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# A Subnational Review of Temporal and Spatial Factors in Catastrophic Health Expenditure

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## ABSTRACT

*A substantial body of research has documented the adverse effects of catastrophic health expenditure (CHE) on household financial stability and access to healthcare. However, much of the literature examined CHE from a limited perspective, focusing either on temporal trends or on spatial differences at a single point in time. As a result, earlier findings were often inconsistent and provided only a partial understanding of the magnitude and distribution of CHE, particularly in low- and middle-income countries such as Pakistan. This study examined the impact of CHE on household financial stability and access to healthcare services while capturing variations across provinces and over time. By combining multiple analytical perspectives, the research provided a more nuanced and context-specific understanding of CHE than previous studies. This study employs secondary data from the Household Integrated Economic Survey (HIES) spanning 2007 to 2019, obtained from official government reports and regional healthcare sources. Six survey rounds, 2007–08, 2010–11, 2011–12, 2013–14, 2015–16, and 2018–19, are used to group household expenditure and annual income data from the HIES. Threshold levels of 10%, 25%, and 40% are applied across all six survey periods for both national and sub-national analysis. The use of diverse data sources enabled the study to capture household-level characteristics, regional healthcare utilization patterns, and broader economic and health system indicators over time. Demographic and socioeconomic variables, such as household income and household size, were incorporated to account for differences in household vulnerability. The study examines the likelihood of households incurring catastrophic health expenditure while controlling for demographic, economic, and spatial factors. This analytical strategy made it possible to identify key determinants of CHE and to assess how the risk of catastrophic spending varied across provinces and over time. The findings generated through this research contributed to a deeper understanding of the patterns and drivers of catastrophic health expenditure in Pakistan.*

***Keywords:*** *Health Expenditure, Out-of-Pocket Expenses, Temporal Trend, Spatial Analysis.*

## INTRODUCTION

Catastrophic Health Expenditure (CHE) is a global concern that puts households' financial security at risk and prevents them from accessing essential healthcare treatments. Rising healthcare expenses have the potential to push people into poverty and deny them access to necessary medical care. The World Health Organization (WHO) defined CHE as a major barrier to healthcare access and a contributor to poverty. CHE is defined as when household out-of-pocket expenses exceed their income level (WHO, n.d)

Healthcare expenditure is a fundamental concern worldwide, affecting individuals' financial well-being and their access to essential healthcare services. Catastrophic Health Expenditure (CHE) occurs when out-of-pocket healthcare payments affect household living (Kien et al., 2016). It is defined as health-related spending exceeding a certain proportion of household income and has gained significant attention in recent years due to its potentially catastrophic effects on households. High CHE can push households into poverty, limit their access to necessary medical care, and undermine overall health outcomes.

Despite the growing recognition of CHE's significance, much of the existing research focuses on national-level analyses, often overlooking sub-national disparities and variations. This research seeks to address this gap by emphasizing the importance of studying CHE at the sub-national level, where healthcare financing and access can vary significantly. Regional analyses can provide a nuanced understanding of the factors contributing to CHE, enabling policymakers to implement region-specific interventions.

Pakistan is included in the list of countries faced with several issues, and the most dominant issue highlighted from the list is health-related concerns. Low health expenditure is a reason for a significant rise in other issues in Pakistan. Pakistan has had numerous health-related crises and challenges from the 1970s to the pre-COVID duration (Gul and Abbasi, 2023). The health crises in this duration consist of malaria, polio, dengue fever, tuberculosis, and HIV/AIDS (Warraich et al., 2011; Abdullah et al., 2014). Pakistan is ranked as the world’s sixth largest populous country with an estimated population of 2,176 million, where 64% of the population lives in rural areas and around 43% of people live in urban areas.

Pakistan's healthcare delivery system faced problems dealing with the heavy burden of governance, finance, service provision, human resources, emerging technologies, and the need for healthcare services. Since the devolution, the provincial government's responsibilities have been changed and provincial governments are now fully responsible for policymaking, health issues, legislation enforcement, and training, preparing, and implementing provincial health initiatives. On the contrary, the federal government monitors regulatory functions and performance, communicating with donors on potential aid opportunities in health research. Moreover, the federal government contributes to international meetings and manages federally controlled hospitals, offices, and procurement. Pakistan has implemented important innovative approaches including institutional and community-based, such as community-based health workers. Such initiatives have a tremendous impact on individuals' health systems (Desresse et al., 2023).

A proper first Health policy was established in 1990, second in 1997. Due to political turmoil second health policy failed to achieve its targets, so a new health policy was introduced in 2001. In 2009 health policy draft was prepared but never implemented due to the devolution of health to provinces. After the 18th Amendment of the Constitution, health was devolved to provinces, so the Dept of Health, Punjab, developed a health policy in 2012. The objective of this document is to analyze the health policy document formulated by the Dept of Health, Punjab.

In the Health Sector strategy of 2012, the notion of universal health care for all members of society was established, combining methods for health funding and service delivery to improve population health. The Punjab Health Sector Strategy was created to assist the Department of Health (DoH) in moving forward

with a sense of direction and purpose by prioritizing policy-related actions based on budgetary resources available. Development partners were to be urged to connect their investments with the Strategy by aid effectiveness standards. (Boyatzis, 1982).

The Sustainable Development Goal is the blueprint for a better and sustainable future for all. They face global challenges, including poverty, inequality, climate, environmental degradation, prosperity and peace, and justice. The goals are linked and leave nobody behind. We should reach every goal and goal by 2030. The SDGs are signed with 17 goals and 193 countries.

Prevalence of Catastrophic Health Expenditure in Pakistan, high levels of catastrophic health expenditure in Pakistan. 25.5% of households in Pakistan incurred catastrophic health expenditures, with the highest burden on households in rural areas (Ahmed et al., 2021). Approximately 30% of households in Pakistan experienced catastrophic health expenditures (Zaidi et al., 2017).

An increase in healthcare spending is a global trend. It is influenced by various factors such as advancements in technology, shifts in demographics, rises in income, the prevalence of non-communicable diseases (NCDs), healthcare management, and health insurance coverage (Zuckerman & McFeeters, 2006; Smith et al., 2009; Fan & Savedoff, 2014). In 1995, global health spending represented 6% of the world's gross domestic product (GDP), which increased to 7.1% by 2013, and it is estimated to increase to 9% by 2040 (Dieleman et al., 2016).

Out-of-pocket (OOP) payments are the main source of health financing in many underdeveloped countries, which creates a barrier to establishing an equitable health system (Palmer et al., 2004). High OOP payments force households to cut spending on other essential needs and, in some cases, deter them from seeking healthcare altogether due to affordability issues (Cavagnero et al., 2006). Developed countries protect their populations from catastrophic spending by providing adequate health facilities, health insurance, and tax-based health systems. In 2016, Pakistan, classified as a lower-middle-income country, had a health expenditure per capita of $40, with out-of-pocket expenses constituting 65.2% of current health expenditures and 2.8% of total health expenditures (%GDP).

This study uses data from the Pakistan Household Integrated Economic Survey (HIES), applying the methodology of Wagstaff and Doorslaer (2003) and three different thresholds to estimate the incidence, intensity, and determining factors of catastrophic health expenditures in Pakistan.

**Problem Statement**

Catastrophic Health Expenditure (CHE) poses a significant threat to household financial stability and access to healthcare worldwide. It is defined as health spending that exceeds a predefined threshold of household income and has been linked to higher poverty rates and reduced access to healthcare. While numerous studies have examined CHE at the national level, a critical research gap remains regarding its national patterns and variations. This gap is particularly concerning because healthcare financing and access often vary substantially across regions within a country or jurisdiction.

There remains limited knowledge about the temporal and spatial patterns of CHE at the national level. In this literature, CHE occurrence among regions. Therefore, it is essential to investigate the determinants of CHE and its temporal and spatial dynamics within specific regions to develop targeted policies and interventions that effectively address this issue. These disparities can result from a myriad of factors, including variations in income levels, healthcare infrastructure, health insurance coverage, and healthcare-seeking behaviors across different sub-national areas. This study aims to fill this research gap by conducting

a comprehensive analysis of CHE at the sub-national level, offering insights into its patterns over time and space, its determinants, and its implications for households and healthcare systems.

**Research Questions**

The primary research questions guiding this study are as follows:

1. How can the incidence of catastrophic health expenditures be assessed?
2. What are the temporal trends in catastrophic health expenditure at the national level over the past decade?
3. What kind of targeted governmental intervention is needed to reduce CHE in Pakistan?

**Research Objectives**

1. To evaluate the incidence of catastrophic health expenditures through temporal and spatial analysis.
2. To examine the trends of catastrophic health expenditure.
3. To classify and assess targeted governmental interventions.

**RESEARCH DESIGN**

**Materials and Methods**

The study outlines the methodological approach for a quantitative investigation of catastrophic health expenditure (CHE) at the sub-national level in Pakistan. It uses a secondary-data quantitative design, focusing on interpreting existing survey and administrative data instead of collecting new data. As defined by George (2023), secondary research involves data collected by others. This study employs secondary data from the Household Integrated Economic Survey (HIES) spanning 2007 to 2019, obtained from official government reports and regional healthcare sources. Six survey rounds, 2007–08, 2010–11, 2011–12, 2013–14, 2015–16, and 2018–19 are used to group household expenditure and annual income data from the HIES. The World Health Organization (WHO) uses two common methods to determine the incidence of CHE. Threshold levels of 10%, 25%, and 40% are applied across all six survey periods for both national and sub-national analysis. Additionally, a logistic regression model is used to evaluate regional differences in CHE and identify factors contributing to it. The study relies on secondary data from the HIES, government reports, and Household expenditure and income data, which are divided into six datasets corresponding to each survey period.

The rationale for this research study is to contribute to the existing literature by incorporating both temporal and spatial dimensions of CHE. By analyzing the incidence of CHE and its determinants at the sub-national level, the study aims to provide insights into the prevalence and distribution of CHE across different regions over time. Various demographics would be involved, such as income, household size, and age structure, from a household survey, HIES, utilized to have temporal (time) and spatial (region) analysis of CHE.

These studies highlight how households in Pakistan, especially those in rural and lower-income areas, are severely impacted financially by healthcare costs. The objective remained achieved through the collection of recent secondary data regarding 4 provinces of Pakistan, from various sources such as DHIS, FABS,

PSLM, PBS, NHA, MIC, and WHO statistics. The healthcare spending of 4 provinces would be monitored, along with factors such as Income, Household Expenditure, Age, Gender, Education, Occupation, Marital Status, Household Size, and drinking water source. The framework explicitly separates spatial (between-province) and temporal (over-time) dimensions. For spatial analysis, provinces are compared side by side by category (e.g., CHE incidence, OOP share). The budget share approach (or basic approach) was popularized by researchers from the World Bank (2008) and Wagstaff & Doorslaer (1998). The budget share approach defines CHE as occurring when OOP payments exceed a defined proportion (generally 10% or 25%) of a household's total income or expenditure within a given period (Wagstaf et al., 2018), (Cylus et al., 2018).

**CHE= (Health expenditures / Out-of-pocket expenditures) * 100 if > 10% / 25% / 40%**

By contrasting a household's out-of-pocket medical expenses and its non-subsistence (discretionary) income, the capacity-to-pay (CTP) technique calculates catastrophic health expenditure. When health expenditure exceeds a set percentage, typically 40% of a household's ability to pay after basic food needs are satisfied, it becomes catastrophic.

**Secondary Source of Data**

The secondary data was collected regarding the 4 provinces of Pakistan, from the Household Integrated Economic Survey (HIES) dataset. The HIES dataset from 2007 to 2019 was collected from a random sample of units within the range of selected clusters (rural and urban areas of the four provinces of Pakistan). The present study highlights total health expenditures as a ratio of out-of-pocket expenses on different thresholds (10%, 25%, 40%). If health expenditures exceed the threshold value, households face catastrophic health expenditures.

**Household Integrated Economic Survey (HIES) 2007-2019**

A nationally representative Pakistan Bureau of Statistics survey of households, covering approximately 24,238 households (16,155 urban and 8,083 rural). HIES collects detailed self-reported information on household income, consumption, and expenditure (including spending on health care). The study uses the HIES microdata to extract indicators of out-of-pocket (OOP) health spending and to compute the incidence of CHE by province and socioeconomic group. HIES is designed with stratified multistage sampling to ensure coverage of all four provinces (Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan) and both urban/rural areas.

**Population and Sampling**

In practical terms, the "sampling" approach is to analyze the entire micro-dataset of households from HIES 2007–2019. Thus, analysis inherently has national coverage. The study does note, however, that HIES provides breakdowns by province (and by urban/rural within province). This enables analysis of sub-national (provincial) CHE patterns. This survey data effectively represents the target population at both national and provincial levels, enabling inference about provincial CHE patterns. Since HIES employed stratified multi-stage cluster sampling across provinces, its sample is designed to represent the provincial populations.

**RESULTS**

Studies on catastrophic health expenditures (CHE) in Pakistan have used a range of criteria to assess the extent to which healthcare costs affect households. These cutoff points are used to classify a household's

financial strain categories. Using these criteria, the study can divide households by how much they spend on healthcare. These thresholds are universal tools for assessing the socioeconomic impact of healthcare expenses, as evidenced by the widespread use of similar methodologies in international studies.

The first part of the first objective section examines catastrophic health expenditure among households at the national level, using selected threshold values. It shows how the incidence of CHE varies with different thresholds, reflecting variances in financial strain from health expenses. This brief review prepares the basis for interpreting the national-level result. Many studies, for instance, utilize 10% of total household spending as a standard threshold, above which expenses are considered catastrophic.

A 40% barrier is also used if expenses exceed what a household can afford without compromising other necessities. Research by Qureshi et al. (2010) examined CHE in Pakistan using a 10% threshold and discovered that a sizable percentage of households are heavily burdened financially by out-of-pocket medical expenses. Using the 40% criterion, the Pakistan Institute of Development Economics (PIDE) investigated the incidence of CHE and discovered that rural households, particularly those with children or the elderly, were more likely to incur catastrophic health costs. These studies highlight how households in Pakistan, especially those in rural and lower-income areas, are severely impacted financially by healthcare costs.

This procedure guarantees that the findings are reliable and supported by a larger body of data, leading to more solid conclusions regarding the effect of CHE on households. This approach also makes use of previous research by Xu et al. (2005) and Wagstaff and Doorslaer (2005), which developed these cutoff points to gauge the financial burden of medical expenses. These thresholds are universal tools for assessing the socioeconomic impact of healthcare expenses, as evidenced by the widespread use of similar methodologies in international studies.

**National Level Household Catastrophic Health Expenditures**

The first part of the first objective section examines catastrophic health expenditure among households at the national level, using selected threshold values. It shows how the incidence of CHE varies with different thresholds, reflecting variances in financial strain from health expenses. This brief review prepares the basis for interpreting the national-level results in the following section.

**Table 1**: **Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2007-08)**

| CHE Threshold Levels | Calculated Values | Total Values | Percentage |
|---|---|---|---|
| 10% | 70295 | 107139 | 66% |
| 10-25% | 24760 | 107139 | 23% |
| 25-40% | 5944 | 107139 | 6% |
| 40% above | 6380 | 107139 | 6% |

This table quantifies and categorizes catastrophic health expenditures (CHE) across several levels to help determine their financial impact on individuals or families. CHE usually occurs when a household's out-of-pocket medical costs exceed a predetermined threshold. Four different CHE thresholds, shown as percentages of household income, are used in the table to separate the data. Catastrophic health expenditures occur when healthcare costs exceed a specified share of household income. Thresholds such as 10%, 25%, or 40% are used to assess the severity of the financial burden. The table categorizes households into four CHE classifications: Healthcare costs constitute 10% or less of household income, reflecting a low burden and indicating manageable out-of-pocket expenses. (10–25% Moderate burden), healthcare costs fall

between 10% and 25% of household income, reflecting a noticeable financial impact but not yet overwhelming. (25–40% High burden), healthcare expenses consume 25% to 40% of household income, creating significant financial stress that can disrupt other essential spending. (≥ 40% Severe burden), healthcare costs exceed 40% of household income, representing a critical financial burden that can lead to poverty and economic instability.

Proportions were calculated by the CHE formula. The absolute number of households experiencing CHE at each stage is 107,139, and the percentage of households in each CHE range is shown below. This shows 66% of the households are classified as CHE ≤ 10%. This suggests that health costs remain affordable for most families in this group, as households bear a comparatively modest financial burden from healthcare expenses. A potential risk of financial pressure as a result of healthcare costs is indicated by the fact that about 23% of households have a high economic burden. Furthermore, a smaller percentage of households, 6% face a substantial financial burden, and another 6% are in the group of those with catastrophic health expenses that are abnormally excessive and may be unsustainable, creating serious economic challenges for these households.

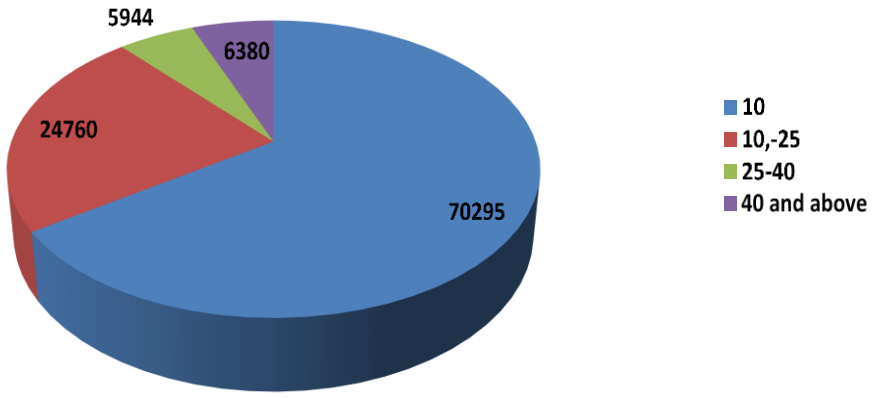


***Figure 1: Burden of CHE Levels***

In terms of Catastrophic Health Expenditure (CHE), the pie chart shows how data is distributed across four categories: 10, 10-25, 25-40, and 40 and above. The largest group, which corresponds to category "10," comprises 70,295 units, suggesting a notable concentration of people or households with lower CHE levels. With 24,760 units, the second largest group, 10–25, represents a significant but lower percentage with significant CHE. The 40 and above group, which represents the greatest levels of CHE, is the smallest, with only 5,944 units, while the 25–40 category has only 6,380 units. It is evident from this distribution that comparatively fewer individuals or households experience severe CHE values, with the majority of the data clustered in the lower CHE ranges. The most severe cases are less common but considerable, highlighting the unequal burden of catastrophic health expenses.

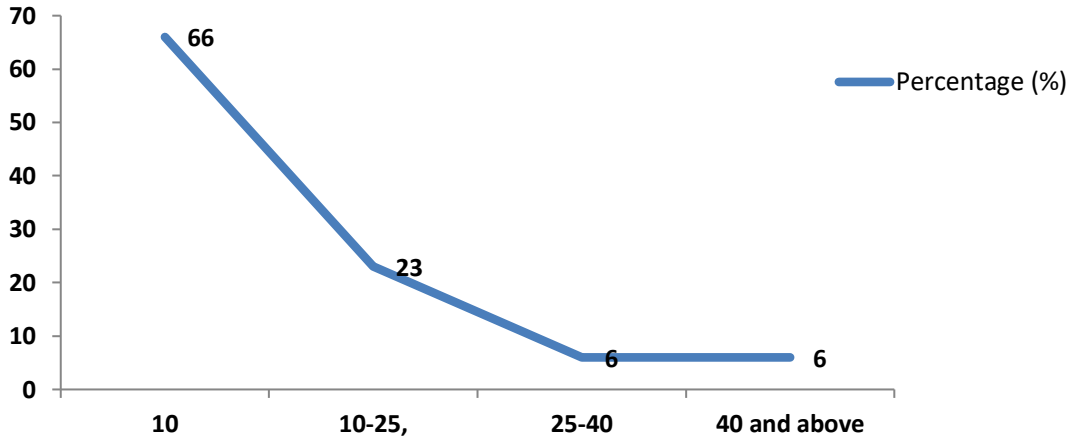


*Figure 2: Financial Burden*

Threshold Estimates of Catastrophic Health Expenditures (CHE) for the years 2007–08 are displayed as a line graph using four thresholds: 10%, 10%–25%, 25%–40%, and 40% and above. Most households experience catastrophic health expenses when the barrier is set at 10% of their income, as shown by the highest percentage at 66%. For the 10–25% barrier, this percentage sharply decreases to 23%, indicating that fewer families are affected by CHE as the threshold increases.

The proportion shows that a small percentage of households experience extreme CHE at higher thresholds, falling further to 6% for the 25–40% threshold and staying steady at 6% for the 40% and above threshold. The graph shows that the percentage of impacted families and the CHE threshold have an inverse connection, highlighting the financial burden that households at lower income thresholds experience.

**Table 2**: **Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2010-2011)**

| CHE Threshold Levels | Calculated Values | Total Values | Percentage |
|---|---|---|---|
| 10% | 69970 | 108933 | 64% |
| 10-25% | 27277 | 108933 | 25% |
| 25-40% | 6107 | 108933 | 6% |
| 40% above | 5776 | 108933 | 5% |

The table shows the distribution of household Catastrophic Health Expenditure (CHE) in Pakistan for 2010–2011 across the following thresholds: 10%, 10%–25%, 25%–40%, and 40% and higher. A substantial financial burden was evident for the majority of households, as 69,970 households suffered CHE at the 10% threshold, making up the biggest proportion (64% of the total 108,933 households). The number of impacted households falls to 27,277 for the 10–25% criteria, which represents 25% of the total, showing a significant decline but still a significant percentage. For the 25–40% criteria, the number drops even further to 6,107 households (only 6%), and for the 40% and above threshold, which represents the smallest and most severe cases, only 5,776 (just 5%) have CHE. All things considered, the data shows a distinct pattern, the percentage of impacted households sharply declines as the CHE threshold rises. While extreme CHE levels, though less common, probably indicate serious financial difficulty, this trend highlights how vulnerable a significant fraction of households are to financial shocks from health costs at lower thresholds.

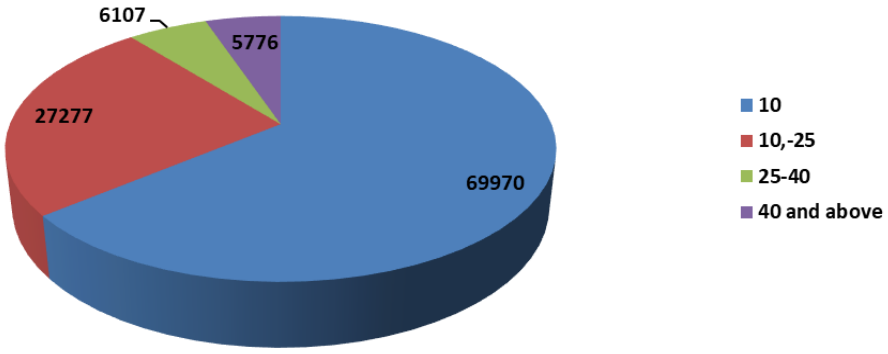


*Figure 3: Distribution of CHE among Pakistan households*

The distribution of catastrophic health expenditure (CHE) among households in 2010–2011 is depicted in the pie chart across four thresholds: 10%, 10%–25%, 25%–40%, and 40% and above. With 69,970 households making up the majority share, the largest component represents the 10% criterion. This demonstrates the huge financial burden, as a large percentage of households spend over 10% of their income on health care. Around 27,277 households, the 10–25% barrier represents the second-largest section, indicating a discernible decline in the percentage of impacted households. The 40% and above barrier represents the smallest group, with 5,776 families, whereas the 25–40% level represents 6,107 households, a significantly smaller fraction. Overall, the graph shows a distinct pattern: smaller numbers of households are impacted as the CHE threshold rises, and the most severe financial effects are less common but still have a big impact on those impacted.

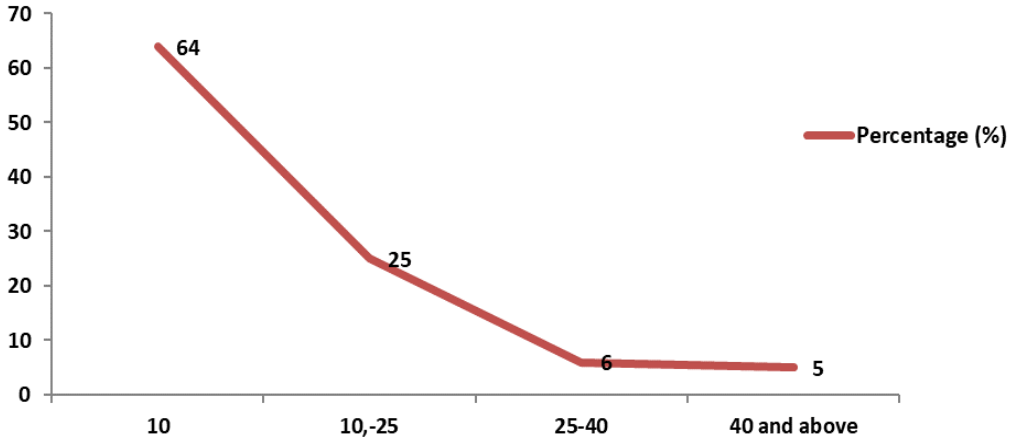


*Figure 4: Threshold levels of catastrophic health expenditures (CHE)*

The graph shows the threshold levels of catastrophic health expenditures (CHE) and the percentages that correspond to them. The thresholds, which show the percentage of a household's income spent on catastrophic healthcare, are separated into four groups: 10%, 10%–25%, 25%–40%, and 40% and beyond. The study indicates that 64% of households incur catastrophic health expenses at the 10% threshold. This implies that although healthcare costs account for merely 10% of income, a significant proportion of households are financially pushed. The percentage of families impacted falls precipitously to 25% as the threshold rises to the 10–25% range, suggesting that when a greater proportion of income is considered,

fewer households experience catastrophic expenses. The study indicates that 64% of households incur catastrophic health expenses at the 10% threshold. This implies that although healthcare costs account for merely 10% of income, a significant proportion of households are financially pushed. The percentage of families impacted falls precipitously to 25% as the threshold rises to the 10–25% range, suggesting that when a greater proportion of income is considered, fewer households experience catastrophic expenses.

**Table 3: Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2011-2012)**

| CHE Threshold Levels | Calculated Values | Total Values | Percentage |
|---|---|---|---|
| 10% | 55625 | 106494 | 52% |
| 10-25% | 34881 | 106494 | 33% |
| 25-40% | 8292 | 106494 | 8% |
| 40% above | 7897 | 106494 | 7% |

According to the 2011–2012 data on catastrophic health expenditure (CHE) thresholds, the percentage of households that are financially strained by healthcare costs at various threshold levels is shown. 52% of families (55,625 out of 106,494) experience catastrophic health expenses at the lowest threshold of 10%, underscoring the extreme vulnerability of households even at very low levels of healthcare spending.

The percentage falls to 33% (34,881 households) in the 10–25% range, indicating a discernible decline in financial difficulty as the threshold rises. On the highest threshold of 40% and above, only 7% of families (7,897) incur catastrophic expenses, while only 8% of households (8,292) are affected at the 25–40% threshold. This pattern highlights the need for initiatives that decrease the impact of even moderate health-related expenses by showing that households at lower thresholds bear a disproportionate amount of the financial burden of healthcare.

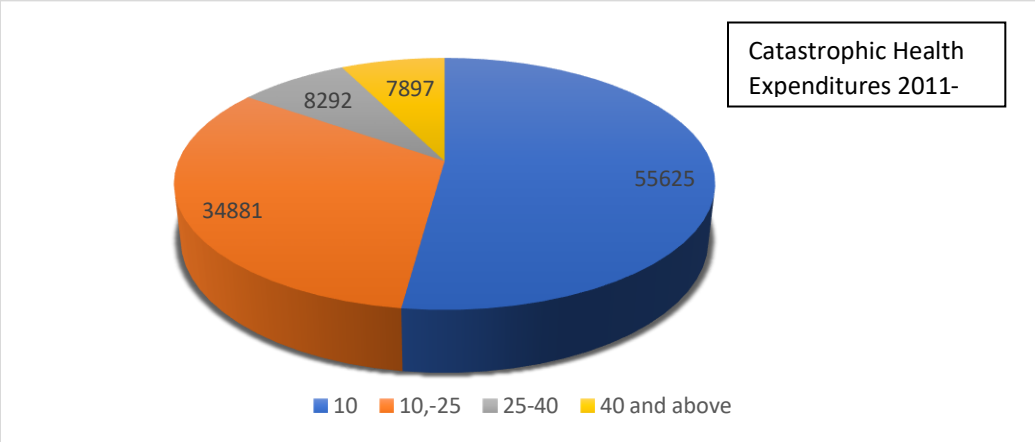


***Figure 5: Thresholds Estimates of Catastrophic Health Expenditures of 2011-12.***

Households with catastrophic health expenditures (CHE) across four threshold levels for 2011–2012 are distributed as shown in the pie chart. Significant vulnerability at this low expenditure level is highlighted by the largest section, which is recorded at the 10% threshold, where 55,625 households (52% of the total) are experiencing financial difficulty. 34,881 households (33%) fall within the 10–25% range, indicating a significant decline but still a significant financial hardship.

Only 8,292 households (8%), at the 25–40% criterion, are affected, and only 7,897 households (7%) suffer catastrophic expenses at the 40% and higher measure. With the impact decreasing significantly as thresholds rise, this distribution shows that the majority of households are sensitive to relatively low healthcare spending levels, underscoring the necessity of specific financial protection measures for low-threshold expenses.

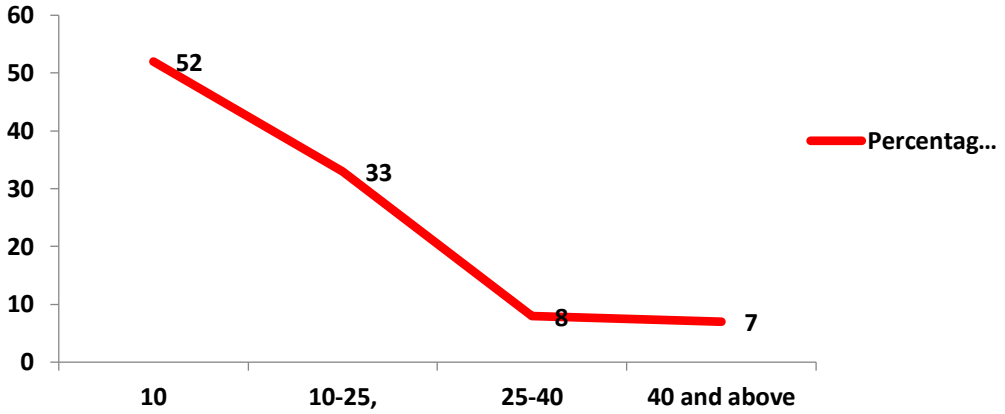


*Figure 6: Thresholds Estimates of Catastrophic Health Expenditures of 2011-12.*

For 2011–2012, the line graph shows the percentage distribution of households with catastrophic health expenditures (CHE) over four threshold levels. Widespread financial vulnerability is highlighted by the fact that 52% of households experience catastrophic expenses at the lowest threshold of 10%. Raising the threshold to 10–25% means the percentage of families impacted drops to 33%. Only 7% of households encounter catastrophic expenses at the highest level of 40% and beyond, while the percentage falls even further to 8% for the 25–40% criterion. Given that most households are sensitive to lower healthcare spending of their income, this downward pattern shows that the financial impact of healthcare decreases as the threshold rises.

**Table 4: Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2013-2014).**

| CHE Threshold Levels (%) | Calculated Values | Total Values | Percentage (%) |
|---|---|---|---|
| 10 | 61080 | 119018 | 51% |
| 10-25 | 37451 | 119018 | 31% |
| 25-40 | 10221 | 119018 | 9% |
| 40 and above | 10400 | 119018 | 9% |

The distribution of catastrophic health expenditure (CHE) across households in 2013–2014, broken down by various threshold levels, is shown in above. More than half of the households (51%) spent at least 10% of their income on healthcare at the lowest criterion of 10%, suggesting a pervasive financial burden.

The percentage of impacted households declines as the thresholds rise; 31% of households have CHE between 10 and 25 percent, while just 9 percent fall into the 25–40% and 40% greater categories. This pattern indicates that whereas the majority have moderate CHE levels, a sizable percentage of households experience extreme financial hardship as a result of medical expenses. Effective health finance and social

protection measures are urgently needed, according to the data, to lessen the financial burden on households that are already at risk, especially those that are badly affected.

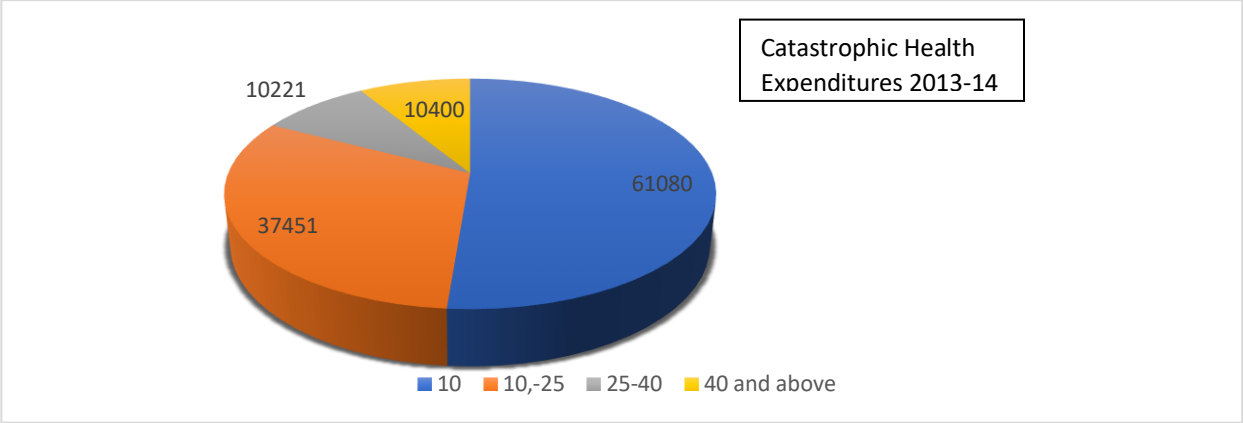


**Figure 7: Catastrophic Health Expenditure (CHE) across various thresholds**

The division of Pakistani households' Catastrophic Health Expenditure (CHE) across various threshold levels is depicted in the pie chart. The majority confront severe financial difficulties, as evidenced by the largest portion, which is shown in blue. 61,080 households (51%) spent at least 10% of their income on healthcare.

Significant financial stress is also highlighted by the second-largest section, shown in red, which translates to 37,451 households (31%) experiencing CHE between 10 and 25 percent of their income. While the purple sector, also at 9%, shows 10,400 households in extreme financial hardship with expenses above 40% of their income, the green area reflects 10,221 households (9%) that endure CHE in the 25–40% range. Although fewer households suffer CHE levels, their economic strain is more severe, as this visual comparison highlights. The financial impact is concentrated at the lower thresholds. According to this distribution, specific actions are needed to lower CHE, especially for the households that are most affected.

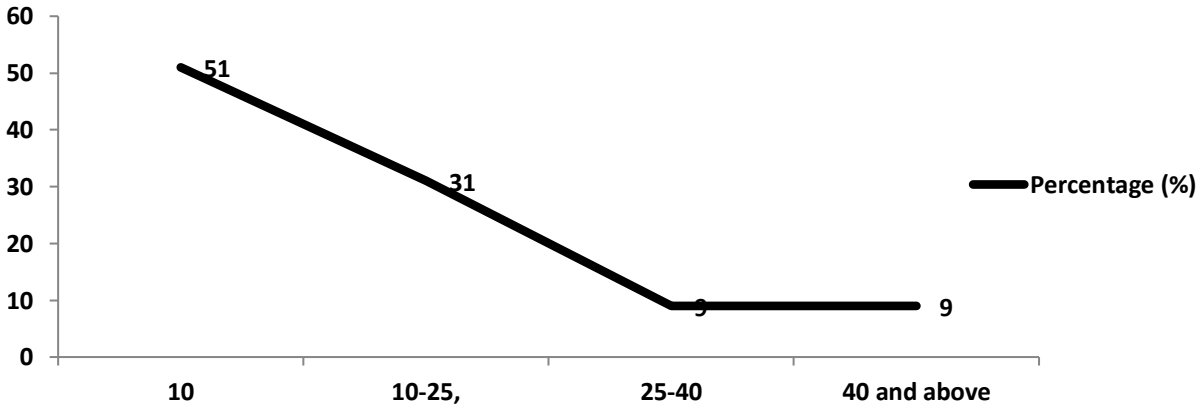


**Figure 8: Thresholds Estimates of Catastrophic Health Expenditures of 2013-14.**

During 2013–2014, the line graph shows the percentage distribution of Pakistani households that had catastrophic health expenditure (CHE) at various threshold levels. As the CHE threshold rises, the trend line indicates a steep drop in the proportion of impacted households. 51% of families are impacted at the

10% threshold, which represents the largest percentage of households that are financially burdened by healthcare costs. These households that spend 10–25% of their income on healthcare see a significant drop in this percentage, reaching 31%. Only 9% of households are in the 25–40% range, while another 9% are at the 40% and above barrier. After this, the numbers drastically decline. Although CHE impacts more households at lower criteria, the graph shows that at higher thresholds, the burden is concentrated among fewer households, which are probably under a lot of financial duress. This trend points to the necessity of measures that address both extreme instances of healthcare-related financial hardship and widespread lower CHE.

**Table 5: Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2015-2016)**

Based on a complete household census of 157,636 homes, the data shows how households in Pakistan spend

| CHE Threshold Levels (%) | Calculated Values | Total Values | Percentage (%) |
|---|---|---|---|
| 10 | 74470 | 157636 | 47% |
| 10-25 | 44422 | 157636 | 28% |
| 25-40 | 16109 | 157636 | 10% |
| 40 and above | 22702 | 157636 | 14% |

Catastrophic Health Expenditure (CHE) across various threshold levels. Nearly half of the population is financially burdened, as seen by the 74,470 households (47%) that spent at least 10% of their income on healthcare at the 10% level. 44,422 homes (28%) are impacted by the 10–25% criterion, which is a significant drop from the lower level. The number of impacted families decreases as the thresholds rise, with 16,109 households (10%) experiencing CHE in the 25–40% range. However, 22,702 families (14%) have severe CHE at the 40% and above criterion, which is a modest increase over the 25–40% range. It suggests that although a considerable proportion of households have moderate CHE, a sizeable minority experience severe financial hardship, especially at the highest threshold. With an emphasis on both the acute difficulties faced by those at the top levels and the general impact at lower thresholds, the data emphasizes the necessity of focused initiatives to reduce healthcare-related financial pressures. It suggests that although a considerable proportion of households have moderate CHE, a sizeable minority experience severe financial hardship, especially at the highest threshold. With an emphasis on both the acute difficulties faced by those at the top levels and the general impact at lower thresholds, the data emphasizes the necessity of focused initiatives to reduce healthcare-related financial pressures.

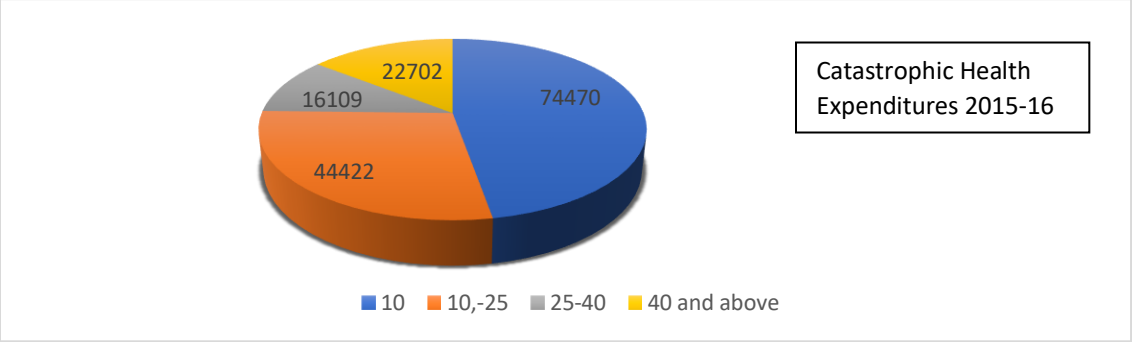


**Figure 9: Allocation of catastrophic health expenditures (CHE)**

Based on 157,636 household census data, the pie chart graphically depicts the allocation of catastrophic health expenditures (CHE) among Pakistani households. A substantial financial burden for almost half of

the population is highlighted by the largest sector, which is represented in blue and corresponds to the 10% threshold, where 74,470 households (47%) spent at least 10% of their income on healthcare. The second-largest category, highlighted in red, indicates a significant decrease from the lower threshold, with 44,422 households (28%) impacted at the 10–25% level. A further reduction is shown by the green segment, which shows 16,109 families (10%) experiencing CHE within the 25–40% range. In contrast to the 25–40% criterion, the purple section indicates that 22,702 households (14%) spend 40% or more of their income on healthcare, indicating a rise in the percentage of households under extreme financial distress. The graph illustrates that although CHE is most common at the lower levels, a significant portion of households have severe financial difficulties at the higher limits. This necessitates interventions that target the acute difficulties faced by those at the highest levels as well as the common modest CHE.

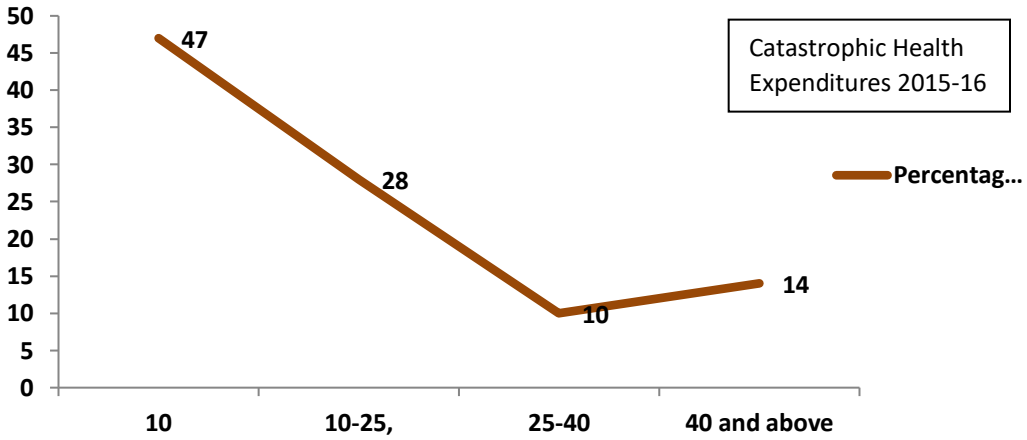


**Figure 10: Thresholds Estimates of Catastrophic Health Expenditures of 2015-16.**

In the shown graph, the percentage pattern for the following age categories is displayed: "10," "10-25," "25-40," and "40 and above." A line chart that displays the percentage for each category is used to illustrate the values. For the "10" age group, the trend starts at the highest rate, 47%. After then, it drops precipitously to 28% in the "10-25" group and further drops to 10% in the "25-40" group, which is its lowest point. The percentage for the "40 and above" group then rises little to 14%. Indicating a sharp early fall, this trend shows a notable decline from the youngest age group to young adults. The proportion exhibits a mild rising tendency, stabilizing at a lower level for middle-aged people and somewhat rebounding in the oldest age group. This demonstrates a significant age-group distribution discrepancy, with the "10" group having a larger share than the rest.

**Table 6: Catastrophic Health Expenditure of Households in Pakistan across selected thresholds (2015-2016)**

Data on household catastrophic health expenditures (CHE) at the national level for 2018–19, broken down by various threshold levels, are shown in Table. The computed values, total values, and percentages for

| CHE Threshold Levels (%) | Calculated Values | Total Values | Percentage (%) |
|---|---|---|---|
| 10 | 59831 | 159949 | 37% |
| 10-25 | 49929 | 159949 | 31% |
| 25-40 | 21177 | 159949 | 13% |
| 40 and above | 29310 | 159949 | 18% |

each threshold group 10%, 10%–25%, 25%–40%, and 40% and above are shown in the table. The computed number is 59,831 at the 10% threshold level, which corresponds to the highest percentage of CHE at 37%. This suggests that at this lower level, a sizable portion of households incur catastrophic health expenses. With a computed value of 49,929, the percentage drops to 31% for the 10–25% threshold, indicating a considerable reduction.

The computed amount further decreases to 21,177 at the 25–40% threshold, making up only 13% of the total, indicating a significant decline. Nevertheless, for the "40 and above. The data indicate that, except for the highest criterion ("40 and above"), which exhibits a slight increase in comparison to the 25–40% group, the percentage of households incurring catastrophic health expenses falls as the threshold rises. This implies that while a sizable percentage of households are affected at lower thresholds, some still experience severe financial hardship at higher levels.

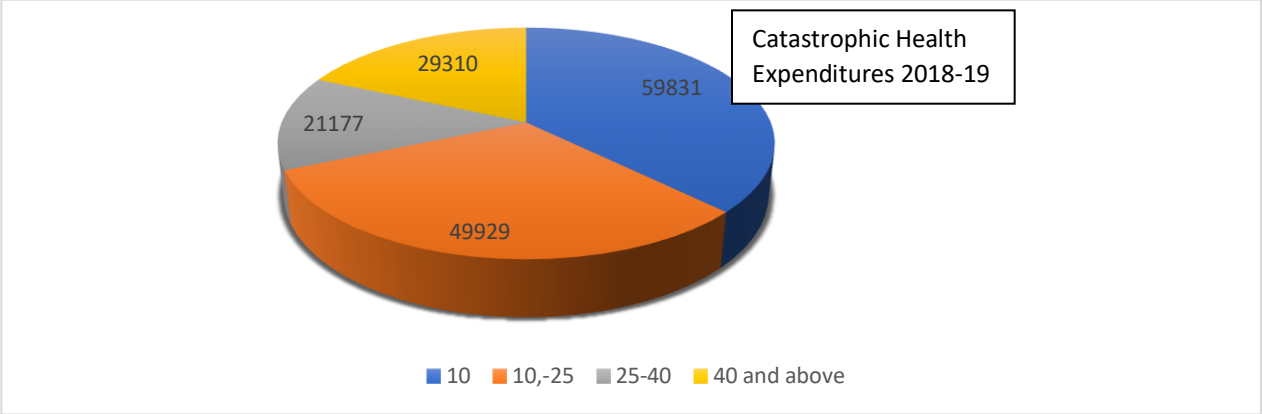


**Figure 11: Thresholds Estimates of Catastrophic Health Expenditures of 2018-19.**

Household catastrophic health expenditures (CHE) at various threshold levels for 2018–19 are depicted in the pie chart by their corresponding computed values. In terms of thresholds, the four segments are 10, 10-25, 25-40, and 40 and above. The "10%" threshold, which has a value of 59,831, is the largest segment, indicating that most households are in this group. With a value of 49,929, the "10-25%" criterion is the next noteworthy component. These two lower criteria together make up a sizable majority of the chart, suggesting that CHE is present in a significant percentage of households. As the threshold rises, the prevalence of CHE significantly decreases, as evidenced by the significantly smaller segment occupied by the "25-40%" threshold, which has a value of 21,177.

Interestingly, the "40 and above" group occupies a somewhat greater area of the pie chart with a value of 29,310, indicating a slight rebound when compared to the "25-40%" group. All things considered, the graphic emphasizes that CHE is most common at lower thresholds but still poses a threat at higher ones, as seen by the comparatively significant percentage of families who are still impacted at "40 and above." With the exception of the modest increase in the top category, this trend highlights the financial burden on households at different thresholds, showing a sharp drop as thresholds rise.

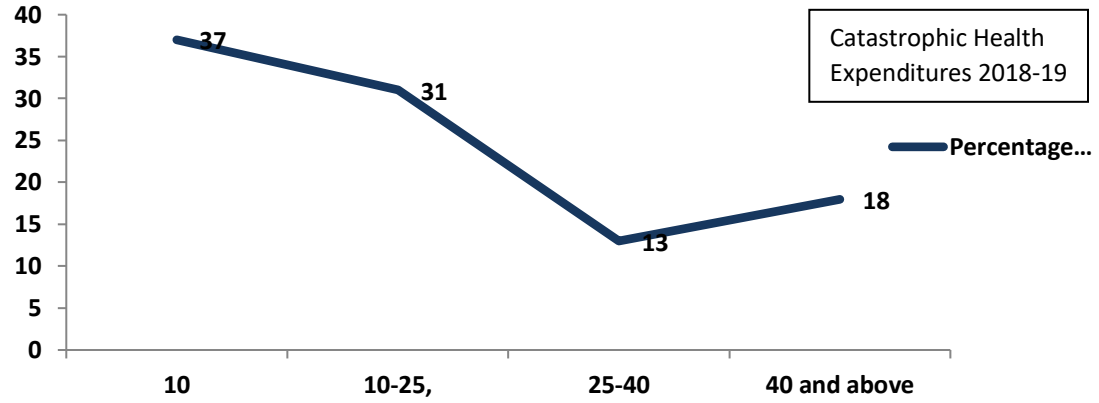


**Figure 12: Thresholds Estimates of Catastrophic Health Expenditures of 2018-19.**

During 2018–19, the line graph shows the percentage distribution of families with catastrophic health expenditures (CHE) at the following threshold levels: "10," "10-25," "25-40," and "40 and above. The graph's highest percentage, 37%, is at the 10% threshold, indicating that a sizable fraction of households suffers from CHE at this level. For the "10-25%" criterion, the proportion drops to 31%, signifying a substantial decline. For the "25-40%" criterion, which represents the smallest percentage of impacted families, it further drops to 13%. However, the percentage rises to 18% at the "40 and above" level, suggesting a minor recovery. The observed trend indicates to a significant stabilization and modest recovery at the highest threshold, followed by a steep decline in the prevalence of CHE as the threshold level first rises. According to the data, the majority of households are influenced at lower thresholds by health costs, while some are still greatly impacted at higher thresholds.

**Table 7: National Level CHE comparison in one table**

| Groups | Thresholds % | Total Values | Calculated Values | Percentages |
|---|---|---|---|---|
| 2007-08 | 10%<br>10-25<br>25-40<br>40 above | 107139 | 70295<br>24760<br>5944<br>6380 | 66%<br>23%<br>6%<br>6% |
| 2010-11 | 10%<br>10-25<br>25-40<br>40 above | 108933 | 69970<br>27277<br>6107<br>5776 | 64%<br>25%<br>6%<br>5% |
| 2011-12 | 10%<br>10-25<br>25-40<br>40 above | 106494 | 55625<br>34881<br>8292<br>7897 | 52%<br>33%<br>8%<br>7% |
| 2013-14 | 10%<br>10-25<br>25-40<br>40 above | 119018 | 61080<br>37451<br>10221<br>10400 | 51%<br>31%<br>9%<br>9% |
| 2015-16 | 10%<br>10-25<br>25-40 | 157636 | 74470<br>44422<br>16109 | 47%<br>28%<br>10% |

| | | | | |
|---|---|---|---|---|
| | 40 above | | 22702 | 14% |
| 2018-19 | 10%<br>10-25<br>25-40<br>40 above | 159949 | 59831<br>49929<br>21177<br>29310 | 37%<br>31%<br>13%<br>18% |

Overall, the data reveal a growing trend in catastrophic health expenditure (CHE) in Pakistan over the years. While the proportion of households spending up to 10% of their income on health decreased from 66% in 2007–08 to 37% in 2018–19, the share of households facing higher thresholds (25–40% and above 40%) increased significantly. This indicates that while some households experienced improved financial protection at lower expenditure levels, an increasing number faced severe financial strain due to healthcare costs. This trend aligns with recent studies that highlight the persistent challenge of CHE in low- and middle-income countries and underscore the need for stronger health financing reforms.

## CONCLUSION

This study provides a comprehensive, subnational examination of catastrophic health expenditure (CHE) across Pakistan, integrating temporal trends and spatial heterogeneity to reveal where and why households are disproportionately burdened by out-of-pocket health costs. At the provincial and district levels, CHE rates vary markedly: some regions demonstrate persistent high incidence over time, while others show recent increases or relative improvement. These divergent trajectories reflect a complex interplay of socioeconomic status, healthcare access, demographic composition, and policy environments. The temporal analysis highlights two broad patterns. First, several regions exhibit long-standing high CHE levels that are resistant to short-term interventions, suggesting structural deficits in health financing and service provision. Second, a subset of provinces shows a rising trend in CHE in recent years, which appears linked to economic shocks, shifts in healthcare utilization patterns, or reductions in public health spending. Spatially, clusters of elevated CHE are concentrated in geographically and economically marginalized areas where health infrastructure is sparse and private sector reliance is high. Conversely, provinces with stronger public health networks and more comprehensive social protection mechanisms tend to record lower CHE incidence. These temporal and spatial patterns underscore that time-bound policies (for example, emergency cash transfers during economic shocks) and place-based reforms (such as investments in local primary care) must work in tandem. subsidized medicines, remains a central mechanism driving catastrophic payments. The interaction effects observed in the analysis indicate that socioeconomic disadvantage amplifies the financial shock of health events, producing a cycle of impoverishment and healthcare avoidance.

## RECOMMENDATIONS/ POLICY IMPLICATIONS

The heterogeneity uncovered by this research implies that national, one-size-fits-all policies are unlikely to fully address CHE. Instead, policymakers should design and implement a layered strategy that is both nationally coordinated and locally adaptive:

- Prioritize investment in primary healthcare infrastructure, staff training, and essential medicine supply in identified CHE hotspots to reduce dependence on costly secondary and private care.
- Expand social health protection programs that are means-tested and regionally prioritized. Examples include targeted premium subsidies, catastrophic coverage thresholds, and vouchers for high-need groups (elderly, households with chronic disease, and large families).
- Implement transport subsidies, mobile clinics, and community health worker networks for remote areas where distance and indirect expenses drive CHE.

- Strengthen public procurement and distribution of essential medicines and incentivize generic substitution to cut household drug spending, a major component of CHE.

- Use the spatial and temporal maps generated by this study to allocate resources and monitor policy impact, ensuring that provinces with persistent CHE receive sustained support while those with emerging risk receive early interventions.

- Coordinate health financing with social protection, education, and employment programs to address the broader socioeconomic determinants that predispose households to CHE.

- These policy directions should be paired with clear implementation roadmaps, measurable targets, and accountability mechanisms to track progress and facilitate course corrections.

## FUTURE VISION OF RESEARCH

This study demonstrates that reducing catastrophic health expenditure in Pakistan requires a nuanced approach, one that recognizes regional specificity, addresses the socioeconomic roots of vulnerability, and combines immediate financial protection with long-term investments in public health infrastructure. The goal of future research is to help Pakistan reduce the number of households that face catastrophic health payments and to make healthcare fairer for everyone. To do this, must produce timely, local evidence that policymakers can use. Short-term work should build better data systems and map CHE hotspots so resources reach the most affected places. Medium-term work should test and evaluate targeted policies (for example, subsidies, insurance schemes, transport vouchers, or medicine-procurement reforms) using rigorous methods so we know what works and for whom. Long-term work should follow households over time to measure how CHE affects poverty, health outcomes, and children's education, and to assess whether policies create lasting protection.

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