REVIEW ARTICLE

Catastrophic health expenditure among elderly and its risk factors: a critical review

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Received 27 June 2024 **Revised:** 8 August 2024 **Accepted:** 16 August 2024 **Available online:** January 2025
DOI: 10.55131/jphd/2025/230121

ABSTRACT

The global elderly population is growing, leading to an increased demand for healthcare services. Consequently, there has been a rise in catastrophic health expenditures (CHE). To address this issue, a desk review was conducted to examine the global factors that contribute to CHE among the elderly by using Andersen's Behavioral Model of Healthcare Utilization as a framework. This review was performed with the PRISMA guidelines. We searched the Scopus, Web of Science, and PubMed databases for studies on CHE among the elderly population. The search was limited to the period from 1986 to August 2023 by using the keywords "Catastrophic health expenditure" and "Elderly". Subsequently, an analysis was conducted to examine the trend of the CHE rate and investigate the factors responsible for it. A total of 48 studies were included, with the CHE thresholds ranging from 10% to 60% and incidence rates ranging from 3% to 93.4%. Age, gender, education, and residential setting emerged as significant predisposing factors. Income, hospitalization, and insurance coverage were prominent enabling factors, especially in middle-income countries. The presence of chronic diseases, noncommunicable diseases (NCDs), and disabilities were significant need factors contributing to CHE. The elderly populations worldwide are especially susceptible to CHE due to factors such as a higher incidence of NCDs and chronic illnesses, combined with insufficient health insurance coverage. To reduce the impact, it is crucial to improve preventive care, effectively manage chronic diseases, and address the socioeconomic factors that affect health. In addition, investigating the relationship between mental health, quality of life, and CHE may potentially help in understanding psychological impacts on individuals as well as households.

Key words:
aged; catastrophic illness; health expenditures; developing countries; noncommunicable disease; systematic review

Citation:
Aditya Narayan Das, Smita Mishra Panda, Anjali Dash. Catastrophic health expenditure among elderly and its risk factors: a critical review. J Public Hlth Dev. 2025;23(1):270-291
(https://doi.org/10.55131/jphd/2025/230121)

INTRODUCTION

Households experiencing financial hardships in their healthcare payments due to a higher share of out-of-pocket health expenses exhibited significant variation across different countries, resulting in the highest levels of catastrophic expenditure in some countries.[1] The term "Catastrophic health expenditure (CHE)" refers to out-of-pocket health payments that surpass a specific threshold of a household's healthcare budget.[2] The incidence of CHE is a global concern, with WHO reporting that a staggering 150 million people are annually experiencing it.[3] This incidence has grown significantly in 133 nations, regardless of the threshold level. Low and middle-income countries are more likely to see the incidence of CHE as they spend an inadequate amount of their GDP on healthcare. Considering the magnitude of the issue;[4] India is spending less than 2% of its GDP on healthcare, which results in people bearing 69% of their healthcare spending out of pocket.[5] Health insurance, to a large extent, can reduce the intensity of out-of-pocket expenditure (OOPE) but it cannot reduce the incidence of CHE.[6] Studies on Chinese people show that universal insurance coverage may successfully decrease the share of OOPE but not the likelihood of CHE, which is higher than in some low and middle-income countries.[7,8]

Across the various demographics, households that have a higher number of elderly individuals are particularly vulnerable.[9] They are at a greater risk of experiencing catastrophic and financially devastating out-of-pocket healthcare expenses in comparison to households with different demographics.[10] Progress in healthcare and medicines has extended human lifespans and improved overall well-being, resulting in a rise in the elderly population.[11] This situation offers both a chance to live longer and the challenges that comes with aging for individuals and families.[12] However, a substantial portion of elderly individuals continue to encounter both physical and emotional challenges.[13,14] The incidence of non-communicable diseases (NCDs) is rising, resulting in higher expenses for medical and healthcare services.[15] Along with this, there is a growing occurrence of multimorbidity and chronic conditions among older individuals. This poses a significant challenge in countries with relatively higher numbers of elderly populations, such as India and China, as chronic illnesses among the elderly can potentially impose a financial burden on families.[16] Moreover, poor families with elderly members experience increasingly significant health and economic consequences due to chronic diseases and multimorbidity.[17]

This CHE threshold is somewhat arbitrary. In a European chronic disease study utilizing 10% household expenditure per person, the Netherlands had the lowest rate (6%) and Hungary had the highest (27%).[18,19] In China, 40% of non-food spending had a 31% CHE incidence.[19] CHE affected Indians by 7% if health costs surpassed 40% of effective income after basic subsistence expenditure.[20] A Brazilian study calculated CHE using consumption expenditure.[21] Previous research used expenditure, income, and consumption as wealth indices. However, no global investigation has examined its causes among the elderly to determine variability in a single study. To address this partial knowledge, a thorough and systematic review was conducted using Andersen's Behavioral Model of Healthcare Utilization, the framework used to understand the factors influencing whether and how people use health services, to identify the main determining factors for elderly populations worldwide.[22]

The paper at hand is based on a review aimed to provide a concise and brief summary of significant factors associated with catastrophic health expenditure among the elderly across the globe. The paper is

divided into five sections. After the introduction, a discussion of methods, including search strategy, criteria for inclusion and exclusion, data extraction, quality assessment, study selection, and variable measures, is presented in detail. This is followed by the results, which include the description of the study, along with the incidence and factors affecting CHE. The fourth section discusses the main factors of CHE, as per Andersen's Behavioral Model of Healthcare Utilization. The last section provides some concluding remarks.

METHODS

The inspection and inclusion of the studies were guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), specifically designed for conducting a systematic review or meta-analysis. The PRISMA flow diagram is utilized to illustrate the progression of research across the various stages of the systematic review. It aids in the identification of potential sources of bias and limits in the review process.[23]

Manuscript search strategy

A comprehensive analysis of studies on CHE incidence and associated variables, covering the period from 1986-2023, was completed in August 2023. This period was chosen since most relevant studies were published after 1986.[24] We thoroughly searched Scopus, Web of Science, and PubMed. Search terms included "Catastrophic health expenditure" and "Elderly." Appendix 1 contains the search approach.

Criteria for inclusion and exclusion

Studies based on primary research that objectively assessed elderly CHE incidence and risk factors using primary or secondary quantitative data were included. All non-English review papers and studies were eliminated from this review. Figure 1 shows article selection and inclusion.

Data extraction

A data extraction form was created and subsequently evaluated by all the authors involved in the review process. We utilized a standardized Excel form to collect data from the studies that were included. The data related to "Year, Title, Author, Country, Study Design, Survey Type, Sample size, Variables, CHE Threshold level, Incidence, Predisposing factors, Enabling factors, Need factors, Result and Method" were collected.

Quality assessment

In collaboration with the other authors, the first author evaluated the quality of the studies included in this review using the "Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies." The quality assessment tool comprises 14 questions, carrying a score of 1 for each, to evaluate various aspects of studies.[25,26] Out of 48 papers, 20 papers are of good quality (scored 10 and above out of 14 questions), while 25 papers are of medium quality (scored 8-9), and three papers are of low quality (scored seven and less), presented in Appendix 2.

Study selection

The manuscript was screened three times. Mendeley stored study details and identified duplications. Titles and abstracts were used to choose studies after eliminating duplicates. We found 1,333 records and removed 386 duplicates. Another 878 papers were rejected after title and abstract evaluation. Unfortunately, 13 of the 69 searched documents were unavailable. Final selections included 56 publications meeting comprehensive literature review criteria. The quality assessment of all studies revealed eight irrelevant papers, five of which were unrelated to the elderly population, and three had no report on CHE in the study

area. Finally, 48 papers were selected for this paper.

Variable measures

We have taken the incidence of CHE as a dependent variable, measured at different threshold levels in different regions. All independent variables like socio-demographic and household characteristics are categorized as per Andersen's Behavioral Model of Healthcare Utilization.[27]

RESULTS

Description of included studies

The review included 48 studies that satisfied the inclusion criteria. Out of the total studies, 35 were conducted as cross-sectional surveys, 10 were carried out as longitudinal studies, and three were performed as cohort studies. Interestingly, all of the included papers were published within the last 10 years. Papers are classified according to the World Bank's categorization of countries into high, middle, and low-income groups. Three studies analyzed CHE in two high-income nations, while 44 studies assessed it in nine middle-income nations. Additionally, one study focused on both high and middle-income countries.

Rate of CHE Incidence

Various thresholds were employed to identify CHE in the different studies; nevertheless, the 40% threshold was the most frequently utilized. Additionally, certain studies have calculated CHE at various levels. In a study conducted in China, researchers used non-food expenditure to establish a threshold of 40% and consumption expenditure to determine a threshold level of 10%. The study revealed that 31.5 and 45.6% of individuals are experiencing CHE.[28] Similarly, one study in India used non-food expenditure to estimate a 40% threshold and food expenditure to estimate a 10% threshold.[29] Of the 48 studies analyzed, 17 utilized food expenditure data, while 16 relied on non-food expenditure data to establish the threshold level. However, seven studies each utilized consumption expenditure and household income as variables to determine the threshold. However, one study utilized monthly non-food expenditure,[30] while another study utilized monthly household income.[31] In China, a total of 30 studies revealed that there is a significant variation in the rate of CHE. Some studies reported a high rate of 56.9%,[32] while others reported a low rate of 12.9%.[6] India's statistics are concerning, particularly the high percentage of 93.4% reported in a cross-sectional survey conducted in 2022.[33] Vietnam and Nepal have lower percentages compared to China and India.[34,35] A multinational cohort study conducted in 2020 examined the impact of health expenditures on households worldwide. The study, which included 23 countries, found that 9.3% of households experienced CHE, with a threshold of 25%. This study provides a comprehensive view of the global implications of health expenditures.[36] In 2022, a study conducted in Brazil reported CHE percentages of 44.48% (10%), 33.81% (25%), and 29.23% (40%).[37]

Factors affecting CHE

We have used Andersen's Behavioral Model of Healthcare Utilization to classify the factors in different regions. Healthcare utilization is affected by "predisposing characteristics, enabling resources and need factors".[27] Table 1 shows the factors as per Andersen's model.

1. Predisposing Factor

As per Andersen, demographic factors, social structure, and health beliefs were included under predisposing factors. These variables can impact CHE by

influencing individuals' healthcare accessibility, financial capacity, and decisions regarding healthcare utilization. Age and gender were considered demographic factors, while educational status, employment status, living arrangements, place of residence, and household size were classified as social factors. Health beliefs are influenced by drinking and smoking habits.

Out of the 48 studies, 24 showed a significant relationship between growing age and CHE. Only two studies, one longitudinal and another cross-section study in 2023 and 2021, respectively, found that higher age was not a risk factor. However, 20 studies found increasing age as a risk factor for CHE. Likewise, five studies showed that females had more risk, while four studies found males were associated with CHE, and a study in China in 2021 found males were not related to incurring CHE. Being educated can result in higher CHE, as found by eight studies, and five were against it. Four studies found unemployment to be a risk factor. In another, three studies found living alone as a potential factor, while five identified being married, and one showed being single as a potential factor. A total of 17 papers found a significant relationship of CHE with respect to place of residence. 13 studies have found that residing in a rural area is associated with a higher risk. In comparison, four papers suggest that living in an urban area can be a risk factor. Similarly, 14 studies examined the association between household size and experiencing CHE with statistical significance. According to six studies, having a large household size increases the risk, while eight studies indicated that it is not a risk factor. Only two studies, one in China in 2021 and another study based on a cohort study of 23 countries, found that smoking and drinking are risk factors.

2. Enabling factors

Enabling factors include the affordability of family and community resources and the accessibility of those resources, such as income, insurance, and facilities available for healthcare. Of the 26 studies that analyzed income as a significant determinant, 16 papers found that low income could be a possible cause. However, 10 studies found that a high level of income leads to incurring CHE. Two studies in China and one in Nepal found poverty as a possible risk factor. However, 10 studies found that insurance cannot prevent the risk of CHE, while two studies, one conducted in China in 2022 and another in India in 2015, found insurance to be a protective factor. Only four studies indicated the use of private healthcare can be a significant cause. Similarly, hospitalization was found to be a significant factor in 15 studies. A study in Brazil using longitudinal data in 2022 found that the number of doctor visits can increase the incidence.

3. Need Factors

Need factors show an individual's perceived and evaluated functional capacity, symptoms, and status of health. Disease, disability, and perception of one's own health status were included in this section. NCDs were found to be a risk factor in 19 studies and the prevalence of chronic diseases was noted in 14 studies. However, two studies conducted in China, as well as one study each in Cambodia and across 15 European countries, have identified both NCDs and chronic diseases as risk factors. Similarly, two studies in China found difficulties in activities of daily living (ADLs) as a risk factor, while five studies highlighted disability as a potential factor. Eight studies examined poor self-rated health (SRH) as a dominant factor of CHE, while two articles showed poor life satisfaction as a risk factor. One study in India and one in China found poor quality of life and poor mental health as risk

factors, respectively. Frailty caused high CHE and was found in a Chinese study in 2021.

DISCUSSION

The above review was conducted to assess the prevalence and determinants of CHE among the elderly population worldwide, using Andersen's Behavioral Model for Healthcare Utilization. Compared with other models, Andersen's behavioral model emphasizes predisposing, enabling, and need factors in older adults' healthcare enrollment.[38] It provides a comprehensive framework for understanding healthcare utilization behavior and is widely used by researchers to study healthcare service utilization across populations and countries.[39–42]The papers included in the review employed different thresholds and study designs to quantify the occurrence of CHE. Our investigation revealed that the elderly experienced CHE due to NCDs, chronic illnesses, and advanced age, for which they sought medical treatment. Our research indicates that there is a significant prevalence of CHE among the elderly, regardless of the specific definition of the threshold. This section is divided into two parts. In the first part, we included all the studies from high-income countries, and in the second part, we included studies from middle-income countries. Along with this, we have also classified the studies according to Andersen's model.

Prevalence and factors of CHE in high-income countries

It was revealed that regardless of the income status of the country being studied, the factors were generally similar. For instance, a study in the USA and South Korea, using a cross-sectional study setting, found that growing age can be a possible factor and reported 5.8% and 3% incidence of CHE at a 25% threshold level, respectively. However, a South Korean study in 2015 found low income and having insurance can lead to high medical expenditure. Similarly, a cross-sectional study in 15 European countries revealed that having NCDs and chronic diseases causes CHE incidence. High-income countries used different threshold levels to measure CHE, i.e., 10%, 20%, 25%, 30% and 40%. This threshold rate ranged from 3% to 42.2% among all high-income countries. Studies conducted in high-income countries showed that CHE was affected by predisposing, enabling, and need factors.

Prevalence and factors of CHE in middle-income countries

In nine middle-income countries, 44 studies were conducted using the threshold level ranging from 10% to 60%. This threshold level was mostly used to measure the percentage of food expenditure in 17 studies. Further, 16 papers used non-food expenditure to measure the threshold. However, only seven studies used consumption expenditure, and five studies used annual income to measure the threshold. However, one study in China in 2021 used the monthly income of the household to determine the threshold level. The highest number of included studies for the review were from China, followed by India. This is because the number of elderly persons is growing in these two middle-income countries.[43]

Predisposing Factors

An increase in the elderly population can be caused by either an increase in life expectancy,[44,45] a decline in birth/ death rates, or both.[45] Since older individuals consume more healthcare services, having elderly people in a family raises the risk of CHE. Middle-income countries' healthcare systems lack the resources to meet the social needs of the

expanding older population. However, two studies found advanced age is not a risk factor.[46,47] Five studies revealed that females were incurring more CHE than males, whereas only three papers mentioned that males were more prone to females. Studies show that females were more aware than males about reporting their illness.[48,49] Rural villagers in middle-income countries exhibited a higher prevalence than those in urban areas. Three studies have linked living in rural areas with large household size may result in high CHE. However, eight studies found that household size is not a risk factor. Seven research studies found that education level affects CHE. People with higher education tend to understand health better and use preventative services and healthcare more often. They also have a better chance of keeping a job and managing finances, especially for healthcare expenses. However, five studies show that education is not a risk factor. Four studies found working status as important. In addition, living alone, smoking, and drinking may also cause higher CHE. The findings regarding the impact of predisposing characteristics exhibit considerable variability across different countries, making it difficult to draw any overarching conclusions. However, it can be stated that predisposing factors were consistently found to be significant in all studies.

Enabling Factors

The ability to pay for medical care correlates with demand and expectations in middle-income countries. However, a substantial proportion of healthcare funding is derived from personal out-of-pocket expenses. Overall, this raises the CHE levels and was supported by nine studies. In middle-income countries, most residents are in the lowest income quartile, limiting preventative healthcare services. According to 14 studies, such people are more likely to delay medical treatment until a medical condition is critical, leading to elevated CHE. Despite their income, people have health insurance to protect them from high healthcare costs and ensure access to critical services. Hence, the need for medical services may increase. When shielded from healthcare costs, people are more likely to seek treatment, which may increase CHE. Therefore, all nine studies revealed that possessing insurance does not provide protection. However, research conducted in China[50] and India[51] has identified insurance as a protective factor. Hospitalization has been recognized as a significant factor as it accounts for a large portion of household expenses, as evidenced by 15 studies. Middle-income countries frequently undergo a shift from communicable diseases to NCDs. As incomes improve, people's lifestyles change, resulting in a rise in diseases such as NCDs and chronic diseases, leading to hospitalization.[52] Thus, the elderly often use private healthcare to treat such diseases, making them vulnerable to incurring CHE.

Need Factors

Globally, the healthcare demands of chronic and NCD patients are rising. NCDs are long-lasting and contribute significantly to global mortality. Preventing and controlling NCDs and improving healthcare systems are needed now to reduce CHE and long-term treatment costs. Studies conducted in 17 middle-income countries found NCDs to be the main cause of CHE, while 13 found chronic illnesses to be a risk factor. Therefore, security measures for vulnerable individuals due to advanced age, disability, and ADL limitations must be carefully considered. Healthcare finance and Universal Health Coverage depend on this. Seven studies revealed that having a disabled household member increased the incidence of CHE because of these morbidities causing physical decline. Two Chinese studies also identified ADL restriction as a risk factor. Such constraints affect elderly psychology and mental health. Seven studies indicated

poor SRH, which measures self-perception of health, is a risk factor. Three Chinese studies indicated poor life satisfaction, quality of life, and frailty as risk factors for CHE, while one Indian study found a significant effect.

Most of the research that was considered for review utilized various parameters for CHE. However, various studies employed different thresholds to classify the existence of CHE in households. Hence, implementing a standardized approach to both the parameters and the threshold levels used in examining CHE could facilitate a more significant and valuable cross-national comparison of the results. Studies show that CHE in low- and middle-income countries causes significant job loss.[53,54] A standardized strategy based on income level and the loss of money incurred by an individual or family during hospitalization may assist researchers in determining the actual prevalence of CHE. Although there were variations in the reporting methods across different studies, this review identified some important findings. First and foremost, even in countries with high-income levels, households still experience CHE. Similarly, there is a prevailing assumption that households in middle-income countries are more susceptible to experiencing CHE. Secondly, the majority of the studies were identified by assessing the capacity of households to pay, either through analyzing their food or non-food consumption. However, a small number of studies employed the consumption or income approach to determine the threshold. In addition, there is a lack of consensus regarding a benchmark threshold. Nevertheless, the threshold that was most commonly utilized was 40% of the household's capacity to pay for healthcare. Fourthly, the studies included in the analysis identified that insurance cannot protect from incurring CHE. Fifthly, advanced age, chronic disease, and NCDs may lead to hospitalization, which increases the prevalence of CHE among the elderly. Additionally, living in rural areas can contribute to a high incidence of CHE. Lastly, having a poor perception of their own health can lead to high CHE.

The assessment of CHE has gained immense importance due to its role as a crucial indicator for ensuring financial security in the attainment of Universal Health Coverage. The strengths of this paper are that it allows us to make cross-national comparisons, provide a more sophisticated understanding of how different healthcare spending affects households by utilizing different thresholds, and analyze the effects of predisposing, enabling, and need factors on CHE. However, this review identified certain overarching limitations as well. For example, the prevalence of chronic illness is determined through self-reported data rather than precise medical diagnosis, potentially resulting in overestimated or underestimated healthcare costs associated with chronic illness. Furthermore, in this review, papers published in languages other than English were deliberately omitted. It is also possible that some studies categorized as 'grey literature' were not included.

RECOMMENDATIONS

The key finding of this review reveals that predisposing, enabling, and need factors have a significant impact on the incidence of CHE among elderly individuals worldwide. Middle-income households are particularly vulnerable to experiencing financial difficulties due to healthcare expenses and are at risk of slipping into poverty. The review revealed that possessing insurance may not be able to protect households from CHE, and females are more prone to experience it than males. The vulnerable status of specific population groups, particularly the

elderly individuals with advanced age and chronic illnesses or disabilities, is clearly apparent in various research studies. These groups often face excessive medical expenses. Henceforth, efforts to decrease CHE should prioritize increasing the availability of healthcare services, enhancing the efficiency of insurance coverage, and responding to the specific needs of elderly populations. Findings may suggest emphasizing the crucial role of adequate budget allocation and promoting health equity. In addition, investigating the relationship between mental health, quality of life, and CHE may help in understanding psychological impacts on individuals as well as households. Along with this, enhancing preventive care, managing chronic diseases, and addressing the socio-economic factors that influence health are essential for reducing the impact and achieving Universal Health Coverage. This can potentially prevent healthcare costs from causing CHE for households worldwide.

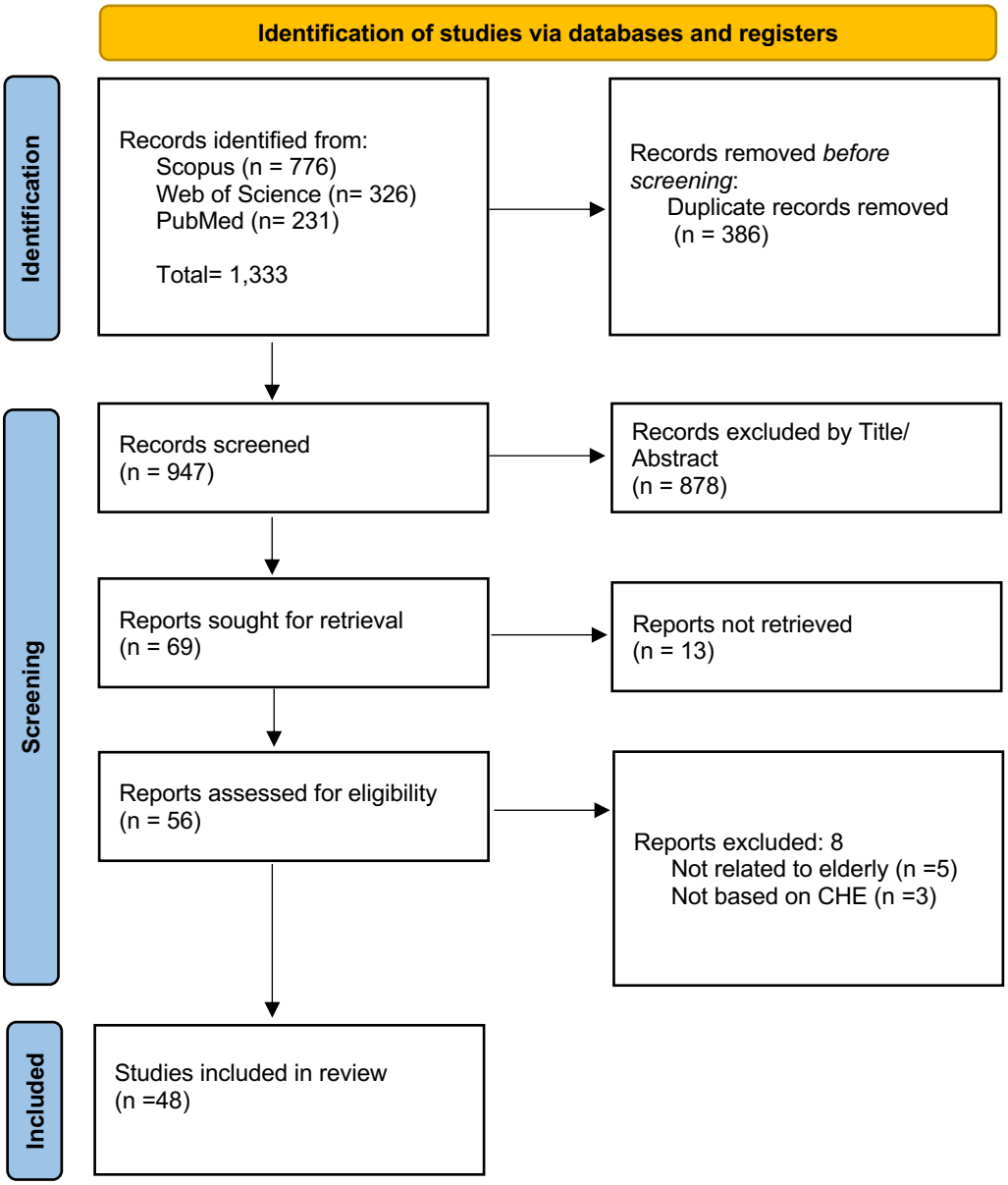


Figure 1. PRISMA Flow diagram for identification and inclusion of manuscript

Table 1. Characteristics and Factors associated with CHE

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
1	Zhen Wang & Zeng, 2023[55]	China	Cross-sectional survey	1721 Individuals	40[a]	36.72	Education (+) Unemployed (+) Age (+)		NCD (+)
2	X. Zhai et al., 2023[56]	China	Cross-sectional survey	884 Individuals	40[a]	20.2	Living Alone (+) Education (+)	Insurance(+)	ADL Difficulty (+)
3	Y. Wang, Liu, et al., 2023[46]	China	Longitudinal Study	5765 Households	40[b]	19.24	Male(+) Rural(+) Age (-)	Low Income(+)	Chronic Disease(+)
4	Y. Wang, Du, et al., 2023[32]	China	Cohort Study	8029 Households	40[b]	56.9	Socio-economic status (-)	Low Income (+)	NCD (+)
5	Y. Chen et al., 2023[57]	China	Cross-sectional survey	7602 Households	40[a]	21.2	Age (+) Rural (+) Married (+)	High Income (+)	Chronic Disease(+) Poor SRH (+) Poor Life satisfaction (+)
6	X. Zhang et al., 2022[58]	China	Longitudinal Study	NR	40[b]	27.5	Age (+)	High Income (+)	Disability (+) NCD (+)
7	Macinko et al., 2022[37]	Brazil	Longitudinal Study	9949 Households	10, 25, 40[c]	44.48, 33.81, 29.23		Private Healthcare (+) Doctor Visit (+)	
8	Valsa Jose et al., 2022[59]	India	Cross-sectional survey	152 Individuals	40[d]	93.4		High Income (+)	Poor Quality of Life (+)
9	Yang & Hu, 2022[50]	China	Longitudinal Study	13,166 Individuals	10, 20, 25[c]	NR		Insurance (-)	Poor mental health (+)

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
10	Xiaocang Xu & Yang, 2022[60]	China	Cross-sectional survey	6872 Households	40[b]	28.3	Age (+) Gender (+) Marriage (+) Poverty (+)		Chronic disease (+) SRH (+)
11	Xiaocang Xu & Yang, 2022[61]	China	Cross-sectional survey	8086 Households	40[b]	27.2	Age (+) Gender (+) Marriage (+) Poverty (+)		NCD (+)
12	Tian et al., 2022[62]	China	Cross-sectional survey	9190 Households	40[b]	19.28	Age (+) Marriage (+) Higher education (-) HH Size (-)	Insurance (+) Hospitalization (+)	Disability (+)
13	Mohanty et al., 2022[63]	India	Cross-sectional survey	42,949 households	40[b]	24.6	Age(+) Urban(+) HH Size(+) Female(+)	High Income(+)	
14	Thuong et al., 2022[34]	Viet Nam	Cross-sectional survey	6640 Households	40[a]	4.6	Female headed HH (-) Rural (+)	Insurance (+) Private healthcare (+) Hospitalization (+) Low Income(+)	Chronic disease (+)
15	Rai et al., 2022[35]	Nepal	Cross-sectional survey	280 Individuals	40[b]	14.6	Poverty(+) Unmarried(+)		NCD (+)
16	Miao et al., 2022[64]	China	Cross-sectional survey	4097 Households	40[b]	NR	HH Size (-) Age(+) Urban(+)	IPD (+) Insurance (+) Low Income(+)	NCD (+) Disability (+)
17	H. Li et al., 2022[28]	China	Cross-sectional survey	3511 Individuals	40[a], 10[c]	31.5, 45.6	Age(+) Male(+) Less Education (+) Married (+) HH size(-)	Hospitalization(+)	Chronic disease (+)

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
18	N. Kim & Jacobson, 2022[65]	United States and South Korea	Cross-sectional survey	14,359 Individuals	25[d]	5.8, 3	Age(+) Higher education (+)	High Income(+)	Poor SRH(+)
19	Giang et al., 2022[66]	Viet Nam	Cross-sectional survey	1536 Individuals	40[b]	8.6	HH size(+) Rural(+)	Private healthcare (+) Hospitalization(+) High Income(+)	NCD (+)
20	Garg et al., 2022[29]	India	Cross-sectional survey	72,250 Individuals	40[a], 25[b]	44.1, 22.47		Private healthcare (+)	
21	Tang et al., 2022[14]	China	Cross-sectional survey	4184 Individuals	40[b]	32.24		Economic support(+)	NCD (+) Poor SRH(+) ADL (+) Emotional support(-)
22	Deng et al., 2022[67]	China	Cross-sectional survey	388 Individuals	40[a]	50.1	HH size(-) Unemployed(+)	Low Income(+)	
23	S. Chen et al., 2022[6]	China	Cross-sectional survey	15,936 Individuals	40[b]	12.9		Insurance (+)	
24	S. Zhai et al., 2021[47]	China	Cross-sectional survey	1072 Individuals	10[d]	32	Male(-) Age(-)	Low Income(+)	
25	Ma et al., 2021[13]	China	Cross-sectional survey	5610 Individuals	40[b]	19.9	HH size(-)	Hospitalization(+) Insurance (+)	Disability (+) Poor SRH(+) Chronic disease (+)
26	Liu et al., 2021[68]	China	Longitudinal Study	2790 Households	40[a]	31		Hospitalizat-ion(+) Low Income(+)	Disability (+)

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
27	Leng et al., 2021[69]	China	Cross-sectional survey	1539 Individuals	15, 25, 40[d]	66.71, 60.07, 54.59	Smoking (+) Drinking (+)	Low Income(+)	NCD (+)
28	Jing et al., 2021[2]	China	Cross-sectional survey	606 Individuals	20, 30, 40, 50, 60[a]	67.8, 59.4, 49.8, 38.4, 28.9		Hospitalization (+) Low Income(+)	NCD (+)
29	Zhou et al., 2021[70]	China	Longitudinal Study	31,942 Households	40[a]	12.9, 26.6, 27.9	Age(+) HH Size (-)	Hospitalization(+) Low Income(+)	Chronic disease (+) Poor SRH(+)
30	Gao et al., 2021[31]	China	Cross-sectional survey	5204 Individuals	40[a]	27.3			NCD (+)
31	Y. Zhang & Gao, 2021[71]	China	Longitudinal Study	8829 Individuals	20 Monthly[d]	NR	Rural(+) Urban(+)		Poor SRH(+)
32	Fan et al., 2021[72]	China	Longitudinal Study	3277 Individuals	40[a]	26.46	Rural(+) Urban(+)	Low Income(+)	Frailty (+)
33	Zhao et al., 2020[73]	China	Longitudinal Study	11,817 Individuals	40[b]	NR	Age(+), Women (+) Rural(+) Education(+)	Hospitalization(+) High Income(+)	NCD(+) Chronic disease (+)
34	Xinpeng Xu et al., 2020[74]	China	Cross-sectional survey	9782 Individuals	40[b]	23.46	Age(+) HH size(-)	Insurance (+)	Chronic disease (+) Poor SRH(+)
35	N. Wang et al., 2020[75]	China	Cross-sectional survey	7080 Households	40[c]	21.8	Age(+) Low Education(+)	Insurance (+) Hospitalization(+)	Chronic disease (+)
36	Ranjan & Muraleedharan, 2020[76]	India	Cross-sectional survey	42,762 Individuals	10, 25[c]	NR	Age(+) Male(+) Rural(+) Education(+) Living Alone(+)	Hospitalization(+) Low Income(+)	NCD (+)

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
37	Macinko et al., 2020[36]	23 Country	Cohort Study	1,10,000 Individuals	25[d]	9.3	Male(+) Rural(+)	Low Income(+)	NCD (+) Smoking (+)
38	Ma et al., 2020[77]	China	Cross-sectional survey	19,144 Individuals	40[d]	20.3	Age(+) Living Area(+) HH size(+)	Hospitalization(+) Insurance(+) High Income(+)	
39	C. Li et al., 2018[78]	China	Longitudinal Study	5624 Individuals	40[a]	48.1	Education(+) Employment(+) Rural(+)	Hospitalization(+) High Income(+)	
40	Jacobs et al., 2016[79]	Cambodia	Cohort Study	36,054 Households	40, 10[a]	6.5, 28.3	Age(+) Education(+) HH size(+) Rural(+)		NCD (+) Chronic disease (+)
41	Negin et al., 2017[80]	South Africa	Cross-sectional survey	2872 Individuals	40[a]	<10	Female(+) Rural(+)		NCD(+)
42	Arsenijevic et al., 2016[81]	15 Euro-pean Country	Cross-sectional survey	51,661 Individuals	10[c]	NR			NCD (+) Chronic disease (+)
43	Zhonghua Wang et al., 2015[82]	China	Cross-sectional survey	9530 Households	20, 30, 40, 50, 60[a]	44.53, 33.62, 25.64, 19.59, 13.9	Age(+) HH Size(+)	Low Income(+)	Chronic disease (+)
44	S.-Y. Kim & Hong, 2015[30]	South Korea	Cross-sectional survey	4188 Households	10, 20, 30, 40 monthly[a]	42.2, 19.9, 9.2, 5.1		Insurance(+) Low Income(+)	Life satisfaction(+)

Sl No	Author and Year	Country	Study Design	Sample size	CHE Level (%)	Result (%)	Predisposing Factors	Enabling Factors	Need Factors
45	Fazaeli et al., 2015[83]	Iran	Cross-sectional survey	28,997 Households	40 CTP	2.1	Age(+) Rural(+) Low Education(+) Unemployed(+) HH size(+)	High Income(+)	
46	Ethel Mary Brinda et al., 2015[51]	India	Cross-sectional survey	2414 Individuals	40[b]	7	Age(+)	Insurance(-)	NCD (+) Chronic disease (+)
47	Adisa, 2015[84]	Nige-ria	Cross-sectional survey	1176 Households	10[c]	9.6	HH size(-) Education(+)	Hospitalization(+) Low Income(+)	
48	E M Brinda et al., 2012[85]	India	Cross-sectional survey	1000 Individuals	10, 40[d]	13.3, 7.5	Education(-)		NCD (+)

Note: NR- Not Reported
CTP- Capacity to pay
a- Non-food expenditure
b- Food expenditure
c- Consumption expenditure
d- Household Income

ACKNOWLEDGEMENTS

This study has not received any external funding. The authors are grateful to the Centurion University of Technology and Management, Odisha, India, for providing all kinds of support for conducting this research.

REFERENCES

1. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJL. Household catastrophic health expenditure: A multicountry analysis. Lancet. 2003;362(9378):111–7. doi: 10.1016/S0140-6736(03)13861-5
2. Jing Z, Li J, Fu PP, Wang Y, Yuan Y, Zhao D, et al. Catastrophic health expenditure among single empty-nest elderly with multimorbidity in rural Shandong, China: the effect of co-occurrence of frailty. Int J Equity Health. 2021;20(1):23. doi: 10.1186/s12939-020-01362-6
3. Azzani M, Roslani AC, Su TT. Determinants of Household Catastrophic Health Expenditure: A Systematic Review. Malays J Med Sci. 2019;26(1):15–43. doi: 10.21315/mjms2019.26.1.3
4. Rahman T, Gasbarro D, Alam K. Financial risk protection from out-of-pocket health spending in low- and middle-income countries: a scoping review of the literature. Health Res Policy Syst. 2022;20(1):83. doi: 10.1186/s12961-022-00886-3
5. Ahuja R. Government Health Spending in India: Who Will Fund the Target of 2.5 Per Cent of GDP ? Journal of Development Policy and Practice. 2019;4(1):3-11.doi: 10.1177/2455133318811726
6. Chen S, Lin Z, Fan X, Li J, Xie Y, Hao C. The Comparison of Various Types of Health Insurance in the Healthcare Utilization, Costs and Catastrophic Health Expenditures among Middle-Aged and Older Chinese Adults. Int J Environ Res Public Health. 2022;19(10):5956.
7. Anjorin SS, Ayorinde AA, Abba MS, Oyebode OO, Uthman OA. Variation in financial protection and its association with health expenditure indicators: an analysis of low- and middle-income countries. J Public Health (Bangkok). 2022;44(2):428–37.
8. Chen S, Lin Z, Fan X, Li J, Xie YJ, Hao C. The Comparison of Various Types of Health Insurance in the Healthcare Utilization, Costs and Catastrophic Health Expenditures among Middle-Aged and Older Chinese Adults. Int J Environ Res Public Health. 2022;19(10):5956. doi: 10.3390/ijerph19105956
9. Wang Y, Du M, Qin C, Liu Q, Yan W, Liang W, et al. Associations among socioeconomic status, multimorbidity of non-communicable diseases, and the risk of household catastrophic health expenditure in China: a population-based cohort study. BMC Health Serv Res. 2023;23(1):403. doi: 10.1186/s12913-023-09391-x
10. Mohanty SK, Chauhan RK, Mazumdar S, Srivastava A. Out-of-pocket Expenditure on Health Care Among Elderly and Non-elderly Households in India. Soc Indic Res. 2014;115(3):1137–57.
11. Beard JR, Bloom DE. Towards a comprehensive public health response to population ageing. Lancet. 2015;385(9968):658-661. doi: 10.1016/S0140-6736(14)61461-6
12. Heller PS. The challenge of an aged and shrinking population: Lessons to be drawn from Japan's experience. The Journal of the Economics of Ageing. Elsevier. 2016;8(C):85–93. doi: 10.1016/j.jeoa.2016.02.001

13. Ma M, Tian W, Kang J, Li Y, Xia Q, Wang N, et al. Does the medical insurance system play a real role in reducing catastrophic economic burden in elderly patients with cardiovascular disease in China? Implication for accurately targeting vulnerable characteristics. Global Health. 2021;17(1):36. doi: 10.1186/s12992-021-00683-7
14. Tang S, Yao L, Li Z, Yang T, Liu M, Gong Y, et al. How Do Intergenerational Economic Support, Emotional Support and Multimorbidity Affect the Catastrophic Health Expenditures of Middle-Aged and Elderly Families?–Evidence From CHARLS2018. Front Public Health. 2022;10:872974. doi: 10.3389/fpubh.2022.872974
15. He L, Biddle SJH, Lee JT, Duolikun N, Zhang L, Wang Z, et al. The prevalence of multimorbidity and its association with physical activity and sleep duration in middle aged and elderly adults: a longitudinal analysis from China. Int J Behav Nutr Phys Act. 2021;18(1):77. doi: 10.1186/s12966-021-01150-7
16. Kothavale A, Puri P, Yadav S. The burden of hypertension and unmet need for hypertension care among men aged 15–54 years: a population-based cross-sectional study in India. J Biosoc Sci. 2022;54(6):1078–1099. doi: 10.1017/S0021932021000481
17. Counts CJ, Skordis-Worrall J. Recognizing the importance of chronic disease in driving healthcare expenditure in Tanzania: analysis of panel data from 1991 to 2010. Health Policy Plan. 2016;31(4):434–43. doi: 10.1093/heapol/czv081
18. Arsenijevic J, Pavlova M, Rechel B, Groot W. Catastrophic Health Care Expenditure among Older People with Chronic Diseases in 15 European Countries. PLoS One. 2016;11(7): e0157765. doi: 10.1371/journal.pone.0157765
19. Liu S, Coyte PC, Fu M, Zhang Q. Measurement and determinants of catastrophic health expenditure among elderly households in China using longitudinal data from the CHARLS. Int J Equity Health. 2021;20(1):62. doi: 10.1186/s12939-020-01336-8
20. Brinda EM, Kowal P, Attermann J, Enemark U. Health service use, out-of-pocket payments and catastrophic health expenditure among older people in India: The WHO Study on global AGEing and adult health (SAGE). J Epidemiol Community Health (1978). 2015;69(5):489–94. doi: 10.1136/jech-2014-204960
21. Macinko J, Seixas B V, de Oliveira C, Lima-Costa MF. Private health insurance, healthcare spending and utilization among older adults: Results from the Brazilian Longitudinal Study of Aging. JEoA. 2022;23:100397. doi: 10.1016/j.jeoa.2022.100397
22. Andersen RM. Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? J Health Soc Behav. 1995;36(1):1-10.
23. Parums D V. Editorial: Review Articles, Systematic Reviews, Meta-Analysis, and the Updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Guidelines. Med Sci Monit. 2021;27:e934475. doi: 10.12659/MSM.934475
24. Azzani M, Roslani AC, Su TT. Determinants of Household Catastrophic Health Expenditure: A Systematic Review. Malays J Med Sci. 2019;26(1):15–43. doi: 10.21315/mjms2019.26.1.3
25. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implementation Science. 2010;5(1):69. doi: 10.1186/1748-5908-5-69

26. Njagi P, Arsenijevic J, Groot W. Understanding variations in catastrophic health expenditure, its underlying determinants and impoverishment in Sub-Saharan African countries: A scoping review. Syst Rev. 2018;7(1):136. doi: 10.1186/s13643-018-0799-1
27. Andersen RM. Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? J Health Soc Behav. 1995;36(1):1-10.
28. Li H, Chang E, Zheng W, Liu B, Xu J, Gu W, et al. Multimorbidity and catastrophic health expenditure: Evidence from the China Health and Retirement Longitudinal Study. Front Public Health. 2022;10:1043189. doi: 10.3389/fpubh.2022.1043189
29. Garg S, Bebarta KK, Tripathi N. Role of publicly funded health insurance in financial protection of the elderly from hospitalisation expenditure in India-findings from the longitudinal aging study. BMC Geriatr. 2022;22(1):572. doi: 10.1186/s12877-022-03266-2
30. Kim SY, Hong GS. Catastrophic Health Expenditures and Life Satisfaction: A Case in South Korea. J Fam Econ Issues. 2015;36(3):369–382.
31. Gao K, Li BL, Yang L, Zhou D, Ding KX, Yan J, et al. Cardiometabolic diseases, frailty, and healthcare utilization and expenditure in community-dwelling Chinese older adults. Sci Rep. 2021;11(1):7776. doi: 10.1038/s41598-021-87444-z
32. Wang Y, Du M, Qin C, Liu Q, Yan W, Liang W, et al. Associations among socioeconomic status, multimorbidity of non-communicable diseases, and the risk of household catastrophic health expenditure in China: a population-based cohort study. BMC Health Serv Res. 2023;23(1):403. doi: 10.1186/s12913-023-09391-x
33. Valsa Jose J, Susan George J, Joseph R, Arun Thomas ET, Philip John G. Out-of-pocket expenditures, catastrophic household finances, and quality of life among hemodialysis patients in Kerala, India. Hemodialysis International. 2022;26(4):569-574. doi: 10.1111/hdi.13037
34. Thuong NTT, Huy TQ, Huy DN. Catastrophic health expenditure in the Northern midlands and mountainous areas and its determinants, Vietnam from 2014 to 2020: a cross-sectional study. BMJ Open. 2022;12(9):e058849. doi: 10.1136/bmjopen-2021-058849
35. Rai S, Gautam S, Yadav GK, Niraula SR, Singh SB, Rai R, et al. Catastrophic health expenditure on chronic non-communicable diseases among elder population: A cross-sectional study from a sub-metropolitan city of Eastern Nepal. Sharma GA, editor. PLoS One. 2022;17(12):e0279212. doi: 10.1371/journal.pone.0279212
36. Macinko J, Cristina Drumond Andrade F, Bof de Andrade F, Lima-Costa MF. Universal Health Coverage: Are Older Adults Being Left Behind? Evidence From Aging Cohorts In Twenty-Three Countries. Health Aff. 2020;39(11):1951–1960. doi: 10.1377/hlthaff.2019.01570
37. Macinko J, Seixas B V, de Oliveira C, Lima-Costa MF. Private health insurance, healthcare spending and utilization among older adults: Results from the Brazilian Longitudinal Study of Aging. JEoA. 2022;23:100397.
38. Gliedt JA, Spector AL, Schneider MJ, Williams J, Young S. A Description of Theoretical Models for Health Service Utilization: A Scoping Review of the Literature. Inquiry. 2023;60:469580231176855. doi: 10.1177/00469580231176855

39. John R, Mohd Salleh NA, Nik Farid ND. Utilization of Sexual Reproductive Health Services Among Youths in Malaysia: A Cross-Sectional Study Applying Andersen's Behavioral Model of Healthcare Utilization. Cureus. 2024;16(5): e60230. doi: 10.7759/cureus.60230
40. Krzyż EZ, Antunez Martinez OF, Lin HR. Uses of Andersen health services utilization framework to determine healthcare utilization for mental health among migrants—a scoping review. Front Public Health. 2023;11: 1284784. doi: 10.3389/fpubh.2023. 1284784
41. Yang S, Wan Hussin WNT. Research on Older Adults' Willingness to Enroll in Health Care Services based on Andersen Behavioral Model. AJMSS. 2023;5(1):23–6.
42. Jang SH, Yi YJ. Revisiting the Andersen Model: Transnational Ties With the Home Country and Healthcare Utilization Among Chinese International Students in South Korea. Sage Open. 2024;14(1):2.
43. Panigrahi A, Joshi V. India vs. China: Past, Present and Future. Panigrahi, Ashok and Joshi, Vijay, India vs. China: Past, Present and Future (December 10, 2019). J Gujrat Research Society. 2019;21(13):235–248.
44. Zhai X, Zhang Q, Li X, Zhao X. Association between multimorbidity patterns and catastrophic health expenditure among Chinese older adults living alone. Arch Gerontol Geriatr. 2023;106:104892. doi: 10.1016/j.archger.2022.104892
45. Alam M. Ageing, Socio-economic Disparities and Health Outcomes: Some Evidence from Rural India. Indian J Human Developm. 2009;3(1):47–76.
46. Wang Y, Liu M, Liu J. Catastrophic health expenditure and the risk of depression among middle-aged and old people in China: a national population-based longitudinal study. Epidemiol Psychiatr Sci. 2023;32:e36. doi: 10.1017/S2045796023000240
47. Zhai S, Yuan S, Dong Q. The impact of health insurance on poverty among rural older adults: evidence from nine counties of western China. Int J Equity Health. 2021;20(1):47. doi: 10.1186/ s12939-021-01379-5
48. Banerjee S, Gogoi P. Exploring the role of financial empowerment in mitigating the gender differentials in subjective and objective health outcomes among the older population in India. PLoS One. 2023;18(1): e0280887. doi: 10.1371/journal. pone.0280887
49. Demirchyan A, Petrosyan V, Thompson ME. Gender differences in predictors of self-rated health in Armenia: A population-based study of an economy in transition. Int J Equity Health. 2012;11(1):1–10. doi: 10.1186/1475-9276-11-67
50. Yang W, Hu B. Catastrophic Health Expenditure and Mental Health in the Older Chinese Population: The Moderating Role of Social Health Insurance. J Gerontol B Psychol Sci Soc Sci. 2022;77(1):160-169. doi: 10.1093/geronb/gbab130
51. Brinda EM, Kowal P, Attermann J, Enemark U. Health service use, out-of-pocket payments and catastrophic health expenditure among older people in India: The WHO Study on global AGEing and adult health (SAGE). J Epidemiol Community Health. 2015;69(5):489-94. doi: 10.1136/jech-2014-204960
52. Haque M, Islam T, Rahman NAA, McKimm J, Abdullah A, Dhingra S. Strengthening Primary Health-Care Services to Help Prevent and Control Long-Term (Chronic) Non-Communicable Diseases in Low- and Middle-Income Countries. Risk

Manag Healthc Policy. 2020;13:409-426. doi: 10.2147/RMHP.S239074
53. Wan Puteh SE, Abdullah YR, Aizuddin AN. Catastrophic Health Expenditure (CHE) among Cancer Population in a Middle Income Country with Universal Healthcare Financing. Asian Pac J Cancer Prev. 2023;24(6):1897–904. doi: 10.31557/APJCP.2023.24.6.1897
54. Hameed A, Saba N, Amjad Bilal M, Zaman S, Gul N, Hussain Khan I. Catastrophic Health Expenditures and Its Socio-Economic Consequences: A Case Study of Tehsil Ali Pur (Pakistan). J Asian Develop Studies. 2024;13(1):675–85.
55. Wang Z, Zeng Z. Effects of multimorbidity patterns and socioeconomic status on catastrophic health expenditure of widowed older adults in China. Front Public Health. 2023;11:1188248.
56. Zhai X, Zhou Z, Liu G, Lu J, Zhao Y, Cao D, et al. Catastrophic health expenditure of households with hypertension: a comparative study in China. Front Public Health. 2023;11:1176170. doi: 10.3389/fpubh.2023.1176170
57. Chen Y, Zhu X, You Y, Zhang Q, Dai T. Evaluation of status quo and determinants of catastrophic health expenditure among empty-nest elderly in China: evidence from the China health and retirement longitudinal survey (CHARLS). Eur Rev Med Pharmacol Sci. 2023;27(4):1398-1412. doi: 10.26355/eurrev_202302_31377
58. Zhang X, Miao W, Wu B, Lai Y, Jiao M, Xia Q, et al. Factors that dynamically affect provincial incidences of catastrophic health expenditure among middle-aged and elderly Chinese population-transition of disease financial risk protection from global to local. BMC Geriatr. 2022;22(1):759. doi: 10.1186/s12877-022-03432-6
59. Valsa Jose J, Susan George J, Joseph R, Arun Thomas ET, Philip John G. Out-of-pocket expenditures, catastrophic household finances, and quality of life among hemodialysis patients in Kerala, India. Hemodialysis International. 2022;26(4):569-574. doi: 10.1111/hdi.13037
60. Xu X, Yang H. Elderly chronic diseases and catastrophic health expenditure: an important cause of Borderline Poor Families' return to poverty in rural China. Humanit Soc Sci Commun. 2022;9(1):291.
61. Xu X, Yang H. Does Elderly Chronic Disease Hinder the Sustainability of Borderline Poor Families' Wellbeing: An Investigation From Catastrophic Health Expenditure in China. Int J Public Health. 2022;67:1605030. doi: 10.3389/ijph.2022.1605030
62. Tian W, Wu B, Yang Y, Lai Y, Miao W, Zhang X, et al. Degree of protection provided by poverty alleviation policies for the middle-aged and older in China: evaluation of effectiveness of medical insurance system tools and vulnerable target recognition. Health Res Policy Syst. 2022;20(1):129. doi: 10.1186/s12961-022-00929-9
63. Mohanty SK, Sahoo U, Rashmi R. Old-age dependency and catastrophic health expenditure: Evidence from Longitudinal Ageing Study in India. Int J Health Plann Manage. 2022; 37(6):3148– 3171. doi: 10.1002/hpm.3546
64. Miao W, Zhang X, Shi B, Tian W, Wu B, Lai Y, et al. Multi-dimensional vulnerability analysis on catastrophic health expenditure among middle-aged and older adults with chronic diseases in China. BMC Med Res

Methodol. 2022;22(1):151. doi: 10.1186/s12874-022-01630-9
65. Kim N, Jacobson M. Comparison of catastrophic out-of-pocket medical expenditure among older adults in the United States and South Korea: what affects the apparent difference? BMC Health Serv Res. 2022;22(1):1202. doi: 10.1186/s12913-022-08575-1
66. Giang NH, Vinh NT, Phuong HT, Thang NT, Oanh TTM. Household financial burden associated with healthcare for older people in Viet Nam: a cross-sectional survey. Health Res Policy Syst. 2022; 20(Suppl 1):112. doi: 10.1186/s12961-022-00913-3
67. Deng P, Fu Y, Chen M, Si L. Factors associated with health care utilization and catastrophic health expenditure among cancer patients in China: Evidence from the China health and retirement longitudinal study. Front Public Health. 2022;10:943271. doi: 10.3389/fpubh.2022.943271
68. Liu S, Coyte PC, Fu M, Zhang Q. Measurement and determinants of catastrophic health expenditure among elderly households in China using longitudinal data from the CHARLS. Int J Equity Health. 2021;20(1):62. doi: 10.1186/s12939-020-01336-8
69. Leng Y, Luo D, Liu L, Ma Y, Deng J. Research on the economic risk of diseases in middle-aged and elderly patients with diabetes—evidence from China. J Public Health (Bangkok). 2021;29(5):1001–1011.
70. Zhou Y, Wushouer H, Vuillermin D, Guan X, Shi L. Does the universal medical insurance system reduce catastrophic health expenditure among middle-aged and elderly households in China? A longitudinal analysis. Eur J Health Econ. 2021;22(3):463-471. doi: 10.1007/s10198-021-01267-3
71. Zhang Y, Gao Q. Catastrophic health expenditure and health-related quality of life among older adults in China. Ageing Soc. 2021;41(7):1474–1494.
72. Fan L, Hou XY, Liu Y, Chen S, Wang Q, Du W. Catastrophic Health Expenditure Associated With Frailty in Community-Dwelling Chinese Older Adults: A Prospective Cohort Analysis. Front Public Health. 2021; 9:718910. doi: 10.3389/fpubh.2021. 718910
73. Zhao Y, Atun R, Oldenburg B, McPake B, Tang S, Mercer SW, et al. Physical multimorbidity, health service use, and catastrophic health expenditure by socioeconomic groups in China: an analysis of population-based panel data. Lancet Glob Health. 2020;8(6):e840– e849. doi: 10.1016/ S2214-109X(20)30127-3
74. Xu X, Gu H, You H, Bai L, Li D, Cui N, et al. Are People Enrolled in NCMS and CURBMI Susceptible in Catastrophic Health Expenditure? Evidence From China. Inquiry. 2020;57:46958020919282. doi: 10.1177/0046958020919282
75. Wang N, Xu J, Ma M, Shan L, Jiao M, Xia Q, et al. Targeting vulnerable groups of health poverty alleviation in rural China— what is the role of the New Rural Cooperative Medical Scheme for the middle age and elderly population? Int J Equity Health. 2020;19(1):161. doi: 10.1186/s12939-020-01236-x
76. Ranjan A, Muraleedharan VR. Equity and elderly health in India: reflections from 75th round National Sample Survey, 2017–18, amidst the COVID-19 pandemic. Global Health. 2020;16(1):93. doi: 10.1186/s12992-020-00619-7
77. Ma M, Li Y, Wang N, Wu Q, Shan L, Jiao M, et al. Does the medical insurance system really achieved the effect of poverty alleviation for the middle-aged and elderly people in China? Characteristics of vulnerable groups and failure links. BMC Public

Health. 2020;20(1):435. doi: 10.1186/s12889-020-08554-3
78. Li C, Young BR, Jian W. Association of socioeconomic status with financial burden of disease among elderly patients with cardiovascular disease: evidence from the China Health and Retirement Longitudinal Survey. BMJ Open. 2018;8(3):e018703. doi: 10.1136/bmjopen-2017-018703
79. Jacobs B, de Groot R, Fernandes Antunes A. Financial access to health care for older people in Cambodia: 10-year trends (2004-14) and determinants of catastrophic health expenses. Int J Equity Health. 2016; 15(1):94. doi: 10.1186/s12939-016-0383-z
80. Negin J, Randell M, Raban MZ, Nyirenda M, Kalula S, Madurai L, et al. Health expenditure and catastrophic spending among older adults living with HIV. Glob Public Health. 2017; 12(10):1282–1296. doi: 10.1080/ 17441692.2016.1173717
81. Arsenijevic J, Pavlova M, Rechel B, Groot W. Catastrophic Health Care Expenditure among Older People with Chronic Diseases in 15 European Countries. Reboldi G, editor. PLoS One. 2016;11(7):e0157765. doi: 10.1371/journal.pone.0157765
82. Wang Z, Li X, Chen M. Catastrophic health expenditures and its inequality in elderly households with chronic disease patients in China. Int J Equity Health. 2015;14(1):8. doi: 10.1186/ s12939-015-0134-6
83. Fazaeli AA, Ghaderi H, Abbas Fazaeli A, Lotfi F, Salehi M, Mehrara M. Main determinants of catastrophic health expenditures: a Bayesian logit approach on Iranian household survey data (2010). Glob J Health Sci. 2015;7(4):335-40. doi: 10.5539/ gjhs.v7n4p335
84. Adisa O. Investigating determinants of catastrophic health spending among poorly insured elderly households in urban Nigeria. Int J Equity Health. 2015;14(1):79. doi: 10.1186/s12939-015-0188-5
85. Brinda EM, Rajkumar AP, Enemark U, Prince M, Jacob KS. Nature and determinants of out-of-pocket health expenditure among older people in a rural Indian community. Int Psychogeriatr. 2012;24(10):1664–1673. doi: 10.1017/S1041610212000 83X