

What do we know about financial protection in health in Africa? A systematic review

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Abstract

Background Financial protection is one of the main indicators to assess progress towards Universal Health Coverage. Efforts have been made globally to monitor financial protection. However, progress in the African Region is limited.

Methods A systematic review was conducted to assess financial protection in health in Africa. The search of five databases was conducted between March and May 2019. Studies were included if they conducted empirical analyses on one or two dimensions of financial protection—catastrophic and impoverishing health expenditures, at the national or subnational levels. The review included peer-review articles, grey literature and reports. Data extraction included study characteristics, the dimension of financial protection, including methods and data sources, and the type of analysis (incidence, equity analysis, determinants, trends over time) of financial protection.

Results Fifty-one studies met the inclusion criteria of the review with at least one study in 41 out of the 47 countries in the WHO African Region. The analyses of the included studies showed that catastrophic and impoverishing health spending occurs in all the countries in the region, albeit at different levels. Various national household surveys were used as data sources. Also, the studies used different methods to assess financial protection. The incidence ranged from 0.29% in Zambia in 2010 to 16.4% in Nigeria in 2009 at a 10% threshold. Due to the wide range of data sources and methods, comparison of findings within and across countries was difficult. Furthermore, the majority of the studies focused on in-depth analysis of catastrophic health spending than impoverishing. Trends over time of both catastrophic and impoverishing health expenditures were even limited in single-country analysis.

Conclusion This review provides evidence that generally, financial protection is being monitored at the national level in the African Region, and the incidence of financial protection has increased generally in the Region. Further research on financial protection should explore methods to harmonize the estimation of OOP from different surveys. In addition, analyses should go beyond measuring the incidence of financial protection and also focus on equity analysis, looking at the drivers and trends of both dimensions of financial protection.

1. Background

In 2015, the United Nations General Assembly adopted the Sustainable Development Goals (SDGs) to promote inclusiveness and ensure that no one is left behind[1]. One of the main commitments of the SDGs is Universal Health Coverage (UHC), meaning to ensure that all people can access needed health services of sufficient quality to be effective without incurring financial hardship. The moral imperatives embodied in the goal of UHC include universality, human rights, a quest for social justice and dignity. Briefly, the absence of financial hardship, often referred to as financial protection in health, relates to the ability of households to utilize health services without paying significant amounts that will compromise their ability to afford for other household necessities such as food and shelter[2].

The World Health Organization (WHO) and the World Bank developed a framework for monitoring UHC[3], which countries could use to monitor progress towards UHC, including financial protection. The framework monitors UHC using two main indicators—coverage of essential interventions and financial protection. Financial protection is assessed using two main indicators—catastrophic and impoverishing health expenditures. The data sources for these indicators are typically national household surveys.

Catastrophic health expenditure (CHE), a core indicator for monitoring progress towards UHC, occurs when a household's out-of-pocket (OOP) payments for health services exceed a certain threshold of total consumption, income or a measure of capacity-to-pay. Various methods have been proposed in the literature for measuring CHE, but the widely used are the budget-share (BS) and capacity-to-pay (CTP) approaches. The budget-share approach describes catastrophic spending headcount as the number of households that OOP payments as a proportion of consumption or income exceed a specific threshold[4], typically 10% or 25%. Capacity-to-pay approach compares household OOP health spending to household consumption after accounting for household necessities. There are two approaches of CTP, one based on subsistence needs (WHO approach) and the other on non-food spending (NFS). The CTP approach typically uses a 40% threshold.

Impoverishing health expenditures (IHE) are OOP payments for health services that push individuals into poverty. It is about assessing the effect of OOP healthcare costs on monetary poverty. An individual is impoverished by OOP payments for healthcare if, at a certain poverty line[4], they become poor by paying OOP for healthcare. Countries use different poverty lines, including the international or national absolute poverty lines.

Although many African countries have implemented health reform programs to work towards attaining the SDGs and UHC in 2030, many still depend heavily on OOP expenditures for healthcare[5-7]. Thus, there is a need to take stock of the status of financial protection in

Africa and the trends in financial protection for monitoring progress towards UHC. Besides, with the goal of “leaving no one behind,” it is crucial to determine whether the burden of financial hardship falls on the poor and how this can be better mitigated.

Rationale: There is global monitoring of financial protection, which includes the African Region [3, 8, 9]. However, it is also essential to monitor the different characteristics of financial protection in the region. Apart from an initial attempt to summarize health financing challenges in Africa including a summary of financial protection in health in sub-Saharan Africa [10], there is a dearth of studies that provide a systematic overview of financial protection in health in Africa. Therefore, this paper aims to systematically review the literature to examine financial protection in health in African countries. It examines the trends, equity dimensions and determinants of financial protection in Africa. Gaps in the availability of information on financial protection are also explored to provide recommendations for the assessment of financial protection in health in Africa.

Objectives: The objectives of our study were to systematically review the literature for on financial protection and impoverishment due to illhealth in the WHO Region of Africa. To this end the particular objectives of the review were:

- To describe the data sources and methods used in countries within the WHO region of Africa for estimating financial protection and impoverishment and;
- To systematically review the evidence on the status of financial protection and impoverishment in countries in the WHO region of Africa.

2. Methods

A systematic review of published literature was conducted on the status of financial protection in health (catastrophic and or impoverishment health expenditures) in the WHO African Region. This review was guided by the PRISMA guidelines [11].

Inclusion criteria

The review included documents published in English, French or Portuguese between 1990 and May 2019. These documents include reports, grey literature and peer-reviewed journals containing empirical analyses on catastrophic and impoverishment out-of-pocket healthcare payments from countries in the WHO African Region.

Exclusion criteria

The review excluded review articles and papers that did not include their own analyses. It also excluded studies that assessed financial catastrophe or impoverishment based on a particular disease or health problem and studies that determined the impact of any health intervention on catastrophic expenditure or impoverishment.

Three reviewers independently examined each paper for eligibility to be included in the review using their titles and abstracts identified by the search. Disagreements between the two reviewers were resolved using a third reviewer. Full-text articles were retrieved for the selected titles.

Information sources: The search was undertaken using the following databases: PubMed, Google Scholar, Econlit, Scopus, World Bank Open Knowledge Repository, and WHO health financing documents.

Search strategy Key phrases used include “out-of-pocket payments”, “catastrophic health expenditure” impoverishment expenditure and “financial protection” and the names of the countries in the WHO African Region (Additional 1). The literature search was conducted from March to May 2019.

Data extraction and analysis

A data collection form was designed to capture the relevant information from the selected documents. The form included questions on the following data items: the year of publication, language, geographical focus (single country or multi-country), regional vs global studies, type and source of data for financial protection, methods and thresholds for estimating the incidence of catastrophic expenditure, the poverty lines for the incidence of impoverishment, status and trends of catastrophic, and impoverishing health expenditures over time. The trend and status of the depth of poverty arising from paying out-of-pocket on healthcare were also analyzed.

3. Results

The initial database searches yielded 771 records in which 48 duplicates were removed. A further 571 papers were excluded after screening their titles and abstract (Fig. 1). The full-text of the remaining articles were screened based on the eligibility criteria. This led to 53 papers which were eligible for inclusion. Two studies were later excluded due to potentially erroneous results. One paper reported that 100% of the population was facing impoverishing spending while the other reported an incidence of 50% for catastrophic spending in another country. A total of 51 studies, all published in English were included in the final review (Fig.1).

3.1 Study characteristics

The studies were all published between 2003 and 2019, with the majority (31/50) published in 2015 or later. Over half of the publications (26/50) were authored by individuals affiliated with academic institutions, followed by the World Bank and WHO. Also, five individuals authored one-third of the papers.

Most of the publications concentrated on a single country, but more than half of the studies (27/50) were from four countries (Ghana, Kenya, Nigeria and Rwanda) as described in Table 1. The remainder of the papers were part of multi-country analyses at the global or regional levels (countries within the Africa region). The review contained articles on the majority of the countries (41/47) in the WHO African Region either in a single or multi-country analysis.

3.2 Data sources

Nationally representative household surveys were used for over three-quarters of the publications reviewed. Table 1 shows the full range of surveys used in the various articles, including the Living Standard Measurement Surveys (LSMS), Household Expenditure and Utilization Survey (HEUS), Household Budget Surveys and World Health Surveys. The median survey year was 2005. The remaining studies (12/50) are cross-sectional surveys at the state, district and community levels, which may not be generalizable to other contexts. Some of these papers focused on the impact of national health insurance initiatives in states or districts (n=6) or among specific communities (n=2).

3.3 Analytical methods used by included studies

The studies assessed different aspects of financial protection (Table 2). Most of the studies (40/51) determined the incidence of catastrophic payments using either the budget-share or capacity-to-pay approaches. Some of these publications (9/40) also determined the intensity (i.e. the extent to which households exceed a given threshold using the mean positive overshoot or gap measure). About half of the papers (25/50) assessed the incidence of impoverishment.

The studies which focused on single countries, also conducted an in-depth analysis of financial protection by examining incidence trends over time, equity stratifiers and determinants of financial protection. Over half (28/50) of the papers identified the factors that are associated with financial protection indicators using logistic regression as the most common statistical model. Most (37/50) of the studies conducted equity analysis using characteristics such as income quintiles, geographical location (rural vs urban) and gender and used either regression analysis or concentration index for their analysis. A few of the studies (12/50) assessed the trends in financial protection with most of the studies (5/8) in a single country (i.e. Rwanda). All the global multi-country papers assessed trends over time.

3.4 Measuring catastrophic health expenditures

About half (n=24) of the publications focused only on catastrophic expenditures while only four papers exclusively assessed impoverishing out-of-pocket healthcare expenditures. The remaining papers (n=23) assessed both measures of financial protection. More than 50% of the papers used the budget-share approach. Twenty-one studies used the capacity-to-pay approach. Some of the studies used multiple methods to assess catastrophic expenditures due to the lack of consensus in the literature. However, all publications with at least one author from the WHO (n=6) used the capacity-to-pay approach that accounts for subsistence needs, while studies by authors from the World Bank used the budget-share method (n=10) either alone or in combination with the capacity-to-pay approach using food expenditure as a measure of basic subsistence.

The threshold at which out-of-pocket payments are defined as catastrophic varied (5-40%). The majority (n=44) of the studies used a uniform range of thresholds regardless of the method selected. Most of the studies that used the budget-share approach also used multiple thresholds; however, the most common threshold was 10% (24/27). Studies which used the capacity-to-pay approach mostly used a threshold of 40% (n=16/21). A few studies (n=3) used rank-dependent thresholds based on socio-economic status[12-14]. Only one study used both a uniform and variable thresholds[15].

Incidence and intensity of catastrophic health expenditures

Figure 2 shows the results using the share of out-of-pocket payments over total consumption or income (budget-share method) at a threshold of 10% for all the nationally representative household surveys. Wagstaff et al. (2017a) and the WHO and World Bank (2017) used the same methods, data source and years and have the same results. Therefore, only the results for the WHO and the World Bank report are included in this review.

The analysis in Figure 2 covers many countries (n=36) with data ranging from 1993-2014. The incidence ranged from 0.29% in Zambia in 2010 to 16.4% in Nigeria in 2009. The mean incidence across the countries was 8.1% with the median incidence being 7.0% (IQR: 3.4-11.0). For countries with more than one data point, the results showed that the incidence of catastrophic expenditures had increased over time except for Ghana, and Zambia. Of the four upper-middle-income countries which were included in the analysis, only one had an incidence of catastrophic spending that was significantly below the regional incidence average. Low-income countries experienced various levels of catastrophic spending.

A few of the studies assessed the intensity of catastrophic expenditures. Results from five countries which used the budget-share method at a 10% threshold estimate the mean intensity at 16.0%, meaning that, on average, households spend 16% over the 10% catastrophic threshold.

Figure 3 shows the incidence of catastrophic expenditures at the 25% threshold (budget-share), which is lower than the incidence at the 10% threshold. The mean incidence of catastrophic expenditure at the 25% threshold was 2.3%. Generally, the incidence at the 25% threshold has also increased over time in countries with some exceptions. Only two studies in Kenya determine the intensity of catastrophic expenditures at the 25% threshold.

A mean incidence of catastrophic payments was estimated at 3.3% using the 40% threshold for the capacity-to-pay approach based on non-food spending (Additional File 2). Although not directly comparable, the results in Figure 3 generally show that the incidence of catastrophic payment at the 10% threshold using the budget-share approach is higher than the incidence using the capacity-to-pay approach at the 40% threshold.

3.5 Measuring impoverishing health expenditures

About half (25/51) of the publications assessed impoverishing expenditures using various approaches, as shown in Table 2. Majority of the studies assessed impoverishing out-of-pocket payments (13/25) used an international poverty line (mostly the \$1.25 per person per day line) to determine the incidence and depth of poverty. However, the recent global multi-country analysis used the \$1.90 and \$3.10[3, 16] international absolute poverty lines. Nearly all of these papers (12/13) used multiple poverty lines. Two studies used both the national and international poverty lines[12, 14].

Incidence of impoverishing out-of-pocket health payments

The incidence of impoverishment at the \$1.90 poverty line in 32 countries in the African Region with all the countries experiencing a certain level of impoverishment with the lowest incidence of impoverishment in Cabo Verde at 0.09% in 2007 and the highest incidence at 9.37% in Guinea in 2012. The mean incidence of impoverishment is 1.81% at the \$1.90 and 3.2% at the \$3.10 poverty lines.

Trend of financial protection

The global multi-country analyses show that generally, the incidence of catastrophic expenditure has increased in the African Region. For single-country papers, it was found that the incidence of catastrophic spending has decreased over time in Uganda, Rwanda and Ghana and has increased in Mauritius. Studies in Rwanda assessed inequality in catastrophic spending over time and showed that the gap between the poorest and the least poor has significantly decreased over time[17, 18].

For impoverishing health expenditures, the trend of its incidence depends on the poverty line used. According to the global-multi-country analyses, the incidence of impoverishing health expenditures decreased for the \$1.25 poverty line while at the \$3.10 poverty line, this incidence increased. Only one study in the single-country showed the trend of impoverishing health expenditure with the incidence of impoverishment decreasing.

Analysis of financial protection by equity stratifiers

For the studies (n=21) which use nationally representative surveys and accounted for income quintiles in catastrophic expenditures, majority of them found that poorer households experienced higher incidences of catastrophic health expenditures. However, exceptions are found in Nigeria and Mauritius where the better-off households had a higher incidence of catastrophic expenditures.[13, 19, 20]. The studies also found that catastrophic health expenditure was concentrated in rural households compared with those in urban areas. Only four papers reported income quintiles for impoverishment expenditures, and there was no clear pattern of concentration of impoverishment among the income quintiles.[20-22] [23]

Due to the few studies, which used concentration indexes to assess whether the poor are more likely than the rich to incur financial catastrophe, it is not possible to determine whether catastrophic spending among the different income groups is sensitive to certain thresholds and methods in the African region.

Determinants of financial hardship

Among the 13 studies reporting the determinants of catastrophic expenditure using national household surveys, most found that household size, use of health facility especially inpatient services, age of household members, and education level of household heads are significantly associated with catastrophic health expenditures. In Nigeria and Rwanda, health insurance was a significant factor associated with catastrophic health spending. While in Kenya there were mixed findings on the significance of health insurance on catastrophic health spending.[24-26]

4. Discussion

We conducted a comprehensive systematic review of the literature on financial protection when accessing health services in the WHO African Region. The review identified 51 studies published in English with more than half of them published in the past four years. The majority of the countries in the Region were represented in at least one of the studies. However, most of the studies were conducted in four countries. Studies focused broadly on the two main domains of financial protection: catastrophic (n=25), impoverishment (n=4) or both (n=22). The studies on catastrophic expenditure, focused on six aspects: incidence (n=41), intensity (n=12), equity (23) trends over time (n=12) and determinants (n=24). Catastrophic spending was measured using budget-share (n=9), non-food spending (n=15) or both (n=17) approaches. For the budget-share approach, 10% and 25% thresholds were the most common while for the capacity-to-pay approaches, the 40% threshold was the most popular. The studies on impoverishing spending also focused on six areas: incidence (n=22), poverty gap (n=19), equity (n=5), trends over time (n=5) and determinants (n=3). The studies used a range of nationally representative surveys as data sources. However, there were studies in some countries that had multiple surveys. This makes it very difficult for the comparability of findings. Due to the countless surveys that have been used in the literature to measure financial protection, it cannot be determined which survey is the preferable choice for assessing financial protection in the region. There needs to be a regional consensus on nationally representative surveys that can be implemented across all countries to have comparability of findings in the region.

Overall, the results show that financial protection in health can be monitored and it is being conducted in the African Region. Also, the analyses go beyond calculating the incidence of impoverishment and catastrophic spending even though many of the studies tend to focus on in-depth analysis of catastrophic spending. The studies which focused on equity analysis and the determinants of impoverishment expenditure were few.

What do we know about financial protection in Africa?

The current review showed that financial protection varies across the countries in Africa. There are some countries which have a low incidence of catastrophic spending while others are still struggling. There was no clear pattern of countries' economic status and the level of catastrophic spending. The different country-income groups experienced different levels of catastrophic spending. The findings also show that generally, catastrophic spending has increased in the region with some exceptions. However, due to the number of included studies, these results might not be statistically significant.

Based on our review, the literature shows that in the African region, the burden of catastrophic spending falls mostly on poorer households than better-off households. Exceptions were seen in some countries. For the few studies that conducted equity analysis for impoverishment spending, there was no clear pattern of whether the middle-class or rich households are highly impacted by impoverishment spending. The findings also showed that the main determinants of catastrophic spending were household size, education of head of household, age of household members, inpatient services. In the few studies which assessed health insurance, it was found to be a statistically significant determinant of catastrophic spending.

Given the limited number of studies, drawing strong conclusions on the current financial protection in the African Region is not straightforward. Besides, many of the studies used household surveys from ten years ago, and a number of countries have undergone health reforms in recent years which might have an impact on policy making for financial protection.

In addition, it was also difficult to compare the results within and across the countries. There were some studies from the same countries. However, due to the selection of different methods and thresholds, there was limitation in determining trends or even comparing results from the same survey for catastrophic spending. There were 16 studies which calculated the incidence of catastrophic spending using more than one method which allowed some comparison of results. Furthermore, even when the same method was used in the same country, due to the different data sources that were used, results were different. However, there were only studies from seven countries which used the same method and data source. The comparison of incidence for impoverishing spending was even more difficult due to the different poverty lines that were used. Authors selected poverty lines due to the context of countries at the time of data source. In addition, the trends over time and equity analysis for impoverishment spending were even limited.

Moving forward in monitoring financial protection in Africa

The review showed that consistent monitoring of financial protection in Africa is feasible. Nationally representative household surveys are being conducted across the region to provide nationally representative data for monitoring financial protection. However, to make sure that no one is left behind in the region, more efforts need to be made to expand assessment of financial protection in the countries which do not have data in the literature.

The national household surveys are critical for financial protection since they are representative and data are collected every three-five years. The surveys in many countries in the region are supported by various donors with a preference for certain surveys. Meanwhile, the sensitivity of the incidence of catastrophic spending, the questionnaire and recall period of surveys are highly important. To compare results across countries, there is a need for a regional consensus of consistent and reliable data sources that can be used in all the countries for monitoring financial protection. Further research could even explore the use of routine administrative data to measure financial protection in order to provide timely evidence for current decision making.

In addition, to make monitoring financial protection in Africa easier, there needs to be an agreement on which methods and thresholds to be utilized for the various country income groups. The poverty lines and thresholds for financial protection might not be appropriate for higher countries such as Mauritius and Seychelles. There has been a discussion in the literature to use rank-dependent of thresholds that are dependent on household income due to the higher effect of out-of-pocket payment on poorer households. The urgency of having an agreed method is even more important in Africa for equity analysis.

Furthermore, studies on financial protection need to go beyond measuring the incidence of financial protection. To be able to track universal health coverage comprehensively, all the various aspects of financial protection need to be assessed including foregone care or unmet need. The distribution of financial protection among income groups, gender and geographical location need further analyses. In some contexts, in the region, it might even be better to analyze further whether poorer households or rich households, within the urban or rural areas, are burdened by out-of-pocket payments. Moreover, to track progress over time, trends of both catastrophic and impoverishing out-of-pocket expenditures need to be examined. The drivers of out-of-pocket payment also need to be explored. The literature showed inpatient services was one of the main determinants of catastrophic spending. Further breakdown of inpatient services and other drivers of catastrophic spending need to be examined. More in-depth analysis of impoverishment spending needs to be conducted.

The global multi-country analyses have provided a generic landscape of financial protection globally, but these in-depth analyses of financial protection need to be conducted at country-levels and context-specific. The research and its dissemination should involve policy-makers to ensure published literature is being used for decision-making.

Limitation

There were some limitations that need to be considered when analyzing the results of this review. Our review focused only on published literature, and it might have missed grey literature. There may be national reports on financial protection which have not been published online and therefore were not available during our search.

Conclusion

The review demonstrated that besides global studies, financial protection in health is being monitored in Africa at the national level using national household surveys. Using the budget-share approach, it emerged from the literature that between 2.3% and 8.1% of households in Africa incurred catastrophic spending depending on thresholds. Also, between 1.81% and 3.2% of households in Africa suffered impoverishing out-of-pocket health payments.

Abbreviations

BS: Budget-share approach; CHE: Catastrophic health expenditure; CX: Concentration indexes; UHC: Universal Health Coverage; CTP: Capacity-to-pay; IHE: Impoverishing health expenditure; HBS: Household Budget Survey; HHEU: Household Health Expenditure and Utilization Survey; ILCS: Integrated Living and Conditions Survey; IHS: Integrated Household Survey; HIES: Household Income and Expenditure Survey; LSMS: Living Standards Measurement Survey; log R: Logistic Regression; MPO: Mean Poverty Overshoot; MPG: Mean Poverty Gap; NHS: National Household Survey; NLSS: National Living Standards Survey; NFS: Non-food spending; OOP: Out-of-pocket; PMS: Poverty Monitoring Survey; QU: Quintiles; SES: Social-economic status; SDGs: Sustainable Development Goals; WHO: World Health Organization; WHS: World Health Survey

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

Please contact the authors for additional data requests.

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Competing interests

All the authors of this manuscript were employees or consultants of the World Health Organization. However, the views expressed in this paper are solely those of the authors and not do not represent the views of their institutions.

Authors' contributions

GAK, and JEA contributed to conceiving the paper. GKA, DOA and MLM collected and extracted the data. GAK, DOA, MLM and JEA analyzed and interpreted the data. GAK and DOA drafted the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1: Characteristics of Included Publications

Author (Year)	Author Affiliation	Country	Administration level	Data Source	Years	Type of FRP	Method	Poverty Line
Adesina and Odaji[11] (2018)	Academia	Nigeria	Community	Primary	2017	IHE		
Akazili et al[12] (2017a)	Research institute	Ghana	National	NLSS	2005/06	CHE	BS, NFS	
Akazili et al[13] (2017b)	Research institute	Ghana	National	NLSS	2005/06	IHE		2 Absolute international
Atake and Amendah[14] (2018)	Academia	Togo	Province	Primary	2016	CHE	BS, CTP (WHO Approach)	
Aregbeshola and Khan[15] (2017)	Academia	Nigeria	National	HNLSS	2009/10	IHE		2 Absolute international
Aregbeshola and Khan[16] (2018a)	Academia	Nigeria	National	HNLSS	2009/10	CHE	BS, NFS	
Aregbeshola and Khan[17] (2018b)	Academia	Nigeria	National	HNLSS	2009/10	Both	BS, NFS	2 Absolute international
Ataguba[18] (2012)	Academia	Nigeria	National	NLSS	2003/04	CHE	BS, NFS	
Aryeetey et al[19] (2016)	Academia	Ghana	Province	Primary	2016	Both	CTP (WHO Approach)	Relative: Food expenditure
Barasa, Maina and Ravishankar[20] (2017)	Research institute	Kenya	National	HHEU	2013	Both	CTP (WHO Approach)	2 Absolute National (consumption expenditure)
Buigut, Ettarh and Amendah[21] (2015)	Research institute	Kenya	Community	Primary	2011	CHE	BS, CTP (WHO Approach)	
Chuma and Maina[22] (2012)	Research institute	Kenya	National	HHEU	2007	Both	BS, NFS	Absolute National (consumption expenditure)
Haazen[23] (2012)	WHO	Tanzania	National	HBS	2007	Both	BS, NFS	Not specified
Ilesanmi, Adebisi and Fatiregun[24] (2014)	Academia	Nigeria	Province	Primary	2012	CHE	NFS	
Kaonga, Banda and Masiye[25]	Academia	Zambia	National	HHEU	2014	CHE	BS	

(2019)									
Kimani, Mugo and Kioko[26]	Academia	Kenya	National	HHEU	2007	Both	BS, NFS, CTP(WHO Approach)	Absolute National (consumption expenditure)	
(2016)									
Kusi et al[27]	Academia	Ghana	District	Primary	2011	CHE	NFS		
(2017)									
Kwesiga, Zikusooka and Ataguba[28]	Consulting Firm	Uganda	National	NHS	2009/10	Both	NFS	Absolute National, Absolute international	
(2015)									
Liu and Lu[29]	Academia	Rwanda	National	ILCS	2005, 2010	CHE	CTP (WHO Approach)		
(2018)									
Liu, Subramanian and Lu[30]	Academia	Rwanda	National	ILCS	2005, 2010, 2014 and 2016	CHE	CTP (WHO Approach)		
(2019)									
Liu, Cook and Lu[31, 32]	Academia	Rwanda	National	ILCS	2005, 2010	CHE	CTP (WHO Approach)		
(2019)									
Lu et al[32]	Academia	Rwanda	National	ILCS	2005, 2010/11	CHE	CTP (WHO Approach)		
(2017)									
Lu et al[33]	Academia	Rwanda	National	ILCS	2005, 2006	CHE	CTP (WHO Approach)		
(2012)									
Masiye, Konga and Kirigia[34]	Academia	Zambia	National	HHEU	2014	CHE	BS, CTP (WHO Approach)		
(2016)									
Mchenga, Chirwa and Chiwaula[35]	Academia	Malawi	National	IHS	2010/11	Both	NFS	Absolute National (consumption expenditure)	
(2017)									
Mekonen, Gebregziabher and Teferra[36]	Academia	Ethiopia	District	Primary	2016	CHE	NFS		
(2018)									
Ngcamphalala and Ataguba[37]	Academia	Eswatini	National	HIES	2009/10	Both	BS, NFS	Absolute National, Absolute international	
(2018)									
Nguyen, Rajkotia and Wang[38]	Consulting Firm	Ghana	District	District household survey	2007	CHE	BS, NFS		
(2011)									
Njuguna, Kimani, and Kinyanjui	MoH	Kenya	National	HIES	2013	Both	CTP (WHO approach)	Not specified	
(2017)									
Nundoochan et al[39]	WHO	Mauritius	National	HBS	2001/02, 2006/07	Both	BS, CTP (WHO)	Absolute National	

(2019)					and 2012		Approach)		
Onoka et al[40]	Academia	Nigeria	Province	Primary	2008	CHE	NFS		
(2011)									
Onwujekwe, Hanson and Uzochukwu[41]	Academia	Nigeria	District	Primary	Not specified	CHE	NFS		
(2012)									
Schieber et al[42]	World Bank	Ghana	National	WHS	2003	Both	BS, NFS	2 Absolute international	
(2012)									
Séne and Cissé[43]	Academia	Senegal	National	PMS	2016	CHE	NFS		
(2015)									
Su, Kouyate and Flessa[44]	Academia	Burkina Faso	District	DHS	2000/01	CHE	NFS		
(2006)									
World Bank[45]	World Bank	Ghana	National	NLSS	2005/2006	Both	BS	2 Absolute National	
(2012a)									
World Bank[46]	World Bank	Kenya	National	WHS	2004	Both	BS, NFS	2 Absolute international	
(2012b)									
World Bank[47]	World Bank	Malawi	National	WHS, IHS	2003, 2004	Both	BS, NFS	2 Absolute international	
(2012c)									
World Bank[48]	World Bank	Zambia	National	WHS	2003	Both	BS, NFS	2 Absolute international	
(2012d)									
Xu et al[49]	WHO	Uganda	National	NHS	1997, 2000 and 2003	CHE	CTP (WHO Approach)		
(2006)									
Xu, James & Carrin[50]	WHO	Kenya	National	HHEU	2003	Both	CTP (WHO Approach)	Relative: food expenditure	
(2006)									
Zeng, Lannes and Mutasa[51]	Academia	Zimbabwe	National	NHS	2016	Both	BS	Absolute National (consumption per month per capita)	
(2018)									
Multi-Country Analysis									
Mills et al[52]	Academia	Regional: Ghana, South Africa, United Republic of Tanzania	National	NLSS, HBS, HIES	2005/06, 2005/06 and 2000/01	CHE	NFS		
(2012)									
Wagstaff et al[53]	World Bank	Global: Ethiopia, Ghana, Kenya, Nigeria and South Africa	National	LSMS	2007, 2007, 2006, 1995, 1997	Both	BS	Absolute international	
(2016)									
Wagstaff et al[54]	World Bank	Global: Angola Benin,	National	Varies	Ranges from 1993-2013	CHE	BS		

(2018a)			Botswana, Burkina Faso, Burundi, Capo Verde, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Ghana, Gabon, Guinea, Kenya, Lesotho, Liberia, Madagascar, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Eswatini, Togo, Uganda, and United Republic of Tanzania					
Wagstaff et al[55]	World Bank	Global: Angola Benin, Botswana, Burkina Faso, Burundi, Capo Verde, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Ghana, Gabon, Guinea, Kenya, Lesotho, Liberia, Madagascar, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Eswatini, Togo, Uganda, and United Republic of Tanzania	National		Ranges from 1993- 2013	IHE	2 Absolute international, Relative: median consumption per capita	
(2018b)								
Scheil-Adlung et al[56]	Other	Regional: Kenya,	National	HEUS or WHS	2003	CHE	CTP (WHO Approach)	

(2006)		Senegal and South Africa						
WHO[8]	WHO	Global: Ghana, Kenya, Malawi, Niger, Rwanda, Senegal, Uganda and United Republic of Tanzania	National	Varies (Typically NLSS)	Ranges from 2003-2011	Both	BS, NFS, CTP (WHO Approach)	2 Absolute International, Relative: Food expenditure
(2015)								
WHO and World Bank[3]	WHO and World Bank	Global: Angola, Benin, Botswana, Burkina Faso, Burundi, Capo Verde, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Ghana, Gabon, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Eswatini, Togo, Uganda, and Zambia	National	Varies (Typically HBS, HIES or WHS)	Ranges from 1993-2011	Both	BS	2 Absolute International
(2017)								
Xu et al[57]	WHO	Global: Ghana, Mauritius, Namibia, Senegal, South Africa, and Zambia	National	Varies	1998/99, 1996/97, 1994, 1995 and 1996	CHE	CTP (WHO Approach)	
(2003)								
Xu et al[58]	WHO	Global: Burkina Faso, Capo Verde Côte d'Ivoire, Ghana, Kenya, Mauritius, Malawi, Namibia, Senegal, South Africa, Uganda, and United Republic of Tanzania	National	Varies	Ranges from 1993-2003	CHE	CTP (WHO Approach)	
(2007)								

HBS: Household Budget Survey; HHEU: Household Health Expenditure and Utilization Survey; HNLSS: Harmonized National Living Standard Survey; ILCS: Integrated Living and Conditions Survey; IHS: Integrated Household Survey; HIES: Household Income and Expenditure Survey; LSMS: Living Standards Measurement Survey; NHS: National Household Survey; NLSS: National Living Standards Survey; PMS: Poverty Monitoring Survey; WHS: World Health Survey

Table 2: Analysis conducted by studies

Author (Year)	Incidence of CHE	Intensity of CHE	Incidence of IHE	Poverty Gap	Determinants	Equity	Trends
Adesina and Odaji[11] (2018)	✓		✓	✓			
Akazili et al[12] (2017a)	✓					✓, CX	
Akazili et al[13] (2017b)			✓	✓		✓, Geographic location	
Atake and Amendah[14] (2018)	✓	✓, MPG			✓, log R	✓	
Aregbeshola and Khan[15] (2017)					✓, binary log R, Ch Sq	✓	
Aregbeshola and Khan[16] (2018a)					✓, Ch Sq	✓, Ch Sq	
Aregbeshola and Khan[17] (2018b)	✓		✓	✓		✓	
Ataguba John[18] (2012)	✓	✓, MPG				✓, CX	
Aryeteey et al[19] (2016)	✓				✓, log R	✓, CX	✓
Barasa, Maina and Ravishankar[20] (2017)	✓		✓	✓	✓, log R	✓, CX	
Buigut, Ettarh and Amendah[21] (2015)	✓				✓, log R		
Chuma and Maina[22] (2012)	✓	✓, MPO	✓	✓		✓, CX	
Haazen Dominic[23] (2012)	✓		✓			✓, QU	
Ilesanmi, Adebisi and Fatiregun[24] (2014)					✓, Ch sq & binary log R	✓, Ch Sq	
Kaonga, Banda and Masiye[25] (2019)	✓				✓, sequential log R	✓, sequential log R	
Kimani, Mugo and Kioko[26] (2016)	✓	✓, MPO	✓	✓	✓, log R	✓,QU	

Kusi et al[27] (2017)	✓	✓, MPO			✓, multiple log R	✓, log R
Kwesiga, Zikusooka and Ataguba[28] (2015)	✓		✓	✓		
Liu and Lu[29] (2018)					✓, log R	✓
Liu, Subramanian and Lu[30] (2019)					✓, log R	✓, SES
Liu, Cook and Lu[31] (2019)					✓, log R	✓, SES
Lu et al[32] (2017)	✓				✓, log R	✓, QU
Lu et al[33] (2012)					✓, log R	✓, QU
Masiye, Konga and Kirigia[34] (2016)	✓	✓, MPO				✓, QU
Mchenga, Chirwa and Chiwaula[35] (2017)	✓	✓, MPG	✓	✓		✓, QU
Mekonen, Gebregziabher and Teferra[35] (2018)					✓, binary log R & propensity score matching analysis	✓, log R
Ngcamphalala and Ataguba[36] (2018)	✓	✓, MPG	✓	✓		
Nguyen, Rajkotia and Wang[37] (2011)	✓				✓	✓, QU
Nundoochan et al[38] (2019)	✓		✓	✓	✓, log R	✓, QU
Onoka et al[39] (2011)	✓					✓, QU
Onwujekwe, Hanson and Uzochukwu[40] (2012)	✓					✓, QU
Séne and Cissé[41] (2015)	✓	✓, MPG	✓	✓	✓, Tobit regressions	✓, CX
Su, Kouyate and Flessa[42] (2019)	✓				✓, multiple log R	✓, log R

(2006)						
Schieber et al[43]	✓	✓			✓, QU	
(2012)						
World Bank[44]	✓	✓	✓		✓, CX	
(2012a)						
World Bank[45]	✓	✓	✓		✓, CX	
(2012b)						
World Bank[46]	✓	✓	✓		✓, CX	
(2012c)						
World Bank[46]	✓	✓	✓		✓, CX	
(2012d)						
Xu et al[47]	✓			✓, Multinomial log R	✓, RATIO	✓
(2006)						
Xu, James & Carrin[48]	✓	✓		✓, log R	✓, QU	
(2006)						
Zeng, Lannes and Mutasa[49]	✓	✓		✓, log R	✓, QU	
(2018)						
Mills et al[50]	✓	✓				
(2012)						
Wagstaff et al[51]	✓	✓				
(2016)						
Wagstaff et al[52]	✓			✓, log R		✓
(2018a)						
Wagstaff et al[53]		✓	✓	✓, log R		✓
(2018b)						
Scheil-Adlung et al[54]	✓	✓	✓	✓, multiple log R		
(2006)						
WHO[8]	✓	✓				✓
(2015)						
WHO and World Bank[3]	✓	✓	✓			✓
(2017)						
Xu et al [55]	✓			✓, Regression analysis		
(2003)						
Xu et al[56] (2007)	✓			✓, log R		

MPG= Mean Poverty Gap, MPO=Mean Poverty Overshoot, log R= Logistic Regression Analysis, CX=Concentration Index, QU=Income quintiles, SES=socio-economic status, Ch Sq= Chi-square.

Figures

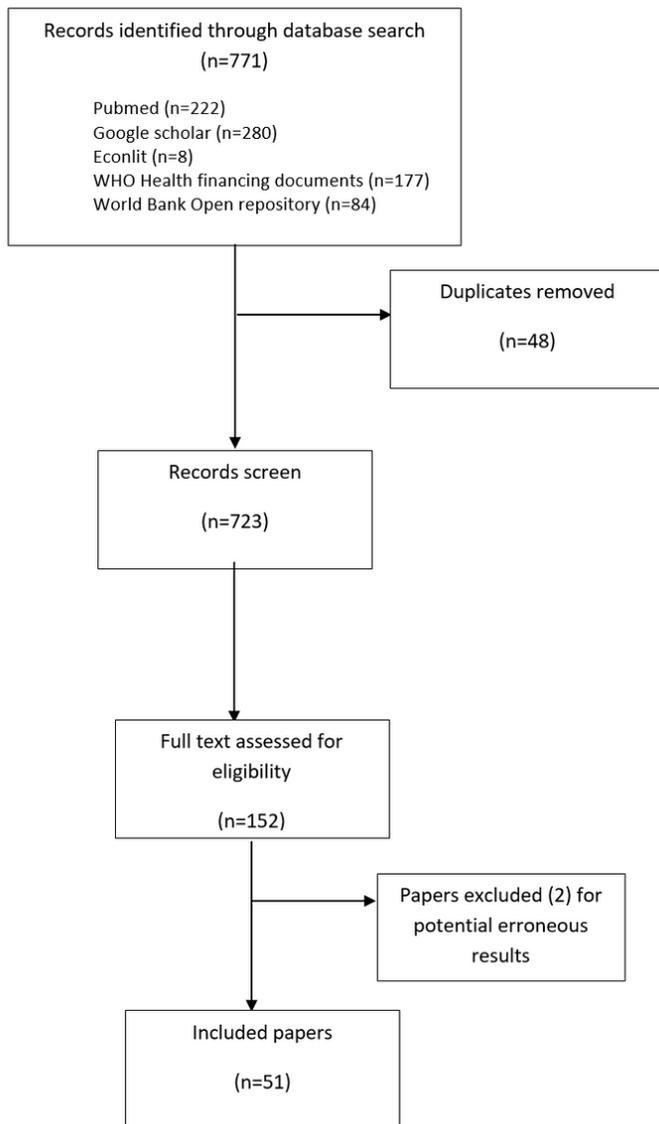


Figure 1

Flowchart of included studies

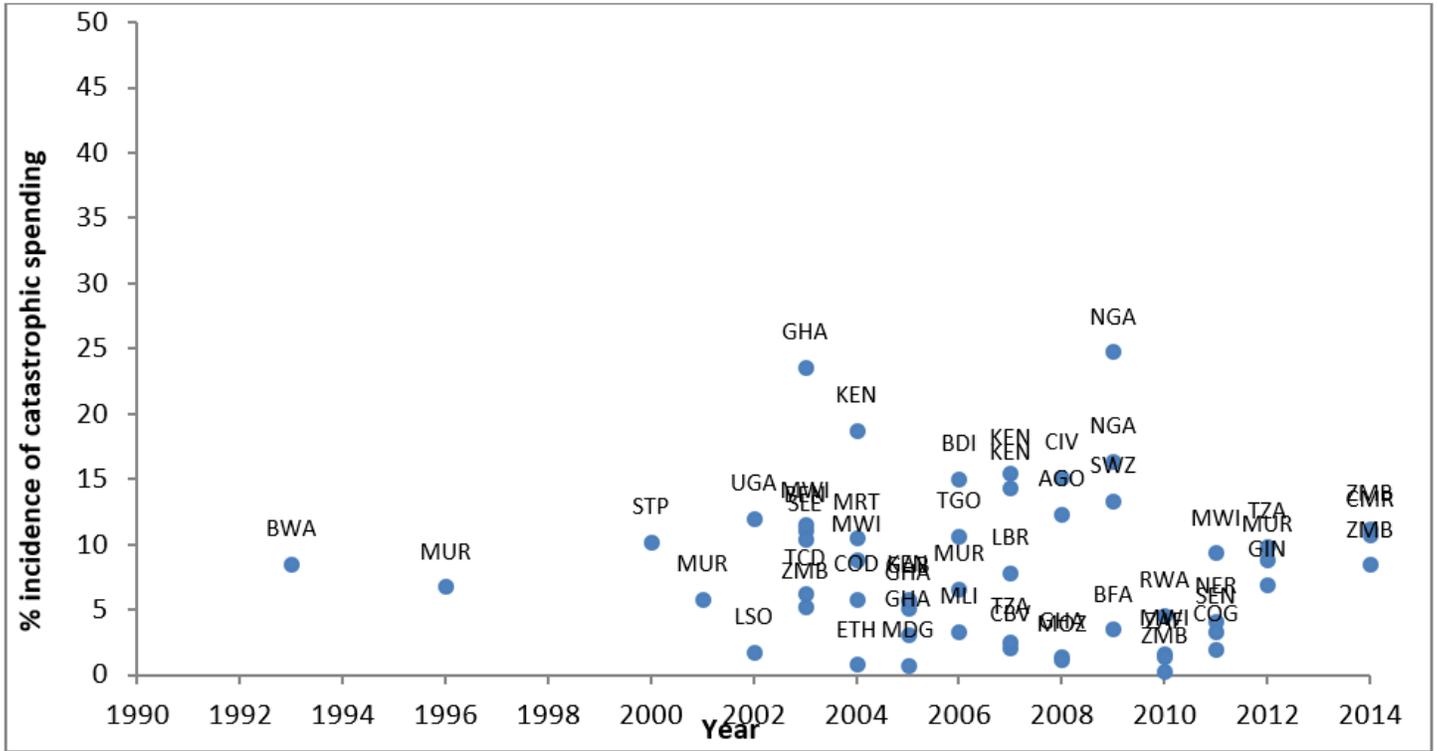


Figure 2

Catastrophic health expenditure at the 10% threshold using total consumption

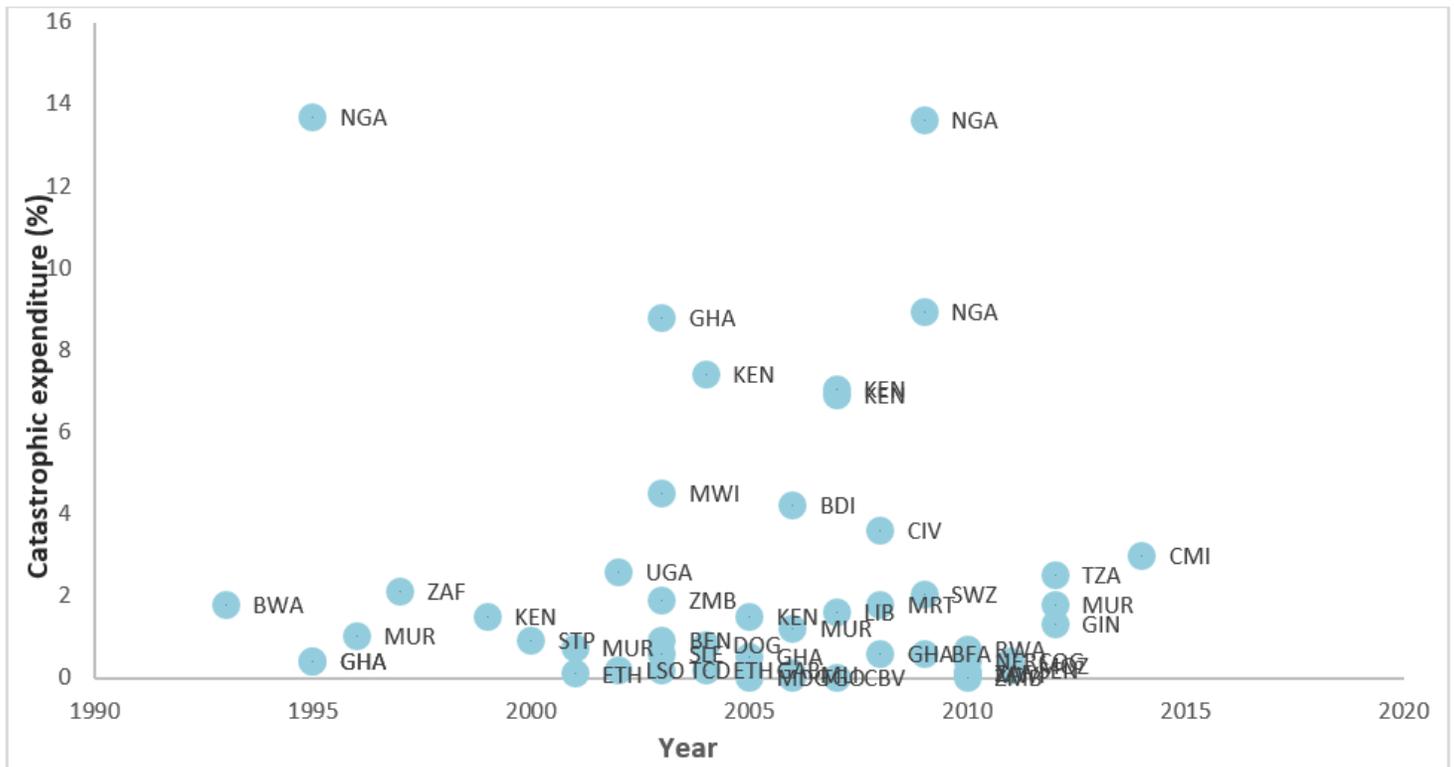


Figure 3

Catastrophic health expenditure at the 25% threshold using total consumption

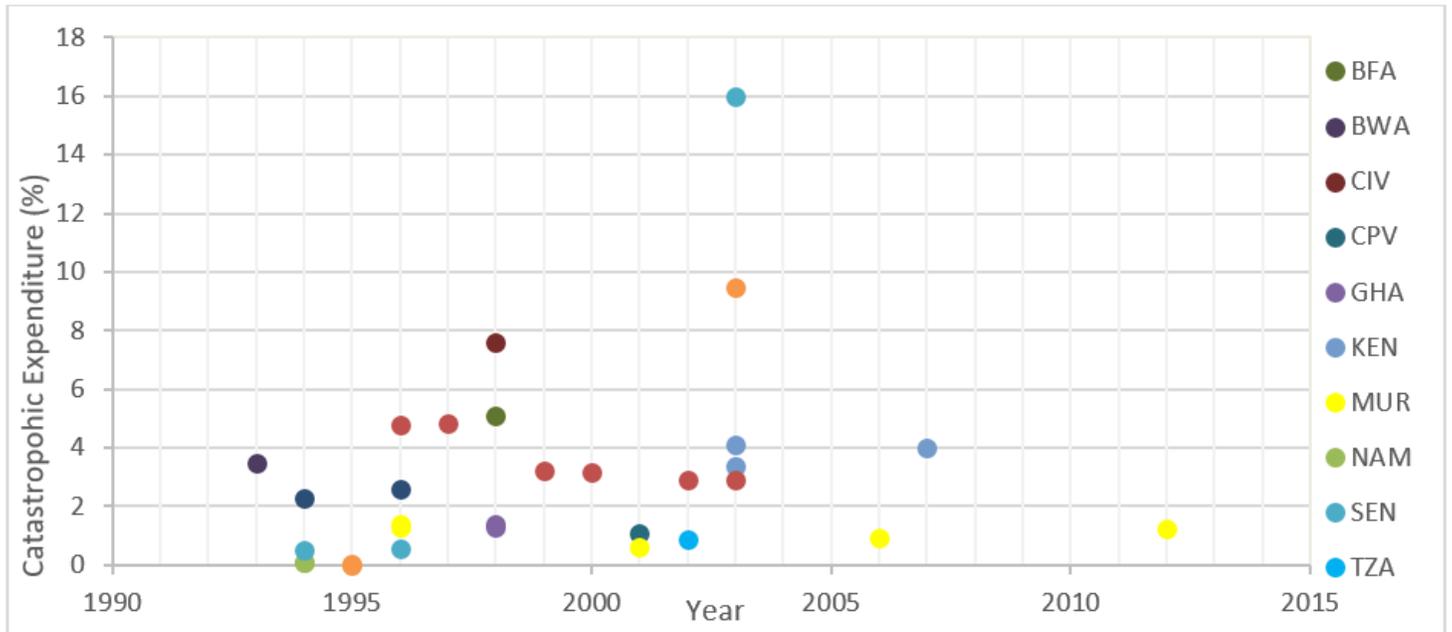


Figure 4

Catastrophic health expenditure at the 40% threshold using the capacity-to-pay approach

Supplementary Files

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