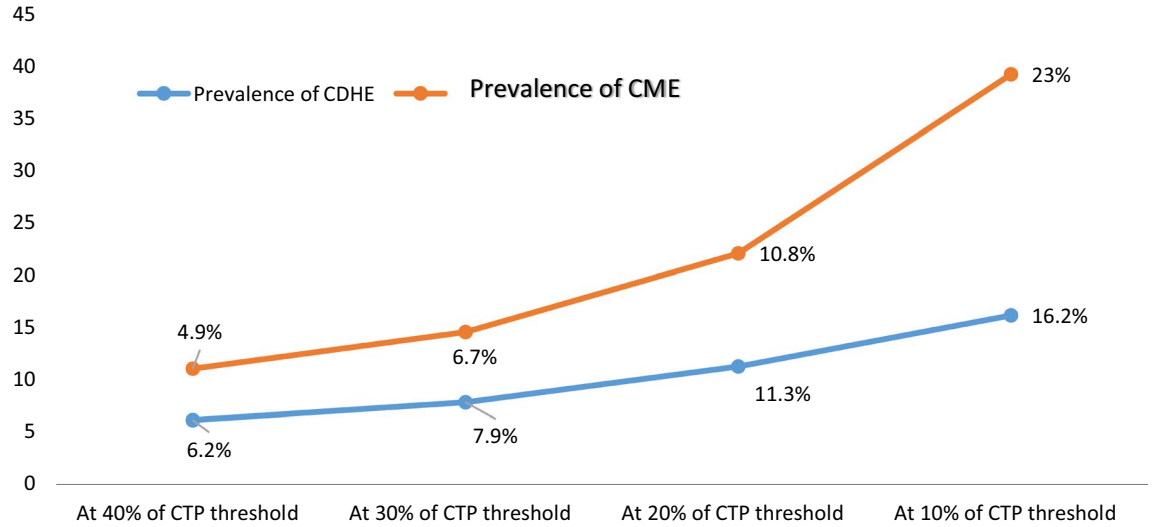

Fig. 1 Prevalence of catastrophic dental health expenditure (CDHE) and catastrophic medicine expenditure (CME) at different levels of capacity to pay (CTP)

CDHE, the analysis revealed statistically significant associations with the educational level of the household head, the economic status of the household, supplementary health insurance coverage, households having a member over 65 years old, the household's urban or rural residence, and the province. Similarly, the study found the main determinants of facing CME to be the age of the household head, the educational level of the household head, the economic status of the household, households having member(s) with chronic disease(s), and the province.

There is substantial disparity in the prevalence of CDHE and CME across different socioeconomic statuses of households. Among the poorest households, the prevalence of CDHE was 9.9% (95%CI 7.1 to 13.7), while the prevalence of CME was 16.8% (95%CI 13.2 to 21.3). Conversely, for the richest households, the corresponding figures were 4.1% (95% CI 2.4 to 6.9) and 1.5% (95%CI 0.6 to 3.7) for CDHE and CME, respectively. The results of the concentration index (CI) and concentration curve (CC) reveal a pro-rich inequality in dental costs and medicine costs, while indicating a pro-poor inequality in the prevalence of CDHE and CME. The CI for dental costs and CDHE prevalence was 0.248 (95% CI 0.115 to 0.381) and −0.185 (95% CI −0.297 to −0.073), respectively. Furthermore, the CI for medicine costs and CME prevalence was 0.149 (95%CI 0.087 to 0.211) and −0.570 (95% CI −0.692 to −0.448), respectively. The CC for dental costs and medicine costs lies above the 45-degree line (Fig. 2), while the CC for CDHE prevalence and CME prevalence lies below the 45-degree line (Fig. 3). These findings indicate that dental costs and medicine costs are more concentrated among the wealthier population, while the prevalence of CDHE and CME are more concentrated among the poor.

Supplementary 1 and Fig. 4 reports the results of the decomposition analysis of economic-related inequality in prevalence of CDHE in Iran. Based on Fig. 4, the primary factor influencing the inequality in the prevalence of CDHE is the economic status of households. In addition to economic status, other contributing factors to the concentration of CDHE among the poor include households with a member over 65 years old, living area, and the age of the household head. For instance, the economic status accounted for approximately 45.4% of the overall inequality in CDHE. This suggests that achieving an equal distribution of economic status among households could potentially reduce socioeconomic-related inequality in CDHE by 45.4%. Conversely, factors contributing to the concentration of CDHE among more affluent households include having supplementary health insurance (−17.8%), the education status of the household head (−16.4%), female-headed households (−3.0%), and province (−2.4%). If the distribution of supplementary health insurance and education status of the household head were equal across all households, the economic inequality in CDHE would have increased by 17.8% and 16.4% respectively.

Supplementary 2 and Fig. 5 reports the results of the decomposition analysis of economic-related inequality in prevalence of CME in Iran. Based on Fig. 5, the main factor influencing the inequality in the prevalence of CME is the economic status of households. In addition to economic status, other contributing factors to the concentration of CDHE among the poor include households with a member over 65 years old, living area, the age of the

Table 2 The results of multiple logistic regression analysis of main determinants of CDHE and CME among households insured by the Social Security Organization, Iran, 2023

Variables	Coefficient for CDHE (95% CI)	Coefficient for CME (95% CI)
Age of household head in year	−0.013 (−0.032 to 0.005)	0.016 (0.005 to 0.0276)*
Sex of household head		
Male	–	–
Female	−0.555 (−1.256 to 0.148)	−0.081 (−0.775 to 0.612)
Education status of the household head		
Illiterate	–	–
Less than diploma	0.516 (−0.623 to 1.656)	1.155 (−0.003 to 2.314)*
Diploma to bachelor	0.891 (−0.212 to 1.994)	1.423 (0.255 to 2.591)*
Master to Ph.D	1.338 (0.138 to 2.538)*	1.303 (−0.112 to 2.717)*
Living area		
Urban	–	–
Rural	−0.669 (−1.341 to 0.001)*	−0.064 (−0.426 to 0.298)
Having supplementary health insurance		
No	–	–
Yes	0.699 (0.225 to 1.172)*	0.002 (−0.538 to 0.542)
Household having member over 65 years old		
No	–	–
Yes	0.612 (0.100 to 1.123)*	0.485 (0.139 to −0.158)
Household having member(s) with chronic disease (s)		
No	–	–
Yes	–[a]	0.660 (0.084 to 1.236)*
Economic status of household		
Poorest	–	
Poor	−0.607 (−1.234 to 0.019)*	−1.809 (−2.528 to −1.091)*
Middle	−0.959 (−1.560 to −0.358)*	−2.411 (−3.180 to −1.643)*
Rich	−1.730 (−2.476 to −0.984)*	0[b]
Richest	−2.062 (−2.839 to −1.284)*	−3.364 (−4.415 to −2.313)*
Province		
Sistan and Baluchestan	–	–
Golestan	0.485 (−0.137 to 1.108)	−0.784 (−1.562 to −0.006)*
Kermanshah	−1.941 (−2.794 to −1.089)*	−2.817 (−3.831 to −1.802)*
Tehran	−0.053 (−0.694 to 0.588)	−0.112 (0.91 to 0.697)
Yazd	−0.734 (−1.406 to −0.062)*	−1.235 (−1.993 to −0.476)*

* : Significant at 5% level; CDHE: Catastrophic dental health expenditure; CME: Catastrophic medicine health expenditure; a: This variable is not included in the analysis; b: None of the households in this category faced catastrophic medicine expenditure (CME)

household head as well as household having member(s) with chronic disease (s). Conversely, factors contributing to the concentration of CDHE among more better-off households include having supplementary health insurance, the education status of the household head, female-headed households, and province.

Discussion

Financial access to healthcare should be unrestricted, ensuring individuals can access services without financial concerns and costs remain within their financial capacity. Healthcare systems aim to provide financial protection when utilizing healthcare services [28, 29]. The study aims to assess financial protection in dental and medication expenses among insured individuals, based on their exposure to catastrophic health expenditures (CHEs). It also examines economic inequality in households' exposure to catastrophic expenditures for dental services and medication, along with its key determinants.

Based on the study findings, there is a considerable financial burden on households insured through SSO due to dental and medication costs in Iran. The study showed that 6.2% and 9.4% of households experienced CDHE and CME, respectively. Woldemichael et al.

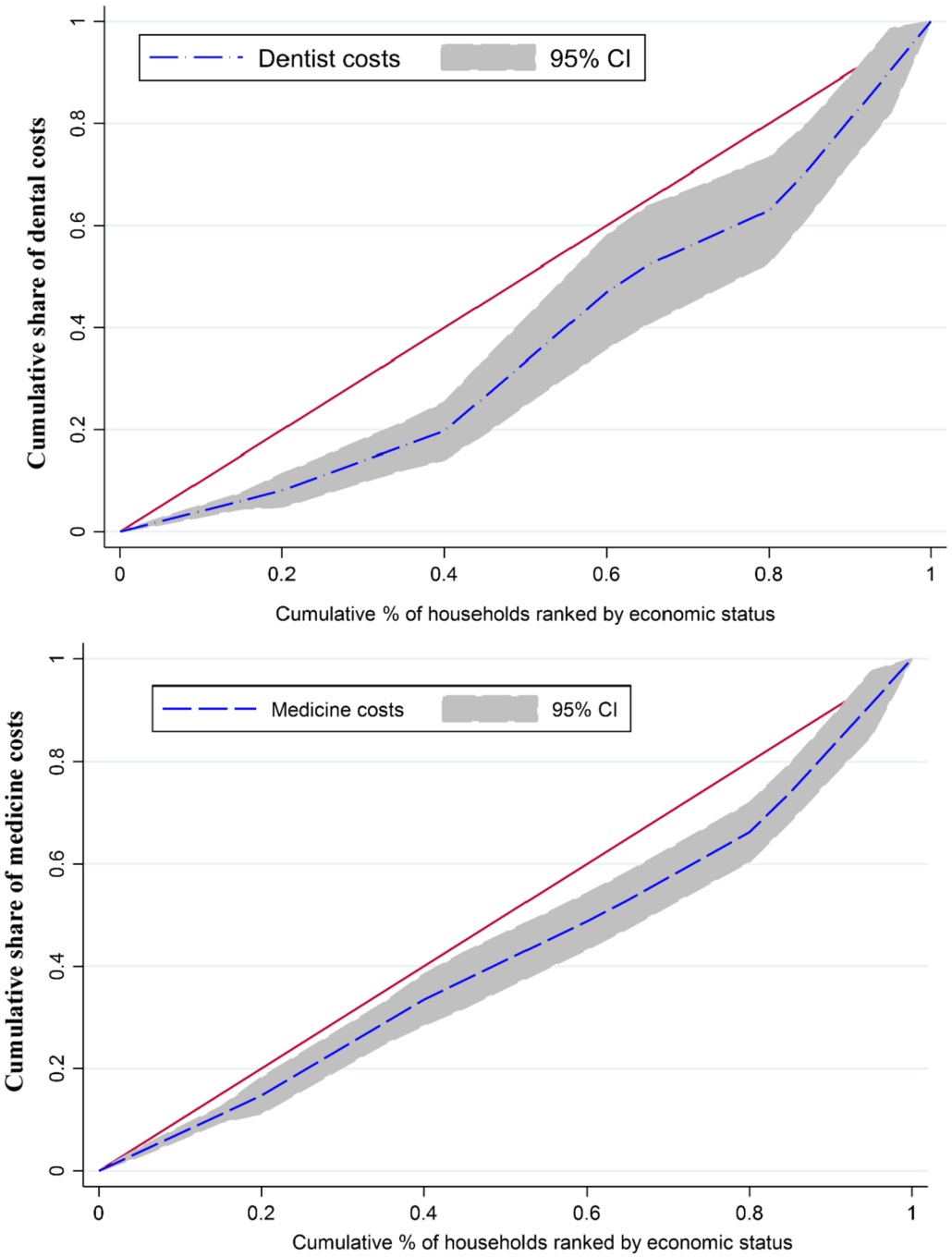

Fig. 2 The concentration curve of dental costs and medicine costs among households insured by the Social Security Organization, Iran, 2024

demonstrated that the prevalence of CHE among Iranian's households that had utilized dental services in the past month was 400% higher compared to those who did not utilize these services (16% vs. 4%) [30]. In another study conducted in South Korea, the results indicated that the prevalence of CHEs among households that used dental services was approximately 25%, while it was around 8% among households that did not use dental services [31]. Furthermore, a study conducted in Tunisia in 2022 revealed that the prevalence of CHE and catastrophic expenditures for medication services were 18.4% and 8%, respectively [32]. Datta et al. in Pakistan revealed that the prevalence of CHE among households that use medications for

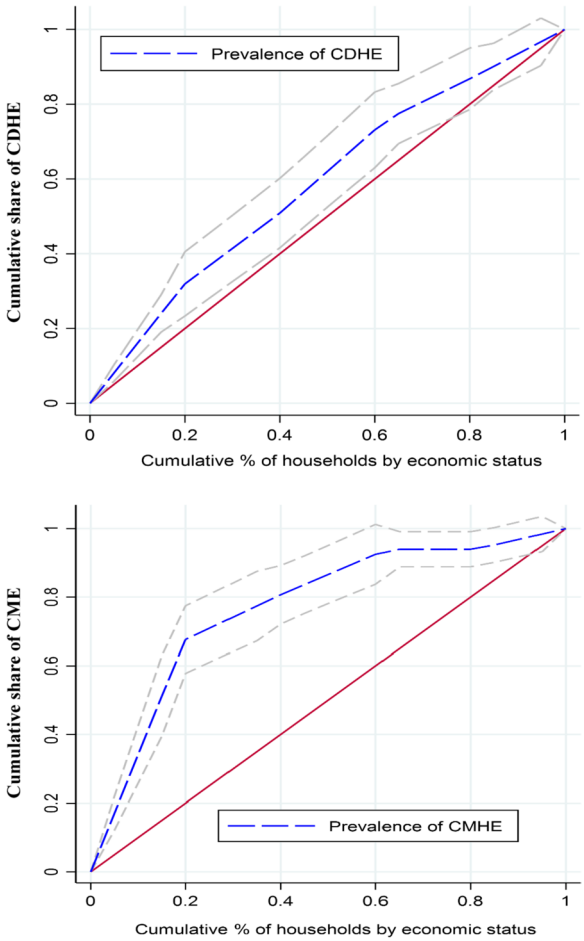

Fig. 3 The concentration curve of prevalence of catastrophic dental health expenditure (CDHE) and catastrophic medicine health expenditure (CME) among households insured by the Social Security Organization, Iran, 2024

hypertension and diabetes is approximately 7% higher than households that do not incur expenses for these types of medication [33]. In some studies, the reported prevalence rates of CHEs differ from the findings of the present study. There are various reasons for the heterogeneity in the results of different studies, and therefore, the findings of this study were consistent with many studies while differing from other studies. One of the most important reasons for the variation in results among different studies is attributed to the specific population under investigation. Other significant factors include sample size, the questionnaire used, the threshold considered, and, of course, the study year. It is essential to highlight that this study focused exclusively on estimating the prevalence of catastrophic health expenditures (CHEs) related to dental and medication costs. If other healthcare expenses incurred by households were included in the analysis, it is highly likely that the prevalence of CHEs would be higher.

The results of our study indicate that specific individual and contextual factors were linked to CDHE and CME among Iranian households insured by SSO. The educational level of the household head, residential location (urban or rural), presence of individuals over 65 years old in the household, household economic status, and province of residence were among the most significant factors influencing households' exposure to CDHE. In line with our results Massoud and colleagues [34] showed that wealthier, urban and larger households and more economically developed countries had higher odds of facing CDHE. The logistic regression results also revealed that the age of the household head, educational level of the household head, presence of a chronic illness in the household, household economic status, and province of residence were the most influential factors affecting households' exposure to catastrophic health expenditures related to medication services. Nooraei Motlagh et al. [35] identified the utilization of dental and hospital services as the primary influential factors contributing to households' exposure to CHEs in Iran. Additionally, factors such as having an individual aged over 65 in the household, low educational level, female household head, and lack of insurance coverage were found to impact households' likelihood of facing CHEs. Another study by Rezapour et al. [36] highlighted that being over 60 years old, utilizing inpatient services, and making informal payments were significant factors influencing households' exposure to CHEs. Furthermore, a separate study revealed that residing in rural areas, income status, the number of employed individuals in the household, and marital status were identified as the most influential factors affecting households' exposure to CHEs [37]. The results of our study demonstrated the relationship between supplementary health insurance coverage and the occurrence of CDHE and CME. Our findings indicated that there was no statistically significant association between supplementary health insurance coverage and CHE in terms of medication expenses. However, for dental services, we observed a positive correlation between supplementary health insurance coverage and the prevalence of CDHE. This seemingly counterintuitive finding may be explained by the limited scope and coverage of dental services within existing supplementary insurance plans in Iran. While individuals with supplementary insurance may access more dental care, the plans may not adequately cover the full cost, leaving households vulnerable to catastrophic expenditures. In Iran, health insurance does not provide full coverage for dental services and medication costs, making households more susceptible to CHEs. Consequently, policymakers

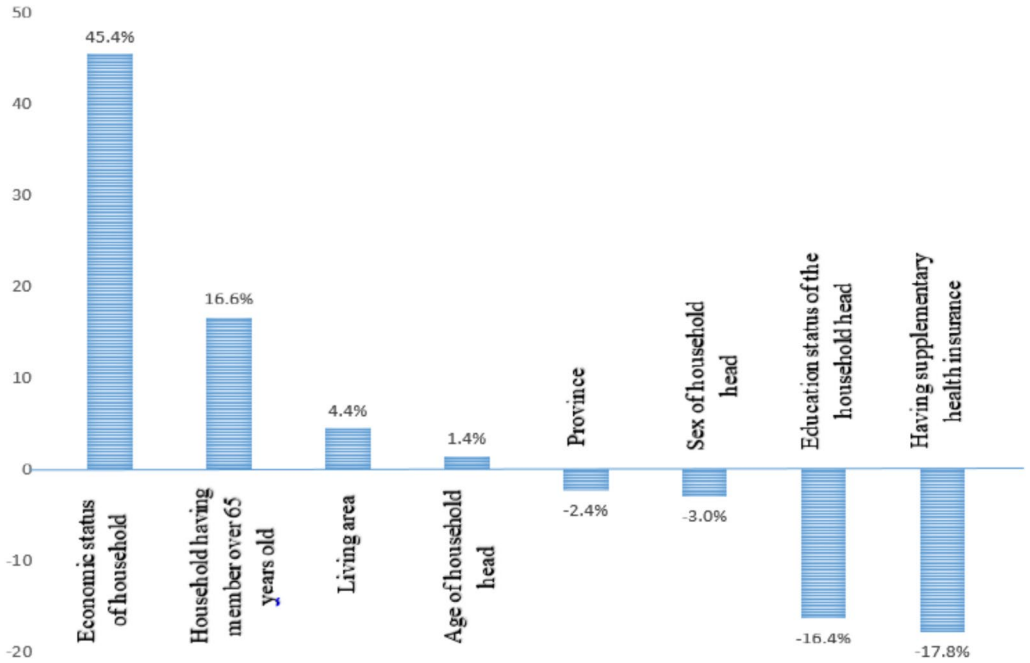

Fig. 4 Percentage contributions of each factor to economic-related inequality in the prevalence of dental catastrophic health expenditure (CDHE) based on decomposition analysis

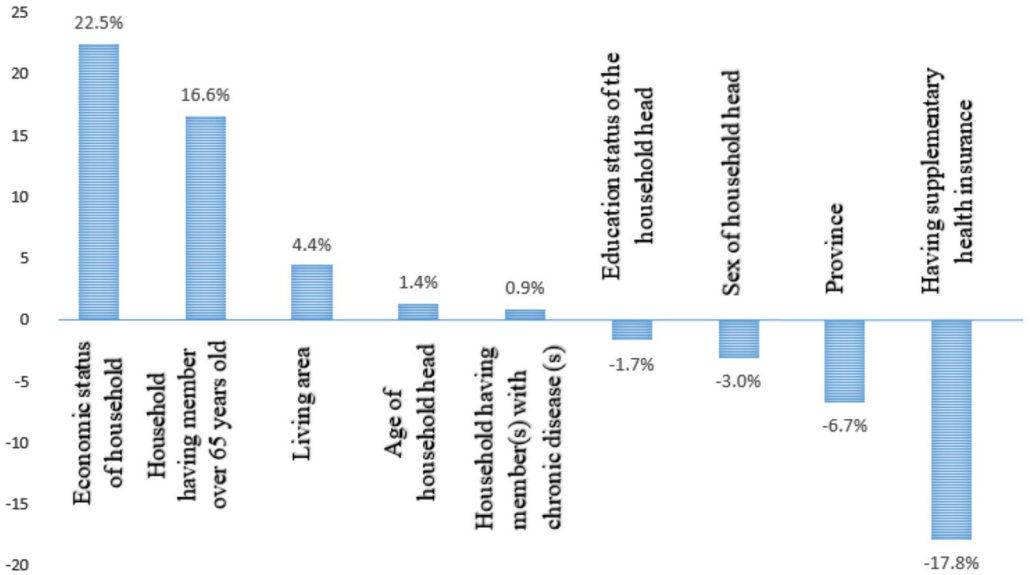

Fig. 5 Percentage contributions of each factor to economic-related inequality in the prevalence of medicine catastrophic expenditure (CME) based on decomposition analysis

should prioritize expanding the coverage of these services to mitigate the occurrence of catastrophic expenses. The findings indicate that the SSO should concentrate on enhancing the coverage level and scope of dental services and medication to improve financial protection for the insured population. Consequently, policymakers should prioritize expanding the coverage of these services to mitigate the occurrence of catastrophic expenses. Learning from other countries that have successfully expanded coverage for essential services could provide valuable insights.

In our study, we examined the economic inequality in dental and medication costs among households, as well as households' exposure to catastrophic expenditures for these two services. The results of the study demonstrated that dental and medication costs were more concentrated among households with higher economic status, whereas the concentration of catastrophic expenditures due to these two services was observed among the poorer households. These findings are consistent with previous studies conducted in Iran and other countries [30, 32, 33]. A study conducted in Spain found evidence of significant socioeconomic disparities and unmet dental care needs among the population [38]. Another study revealed that OOP payments for dental services can impose a substantial and unnecessary financial burden on households [39]. Decomposition analysis also indicated that economic status of household is the main factor that contributed to the concentration of CDHE and CME among the poor. Evidence has shown that poorer households were more likely to experience CDHE [39]. Low-income families generally have a lower ability to pay for healthcare services [23, 40]. A study by Kavosi et al. [41] found that 83% of the observed socioeconomic inequality in facing CHE was attributable to the economic status of households.

This study is subject to certain limitations that should be taken into account when interpreting the findings. A key limitation of this study is its cross-sectional design, which prevents us from establishing causal relationships between the prevalence of CDHE or CME and the explanatory variables. This limitation is particularly important when considering policy recommendations, as we cannot definitively conclude that interventions targeting specific explanatory variables will directly lead to a reduction in CDHE or CME. Further research is needed to confirm these relationships before implementing large-scale policy changes. Another limitation of this study is that it used self-reported household expenditures, which are prone to recall bias. To minimize the effect of this bias, the study utilized a monthly recall period for participants to report their household expenditures on dental care and medication. While this study effectively utilizes decomposition analysis to examine catastrophic health expenditures, it is important to note that we did not have access to data regarding certain factors, such as the role of supplementary insurance or chronic diseases. Additionally, systemic factors like inflation, economic crises, or healthcare reforms that may influence the financial burden on households were not considered in our analysis. These limitations highlight areas for future research and underscore the complexity of understanding health expenditure dynamics.

Conclusion

The findings of this study, particularly regarding the impact of supplementary health insurance and the economic inequalities in accessing dental and medication services, have significant implications for achieving Universal Health Coverage. Our research highlights the significant financial burden that households covered by the Social Security Organization (SSO) face regarding out-of-pocket (OOP) healthcare expenses, particularly in dental care and medications. The study found that 6.2% of households experienced catastrophic dental health expenditures (CDHE), while 4.9% faced catastrophic medical expenditures (CME). Importantly, these catastrophic expenses were disproportionately concentrated among economically disadvantaged households, with a concentration index indicating that financial status is a critical factor in this disparity. The decomposition analysis revealed that the household wealth index accounted for 45.4% of the concentration of CDHE and 22.5% of CME among poorer households, underscoring the role of socioeconomic status in determining health expenditure outcomes. To mitigate these disparities, it is essential for policymakers to implement targeted health policies aimed at reducing OOP payments, specifically for low-income households insured through the SSO. Furthermore, to enhance financial protection for its members, the SSO should consider expanding both the depth and breadth of coverage for dental services and medications. These measures are crucial in addressing the socioeconomic inequalities observed in our findings and ensuring equitable access to necessary healthcare services.

Supplementary Information

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Supplementary Material 1.

Supplemntary Material 2.

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Author contributions

SR and SA developed the idea, collected and analyzed the data and drafted the initial report. MAMGH critically reviewed the paper, offering comments on the first draft. SA and SR collaborated on implementing the revisions and producing the final edition of the manuscript. Writing—review & editing: all authors.

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Availability of data and materials
The datasets are not publicly available but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The research protocol was reviewed and approved by the Research Deputy of Kermanshah University of Medical Sciences, with the approval number IR.KUMS.REC.1402.616. The study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. Before data collection began, the researchers verbally explained the study's purpose to each potential participant and obtained their verbal consent to participate. Participants were informed of their right to withdraw from the study at any time without consequence.

Competing interests
The authors declare no competing interests. Supplementary Material 1

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