



# Catastrophic Health Expenditure among Iranian Households: Evidence from the COVID-19 Era

Mohammadreza Sheikhy-Chaman<sup>1</sup>, Aziz Rezapour<sup>2</sup>, Aidin Aryankhesal<sup>3</sup>, Ali Aboutorabi<sup>1\*</sup>

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## Abstract

**Background:** Monitoring households' exposure to catastrophic health expenditure (CHE) based on out-of-pocket (OOP) health payments is a critical tool for evaluating the equitable financial protection status within the health system. The COVID-19 pandemic has brought unprecedented global change and potentially affected the mentioned protection indicators. This study aimed to assess the prevalence of CHE among households in Iran during the COVID-19 period.

**Methods:** The present study employed a retrospective-descriptive design utilizing data derived from two consecutive cross-sectional Annual Household Income and Expenditure Surveys (HIES) undertaken by the Statistical Centre of Iran (SCI) in 2020 and 2021. The average annual OOP health payments and the prevalence of households facing CHE were estimated separately for rural and urban areas, as well as at the national level. Based on the standard method recommended by the World Health Organization (WHO), CHE was identified as situations in which OOP health payments surpass 40% of a household's capacity to pay (CTP). The intensity of CHE was also calculated using the overshoot measure. All statistical analyses were carried out using Excel-2016 and Stata-14 software.

**Results:** The average OOP health payments increased in 2021, compared to 2020, across rural and urban areas as well as at the national level. Urban residents consistently experienced higher OOP health payments than rural residents and the national level in both years. At the national level, the prevalence of CHE was 2.92% in 2020 and increased to 3.18% in 2021. In addition, rural residents faced a higher prevalence of CHE based on total health services OOP, outpatient services OOP, and inpatient services OOP compared to urban residents and the national level. Regarding the intensity of CHE using overshoot, the results for 2020 and 2021 revealed that the overshoot ranged between 0.60% and 0.65% in rural areas, between 0.30% and 0.33% in urban areas, and between 0.38% and 0.41% at the national level.

**Conclusion:** A considerable percentage of households in Iran still incur CHE. This trend has increased in the second year of COVID-19 compared to the first year, as households received more healthcare services. The situation is even more severe for rural residents. There is an urgent need for targeted interventions in the health system, such as strengthening prepayment mechanisms, to reduce OOP and ensure equitable protection for healthcare recipients.

**Keywords:** Catastrophic Health Expenditure, Out-of-Pocket, Health Equity, COVID-19, Iran

**Conflicts of Interest:** None declared

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## Introduction

The health system aims to provide healthcare services to all segments of the population and eliminate any related

**Corresponding author:** Dr Ali Aboutorabi, [abutorabi.a@iums.ac.ir](mailto:abutorabi.a@iums.ac.ir)

<sup>1</sup> Department of Health Economics, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran

<sup>2</sup> Health Management and Economics Research Center, Health Management Research Institute, Iran University of Medical Sciences, Tehran, Iran

<sup>3</sup> Department of Health Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran

### ↑What is "already known" in this topic:

Catastrophic health expenditure (CHE) represents a substantial financial burden on the health system. However, there is a lack of evidence regarding the prevalence and intensity of CHE during the COVID-19 pandemic among Iranian households. This study aims to address this knowledge gap and provide valuable insights for health policymakers and managers in the Iranian health system, helping them develop strategies to alleviate the economic impact of healthcare services on households.

### →What this article adds:

The average out-of-pocket (OOP) health payments increased in 2021 compared to 2020, and households faced higher CHE in the second year of the COVID-19 pandemic compared to the first year across rural and urban areas, as well as at the national level. The situation was worse for rural households. Overall, to expand health equity, Iran's health system needs comprehensive measures in different areas, with a particular focus on economically disadvantaged populations.

barriers (1). This objective is closely linked to the concept of Universal Health Coverage (UHC), which has been emphasized by the World Health Organization (WHO) and World Bank (WB) (2). Financial hardship is one of the main challenges in achieving this coverage (3).

The financing sources of the health system can be broadly divided into two branches. In the first branch, individuals pay for their healthcare services through prepayments before needing these services (4). In the second branch, the prepayment mechanisms are weak, and individuals are forced to bear a larger portion of healthcare costs through out-of-pocket (OOP) payments at the time of service utilization (5). Financial hardship primarily falls on service recipients in the second branch.

Accessing and utilizing healthcare services is not solely determined by physical availability, including the establishment of healthcare facilities and the provision of human capital. The health system must also ensure equitable financial protection for all recipients of these services (6). In the absence of this protection, groups who lack the financial capacity to pay (CTP) for healthcare costs may altogether refuse or delay receiving these services at the appropriate time. Those who do seek healthcare services may face catastrophic health expenditure (CHE) and medical impoverishment (7). Additionally, households may also be forced to displace other household consumption, sell their belongings and cars, borrow money from friends and relatives, or resort to bank loans to cover healthcare expenses (8, 9). All of these circumstances have a significant impact on the living standards and well-being of individuals, households, and society as a whole.

The concept of CHE has gained significant attention globally by the health systems as a means to assess and monitor the status of equitable financial protection. CHE refers to a situation where the payment for healthcare services exceeds a certain threshold of income or CTP of households (10, 11). According to data from 133 countries, the incidence of CHE at the 10% threshold was estimated to be 9.7% in 2000, 11.4% in 2005, and 11.7% in 2010, affecting 808 million people worldwide in 2010 (12). A scoping review study conducted in Iran in 2023 reported an average occurrence of CHE at 3.19% and 3.21% of households falling into poverty due to OOP health payments (13). The COVID-19 pandemic is also likely to be a contributing factor to the extent of households facing CHE.

COVID-19, which began towards the end of 2019, had a significant impact on the world, particularly on health systems. Governments and health systems made extensive efforts to control its spread by allocating substantial financial resources (14). This pandemic, along with the social distancing measures and fear of contracting the disease, altered the pattern of healthcare utilization. According to findings, healthcare utilization during the pandemic decreased by approximately one-third. This reduction was more pronounced among individuals with less severe illnesses (15). In Iran, COVID-19 had negative consequences on the utilization of primary healthcare services (16).

As a lower middle-income country, Iran has emphasized the importance of achieving social and health equity

through numerous upstream documents. Reduction of the OOP proportion of total health expenditure from 50% to 30% and decreasing households' exposure to CHE to 1% were important targets in the country's last national development plans (17, 18). Iran's health transformation plan was another key reform aimed at increasing access to healthcare services by expanding basic health insurance, improving the quality of healthcare services, and reducing OOP health payments for patients in hospitals affiliated with the Ministry of Health and Medical Education (MoHME) (19). Nevertheless, the predefined objectives of these measures have not been optimally achieved (20, 21).

Being aware of the latest status of equitable financial protection indicators after COVID-19 is crucial for policymakers, health managers, and health economists to align the path towards universal health coverage, sustainable development goals, and health for all. However, to the best of our knowledge, no study has specifically addressed households' exposure to CHE during the COVID-19 pandemic in Iran. Therefore, the present research was conducted in 2023 to fill this essential knowledge gap.

## Methods

### Samples and Data Source

We conducted a retrospective-descriptive study at the national level, using data obtained from two cross-sectional annual Household Income and Expenditure Surveys (HIES) conducted by the Statistical Center of Iran (SCI) in 2020 and 2021. These years were affected by the COVID-19 pandemic on a global scale, and consequently in Iran.

The surveys collected information on (1) the social characteristics of household members; (2) housing characteristics, living facilities, and assets; (3) household expenditures on both food and non-food items; and (4) household income. To select households for the surveys, the SCI used a three-stage stratified random cluster sampling method. Both rural and urban areas were included in the samples, and households were weighted by the SCI in conformity with the rural and urban population ratio. Based on this, the proportion of households within each cluster, rural/urban areas, and provinces were determined, and sampling weights were calculated for each household according to the inverse of the likelihood of being sampled (i.e.,  $\frac{N}{n}$ , where N is the population size and n is the sample size) (22).

After excluding households whose food expenditure was not reported (missing, zero), the final sample size was 37,397 for 2020 and 37,830 for 2021. Further details on this matter are provided in [Table 1](#).

*Table 1.* Sample Size of the Study Years: 2020-2021

Year	Residency	Primary Sample	Excluded Sample*
2020	Rural	18,251	87
	Urban	19,306	73
2021	Rural	19,618	74
	Urban	18,370	84

\* Number of households with no food expenditure report

### Measurements

Various methods exist for measuring CHE. In this study, we used the standard method of the WHO, which is widely recognized. A household was considered to have experienced CHE if its OOP health payments exceeded 40% of its CTP (23). The recall period for each item in the household expenditure questions varied from one month to one year in the surveys. To ensure consistency, we chose the month as the basis of analysis. Moreover, since each survey took more than 1 month to complete, the SCI adjusted the expenditures using the consumer price index.

1. To measure CHE, the initial step is to calculate the household's CTP, which is defined as the effective income (total household expenditure) minus the subsistence spending (basic living needs) adjusted for household size. In other words, CTP equals the household's non-food expenditure.

In the calculation of CTP, to account for economies of scale in household consumption, we used an equivalence scale instead of actual household size as below:

$$eqsize_h = hsize^\beta$$

where "hsize" represents the actual household size and "eqsize<sub>h</sub>" represents the household's equivalence size. The value of  $\beta$ , which was set at 0.56, was based on a similar study conducted in 59 countries (24).

In the subsequent, it is necessary to determine the poverty line (PL), which is the minimum spending required to meet basic needs, also known as subsistence spending.

To begin with, the share of food expenditures of the households' total expenditure was calculated as follows:

$$foodexp_h = \frac{food_h}{exp_h}$$

Specifically, for households whose food share ranged from 45% to 55%, the mean of their absolute food expenditure was determined. The PL was estimated separately for rural and urban households, as illustrated below:

$$eqfood_h = \frac{food_h}{eqsize_h}$$

$$PL = \frac{\sum w_h \times eqfood_h}{\sum w_h}, \quad food_{45} < foodexp_h < food_{55}$$

where  $w_h$  is the sampling weight of households, and PL denotes the poverty line.

Moreover, the subsistence spending of households ( $se_h$ ) was calculated as follows:

$$se_h = PL \times eqsize_h$$

When households reported that their food expenditure was lower than subsistence spending ( $se_h > food_h$ ), it may be due to factors such as coupons, food subsidies, self-production, or other non-cash means of food consumption that were not taken into account in the surveys. In such cases, the estimated poverty standard for the country exceeds the reported food expenditure, resulting in CTP or household non-subsistence spending equaling (25, 26):

$$ctp_h = exp_h - se_h \quad \text{if} \quad se_h \leq food_h$$

$$ctp_h = exp_h - food_h \quad \text{if} \quad se_h > food_h$$

where  $ctp_h$  represents the CTP and  $exp_h$  represents the total expenditure.

2. After completing the above steps, it is necessary to divide the OOP (health payments made directly at the time of service delivery) by the CTP. The resulting value is referred to as the burden of household health payments:

$$oopctp_h = \frac{oop_h}{ctp_h}$$

If the value of the above equation ( $oopctp_h$ ) is  $\geq 0.4$ , the household is considered to have experienced CHE.

The percentage of households experiencing CHE, referred to as the catastrophic head count (HC), is estimated as follows:

$$HC = \frac{1}{N} \sum_{i=1}^N E_i$$

where N stands for the sample size. In regard to  $E_i$ , OOP health payments of household  $i$  is  $\geq 0.4$ ,  $E_i$  is assigned a value of 1; otherwise, it is assigned a value of 0.

The HC measures the proportion of households whose OOP health payments exceed the threshold, but it does not quantify the degree to which payments surpass the threshold. This is a limitation of the HC.

3. After measuring CHE, it is time to calculate the intensity of CHE that overcomes the mentioned limitation using overshoot:

The overshoot measure indicates how much OOP health payments exceed the threshold ( $Z$ ), which is set at 0.4 in this study, and is a key factor in determining the intensity of CHE.

The overshoot is calculated using the following formula:

$$O_i = E_i \left( \left( \frac{oop_h}{ctp_h} \right) - Z \right)$$

A household is considered to have experienced CHE when the ratio of  $oop_h$  to  $ctp_h$  exceeds the threshold. Thus, the average overshoot is (27):

$$O = \frac{1}{N} \sum_{i=1}^N O_i$$

### Data Analysis

All preliminary calculations were conducted using the official currency of Iran, which is the Rial. To convert the Rial to international dollars based on purchasing power parity (PPP), the PPP conversion factor was obtained from the WB for 2020 and 2021, which were 30,697.96 and 46,072.46, respectively (28). The equivalence of 1 PPP in terms of Iran's Rial was estimated for each year using these factors.

The prevalence of CHE and its intensity (using the overshoot measure) were calculated separately for rural areas, urban areas, and at the national level. Furthermore, the 95% confidence interval (CI) was reported for the prevalence of CHE and overshoot in each study year.

While the main analysis and interpretation of the results were based on the 0.4 threshold, to enhance the robustness and applicability of the results for health system policy-makers, managers and economists, the results were also calculated using 0.1 and 0.2 thresholds.

The statistical analysis was first performed by Microsoft Excel software (version 2016), and then with Stata software (version 14).

## Results

To present the research findings as clearly as possible, they were organized into three classifications— (1) OOP health payments; (2) prevalence of CHE; and (3) intensity of CHE.

### OOP Health Payments

Regarding the average annual OOP health payments per household, there are a few important points to consider. Firstly, this amount was increased in 2021 (the second year of the COVID-19 pandemic) compared to 2020 (the first year of the COVID-19 pandemic), across rural and urban areas as well as at the national level. Secondly, urban residents consistently incurred higher OOP health payments compared to rural residents and the national level in both years. Thirdly, outpatient services account for a significant percentage of OOP health payments, while inpatient services represent a smaller share. Further details on this matter are provided in [Table 2](#).

### Prevalence of CHE

Based on the total health services OOP—outpatient services plus inpatient services—in the year 2020, 4.38% of households in rural areas, 2.43% in urban areas, and 2.92% at the national level experienced CHE. In the subsequent year, these percentages increased to 4.60% for rural areas, 2.71% for urban areas, and 3.18% at the national level. Furthermore, it is noteworthy that the rural residents consistently faced a higher prevalence of CHE compared to urban residents and the national level in both study years. Further details on this matter are provided in [Table 3](#).

With respect to the prevalence of CHE based on the outpatient services OOP, the first-year data revealed that

2.59% of rural households, 1.38% of urban households, and 1.69% of households at the national level experienced CHE. In the second year, these percentages slightly increased to 2.77% for rural households, 1.72% for urban households, and 1.98% at the national level. Moreover, in both years, rural residents faced higher percentages of CHE compared to urban areas and the national level. Further details on this matter are provided in [Table 4](#).

Concerning the prevalence of CHE based on the inpatient services OOP, the data for 2020 indicated that 1.7% of rural residents experienced CHE, while this percentage was 0.51% for urban areas and 0.65% at the national level. In 2021, the prevalence of CHE decreased for rural residents, urban residents, and at the national level to 0.99%, 0.46%, and 0.59%, respectively. Similar to previous findings, rural residents consistently encountered higher percentages of CHE compared to urban areas and the national level in both years. Further details on this matter are provided in [Table 5](#).

### Intensity of CHE

The degree to which OOP health payments exceeded the determined threshold (intensity of CHE) was investigated using the overshoot measure. With consideration of 40% CTP, the results for 2020 and 2021 revealed that in rural areas, the overshoot ranged between 0.60% and 0.65%. Similarly, in urban areas, the range was observed to be between 0.30% and 0.33%. At the national level, the overshoot was found to be between 0.38% and 0.41%. Again, the values pertaining to rural areas were higher than urban areas and the national level. Further details on this matter are provided in [Table 6](#).

**Table 2.** Average Annual OOP Health Payments Per Household (PPP \$): 2020-2021

Year	Residency	Total Health Services	Outpatient Services	Inpatient Services
2020	Rural	737.51	549.07 (74%)	188.44 (26%)
	Urban	1017.79	814.96 (80%)	202.83 (20%)
	National	881.58	685.75 (78%)	195.83 (22%)
2021	Rural	764.14	587.17 (77 %)	176.97 (23%)
	Urban	1049.40	845.64 (81 %)	203.76 (19 %)
	National	911.45	720.65 (79%)	190.80 (21%)

**Table 3.** Prevalence of CHE Based on the Total Health Services OOP: 2020-2021

Year	Residency	Threshold	Prevalence (%)	95% CI
2020	Rural	10% CTP	26.54	(25.72 – 27.37)
		20% CTP	13.92	(13.29 - 14.58)
		40% CTP	4.38	(4.01 - 4.78)
	Urban	10% CTP	22.11	(21.28 - 22.96)
		20% CTP	9.83	(9.25 - 10.44)
		40% CTP	2.43	(2.14 - 2.76)
	National	10% CTP	23.28	(22.62 - 23.96)
		20% CTP	10.89	(10.42 - 11.38)
		40% CTP	2.92	(2.67 - 3.18)
2021	Rural	10% CTP	28.43	(27.61 - 29.26)
		20% CTP	14.70	(14.07 - 15.36)
		40% CTP	4.60	(4.23 - 5.00)
	Urban	10% CTP	24.00	(23.16 - 24.86)
		20% CTP	10.63	(10.04 - 11.24)
		40% CTP	2.71	(2.40 - 3.06)
	National	10% CTP	25.14	(24.46 - 25.83)
		20% CTP	11.62	(11.14 - 12.11)
		40% CTP	3.18	(2.92 - 3.45)



*Table 4.* Prevalence of CHE Based on the Outpatient Services OOP: 2020-2021

Year	Residency	Threshold	Prevalence (%)	95% CI
2020	Rural	10% CTP	21.37	(20.61 – 22.14)
		20% CTP	9.90	(9.34 - 10.49)
		40% CTP	2.59	(2.30 - 2.92)
	Urban	10% CTP	17.22	(16.48 - 17.99)
		20% CTP	6.72	(6.24 - 7.23)
		40% CTP	1.38	(1.18 - 1.62)
	National	10% CTP	18.31	(17.72 - 18.93)
		20% CTP	7.56	(7.17 - 7.97)
		40% CTP	1.69	(1.52 - 1.89)
2021	Rural	10% CTP	23.79	(23.02 - 24.58)
		20% CTP	11.08	(10.51 - 11.67)
		40% CTP	2.77	(2.48 - 3.09)
	Urban	10% CTP	18.51	(17.76 - 19.28)
		20% CTP	7.47	(6.98 - 7.99)
		40% CTP	1.72	(1.47 - 2.01)
	National	10% CTP	19.83	(19.23 - 20.46)
		20% CTP	8.35	(7.95 - 8.77)
		40% CTP	1.98	(1.78 - 2.21)

*Table 5.* Prevalence of CHE Based on the Inpatient Services OOP: 2020-2021

Year	Residency	Threshold	Prevalence (%)	95% CI
2020	Rural	10% CTP	5.50	(5.12 – 5.92)
		20% CTP	3.06	(2.77 - 3.38)
		40% CTP	1.07	(0.91 - 1.27)
	Urban	10% CTP	4.52	(4.10 - 4.97)
		20% CTP	1.97	(1.70 - 2.28)
		40% CTP	0.51	(0.37 - 0.71)
	National	10% CTP	4.78	(4.44 - 5.14)
		20% CTP	2.23	(2.01 - 2.48)
		40% CTP	0.65	(0.52 - 0.80)
2021	Rural	10% CTP	5.24	(4.86 - 5.66)
		20% CTP	2.63	(2.36 - 2.92)
		40% CTP	0.99	(0.83 - 1.18)
	Urban	10% CTP	4.79	(4.36 - 5.25)
		20% CTP	1.99	(1.73 - 2.29)
		40% CTP	0.46	(0.34 - 0.63)
	National	10% CTP	4.91	(4.57 - 5.27)
		20% CTP	2.15	(1.94 - 2.38)
		40% CTP	0.59	(0.48 - 0.72)

*Table 6.* Intensity of CHE Based on the Total Health Services OOP: 2020-2021

Year	Residency	Threshold	Overshoot (%)	95% CI
2020	Rural	10% CTP	4.20	(4.00 – 4.39)
		20% CTP	2.26	(2.12 - 2.40)
		40% CTP	0.60	(0.54 - 0.67)
	Urban	10% CTP	2.82	(2.66 - 2.98)
		20% CTP	1.33	(1.22 - 1.44)
		40% CTP	0.30	(0.26 - 0.35)
	National	10% CTP	3.17	(3.04 - 3.30)
		20% CTP	1.57	(1.48 - 1.66)
		40% CTP	0.38	(0.34 - 0.42)
2021	Rural	10% CTP	4.49	(4.29 - 4.68)
		20% CTP	2.40	(2.26 - 2.55)
		40% CTP	0.65	(0.58 - 0.72)
	Urban	10% CTP	3.09	(2.92 - 3.26)
		20% CTP	1.48	(1.36 - 1.60)
		40% CTP	0.33	(0.28 - 0.38)
	National	10% CTP	3.44	(3.30 - 3.57)
		20% CTP	1.71	(1.61 - 1.81)
		40% CTP	0.41	(0.37 - 0.46)

## Discussion

The COVID-19 pandemic has changed the pattern of healthcare utilization, which highlights the importance of equitable financial protection in the health system. By using CHE as a measure of this protection, policymakers and managers can ensure that healthcare services continue

to be provided at all levels. This study aimed to evaluate the prevalence of CHE among Iranian households during the pandemic. Key findings showed an increase in average annual OOP health payments in 2021 compared to 2020, with urban residents facing higher expenses than rural residents. Outpatient services accounted for a substantial

portion of OOP payments, while inpatient services represented a smaller share. The prevalence of CHE based on total health services OOP and outpatient services OOP increased from 2020 to 2021 for rural areas, urban areas, and the national level. However, the prevalence of CHE based on inpatient services OOP decreased for all three examined categories during the same period. Furthermore, the intensity of CHE, measured by the overshoot, increased across rural and urban areas as well as at the national level from 2020 to 2021.

The OOP health payments in Iran have shown a consistent upward trend in recent years. Rezaie et al. (2020) reported that in 1991, the share of OOP health payments from the total household expenditure in Iran was 2.09%. However, this proportion increased to 10.61% in 2017. Notably, the disparity between urban and rural areas in terms of OOP health payments decreased in 2017 compared to 1991 (29). In a study conducted in Turkey titled "Poverty Effects of Public Health Reforms in Turkey: A Focus on Out-of-Pocket Payments", it was observed that the average monthly OOP health expenditures per household moderately increased from 2003 to 2015. Moreover, the burden of OOP health expenditure fell heavily on vulnerable groups (30). Between 2006 and 2014, the average total household expenditure on healthcare items in Australia, a developed high-income country, remained relatively stable after adjusting for inflation, with a slight increase from \$3133 to \$3199 (31). In a cross-sectional study conducted in the United States aimed at assessing the trends of OOP healthcare expenses before and after the Passage of the Patient Protection and Affordable Care Act, it was found that from 2000 to 2018, total OOP per capita health expenses increased from \$1028 to \$1148, and the average annual growth rate of OOP spending significantly decreased following the implementation of this act (32). The increasing trend of OOP health payments is a concerning issue for the health system with significant consequences that need to be addressed promptly. In Iran, while primary healthcare services are mostly provided free of charge, OOP health payments mainly pertain to medical services. Although several other reasons can be mentioned, the rise in OOP health payments in household budgets can be attributed to increased demand for healthcare services, rising services tariffs, the introduction of expensive technologies and medical interventions into the health system, insufficient coverage of healthcare services by basic health insurance, and higher inflation in the healthcare sector compared to other sectors (33, 34). To mitigate the escalating OOP health payments, extensive investments in public health is crucial to prevent the further spread of various diseases in the country. Furthermore, establishing a comprehensive referral system and deploying family physicians can prove beneficial in addressing this issue.

Along with OOP health payments, the trend of households in Iran facing CHE based on the total health services OOP has also been ascending. A previous study conducted by Yazdi-Feyzabadi et al. in Iran, using similar surveys and methodologies as the present study, indicated a CHE rate ranging between 2.57% and 3.25% over the period

2008 to 2015 at the national level, with an average growth rate of 2.5% (18). According to another study titled "Measuring Catastrophic Health Expenditures and its Inequality: Evidence from Iran's Health Transformation Program", the prevalence of CHE at the national level, using the 40% threshold of the WHO methodology, increased from 1.99% in 2011 to 3.46% in 2017 (35). Regarding studies conducted in other countries, the rate of households facing CHE was found to be 8.66% in one of the states of Burkina Faso (36). Similarly, the investigation in Egypt showed a similar upward trend in CHE from 2000 to 2010, with a mean CHE of approximately 6% (37). Both studies reported a higher prevalence of CHE compared to the findings observed in the present study. As evident from its calculation method, the prevalence of CHE is influenced by two main factors, including OOP health payments and households' CTP. While both have increased in recent years, the rising trend of CHE prevalence indicates that OOP health payments have outweighed CTP. Regarding OOP health payments, in addition to the reasons mentioned earlier for their increase, factors such as a medical-oriented approach, population aging, the spread of non-communicable (chronic) diseases, and induced demand in Iran's health system have also contributed to this phenomenon (33, 38). As for CTP, the Iranian economy has experienced difficult and unstable conditions in recent years. It is mainly dependent on oil and has been affected by various international sanctions. The increased inflation rate caused significant pressure on limited household budgets. Urban households have experienced housing expenses as their largest share of expenditures, while food and clothing expenses have been predominant for rural households (20). These factors collectively demonstrate the need for serious measures to protect the country's households from health-related financial burdens in an equitable manner. This involves not only controlling the growth of OOP health payments but also improving the living standards of the population.

The COVID-19 pandemic has resulted in a global shift in the utilization of healthcare services. China witnessed a significant decline in healthcare utilization due to the pandemic, and similar trends have been observed in other heavily affected countries, including the UK, the United States, France, Spain, Italy, and Iran (39-41). Factors such as the fear of contracting SARS-CoV-2, the suspension of nonessential services, and the implementation of lockdowns and stay-at-home policies likely contribute to this change in healthcare utilization patterns during the pandemic. If we consider the year 2019 as the pre-COVID-19 era and the years 2020 and 2021 as the COVID-19 era, the prevalence of CHE in Iranian households was 3.40% in 2019 (42), 2.92% in 2020, and 3.18% in 2021 at the national level. In other words, the prevalence of CHE decreased in the first year of the pandemic compared to the pre-pandemic year, and in the second year, when society returned to a relatively normal state, the trend of CHE increased again. Hence, the observed decrease in the prevalence of CHE in 2020, as indicated by the present study, could be attributed to a decline in healthcare utilization rather than improvements in financial protection mecha-

nisms for Iranian households.

If OOP health payments are divided into two groups—including payments for outpatient services and payments for inpatient services—the present study reveals that the majority of OOP health payments for both rural and urban residents, as well as at the national level, belong to the outpatient services group. This leads to a higher prevalence of CHE associated with these services. In a study, Ghiasvand et al. also found that over 80% of the average OOP health payments by Iranian households are related to outpatient services (43). Another study conducted in Iran found a significant association between the number of outpatient visits and the incidence of CHE in patients with chronic diseases (44). Belgium, the Czech Republic, and Germany had a higher percentage of outpatient services than inpatient services in the distribution of the OOP burden related to chronic disease in older adults (45). These services, such as laboratory and medical imaging services, have a wide range and generally carry a lower tariff compared to inpatient services. They are predominantly provided by the private sector in the Iranian health system. This separates them from services covered by basic health insurance and places them under supplementary health insurance coverage. However, only a small percentage of Iranian households have supplementary health insurance. As a result, OOP payments for this group of services have significantly increased, and the likelihood of experiencing CHE has risen. In contrast, inpatient services in this health system are mainly provided by university-affiliated teaching hospitals, and basic health insurance plays a more prominent role in covering them. Even in all three examined categories, there was a reduction in the prevalence of CHE related to inpatient services OOP from 2020 to 2021. Additionally, self-medication is prevalent among Iranian households, with a notable reliance on over-the-counter drugs (46). Financially vulnerable households should receive government subsidies and supplementary health insurance support when seeking outpatient services from the private sector.

In this study, the findings were not only presented at the national level but also disaggregated by place of residence to offer policymakers a better understanding of the prevalence of CHE during the COVID-19 period. Both in 2020 and 2021, urban residents had higher OOP health payments compared to rural residents and the national level. However, the percentage of rural residents experiencing CHE was higher than that of urban residents and surpassed the national level. This trend was observed across various OOP groups, including total health services OOP, outpatient services OOP, and inpatient services OOP. Research conducted in China among cancer patients found that the incidence of CHE decreased by 22% in urban areas but increased by 31% in rural areas, despite a higher proportion of urban patients receiving cancer treatment in 2015 (47). Additionally, an investigation in Canada has shown that households with low socioeconomic status have a higher concentration of CHE (48). In contrast to urban households, a national study in India found that between 2014 and 2018, rural households had a higher incidence and intensity of CHE, with an upward trend in

CHE for both rural and urban residents, but a downward trend in its intensity (49). In Iran, multiple documents have highlighted that residing in rural areas is one of the contributing factors to the prevalence and intensity of CHE (50, 51). The higher OOP health payments for urban households compared to rural households and the national level, coupled with the higher prevalence and intensity of CHE for rural households compared to urban households and the national level, indicate two significant points. Firstly, urban residents tend to utilize more healthcare services because of better access to healthcare facilities. Secondly, rural households have lower CTP, increasing their likelihood of facing CHE. People living in rural areas face different barriers to accessing healthcare services, including the high costs and difficulties associated with traveling to cities, resulting in unmet healthcare needs. They play a crucial role in ensuring food security and promoting health in the country. Unfortunately, in recent years, a significant percentage of them have migrated to provincial and industrial cities because of unfavorable living conditions and severe rural-urban inequalities (52). The central government should provide comprehensive support to rural residents, create better conditions for rural occupations, and reduce poverty in society. Furthermore, the Rural Health Insurance Scheme, which was one of the key initiatives implemented in the Iranian health system to improve equitable protection of rural households (53), needs to be revised completely and strengthened. Travel costs to healthcare facilities can also be covered for the poor (54).

#### Study Limitations

Firstly, the commonly used methodologies for estimating CHE only account for direct medical expenditure, overlooking the significant financial impact of indirect expenditure related to illnesses, such as transportation, residency, and loss of income. Secondly, the absence of effective communication between the data source of the SCI and other relevant organizations, such as the MoHME and insurance organizations, limits the accuracy and reliability of the reported expenditure values by households. Lastly, the findings of this study were based on a certain period (the COVID-19 era) and may not fully reflect the long-term dynamics of CHE in Iran. All of the aforementioned limitations should be taken into consideration when utilizing and interpreting the results of this study. For future research, it is recommended to analyze the factors affecting CHE during the COVID-19 era using the same dataset utilized in this study or other reliable data sources. Additionally, besides using the overshoot to assess the intensity of CHE, researchers can also consider Mean Positive Overshoot as another measure.

#### Conclusion

The overall trend of OOP health payments and CHE in Iran's health system is increasing, which deviates from the desired goals. This situation is particularly challenging for rural residents, who are mainly among the financially vulnerable groups. The observed reduction in these two indi-

cators during the COVID-19 period can be attributed to decreased access and utilization of healthcare services rather than improved equity in financial protection. Policymakers and managers at the macro level of the country must provide support to the health system, aiming to alleviate the financial burden associated with accessing and utilizing healthcare services. This support should contribute to the country's progress towards achieving UHC and ensuring health for all. Implementation of programs that enhance living conditions and increase CTP among different population groups is necessary. Furthermore, shifting the health system's focus from a medical-oriented approach to substantial investments in preventive measures and public health, establishing pre-payment methods in health financing instead of relying on OOP payments, strengthening basic health insurance, and expanding supplementary health insurance coverage can potentially be effective in this regard.

### Abbreviations

UHC: Universal Health Coverage  
 WHO: World Health Organization  
 WB: World Bank  
 OOP: Out-of-Pocket  
 CTP: Capacity to Pay  
 CHE: Catastrophic Health Expenditure  
 MoHME: Ministry of Health and Medical Education  
 HIES: Household Income and Expenditure Surveys  
 SCI: Statistical Center of Iran  
 PL: Poverty line  
 HC: Head Count  
 PPP: Purchasing Power Parity  
 CI: Confidence Interval

### Availability of Data and Materials

The data for this study were obtained from the HIES surveys conducted by the SCI. The data can be accessed publicly at: <https://www.amar.org.ir/english/Statistics-by-Topic/Household-Expenditure-and-Income#2220530-releases>.

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### Ethics Approval

This study was approved by the ethics committee of Iran University of Medical Sciences with the ethics code IR.IUMS.REC.1400.1039.

### Conflict of Interests

The authors declare that they have no competing interests.

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