



**Assessing Catastrophic and Impoverishing Health Expenditure from Out-of-Pocket
Health Payments in Botswana**

By

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Declarations

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Dedication

This Dissertation is dedicated to my beloved mother, whose unwavering support and sacrifices have been my greatest source of strength, and to my son, whom I left behind at just three months old to pursue this degree.

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I am grateful to God as well as the support and contributions from individuals who have helped me complete this Dissertation.

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Abstract

Out-of-pocket (OOP) health expenditures can place a heavy financial strain on households, often resulting in catastrophic healthcare costs and driving families into poverty. This thesis assesses the extent to which OOP health costs impact households in Botswana because of healthcare utilization.

The study is divided into four main sections. **Part A: Literature Review** provides an overview of key concepts, theoretical frameworks, and empirical evidence related to catastrophic and impoverishing health expenditures. It explores regional and international studies on the financial hardships caused by OOP healthcare costs.

Part B: The manuscript presents the main research findings, utilizing data from the nationally representative Botswana Multi-Topic Household Survey 2015/16, conducted by Statistics Botswana, which includes a sample of 7,049 households. Catastrophic and impoverishing OOP healthcare payments were evaluated using a threshold that varies according to household income. Impoverishment was measured using Botswana's national poverty line of BWP 1,014.00/month and the international poverty line of \$1.90 per day. The findings reveal that 13.8% of households in Botswana experienced financial hardship when applying a threshold of 10% of total consumption expenditure. In comparison, 3.1% faced financial hardship using a 40% threshold of non-food expenditure. Additionally, approximately 0.1% of households—equivalent to around 122,588—were pushed below the poverty line based on Botswana's national poverty line.

In Part C: Policy Brief, the study's conclusions are summarized into actionable recommendations for policymakers. It advocates for strategies such as the establishment of a national health insurance scheme to enhance financial protection and ensure equitable access to healthcare services. The final section includes Appendices, which provide the study protocol, research instruments used for data collection and analysis, and ethical clearance.

The findings from this thesis contribute to the ongoing discourse on universal health coverage in Botswana by offering evidence-based insights into the financial barriers to accessing healthcare. The policy recommendations aim to inform health financing reforms that mitigate the adverse effects of OOP payments while promoting equitable access to healthcare services.

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Acronyms

AE	Adult Equivalent
BMTHS	Botswana Multi-Topic Household Survey
CHE	Catastrophic health expenditure
EAs	Enumeration Areas
GDP	Gross Domestic Product
IHSP	Integrated Health Services Plan
LMIC	low-and middle-income countries
NHP	National Health Plan
OOP	Out-of-Pocket
PPP	Purchasing Power Parity
SDGs	Sustainable Development Goals
SB	Statistics Botswana
SES	Socioeconomic status
UHC	Universal Health Coverage
WHA	World Health Assembly
WHO	World Health Organisation
WHR	World Health Report

1 PART A: Literature Review

1.Introduction

An analysis of the theoretical, methodological, and empirical aspects of financial risk protection in healthcare is provided in this literature review. The theoretical section explores key discussions on financial risk protection, while the methodological section examines the approaches used to assess it. The empirical review highlights previous studies on financial protection assessment. The literature review guides the design and methodology of the current study and helps identify gaps in existing research.

1.1Theoretical Literature Review

The Wagstaff-Grossman model of health demand offers a theoretical framework for understanding the relationship between healthcare costs and the financial burden they impose (Grossman, 1972; Wagstaff, 1986b). According to this model, the financial cost of healthcare to a household is reflected in the basic consumption that must be sacrificed to cover medical expense (Grossman, 1972; Wagstaff, 1986a). The demand for healthcare is influenced by an individual's health status, which in turn affects the likelihood of facing financial hardship due to medical costs (Grossman, 1972). These medical costs are the direct expenses households incur when seeking healthcare services. Measuring financial risk protection (FRP) in healthcare is essential for safeguarding households from the financial burden of illness. FRP aims to shield individuals from financial hardship arising from healthcare use (Wagstaff, 2010; WHO, 2021). It is assessed by comparing out-of-pocket (OOP) payments to a specified threshold (Wagstaff & Doorslaer, 2003). OOP payments refer to the direct healthcare costs paid by individuals, which may or may not be reimbursed by a third party. (Wagstaff, 2010; WHO, 2021).

Households may use various financial coping strategies to manage unexpected medical expenses, such as borrowing, selling assets, or using savings (Krishna, 2004, 2006; Rajeswari et al., 1999; Sen, 2003). However, despite these strategies, McIntyre et al. (2006) highlight that the inability to cover medical costs often forces households into poverty, a phenomenon known as the "medical poverty trap" (Whitehead et al., 2001). Medical debt is recognized as both a major pathway into poverty and a significant factor in its persistence. The concept of the "medical poverty trap" underscores how healthcare costs can increase untreated morbidity, restrict access to care, and ultimately worsen long-term poverty (McIntyre et al., 2006).

1.2 Methodologies for the Measuring Financial Risk Protection

The catastrophic and impoverishment methodologies are the two primary approaches for measuring financial risk protection (Wagstaff & Doorslaer, 2003; Xu et al., 2003). These methods assume that household OOP healthcare costs are both involuntary and non-discretionary. Furthermore, they assume that household resources are fixed, which means that existing non-medical spending must be reduced in order to fully cover healthcare costs (Wagstaff, 2008).

1.2.1 Catastrophic Health Expenditure

Catastrophic health expenditure is defined as medical expenses that exceed a certain percentage of household income or capacity to pay in a specific time frame, typically one year (Berki, 1986; Russell, 2004; Wagstaff & Doorslaer, 2003; Wyszewianski, 1986; Xu et al., 2003). The reasoning for this is that allocating a significant amount of the household budget to healthcare depletes funds for other necessities like clothing, food, and housing (Wagstaff & Doorslaer, 2003). Total household out-of-pocket healthcare spending and a measure of household living standards are the main variables used to calculate catastrophic health cost (Wagstaff & Doorslaer, 2003).

The Wagstaff and Doorslaer (2003) method assesses household socioeconomic status using total household expenditure and non-food expenditure. Non-food expenditure is calculated by subtracting actual household food consumption from total household consumption (Wagstaff & Doorslaer, 2003). This approach applies a predetermined threshold of 10% for total household expenditure and 40% for non-food expenditure. Similarly, the method proposed by Xu et al. (2003) uses "capacity to pay," which is determined by subtracting the consumption of subsistence food from the overall consumption of the household, to define the socioeconomic status of the household. This approach employs a fixed threshold of 40%. The rank-dependent threshold methodology, as applied by Ataguba (2012), Mutyambizi et al. (2019) and Edeh (2022a), builds upon the approach by Wagstaff and Doorslaer (2003) by introducing an aversion parameter to determine income-sensitive thresholds. This enhancement explicitly captures the diminishing marginal utility of income and incorporates the principle of vertical equity, which is essential for assessing the fairness of a health system (Ataguba, 2012). As a result, it allows threshold payment levels to vary across different income groups, ensuring a more equitable assessment of financial burden.

The catastrophic health expenditure methodology does not fully reflect the hardship households experience from OOP healthcare payments. Hence, it is essential to examine the impoverishing effects of health expenditures, which are addressed in the following section.

1.2.2 Impoverishment resulting from out-of-pocket health payments

The impoverishment methodology is founded on the principle that OOP healthcare payments should neither drive individuals into poverty nor worsen the financial hardship of those already living in poverty (Wagstaff, 2008; Wagstaff & Doorslaer, 2003). OOP healthcare expenses are considered impoverishing if they lower a household's standard of living below the poverty line or further worsen the financial situation of those already in poverty (Wagstaff, 2008; Wagstaff & Doorslaer, 2003). The impact of medical costs on poverty is assessed by comparing the poverty headcount and poverty gap before and after healthcare payments (Wagstaff, 2010; Wagstaff & Doorslaer, 2003). The poverty headcount reflects the number of individuals living in poverty, while the poverty gap measures the total shortfall from the poverty line (Wagstaff, 2010).

Poverty lines are utilized to evaluate the impoverishment, using both the international and country-specific poverty lines. The World Bank advises applying international poverty lines of \$1.90/day and \$3.10/ day, based on 2011 Purchasing Power Parity (PPP) values (Wagstaff, Flores, Smits, et al., 2018). These international poverty lines facilitate cross-country comparisons of poverty levels.

1.3 Empirical Review

Keyword searches were performed across several electronic databases, including SCOPUS, Web of Science, EBSCOhost, PubMed, Medline, and Google Scholar as well as institutional websites for World Bank and World Health Organization.

1.3.1 Inclusion and Exclusion Criteria

The inclusion criteria were established in accordance with the objective of the study. In total fifty-one studies were reviewed: twenty-six focused on catastrophic health expenditure, and twenty-five examined impoverishments. While some studies explored both aspects simultaneously, others addressed only one. The reviewed research covers a diverse range of countries, including low-, middle-, and high-income settings. The literature review spans a

10-year period (2014–2024) but also includes seminal works published outside this timeframe. Studies that are not in English, opinion pieces, articles that lack empirical data, or those that are outside of the designated time frame or subject area were excluded from the literature review. Listed below are a combination of keywords that were used to search for articles published in English:

Catastrophic, Catastrophe, impoverishment, out-of-pocket, healthcare payments, healthcare costs, financial risk Protection, financial ruin

1.3.2 Catastrophic health expenditure

The studies on catastrophic health expenditure used a cross-sectional design and were nationally representative. The literature reviewed covered both single country and multi country research.

Table 1 ; Studies assessing catastrophic health expenditure

	STUDY AUTHOR YEAR	COUNTRY	DATA SOURCE	OBJECTIVE S	METHODS (STANDARD OF LIVING MEASUREMENT)	FINDINGS
1.	(Akazili, McIntyre, et al., 2017)	Ghana	Ghana Living standard Survey (GLSS) 2005/2006	To evaluate the catastrophic impact of out-of-pocket (OOP) healthcare payments.	(Wagstaff & Doorslaer, 2003) was adapted, defining catastrophic health expenditure (CHE) as 10% of total household expenditure or 40% of non-food expenditure. Household socioeconomic status (SES) was assessed based on total household expenditure.	CHE was recorded at 5.16% using the 10% threshold of total household expenditure and 2.56% at the 40% threshold of non-food expenditure. The catastrophic payment headcount decreased as the threshold increased for both total household and non-food expenditures.
2.	(Amaya-Lara, 2016)	Colombia	Colombia Quality of Life National Survey 2011	To examine the incidence and determinants of catastrophic OOP healthcare	(Xu et al., 2003) methodology was adapted, defining catastrophic health expenditure (CHE) as out-of-pocket (OOP) payments equal to or exceeding 20% of a household's capacity to pay.	9.6% of Colombians experienced CHE. The region in which a household is located significantly influences the likelihood of incurring CHE.

				expenditures in Colombia.	Household socioeconomic status (SES) was assessed based on total household expenditure.	
3.	(Araujo & Coelho, 2021)	Brazil	Brazilian Consumption Survey (POF 2017/2018).	To estimate the incidence of CHE and examine its determinants across households.	(Wagstaff & Doorslaer, 2003) was adapted, defining catastrophic health expenditure (CHE) as OOP spending that surpasses 10% or 25% of a household's total consumption. Household socioeconomic status was assessed based on total household expenditure.	Using a 10% threshold of total household consumption, 33.4% of Brazilian households experience CHE. However, when the threshold is raised to 25%, the incidence drops significantly to 11.5%.
4.	(Aregbeshola & Khan, 2018)	Nigeria	Harmonized Nigeria Living Standard Survey (HNLSS) 2009/2010	To assess the financial impact of OOP health payments on Nigerian households.	(Wagstaff & Doorslaer, 2003) was adapted, defining catastrophic health expenditure (CHE) as out-of-pocket (OOP) payments exceeding 10% of total household expenditure or 40% of non-food expenditure. Household socioeconomic status was assessed based on total household expenditure.	CHE was 16.4% when measured at 10% of total household expenditure and 13.7% at 40% of non-food expenditure. In both instances, the incidence of CHE decreases as the threshold increases.

5.	(Arenliu Qosaj et al., 2018)	Kosovo	Kosovo Household Budget Survey 2014	To assess the impact of OOP payments on households by estimating the incidence of catastrophic health expenditure and its effect on national poverty levels.	(Wagstaff & Doorslaer, 2003) was adapted, defining catastrophic health expenditure (CHE) as OOP payments exceeds 10% of total household consumption expenditure or 40% of non-food expenditure. Household socioeconomic status was evaluated based on the total household expenditure.	CHE was 13.09% at a 10% threshold and 1.65% at a 25% threshold of household consumption expenditure. Likewise, at 10% and 40% of non-food expenditure, CHE stood at 30.24% and 5.34%, respectively. In both cases, CHE decreased as the threshold increased. However, the mean positive overshoot remained unchanged despite the rising threshold.
6.	(Barasa et al., 2018)	Kenya	Kenya Household Expenditure and Utilization Survey (KHHEUS) 2013	To estimate both the incidence and intensity of catastrophic health expenditure (CHE) and explore the factors	Adapted methodology proposed by (Xu et al., 2003), CHE was defined as out-of-pocket (OOP) payments exceeding 40% of capacity to pay. HH SES was estimated using household expenditure.	The incidence of CHE was 4.52% when only direct medical costs were considered, increasing to 6.57% when transport costs were included. Households with an unemployed head, elderly members, individuals with chronic illnesses, larger

				contributing to its occurrence.		household sizes, lower socioeconomic status, or those living in marginalized areas of the country are more likely to incur CHE.
7.	(Bredenkamp & Buisman, 2016)	Philippines	Family income and Expenditure Surveys (FIES) 2000,2003 ,2006,2009 and 2012.	Evaluate the progress of the Philippines in achieving its Universal Health Coverage (UHC) goal of financial risk protection, by analyzing estimates of health insurance coverage, out-of-pocket expenses, catastrophic payments, and impoverishing	Wagstaff and van Doorslaer's methodology (2003) was adapted. CHE was defined as total consumption expenditure and total non-food expenditure. HH SES was estimated using household expenditure. Threshold applied were 10% total consumption and 40% of non-food consumption.	The incidence of CHE at 10% of consumption expenditure increased over time, rising from 2.5% in 2000 and 2003 to 7.7% in 2012. When using 40% of non-food expenditure, CHE was 0.5% in 2000 and 2003, and increased to 2.3% in 2012.

				health expenditures.		
8.	(Edeh, 2022b)	Nigeria	Nigeria General Household survey (2010/11, 2012/13, 2015/16)	To examine the proportion of households incurring CHE.	Adapted Wagstaff and Van Doorslaer (2003) methodology and incorporated an aversion parameter to generate the rank -dependent thresholds. CHE was defined as total household expenditure and non-food expenditure for various initial thresholds 10%,15% and 20% . HH SES was estimated using total household consumption expenditure.	The rank-dependent threshold showed an increase in the proportion of households experiencing CHE, rising from 27% in 2010/2011 to 48% in 2015/2016. The rank-dependent catastrophic headcount is sensitive to changes in the parameter value. Lowering the parameter increases the headcount of CHE across all thresholds and regions. For example, at the 10% threshold, reducing the parameter from 1.0 to 0.8 led to an increase in the headcount from approximately 23% to 27% in 2010/2011.

(Edmonds & Hajizadeh, 2019)	Canada	Canada's survey of household spending (SHS)	To assess the progressivity and catastrophic impact of out-of-pocket payments (OOP) in Canada from 2010 to 2015.	(Wagstaff & Doorslaer, 2003) was adapted, defining catastrophic health expenditure (CHE) as OOP exceeding 10% of total household consumption. HH SES was estimated using total household expenditure.	At the 10% threshold of total household consumption, 7% of Canadian households incurred CHE. The incidence of CHE was higher in rural areas than in urban areas. OOP represent a regressive form of healthcare financing in Canada, with their regressivity intensifying over the study period.

10.	(Flores et al., 2021)	161 countries	Household surveys	To track the status of financial risk protection as part of overall measurement of UHC.	Adapted Wagstaff and Van Doorslaer's (2003) methodology. CHE was defined as 10% of total expenditure. HH SES was estimated using total household consumption expenditure.	At the 10% threshold of total household expenditure, 13.2% of households experienced CHE, affecting approximately 996 million people worldwide.
11.	(Khan et al., 2017)	Bangladesh	Household Income and expenditure survey 2010	To investigate the impact of OOP payments on CHE and poverty in Bangladesh.	Adapted Wagstaff and Van Doorslaer's (2003) methodology. CHE was defined as OOP exceeding 10% total household expenditure and 40% non- food expenditure. HH SES was estimated using household expenditure.	The incidence of CHE decreased as the threshold increased from 5% to 10% and 15% of total household expenditure. Overall, 14.2% of households experienced CHE. The burden was higher among rural households (16.3%) compared to urban households (8.6%) and was more prevalent among households with lower socioeconomic status.
12.	(Koch & Setshegetso, 2020)	South Africa	South Africa income and expenditure survey	To examine CHE and the potential for such payments to impoverish	Xu et al. (2003) Methodology: CHE was defined based on non-subsistence expenditure, with thresholds ranging from 5% to 40%.	CHE remains low, regardless of the methodology or threshold applied.

			(1995, 2000, 2005/2006, 2010/2011	South African households.	Wagstaff and Van Doorslaer (2003) Methodology: CHE was assessed using total consumption expenditure and non-food expenditure, applying thresholds between 5% and 40%. HH socioeconomic status was assessed based on household expenditure.	Between 1995 and 2000, CHE was approximately 5% when measured at a 5% threshold of subsistence expenditure. During the same period, CHE reached 10.5% at a 5% threshold of total consumption expenditure and 17.5% at a 5% threshold of total non-food expenditure.
13.	(Kwesiga et al., 2020)	Uganda	Uganda National Household Survey (UNHS) 2005/2006 to 2016/2017	To provide an updated assessment of financial risk protection (FRP) in healthcare using indicators from the World Bank/World Health Organization (WB/WHO) framework. Additionally, the paper examines trends from 2005/06 to 2016/17 to track	Adapted Wagstaff and Van Doorslaer's 2003 methodology and incorporated an aversion parameter to generate the rank-dependent thresholds. CHE was defined as total household consumption expenditure. HH SES was estimated using household expenditure. Thresholds applied were 10% and 25% of household consumption expenditure.	At the 10% threshold, the incidence of CHE declined from 22.4% in 2005/06 to 13.8% in 2012/13 but rose slightly to 14.2% in 2016/17. These findings indicate some progress in reducing financial risk; however, the improvement has been limited, and there remains a possibility of a reversal in this trend.

				Uganda's progress toward achieving universal health coverage (UHC).		
14.	(Ma et al., 2019)	China	China Family Panel Studies (CFPS 2010, 2012, 2014, 2016)	To estimate the level and trends in CHE and to examine the relationship between income growth and CHE.	The methodology adapted from Xu et al. (2003) defined CHE as out-of-pocket (OOP) health payments exceeding 40% of a household's capacity to pay. Household socioeconomic status was assessed based on household consumption	The percentage of households experiencing CHE declined from 12.57% in 2010 to 8.94% in 2016. The reduction in CHE was more pronounced among the poorest income quintile compared to the richest quintile.
15.	(Masiye et al., 2016)	Zambia	Zambia Household health expenditure and utilization survey 2014	To assess the extent and patterns of financial protection from healthcare costs following the abolition of user fees.	The methodology adapted from Xu et al. (2003) defined CHE as out-of-pocket health payments exceeding 40% of non-food expenditure. Additionally, a threshold of 10% of total household expenditure was used for comparison. Household socioeconomic status (SES) was assessed based on household expenditure.	Using a 10% threshold of total household expenditure, CHE ranged from 9.3% to 11.2%. When applying a 40% threshold of non-food expenditure, CHE varied from 16.3% in the lowest income quintile to 4.8% in the richest quintile. Overall, 10% of

						households experienced CHE.
16.	(Mulaga et al., 2021)	Malawi	Integrated household survey (IHS4) 2016/2017	To investigate the incidence of catastrophic health expenditure (CHE) among households and the factors associated with catastrophic spending in Malawi.	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE as OOP exceeding 40% of non-food expenditure and 10% of total consumption expenditure. For comparison, threshold levels of 20%, 25%, and 30% were also reported. Household socioeconomic status (SES) was estimated based on household expenditure.	At a threshold level of 40% of non-food expenditures, 1.37% of households experienced CHE, while 4.14% of households incurred CHE at a threshold of 10% of total consumption expenditures. The mean positive overshoot (MPO) was 12.71% for the 40% non-food expenditure threshold.
17.	(Ngcamphalala & Ataguba, 2018)	Swaziland	Swaziland Household Income and Expenditure Survey (2009/2010)	To evaluate financial catastrophe and impoverishment caused by out-of-pocket payments for healthcare services in Swaziland.	The methodology adapted from Wagstaff and Van Doorslaer (2003) incorporated an aversion parameter to create rank-dependent thresholds. CHE was defined based on OOP exceeding 10% total household expenditure and 40% non-food expenditure. Household socioeconomic status (SES) was assessed using household expenditure.	With an initial threshold of 10.0% of household expenditure, 9.7% of Swazi households experience financial catastrophe, whereas the proportion is estimated at 2.7% when using a threshold of 40.0% of non-food expenditure.

18.	(Obse & Ataguba, 2020)	Ethiopia	Ethiopian Household Consumption Expenditure Survey 2010/11	To evaluate financial catastrophe caused by out-of-pocket health spending.	The methodology adapted from Wagstaff and Van Doorslaer (2003) included an aversion parameter to generate rank-dependent thresholds. Catastrophic health expenditure (CHE) was defined based on total household expenditure and non-food expenditure, with thresholds ranging from 10% to 40%. Household socioeconomic status was assessed using household expenditure.	With an initial threshold of 10% of household expenditure, CHE was 4.08%. At 40% of non-food expenditure, CHE stood at 0.82%. CHE was primarily concentrated among poorer and urban households.
19.	(Pandey et al., 2018)	India	National consumer expenditure survey and healthcare utilization survey	To examine trends in out-of-pocket healthcare payments and catastrophic health expenditure in India based on household age composition.	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined catastrophic health expenditure (CHE) as OOP health payments exceeding 10% of total household expenditure. Household socioeconomic status was assessed based on household expenditure,	CHE in India increased over the years. The proportion of households experiencing CHE was 11.1% in 1995–1996, 12.4% in 1993–1994, 18.2% in 2011–2012, and 24.9% in 2014. CHE was highest among households with older individuals.
20.	(Rashad & Sharaf, 2015)	Egypt Jordan Palestine	Household Income, Expenditure and Consumption Surveys (HIECS) 2010/2011	To evaluate the extent to which households are financially protected from the medical expenses	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE based on OOP health payments exceeding 10% of total expenditure and 40% non-food expenditure.	At a 10% threshold of total expenditure, CHE was 22.4%, 2.7%, and 6.7% in Egypt, Jordan, and Palestine, respectively. In both approaches, CHE

				associated with healthcare use across the three Arab countries.	Household socioeconomic status was estimated using household expenditure.	decreases as the threshold increases.
21.	(Salari et al., 2019)	Kenya	Kenya Household Health Expenditure and Utilization Survey (KHHEUS) 2018	To evaluate the performance of the Kenyan health system in terms of financial protection, enabling the monitoring of trends over time.	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE as OOP health payments exceeding 10% of total expenditure and 40% of non-food expenditure. Household socioeconomic status was assessed using total household expenditure.	At the 10% threshold, 10.7% of households experience CHE, while at 40% of non-food expenditure, 7.1% of households incur CHE. The incidence of CHE is higher among poorer households compared to wealthier ones, and in rural areas compared to urban areas.
22.	(Ssewanyana & Kasirye, 2020)	Ethiopia Malawi Tanzania Uganda Nigeria	Living standard measurement survey (LSMS) on Agriculture	To analyze how the burden of out-of-pocket health expenditures varies across different thresholds for financial catastrophe in five Sub-	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE OOP payments exceeding 15% or 25% of non-food expenditure. Household socioeconomic status was assessed using household expenditure.	At the 25% threshold, CHE ranged from 0.84% in Nigeria to 20.2% in Tanzania. Tanzania and Uganda had the highest proportion of households spending more than 25% of their non-food expenditure on healthcare. Malawi recorded the lowest CHE at 1.57%. The overshoot

				Saharan African countries.		varied from 0.08% in Nigeria to 4.23% in Tanzania.
23.	(Thuong, 2021)	Vietnam	Vietnam Household Living Standards Surveys (2002 - 2010)	To investigate the incidence and intensity of catastrophic health expenditure (CHE), assess the poverty impact of out-of-pocket (OOP) health payments, and perform a sensitivity analysis across different thresholds, examining trends from 2008 to 2018. The findings aim to enhance current research and provide comprehensive evidence for policymakers.	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE based on OOP health payments exceeding 10% and 25% of total consumption expenditure and 40% of non-food expenditure. Household socioeconomic status was assessed using household expenditure.	At a 10% initial threshold of total consumption expenditure, CHE was 12.89% in 2012, 13.69% in 2016, and 13.98% in 2018. The incidence of CHE decreased as the threshold increased.

24.	(Wagstaff, Flores, Hsu, et al., 2018)	133 countries	Nationally representative household survey	To estimate the global incidence of catastrophic health spending, analyze trends from 2000 to 2010, and examine the associations between catastrophic health spending and macroeconomic as well as health system variables at the country level.	The methodology adapted from Wagstaff and Van Doorslaer (2003) defined CHE based on OOP health payments exceeding 10% and 25% total consumption expenditure. Household socioeconomic status was assessed using household expenditure.	The global incidence of CHE at the 10% threshold was estimated at 9.7% in 2000, 11.4% in 2005, and 11.7% in 2010. In 2010, approximately 808 million people worldwide experienced catastrophic health spending.
26.	(Xu et al., 2007)	89 countries	Household surveys (1990 – 2003)	To estimate the global extent of catastrophic health expenditure (CHE) and impoverishment caused by out-of-pocket (OOP) healthcare payments. Additionally, to	The methodology proposed by Xu et al. (2003) was adapted, CHE was defined as OOP health payments exceeding 40% of capacity to pay. Household socioeconomic status was assessed using household expenditure.	Every year, 150 million people globally face financial catastrophe due to medical expenses. The incidence of catastrophic health expenditure (CHE) varies widely between countries, ranging from nearly 0% in the Czech Republic, Slovakia, and the United Kingdom to over 10% in

				examine the characteristics of health systems and populations associated with high levels of CHE across countries.		Brazil and Vietnam. In South Africa, CHE was close to 0% in 1995.
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1.3.3 Impoverishing health expenditure

Reviewed Studies used either international poverty lines, country-specific poverty lines, or both to measure impoverishment. International poverty line of \$1.25/day, \$1.90/day and \$2.50/day based on 2005 purchasing power parity values (World Bank, 2020), were employed in most of the examined research. The table below provides an overview of the examined research and their conclusions.

Table 2 ; Studies assessing impoverishing health expenditure

	STUDY AUTHOR YEAR	COUNT RY	DATA SOURCE	OBJECTIVES	STANDARD OF LIVING MEASUREMENT	FINDINGS
1.	(Akazili, Ataguba, et al., 2017)	Ghana	Ghana Living Standard Survey 5 (2005/2006)	To investigate the impoverishing effects of out-of-pocket (OOP) healthcare payments in Ghana before the implementation of the country's national health insurance scheme.	Household socioeconomic status was estimated using Household expenditure. Two absolute poverty lines were applied: \$456.25 and \$912.50 per capita per year, or \$1.25 and \$2.50 per capita per day, based on 2005 purchasing power parity (PPP).	Out-of-pocket payments increased the relative poverty headcount by 9.4% and 3.8%, respectively, when using the \$1.25/day and \$2.50/day poverty lines.
2.	(Aregbeshola & Khan, 2018)	Nigeria	Harmonized Nigeria Living Standard Survey (HNLSS) 2009/2010	To assess the financial burden of out-of-pocket health payments on households in Nigeria.	Total household consumption expenditure was used as a measure of household socioeconomic status. The international poverty line of \$1.25, based on 2005 purchasing power parity (PPP) values, was applied.	The poverty headcount was 97.9% before accounting for health payments when using the \$1.25 per day poverty line. Out-of-pocket health payments led to a 0.8% increase in the poverty headcount, pushing nearly 1.3 million Nigerians below the poverty line. The poverty gap rose from 2492.2 Naira (US\$ 16.40) to 2539.8 Naira (US\$ 16.70).

3.	(Barasa et al., 2017)	Kenya	Kenya Household Expenditure and Utilization Survey 2016(KHHEUS)	To evaluate the impoverishing impact of out-of-pocket health payments.	Total household consumption expenditure was used as a measure of socio economic status. The national poverty line in Kenya, set at 1562 Kenyan Shillings (USD 15.62) per individual per month for rural areas and 2913 Kenyan Shillings (USD 29.13) for urban areas, was applied.	Before making any payments for healthcare services, 66.6% of people were already living below the poverty line. This increased by 1.17% and 1.60%, respectively, when transportation costs were considered. This indicates that out-of-pocket healthcare payments push an estimated 453,470 people into poverty each year.
4.	(Bashir & Kishwar, 2021)	Pakistan	Household Integrated Economic Survey (2015/2016, 2018/2019)	To estimate the incidence and factors contributing to catastrophic health expenditure (CHE) and impoverishment in Pakistan.	Total household expenditure was used as a measure of household socioeconomic status. Two national poverty lines for Pakistan were applied: Pakistani Rupee (PKR) 3,250 for 2015/16 and PKR 3,776 for 2018/19.	In 2015/16 and 2018/19, the poverty headcount was 23.28% and 18.43%, respectively, before accounting for healthcare payments. After including out-of-pocket healthcare expenses, the headcount increased to 24.68% and 22.02%, representing rises of 1.4 and 3.59 percentage points, respectively.
5.	(Chantzaras & Yfantopoulos, 2018)	Greece	Greek Household Budget Surveys 2008-2015	To examine the changes in household financial protection against out-of-pocket (OOP) health	Household socioeconomic status was assessed using total household expenditure.	Using the subsistence poverty line, the poverty headcount in 2015 was estimated at 0.62% of the population before healthcare payments, increasing to 0.68% after. Based on the relative

				expenditures in the Greek health system during the economic crisis, using both catastrophic and impoverishing OOP approaches.	Two national poverty lines were applied: a subsistence poverty line of 2,620.64 euros and a relative poverty line of 9,365.99 euros.	poverty line, 47.1% of the population was in poverty before out-of-pocket payments, rising to 49% afterward, reflecting a steady increase since the onset of the crisis.
6.	(Dorjdagva et al., 2016)	Mongolia	Household Socio-Economic Survey 2012	To analyze the incidence of catastrophic health expenditure (CHE) and assess the rate of impoverishment caused by healthcare payments under Mongolia's social health insurance scheme.	Total household expenditure were used as a measure of living standards. The Mongolian national poverty line of 118,668 Mongolian tugrik (MNT) per month (\$201.02 PPP in 2011) and the World Bank poverty line of \$1.90 per day were applied to estimate the poverty headcount.	After accounting for out-of-pocket (OOP) healthcare expenses, the poverty headcount increased by 0.78%, resulting in approximately 20,000 Mongolians falling into poverty when using the national poverty line.
17.	(Kwesiga et al., 2020)	Uganda	Uganda National Household Survey(2009/2010)	To evaluate the catastrophic and impoverishing effects of out-of-pocket (OOP) healthcare payments in Uganda.	Total household expenditure was a measure of living standards. Both the international poverty line of \$1.25 per day and Uganda's national poverty line, which varies by region and location (urban/rural), are applied.	Using the Ugandan national poverty line, out-of-pocket health payments resulted in a 4.2% increase in the poverty headcount ratio, pushing over one million additional Ugandans below the poverty line. The normalized poverty gap widened by approximately 1.4%, reflecting a 21% relative increase. A similar

						trend was observed when applying the World Bank poverty line of \$1.25 per day.
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18.	(Mchenga et al., 2017)	Malawi	Malawi Integrated Household Survey	To examine the impact of catastrophic health expenditure (CHE) on the incidence and depth of poverty in Malawi.	Total household expenditure was used as an indicator of household socioeconomic status. The Malawian poverty line of K37,002 per year was applied.	Approximately 0.93% of households fall below the poverty line after accounting for health services, equating to 110,439 households in Malawi. Additionally, the poverty gap increases from 9.37% to 9.67%.
19.	(Molla & Chi, 2020)	Bangladesh	Bangladesh Household Income and Expenditure Survey 2010	To examine the effects of catastrophic health expenditure (CHE) on poverty in Bangladesh.	Total household expenditure was used as a measure of household socioeconomic status. Two national poverty lines were applied: Tk. 19,813 per year and Tk. 15,888 per year.	When total household consumption is considered, 33.2% of the population is estimated to be living in poverty. However, after deducting out-of-pocket (OOP) healthcare payments from household consumption, this percentage rises to 36.4%. As a result, 3.2% of the population, who were not initially considered poor, would be classified as poor if healthcare costs were subtracted from household resources. The poverty gap also increases by approximately 25%, from Tk. 1,458 to Tk. 1,817.

20.	(Ngcamphalala & Ataguba, 2018)	Swaziland	Swaziland Household Income and Expenditure Survey (2009/2010)	To evaluate financial hardship and poverty resulting from out-of-pocket expenses for healthcare services in Eswatini.	Household socioeconomic status was estimated based on household expenditure. The Swazi national poverty line (E461 per person per month) and the international poverty line (\$1.25 per day, adjusted for 2005 purchasing power parity (PPP)) were used for comparison.	Out-of-pocket payments raised the poverty headcount from 62.3% to 63.3%, meaning that 1.0% of the Swazi population, or over 10,000 individuals, were pushed into poverty due to healthcare costs. In relative terms, the poverty headcount in Eswatini increased by 1.6%. Additionally, the poverty gap widened by E56.90, reflecting a 3.4% relative increase.
21.	(Salari et al., 2019)	Kenya	Kenya Household Health Expenditure and Utilization Survey(KHHE US)2018	To evaluate the performance of the Kenyan health system in terms of financial protection, enabling the monitoring of trends over time.	Household socioeconomic status was estimated based on total household expenditure. The Kenyan national poverty line of Ksh 3,252 (US\$32.5) for rural areas and Ksh 5,995 (US\$59.9) for urban areas were applied.	Before health payments, 46.9% of individuals in rural areas and 41.2% in urban areas were living below the national poverty line. After health payments, the poverty headcount increased by 2.2 percentage points in both rural and urban areas. As a result, approximately 1.1 million individuals were pushed into poverty.
22.	(Sangar et al., 2022)	India	National Health and Mobility Survey 2014	To investigate the economic burden of out-of-pocket health expenditures and the resulting	Household socioeconomic status was estimated based on household expenditure.	8% of households were pushed into poverty due to healthcare expenses, with 2.2% attributable to inpatient care and 5.8% to outpatient care. The poverty gap

				impoverishment in India.	The national poverty line was used for the assessment.	was 63.1 Indian Rupees, and the normalized poverty gap was 5.7.
23.	(Wagstaff et al., 2015)	Latin America countries	Household Surveys (1990 – 2013)	To track progress in achieving UHC.	Total household consumption expenditure was used as an indicator of living standards. The \$2.00 per day international poverty line was applied to estimate the poverty headcount and poverty gap.	The percentage of households falling into poverty due to out-of-pocket expenses decreased across the 14 nations, from 1.2% in 1992 to 1.0% in 2012. It was estimated that 5.6 million individuals were pushed into poverty by OOP costs. Apart from one country, all others saw an increase in overall UHC during the period studied.
24.	(Wagstaff, Flores, Smitz, et al., 2018)	122 countries	Household surveys (Between 1984 and 2015)	To assess the incidence and severity of impoverishment caused by out-of-pocket expenses.	Total household consumption expenditure was used as an indicator of household socioeconomic status (SES). Three poverty lines were applied to estimate the poverty headcount and poverty gap: the US\$1.90 per day and US\$3.10 per day international poverty lines, as well as a relative poverty line set at 50% of	The population-weighted median annual rate of change in poverty is negative at the \$1.90 per day poverty line but positive at both the \$3.10 per day and relative poverty lines across countries. Between 2000 and 2010, the global incidence of poverty at the \$1.90 per day line decreased from 131 million (2.1% of the world's population) to 97 million (1.4%). Among the 122 countries, the population-weighted median increase in the poverty gap due to out-of-pocket health expenditures

					median per capita consumption.	is \$122 per capita at the \$1.90 per day poverty line and \$374 per capita at the \$3.10 per day poverty line. While out-of-pocket payments can lead to impoverishment across all income levels and countries, the extent of this effect is largely determined by the chosen poverty threshold.
25.	(Wang et al., 2018)	South-East Asia - Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka, Thailand and Timor-Leste	Household surveys	To assess the impoverishing impact of healthcare spending by households.	Household socioeconomic status (SES) was estimated based on household expenditure. Two international poverty lines were applied: \$1.90 per day and \$3.10 per day, using 2011 purchasing power parity (PPP).	Using the \$1.90 per day poverty line, 58.2 million people across the countries were pushed below the poverty line. When applying the \$3.10 per day poverty line, this number increased to 64.2 million. India and Bangladesh had the highest proportion of their populations impoverished by health payments, accounting for 52.5 million and 5.2 million individuals, respectively, when using the \$1.90 per day poverty line. Thailand had the fewest people affected by health-related impoverishment.

1.3.4 Discussion of the Studies Reviewed

According to the reviewed research, the burden of catastrophic health expenditures varies according to the income level of a nation (WHO, 2023b). Evidence suggests that financial hardship is primarily felt in low- to middle-income countries, which experience higher rates of catastrophic health expenditures (Flores et al., 2021; Wagstaff, Flores, Hsu, et al., 2018). In low and middle income countries, catastrophic health spending is more concentrated due to their larger population size and higher incidence compared to other income groups. Furthermore, this may also indicate a high rate of unmet healthcare needs in low-income countries (Flores et al., 2021). In poorer nations, many individuals forgo seeking care at health facilities due to financial constraints. In Nigeria, OOP payments constituted 74.62% of current health expenditure in 2021, with 48% of households incurring catastrophic health expenditures at the 10% threshold of total household expenditure indicating that a high share of OOP health payments in current health expenditure leads to increased levels of financial catastrophe (Edeh, 2022a; WorldBank, 2025). Furthermore, a study conducted in Uganda, Tanzania, Malawi, and Ethiopia found that catastrophic health expenditure at the 25% threshold of total household non-food expenditure ranged from 11.45% in Ethiopia to 32.24% in Tanzania (Ssewanyana & Kasirye, 2020). Tanzania and Uganda had the highest proportion of households allocating more than 25% of their non-food expenditure to healthcare (Ssewanyana & Kasirye, 2020).

Most of the analyzed studies defined catastrophic health expenditure using either total household expenditure or non-food expenditure. The evidence showed that catastrophic health expenditure indices were generally higher when assessed using the non-food expenditure approach compared to the total expenditure approach (Aregbeshola & Khan, 2018; Bredenkamp & Buisman, 2016; Masiye et al., 2016). Some studies, however, modified the Wagstaff and Doorslaer (2003) methodology by incorporating an aversion parameter to establish rank-dependent thresholds (Edeh, 2022a; Mutyambizi et al., 2019; Ngcamphalala & Ataguba, 2018; Obse & Ataguba, 2020). Compared to research that used a uniform threshold, these studies that used a variable threshold technique found greater estimates of catastrophic health cost.

Regarding impoverishment, the reviewed studies indicate that out-of-pocket medical expenses not only reduce household living standards but also deepen poverty among those who were already financially vulnerable before incurring health costs (Wagstaff, Flores, Smits, et al., 2018). Research conducted in Sub-Saharan Africa showed that the poverty levels of people who were already impoverished were getting worse poor (Aregbeshola & Khan, 2018; Barasa

et al., 2017; Salari et al., 2019). Furthermore, Wang et al. (2018) discovered that while Thailand had fewer occurrences, Bangladesh and India had the most severe and widespread impoverishing effects, followed by the Maldives and Nepal.

While this study draws broader insights by comparing findings with similar international research, it is equally important to critically examine the contextual and structural factors specific to Botswana that influence access to affordable healthcare. Although household OOP expenditure in Botswana accounts for only 4.5% of current health expenditure (Ministry of Health, 2023), this national average can obscure substantial disparities in the financial burden experienced by different segments of the population. Structural challenges—such as persistent income inequality, regional disparities in the availability of health services, and the high prevalence of informal sector employment—significantly limit access to affordable care, especially for low-income and rural households. Despite Botswana’s classification as an upper-middle-income country (World Bank, 2020), about 337 410 individuals continues to live below the poverty line of BWP 1014.00 per month , with 503 196 individuals living below the poverty line when considering those receiving government aid (Statistics Botswana, 2018). This economic inequality undermines the capacity of many households to afford even small OOP health expenses, particularly when these costs are unforeseen or recurring. Furthermore, residents in remote districts often face restricted access to essential health services, necessitating long-distance travel that adds transport costs to their overall healthcare burden , as 17% of the rural population lives within 5-8km radius of the health facility (Seitio-Kgokgwe et al., 2014). These geographic and economic barriers not only constrain physical access to healthcare but also introduce indirect costs that may discourage timely health-seeking behaviour, further deepening health and financial burden.

The examined studies mentioned above had limitations. One of the limitations was that the evaluation of catastrophic health expenditures only included those who were ill and sought medical attention, others who were ill but did not seek care were not included. Additionally, the research was conducted using cross-sectional data, which could lead to an underestimation of the prevalence of catastrophic health spending and impoverishment.

1.4 Conclusion

OOP health payments cause households to experience financial catastrophe and impoverishment, as the literature review has shown. Therefore, evaluating catastrophic health

expenditure and impoverishment brought on by OOP health payments is crucial to determining if nations are moving closer to attaining universal health coverage. Though they differ from nation to nation, catastrophic expenditure and impoverishment are more common in the majority of low- and middle-income nations than in high-income ones.

1.5 Literature Review Gaps

According to the literature analysis, most of the research have evaluated financial risk protection using the approaches created by Wagstaff and Doorslaer (2003) and Xu et al. (2003). Only a small number of research, nevertheless, have modified the methodology Wagstaff and Doorslaer (2003) by adding an aversion element to establish thresholds that are dependent on rank. By using the latter methodology, this study will add to the expanding body of research on impoverishment and catastrophic healthcare payments.

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2 PART B: Manuscript

Assessing Catastrophic and Impoverishing Health Expenditure from Out-of-Pocket Health Payments in Botswana

Banyana Sekwati and Olufunke Alaba

Abstract

Introduction

Out-of-pocket medical costs have the potential to push households into extreme poverty by limiting their access to necessary healthcare services and endangering their health. Assessing the incidence and intensity of catastrophic health expenditures as well as the impoverishment brought on by healthcare costs is essential to tracking Botswana's progress towards universal health coverage. The purpose of this paper is to examine the financial burden that households experience because of using healthcare services.

Methods

The nationally representative Botswana Multitopic Household Survey (2015/2016) dataset collected by Statistics Botswana was used for the analysis. The dataset consisted of 7049 households and 24 720 individuals. Catastrophic health expenditure was measured using a threshold that varies with household consumption expenditure. Impoverishment resulting from out-of-pocket health expenses was measured using the Botswana national poverty line (BWP 1014.00/month) and the international poverty line (\$1.90/day). STATA 17 was used for the analysis.

Results

With an initial threshold set at 10% of total consumption expenditure, approximately 13.8% of households in Botswana faced catastrophic health expenditure. When the threshold is adjusted to 40% of non-food expenditure, 3.1% of households experienced such financial strain. Poverty headcount increased from 49.58% to 49.63% when using the national poverty line BWP 1014/month. These payments resulted in a relative increase in the poverty headcount by 0.1% based on the BWP 1014/month national poverty line.

Conclusion

The findings reveal that, despite out-of-pocket payments comprising only 4.5% of Botswana's total health expenditure, households still experience financial hardship when accessing healthcare, with many being driven into poverty by these costs. To address this, Botswana

should reduce the proportion of healthcare costs borne by individuals and introduce subsidized insurance for the poor.

Keywords: Financial risk protection, catastrophic health expenditure, Impoverishment, out-of-pocket health expenditure , Botswana , universal Health Coverage

Background

Numerous international, regional, and national treaties and constitutions recognize the right to health as a fundamental human right. The concept includes timely, adequate, and affordable healthcare (1) , which remains a significant challenge for billions of poor and vulnerable people worldwide. The 2030 Agenda and its Sustainable Development Goals (SDGs) underscore the importance of human rights in achieving these goals. Universal Health Coverage (UHC), a key target within the SDGs (target 3.8), reflects the global commitment to advancing health and well-being(2). Providing universal health coverage ensures that all people have access to the health services they need without facing financial hardship(WHO 2010). In addition to providing financial protection against catastrophic health spending and impoverishment , it aims to make sure that access to essential services of high quality is accessible to all (3,4). A critical aspect of UHC is financial risk protection, which guarantees that people can receive the healthcare they need without jeopardizing their ability to afford essential necessities such as food, shelter, and clothing. Strengthening financial protection for all remains a vital priority

Financial catastrophe and impoverishment caused by out-of-pocket (OOP) healthcare expenses are two primary indicators used to assess financial risk protection in health (5). Catastrophic health expenditure, defined as 10% of total consumption expenditures, serves as the official indicator for monitoring financial protection under universal health coverage(5) . In many low- and middle-income countries (LMICs), out-of-pocket payments remain an important source of health financing despite global commitments to universal health coverage. Globally , catastrophic payments accounted for 12.6% of the household budget in 2015 while in 2019 they accounted for 13.5% (5). Based on the \$2.15 poverty line in 2000, 22.2% of the global population lived in extreme poverty or poverty, which reduced to 15.6% in 2015 and 4.4% in 2019(6). Rural areas, informal sectors, and low-income populations bear a disproportionate burden. Although SDG 3.8 (1), emphasize financial protection in health, progress has been slow. Despite improved coverage of health services, some countries lack financial risk protection measures, leading to an increase in OOP burdens.

In sub-Saharan Africa (SSA), healthcare financing remains a significant challenge, largely due to the heavy reliance on out-of-pocket payments. These expenses not only deepen household poverty but also limit access to essential health services. As a result, many households are forced to forego needed care or adopt harmful coping strategies, such as borrowing money or selling assets. Evidence from across the region illustrates the severe financial impact of OOP payments. In Nigeria, 47.6% of households experienced catastrophic health expenditures at the 10% household expenditure threshold, while Togo reported a 33% incidence at the same threshold(7,8). In Ghana, the rate ranged from 2.5% at the 20% threshold to 11% at the 5% threshold when based on total household expenditure; using non-food expenditure, the incidence varied from 2.43% at the 40% threshold to 10.7% at the 10% threshold. Uganda showed a similar trend, with catastrophic headcounts ranging from 22.8% at the 10% threshold to 6.7% at the 25% threshold. Swaziland (Eswatini) reported a 9.6% incidence at the 10% threshold, and Kenya exhibited comparable patterns of financial distress(9–11). These findings highlight the significant burden that healthcare costs place on households in SSA.

Botswana aims to achieve Universal Health Coverage (UHC), ensuring that all individuals have access to quality healthcare services without experiencing financial hardship. Botswana is an upper middle-income country with an estimated population of 2 346 179 from the 2022 population and Housing Census (12). The country has a per capita GDP of US\$ 7, 251 in 2021(12). The health system is financed through government schemes (65%), Employers (16%) , households (12%) and donors at (7%) in 2021(13). In the same year, total health expenditure accounted for 5.47% of GDP, government health spending represented 12% of total general government expenditure, and household out-of-pocket payments constituted 4.5% of total health expenditure(13).Health care services in Botswana are provided by public, private for-profit, private not-for-profit, non-governmental organizations, and traditional medicine practices. The Ministry of Health provides public health services with more than 80% of services accessed through public health facilities based on the primary healthcare model (14). Citizens are charged a nominal cost recovery of BWP5 (approximately US\$0.45) for inpatient and outpatient services in public services, except for those exempted as per the medical fee structure.

Based on the 2002/2003 Household and Expenditure Survey, 11% of households in Botswana experienced catastrophic health expenditure at the 20% threshold of household capacity to

pay, while 7% faced such expenditure at the 40% threshold(15). Furthermore about 80% of households were pushed into poverty after making these payments(15).

Achieving universal health coverage requires ensuring financial protection for all. The aim of this study is to assess catastrophic and impoverishing health expenditures caused by out-of-pocket OOP payments. Given that the last comparable study was carried out in 2002–2003, more than ten years ago, this evaluation is both pertinent and crucial for comprehending the difficulties and advancements of the present.

Methods

Data

The 2015/2016 Botswana Multitopic Household Survey dataset was used for this study. This is a nationally representative survey conducted by Statistics Botswana. The main goal of the BMTHS was to generate a comprehensive set of indicators on poverty and the labour market while also serving as a foundation for the Continuous Botswana Multi-Topic Household Survey (CBMTHS). The survey included various modules, covering household consumption and expenditure, education, health, access to amenities, economic activity, and household enterprises.

The survey employed a two-stage stratified sampling design. This approach was facilitated by the stratification of 27 census districts, each exhibiting heterogeneity and aligning with administrative districts. Under this framework, the census districts were categorized into three groups: cities/towns, urban villages, and rural areas. The survey covered households across all districts and sub-districts. In the first stage, enumeration areas (EAs) were selected as primary sampling units using probability proportional to size, resulting in 599 EAs. In the second stage, households were systematically selected as secondary sampling units, yielding a total of 7049 households and 25 130 individuals(16). Data was analysed using Stata version 17. The sampling design was modified by applying the appropriate sampling weights, resulting in the modification of all estimates and standard errors.

Living Standards, OOP measurements and Adjustment

Household income is commonly measured using total consumption expenditure, which also serves as a key indicator of living standards (12) . Taking household size and composition into account, total consumption expenditure is adjusted to adult equivalent(18). In this

modification, we acknowledge that different members of a household have different consumption requirements and that sharing resources leads to economies of scale. Adult equivalent (AE) is estimated as:

$$AE_i = (A_i + \alpha K)^\theta$$

In a household, A is the number of adults (over 18 years), K is the number of children (under 18 years), α is the cost of children, and θ is economies of scale(18). Since developing countries consume a large proportion of subsistence food, suggested values for α ranging from 0.3 to - 0.5 in developing nations (with higher values observed in developed countries) and a value close to unity for θ , reflecting the higher share of subsistence food consumption in these regions(18). Adult equivalent was estimated as: $AE_i = (A_i + 0.5K)^{0.75}$

Out of Pocket measurements

All direct household health costs paid to healthcare providers that are not reimbursed by any third party or prepayment plan (19) , are included in the OPP. From the Botswana Multitopic Household Survey OOP payments included consultations with private doctors or traditional healers, diagnostic services, dental treatment, surgery, and the purchase of drugs or medicines. These are payments done by households who utilized healthcare (defined as whether individuals accessed any form of health care in the survey).

OOP payments also include user fees, which are the formal fees that medical professionals charge at the point of service for consultations or treatments. In this case, user fees fall under the larger category of OOP expenses that were recorded in the survey, especially for services that are not covered by medical insurance.

Measuring Catastrophic Out-of-Pocket health expenditure

OOP health expenditures are considered catastrophic if they surpass a predetermined threshold (z%) of household income (20,21) or capacity to pay(22,23) within a specific period. OOP payments are also deemed "catastrophic" when they reach a level substantial enough to significantly reduce a family's standard of living over a specific period. Financial catastrophe can be assessed using a uniform threshold, where the same threshold applies to all households regardless of income level(20,21) or a variable (rank-dependent) threshold, which increases with household income(24–26). It is suggested that the threshold should vary based on a household's socioeconomic level, increasing with household income(24,26,27) . In

addition, small OOP expenses can be particularly harmful to individuals who are already living in poverty. Therefore, this paper incorporates an aversion parameter to create rank-dependent thresholds to examine financial catastrophe in Botswana.

In this analysis:

Let:

- y_i represents total household income
- T_i is total household out of pocket payments
- Z_{cat} is an initial threshold, then a rank dependent threshold (Z'_{cat}) is defined as:

$$Z'_{cat} = w(p; \gamma) * Z_{cat}$$

- P represents the household income percentile.
- $\gamma \in (0, 1)$ is the inequality aversion parameter

The rank dependent weight is defined as:

$$w(p; \gamma) = (1 - p)^{\gamma-1} \quad \text{for } \gamma \in (0, 1)$$

This implies that when $\gamma = 1$, the rank dependent threshold (Z'_{cat}) becomes equal to the standard catastrophic threshold (Z_{cat}) (20). In this study, the inequality aversion parameter is set to $\gamma = 0.8$ and the initial catastrophic thresholds are as follows:

- For total consumption expenditure: 5%, 10%, 20% and 25%
- For total household non-food expenditure: 20%, 25%, 30% and 40%

Rank Dependent Catastrophic Headcount

This is an indicator that represents households whose out-of-pocket health spending exceeds the rank dependent threshold as a percentage of their income (24,27)

Let O'_i represent the rank dependent catastrophic overshoot (extent to which a household i has exceeded the threshold (Z'_{cat})) (24,25,27)

Let y_i represent total consumption expenditure or non -food expenditure, T_i represent total household out-of-pocket payments

The rank dependent overshoot (O'_i) for each household is defined as:

$$O'_i = \max (0, T_i / y_i) - Z'_{cat}$$

Additionally, Let $E'_i = 1$ when $O'_i > 0$, indicating that the household exceeded the rank-dependent threshold, $E'_i=0$ otherwise.

The rank- dependent catastrophic headcount ratio (H'_{cat}) is then given by:

$$H'_{cat} = \frac{1}{N} (\sum_{i=1}^N E'_i) = \mu'_{E'}$$

Where $\mu'_{E'}$ is the mean of E' , and N is the total number of households.

The rank dependent catastrophic Gap

This measure quantifies the deviations from the catastrophic threshold (Z'_{cat}) representing the difference between (T_i / y_i) and (Z'_{cat}) for each household where $E'_i = 1$ (24,25,28). It is calculated as follows: is

$$G'_{cat} = \frac{1}{N} (\sum_{i=1}^N O'_i) = \mu'_{O'}$$

Where $\mu'_{O'}$ denotes the mean of overshoots (O'_i)

The mean positive rank dependent gap

The Mean Positive Gap measures the average extent by which households experiencing financial catastrophe exceed the threshold (Z'_{cat}) (24,25,28). It is calculated as follows:

$$MPG'_{cat} = \frac{(\sum_{i=1}^N O'_i)}{(\sum_{i=1}^N E'_i)} = \frac{\mu_{O'}}{\mu_{E'}}$$

Impoverishment resulting from Out-of-pocket Health payments

The impoverishing impact of OOP healthcare payments is measured by the extent to which individuals are driven below the poverty line (or pushed deeper into poverty)(17,20). In measuring impoverishment resulting from OOP health payments the similar methodology have been adapted.

Poverty headcount

The poverty headcount reflects the proportion of the population living below the poverty line (20).

In this analysis:

Let:

- If PL_0 represents the poverty line
- Y_i denotes individual prepayment adult equivalent household consumption expenditure

An individual is classified as poor before OOP health payments if:

$$Y_i < PL_0$$

This condition defines prepayment poverty (P_i^{pre}).

The prepayment poverty headcount is computed as:

$$H_{pov}^{pre} = \frac{\sum_{i=1}^N P_i^{pre}}{N} = \mu_{p^{pre}}$$

Where N represents the sample population

Prepayment poverty Gap

This measure indicates the average extent to which individuals fall below the poverty line(20).

Let:

g_i^{pre} represents the shortfall from the poverty line for individual I

The shortfall is defined as :

$$g_i^{pre} = P_i^{pre} (PL_0 - Y_i)$$

Where:

- PL_0 is the poverty line
- Y_i is the individual's prepayment adult-equivalent household consumption expenditure
- P_i^{pre} is an indicator that equals 1 if the individual is below the poverty line and 0 otherwise

The prepayment poverty Gap (G_{pov}^{pre}) is calculated as:

$$G_{pov}^{pre} = \frac{1}{N} \sum_{i=1}^N g_i^{pre} = \mu_{g^{pre}}$$

Where:

- $\mu_{g^{pre}}$ is the mean shortfall from the poverty line

N is the total number of individuals

Normalised Poverty Gap

It represents the weighted total of poverty gaps, expressed as a proportion of the poverty line, with the weights corresponding to the fraction of the poverty line(20).

It is calculated as:

$$NG_{pov}^{pre} = G_{pov}^{pre} / PL_0$$

Where:

- NG_{pov}^{pre} is the normalized prepayment poverty gap.
- G_{pov}^{pre} is the prepayment poverty gap
- PL_0 is the poverty line

Post payment poverty indices are calculated by replacing 'pre' with 'post'.

- Post payment poverty headcount H_{pov}^{pos} ,
- Post payment poverty gap G_{pov}^{pos}
- Normalized post payment poverty gap NG_{pov}^{pos}

Impoverishment due to OOP health payments is determined by the difference between prepayment and post payment measures as shown below:

Poverty Headcount Impact

- $PI^H = H_{pov}^{post} - H_{pov}^{pre}$

Where PI^H reflects the change in the proportion of individuals living below the poverty line due to OOP health costs.

Poverty Gap

- $PI^G = G_{pov}^{post} - G_{pov}^{pre}$

Where PI^G indicates the change in the average shortfall from the poverty line resulting from OOP health expenditures.

Normalised Poverty Gap

- $PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}$

The Botswana national poverty line of (BWP 1014.00 /month) and the international poverty line (\$1.90/day) at the 2010 purchasing power parity (PPP) poverty lines are used in the analysis.

Results

Descriptive Statistics

Table 1 presents a summary of the key variables used in the analysis. Among the 7,049 households surveyed, over half (53.2%) were headed by males. Of the household heads who had attained tertiary education, 58% were male. Households from urban villages and rural areas accounted for 37.6% and 37.5%, respectively, while 24.9% resided in cities or towns. Approximately 45.6% of households with large family sizes (more than five members) resided in urban villages. The average annual household consumption expenditure per adult equivalent was estimated at BWP 4,110.37, with households incurring OOP health payments spending an average of BWP 123.03. Furthermore, 23.9% of households reported seeking healthcare during the survey.

Table 1 ; Descriptive Statistics from the Botswana Multitopic Household Survey 2015/16

variables	N (%)
Sex of household head	
male	3753 (53.2 %)
female	3296 (46.8%)
Total	7049
Place of residence	
cities/towns	1756 (24.9%)
urban villages	2649 (37.6%)
rural areas	2642 (37.5%)
Total	7049
Household head with at least a tertiary education	
Male	1201 (58%)
female	852 (41.5%)
Total	2053
Household size by location	
> 5 members cities/towns	174(13.6%)
urban villages	585(46%)
Rural areas	512(40.3%)
total	1271
<= 5 members cities/towns	1585(27.4%)
urban villages	2064(35.7%)
rural areas	2129(36.8%)
total	5778
TOTAL	7049
Healthcare Utilization (Did you see any healthcare)	1679 (23.9%)
Average Adult equivalent consumption expenditure (BWP)	4 110.37
Average out-of-pocket expenditure (BWP)	123.03
Average non-food expenditure (BWP)	3232.80
Average food expenditure (BWP)	500.00

Figures are in Botswana Pula (BWP)

Household's catastrophic OOP health expenditure

Catastrophic headcount differs based on the household ability to pay. When measuring catastrophic expenditure using total non-food expenditure the indices are higher as compared to using total food expenditure. For example, at 25% consumption expenditure catastrophic headcount is 2.0%, while when using 25% non- food expenditure catastrophic headcount is 4.9%. It can also be noted that as the threshold increases the catastrophic headcount decreases both for consumption expenditure and total non-food expenditure. The mean positive catastrophic gap for total consumption expenditure ranges from 9.2% at the 5% initial threshold to 13.3% at the 25% threshold. When measured using non-food expenditure, the gaps are notably higher, ranging from 15.4% to 30%.

Table 2; Catastrophic health expenditure for healthcare using rank-dependent thresholds, Botswana 2015/2016

	Total consumption expenditure				Total non-food expenditure			
Initial threshold	5%	10%	20%	25%	5%	10%	25%	40%
Catastrophic headcount	13.8%	7.8%	3.0%	2.0%	18.0%	12.2%	4.9%	2.7%
Catastrophic gap	1.2%	0.8%	0.3%	0.2%	2.9%	2.2%	1.9%	0.8%
Catastrophic Mean positive gap	9.2%	10.5%	12.6%	13.3%	15.4%	18.5%	26.3%	30%

The parameter of aversion to inequality $\gamma = 0.8$

Impoverishment effect of out-of-pocket health Payments

The poverty headcount increased slightly from 49.58% to 49.64% based on the national poverty line of BWP 1014/month. OOP payments impoverished 0.1% of the population, pushing approximately 122,588 Batswana below the poverty line. Additionally, there was a 0.2% relative increase in the poverty headcount compared to the prepayment poverty level. The poverty gap also showed an absolute increase of 3.82 BWP, rising from BWP 2,422.44 to BWP 2,426.26. Furthermore, the normalized poverty gap rose by 0.03%, resulting in a 0.5% relative increase. Using the international poverty line of \$1.90 per day, the poverty

headcount remained at 46.25%, with no differences observed between gross payments and net payments.

Table 3 : Impoverishment due to healthcare costs in Botswana, 2015/16

National poverty line (BWP 1014/month)					International poverty line (\$1.90 /day)			
	Gross payments (a)	Net payments (b)	Absolute Poverty (c)= b - a	Relative poverty =Absolute/ gross	Gross payments (a)	Net payments (b)	Absolute Poverty (c)= a - b	Relative poverty =Absolute/ gross
Poverty headcount	49.58%	49.64%	0.1%	0.2%	46.25%	46.25%	0 %	0%
Poverty gap	2422.44	2426.26	3.82	0.16%	34.10	34.21	11%	32.25%
Normalized gap	19.91%	19.94%	0.03%	0.15%	0.926%	0.9258%	0.0003%	0.03%
Mean positive gap	40.15%	40.17%	0.02%	0.05%	19.94%	20.01%	0.07%	0.35%

Discussion

The study revealed that 13.8% of households in Botswana incurred catastrophic health expenditures when the threshold was set at 10% of consumption expenditure. This proportion dropped to 3.1% when the threshold was adjusted to 40% of non-food expenditure. These findings suggest a rise in catastrophic health expenditures in Botswana compared to earlier data. For instance, a previous study conducted using the 2002/2003 Household and Expenditure Survey reported that 11% and 7% of households faced catastrophic expenditures at the 20% and 40% thresholds of household capacity to pay, respectively(15).

The findings of this study are consistent with patterns observed in previous research on the financial burden of OOP health payments in low- and middle-income countries. For example in Uganda, the catastrophic headcount was 14.2% when using a threshold of 10% of total expenditure(29). Similarly , in Swaziland the incidence of catastrophic health expenditure was 9.7% at a 10% threshold of total expenditure, decreasing to 2.4% when the threshold was raised to 25% (28). In Malawi, 1.37% of households experienced catastrophic health expenditure at a threshold of 40% of non-food expenditures, while 4.14% incurred catastrophic health expenditure at a threshold of 10% of total consumption expenditures(30).

A multi-site study conducted in five Sub-Saharan African countries revealed that, at the 25% threshold of non-food expenditure, the incidence of catastrophic health expenditure ranged from 0.84% in Nigeria to 20.2% in Tanzania. Among the countries studied, Tanzania and Uganda had the highest proportion of households spending more than 25% of their non-food expenditures on healthcare(31).

OOP health payments pushed approximately 0.1% of households in Botswana below the national poverty line of BWP 1,014 per month. This equates to about 122,588 Batswana falling into poverty due to healthcare expenses. Compared to a previous which reported a poverty headcount of 80%, there has been a positive shift in impoverishment resulting from healthcare costs(15). To advance toward universal health coverage, policies should be established to provide financial risk protection for vulnerable population groups. Additionally, efforts should focus on expanding health service coverage to underserved populations, including the poor, the elderly, and those living in rural and marginalized areas. Implementing a National Health Insurance system will be a crucial step in achieving these goals.

Study Limitations

This study relied on self-reported data collected over a four-week period, which is susceptible to recall bias, potentially leading to underestimation or overestimation of household OOP spending. Moreover, the estimates of catastrophic expenditure excluded individuals who did not seek care. Only about 23% of individuals in this study sought care. Although, the study utilized the 2015/16 dataset, this is latest national survey available from Statistics Botswana.

Conclusions

Out-of-pocket healthcare payments lead to financial hardship for households, and some are forced into poverty in Botswana. Financial protection is currently lacking in Botswana's health system. As a strategy for ensuring all citizens have access to essential health services without financial burden, a national health insurance scheme is recommended. This will help advance the country's progress towards universal health coverage, where individuals will be able to receive necessary healthcare services without financial burden.

Declarations

Ethics Approval and consent to participate

This study used secondary household survey data that was collected by Statistics Botswana. An ethics approval was obtained from the Health Research Ethical Committee (HREC) of the University of Cape Town and The Health Research Development Committee at Ministry of Health Botswana.

Consent for publication

Not applicable.

Availability of Data and Materials

Data are available on request from Statistics Botswana (<https://www.statsbots.org.bw/data-portal-0>).

Competing Interest

Author declares that there is no conflict of interest.

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Authors Contributions

Banyana Sekwati and Olufunke Alaba contributed to the study design analysis and the manuscript.

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3 PART C : Policy Brief

Out-of-Pocket Cost of Healthcare in Botswana: How Catastrophic and Impoverishing are They?

Introduction

Households in Botswana contribute 4.5% through direct out-of-pocket (OOP) payments, which serve as one of the health system's funding mechanisms (13). The World Health Organisation (WHO) advocates for countries to transition from form of healthcare financing to prepayment systems, which involve contributing to healthcare costs in advance of requiring services(3,32). Ensuring Financial risk protection from out-of-pocket spending is crucial for Botswana 's health system and its pursuit of universal health coverage (UHC). UHC aims to guarantee that everyone can access the healthcare services they need without facing financial hardship due to unaffordable OOP expenses(3).

Primary healthcare is the cornerstone of Botswana's decentralised healthcare system. Public, private, and non-governmental organisations are among the healthcare providers. 80% of all services are provided by the public sector, which is the major provider with about 96% of the population living within an 8km radius of a health facility(13). User fees are still charged to citizens for outpatient services in public facilities, with exemptions for vulnerable populations.

Households especially the poor are adversely affected by paying for health out-of-pocket as it affects how they access and utilize healthcare services. Out-of-pocket health finance prioritises service provision for those who can afford it, while the poor who require more care often cannot pay. Those who can afford it often neglect fundamental necessities like food and shelter, leading to financial ruin.

KEY MESSAGE

About 13.8% of households in Botswana pay more than 10% of their household income on healthcare out of pocket.

Based on the national poverty line 0.1% of individuals in Botswana are further pushed below the poverty line by such payments representing about 122 588 individuals.

Without financial risk protection, households' risk financial ruin when accessing health services, with many falling into poverty due to these expenses.

Methods

The nationally representative Botswana Multitopic Household Survey dataset collected by Statistics Botswana was used for the analysis. The dataset consisted of 7040 households and 25130 individuals. Catastrophic health expenditure was measured using 10% of total household consumption and 40% of total non-food expenditure. Impoverishment due to out-of-pocket health payments was measured using Botswana national poverty line (BWP 1014.00/month) . STATA 17 was used for the analysis.

Findings

Table 1 ; catastrophic healthcare expenditure in Botswana, 2015/16

	Consumption expenditure	Total non-food expenditure
Initial threshold	10%	40%
Headcount	13.8%	3.1%

At an initial threshold of 10% of household consumption expenditure, catastrophic headcount was 13.8%. This means that, on average, about 13.8% of households in Botswana pay catastrophic health payments if the initial threshold is set at 10% of total consumption. This represents about 122 588 individuals based on an estimated population of 1 225 886 of the survey data(12). When financial catastrophe is measured using 40% of non -food expenditure households experiencing catastrophic expenditure reduces to 3.1%.

Table 2 : Impoverishment due to out-of-pocket healthcare costs using the BWP 1014/month poverty line, 2015/16

	Gross of health payments (a)	Net of health payments (b)	Absolute (c)= a - b	Relative =Absolute/ gross
Poverty headcount	49.58%	49.64%	0.1%	0.2%
Poverty gap	2422.44	2426.26	3.82	0.16%

Out-of-pocket payments resulted in financial hardship for some households and pushed others into poverty. The poverty headcount rose from 49.58% to 49.64% when measured against the national poverty line of BWP 1,014 per month. Out-of-pocket health payments

impoverished an additional 0.1% of the population, equivalent to approximately 122,588 individuals falling below the poverty line. The poverty gap also increased by an absolute value of 3.82, rising from BWP 2,422.44 to BWP 2,426.26.

Limitations

This study relied on self-reported data collected over a four-week period, which is susceptible to recall bias, potentially leading to underestimation or overestimation of household OOP spending. Moreover, the estimates of catastrophic expenditure excluded individuals who did not seek care due to various barriers. Only about 23% of individuals in this study sought care. Additionally, the study utilized the 2015/16 dataset, which, while the latest available from Statistics Botswana, is outdated.

Policy Recommendations

Out-of-pocket payments discourage the utilisation of health services; therefore, Botswana should reduce the fraction of the cost of care that people pay out-of-pocket. Moreover, there should be subsidized insurance for the poor and near poor.

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3.1 Introduction

Numerous international, regional, and national treaties and constitutions recognize the right to health as a fundamental human right. The concept includes timely, adequate, and affordable healthcare (Dovlo, 2020), which remains a significant challenge for billions of poor and vulnerable people worldwide. The 2030 Agenda and its Sustainable Development Goals (SDGs) underscore the importance of human rights in achieving these goals. Universal Health Coverage (UHC), a key target within the SDGs (target 3.8), reflects the global commitment to advancing health and well-being (Tangcharoensathien et al., 2015). Providing universal health coverage ensures that all people have access to the health services they need without facing financial hardship (WHO 2010). In addition to providing financial protection against catastrophic health spending and impoverishment, it aims to make sure that access to essential services of high quality is accessible to all (WHO, 2010, 2021).

Through health financing, a core function of health systems, effective service coverage and financial protection can be achieved. Health financing systems encompass three main functions: revenue collection, fund pooling, and purchasing (WHO 2010). Revenue collection involves determining the sources of funds, the structure of contributions, and the methods used to collect them (Kutzin, 2013). By pooling funds, members share the financial risk of healthcare costs by accumulating and managing revenues. To ensure access to appropriate and efficient healthcare, pooled resources are allocated to healthcare providers through purchasing (Kutzin, 2013). Various mechanisms can finance health systems, including direct out-of-pocket (OOP) payment, tax revenues, and health insurance. (Kutzin, 2013; McIntyre, 2007). Consequently, health financing plays an integral role. Various mechanisms, including direct out-of-pocket (OOP) payment, tax revenues, and health insurance, can finance health systems in achieving universal health coverage and protecting individuals from the financial burdens associated with illness and healthcare use.

Financial catastrophe and impoverishment are two ways to measure financial risk protection (Wagstaff, 2008; Wagstaff & Doorslaer, 2003; Wagstaff, Flores, Hsu, et al., 2018; Xu et al., 2003). These measures are developed using OOP payments. OOP healthcare payments are considered catastrophic when they exceed a certain percentage or threshold of a household's income or capacity to pay in a given time, which is usually a year (Van Doorslaer et al., 2007; Wagstaff, 2007; Wagstaff & Doorslaer, 2003; Xu et al., 2003). Impoverishing health expenditure occurs when a household's living standard is pushed below or further below

the poverty line due to medical outlays (Van Doorslaer et al., 2006; Wagstaff & Doorslaer, 2003; Wagstaff et al., 2007). Globally, the incidence of catastrophic payments defined as OOP payments that exceed 10% of their household budget increased from 9.6% in 2000 to 12.6% in 2015 and 13.5% in 2019 (WHO, 2023b). Moreover, using the \$2.15 per day poverty line, 22.2% of the global population were impoverished or pushed into extreme poverty in 2000, and reduced to 15.6% in 2015 and 4.4% in 2019 respectively (WHO, 2023b). It is well recognised that the financing structure of health systems plays a crucial role in influencing people's access to basic healthcare and whether they endure financial hardship as a result of receiving care. (Ataguba & McIntyre, 2018).

Building robust health financing systems is a shared goal for all nations. In Africa, the 2001 Abuja Declaration, which calls for allocating at least 15% of government budgets to the health sector, aim to address the significant burden of ill health across the continent (Govender et al., 2008). However, inadequate government spending has forced households in the African region to rely on out-of-pocket payments to finance their healthcare. In Sub-Saharan Africa catastrophic expenditure accounts for about 36%, the second-highest rate globally after South Asia (WHO, 2018). To address this challenge, the WHO advocates for the adoption of prepayment mechanisms as an alternative to direct OOP payments (WHO 2011).

Botswana an upper middle-income country had an estimated population of 2 346 179 according to the 2022 population and Housing Census (Statistics Botswana, 2022). In 2021 the country recorded per capita GDP of US\$ 7, 251 in 2021 (WHO, 2023a). According to the 2018/19 2019/20 Botswana national health accounts, health system is primarily financed through general taxation (80.5%), employers (4.1%), households (10%), and donor funding through bilateral and multilateral agencies (5.4%) (Ministry of Health, 2023). During the same period government health spending accounted for 12% of total general government expenditure, while household OOP payments for health stood at 4.5% (Ministry of Health, 2023).

Botswana's healthcare services are offered by private for-profit, private not-for-profit, public, traditional medical practices and non-governmental organisations (Ministry of Health 2016). More than 80% of the population receives care from public health institutions that follow the primary healthcare model. (Ministry of Health, 2023). Botswana implemented user fees for primary healthcare consultations in 1975 (Pagiwa et al., 2021). The medical price system

currently requires citizens to pay BWP 5 (US\$0.45) for inpatient and outpatient care in public facilities, with exceptions granted for vulnerable populations (Ministry of Health, 2023) .

Botswana's private health insurance covers 20% of the population, largely formal sector employees.(Ministry of Health, 2023). Private health insurance predominantly utilizes private healthcare facilities. Individuals with medical aid benefit from employer-subsidized access to healthcare services, while those without insurance—mainly the unemployed and poor—must pay the full cost out-of-pocket. Households, especially those without medical assistance who are primarily impoverished, are frequently forced to seek treatments in the private sector due to inefficiencies in the public healthcare system, such as drug shortages. Evidence from other settings indicates that impoverished, mostly rural communities still cannot afford private health care (Onwujekwe et al., 2012).

3.2 Problem Statement and Justification

Botswana is among the Southern African countries with low OOP healthcare expenditure. OOP spending constitutes 4.5% of current health expenditure (Ministry of Health, 2023), well below the WHO's recommended target of 15-20% , which is considered critical for ensuring financial risk protection. Additionally , current health expenditure accounted for 5.22% of GDP in the 2019/2020 fiscal year (Ministry of Health, 2023). This aligns with the recommendation from the World Health Report (WHR) 2010 , which suggests that government health spending should be around 5% of GDP to ensure access to essential services and effective financial protection (Etienne et al., 2010; WHO 2010; WHO, 2019). Despite favourable health financing and expenditure indicators, OOP spending in Botswana remains low. However , a study conducted in Botswana revealed that catastrophic health spending at the 20% and 40% threshold of household non subsistence expenditure was 11% and 7% respectively based on data from 2002/2003 Household and Expenditure Survey (Akinkugbe et al., 2012). The study further indicated that 80% of Batswana experienced impoverishment due to OOP healthcare payments. Since this study, no updated data or research has been conducted to evaluate the current state of financial risk protection in Botswana.

Achieving equitable financing and financial protection within the health system is a key objective emphasized in all current health sector plans in Botswana. This priority is embedded in long-term development strategies such as the National Development Plan 11 (Ministry of Finance, 2016) and the National Health Policy (NHP) which provides strategic guidance for the health sector (Ministry Of Health, 2011). The NHP outlines critical reforms in areas such as service delivery and healthcare financing. Furthermore, Botswana developed a National

Health Financing Strategy to establish a sustainable health financing system aligned with the principles of quality, equity, and financial protection. In this context, generating reliable data is crucial to support the implementation of these policies and monitor the effectiveness of existing strategies.

Protecting everyone from financial hardship is essential to achieving universal health coverage. This study aims to assess financial hardships related to health care utilization among households in Botswana in 2015. Consequently, the Botswana government and policymakers need this evidence to develop policies and programs that safeguard the population from financial hardship, highlighting the importance of current empirical research.

3.3 Aim of the Study

The study aims to assess financial hardships related to health care utilization among households in Botswana in 2015.

3.4 Objectives

- To assess catastrophic out-of-pocket healthcare expenditure among households in Botswana.
- To assess the poverty impact of out-of-pocket healthcare expenditure among the population in Botswana.

3.5 Brief Literature Review

3.5.1 Financial risk protection and fair financing

The significance of financial risk protection became widely recognized following the release of the World Health Report (WHR) 2000 (McIntyre, 2010), which identified fairness in health financing as a crucial aspect of performance of the health system. The report advocated reducing reliance on OOP health expenditures and aligning healthcare payments with household income distributions. Financial risk protection is a fundamental aspect of an equitable health system, aimed at guaranteeing access to essential, high-quality health services without imposing financial strain (Saksena et al., 2014). The WHR 2000 further defines equity in health financing as a system where households contribute to healthcare costs based on their ability to pay rather than their risk of illness, ensuring that resources are allocated according to need (WHO, 2000). Similarly Wagstaff (2001) emphasizes that fair financing ensures healthcare payments do not disproportionately burden household disposable income. However OOP payments have shown to negatively impact key health

system indices , particularly equity (Almasiankia et al., 2015). OOP payments are often deemed unfair because they expose households to catastrophic financial burdens (Wagstaff & Doorslaer, 2003; Wagstaff & van Doorslaer, 2001)

3.5.2 Theoretical Review of Financial risk Protection

Households without formal health insurance often depend on OOP payments , which can heavily disrupt their spending patterns and deepen poverty (Flores et al., 2008). When a household member falls ill, medical expenses typically increase, while the time and resources available for income-generating activities decrease. Consequently, spending on non-medical goods and services declines, resulting in significant welfare losses. The Wagstaff-Grossman model highlights that households reduce consumption to cover medical costs (Grossman, 1972; Wagstaff, 1986a). Healthcare expenses are often unpredictable and can severely impact households' finances. In some instances , the combined effect of high medical costs and income loss due to illness pushes households into poverty (Wagstaff & van Doorslaer, 2001). Research indicates that the disease burden disproportionately affects the poor, placing greater financial strain on impoverished households and increasing their vulnerability to health shocks (McIntyre et al., 2006) . These shocks frequently lead to what is known as “the medical poverty trap” , where health related crises become a significant threat to household welfare and financial stability . Such impacts are especially severe for poorer households (Gertler & Gruber, 2002)

OOP health payments place a significant financial burden on households, highlighting the importance of measuring financial protection through catastrophic and impoverishing approaches. These approaches assume that health expenditures are both involuntary and non-discretionary, with household income considered fixed. As a result, it is presumed that health spending is covered solely by reducing current non-medical consumption, without relying on borrowing, dissaving, or selling assets (O'Donnell et al., 2008).

3.5.3 Catastrophic healthcare expenditure resulting from out-of-pocket payments

OOP health spending is considered catastrophic if it exceeds a specified threshold relative to a household's standard of living or capacity to pay (Wagstaff & Doorslaer, 2003; Xu et al., 2003). Since this threshold is inherently arbitrary, various levels are often applied in studies. It is recommended that all threshold levels be reported rather than one, allowing readers to

interpret the findings based on their context (Russell, 2004; Xu et al., 2010). However, applying a uniform threshold may overlook fairness considerations. Research shows that households with different socioeconomic statuses experience varying marginal utilities relative to their income (Ataguba, 2012; Edeh, 2022a). To address this disparity, Ataguba (2012) proposes using rank-dependent weights, allowing financial thresholds to vary across socioeconomic groups. This approach acknowledges that no household should spend more than a reasonable portion of its income on healthcare and that this portion should differ based on household income levels (Ataguba, 2012; Edeh, 2022a; Onoka et al., 2011).

Financial catastrophe is assessed based on a household's capacity to pay or overall income (WHO, 2005; Xu et al., 2007; Xu et al., 2003). Capacity to pay for healthcare services refers to the income remaining after covering basic subsistence needs (Xu et al., 2003). According to Wagstaff and Doorslaer (2003), capacity to pay is defined as total household consumption expenditure (income) minus food expenditure. Catastrophic health expenditure is measured using two key indicators: the catastrophic headcount and the catastrophic payment gap (Wagstaff, 2008; Wagstaff & Doorslaer, 2003; Xu et al., 2003). The catastrophic headcount represents the proportion of households whose out-of-pocket medical expenses exceed a specified threshold. Meanwhile, the catastrophic payment gap quantifies the total amount by which household health spending surpasses this threshold (Wagstaff, 2008; Wagstaff & Doorslaer, 2003; Xu et al., 2003).

The global incidence of catastrophic health spending, measured at 10% of household consumption expenditure across 133 countries, was estimated at 9.7% in 2000, 11.4% in 2005, and 11.7% in 2010 (Wagstaff, Flores, Hsu, et al., 2018). Additionally, a multicountry study of 146 countries found that, at the same 10% threshold, catastrophic health expenditures exceeded 15% in 26 countries. Among these were five low-income countries—Afghanistan, Cambodia, Nepal, Tajikistan, and Uganda—and five high-income countries—Barbados, Chile, Greece, Malta, and Portugal (Wagstaff et al., 2020).

In sub-Saharan Africa, countries with high levels of OOP health payments experience a high incidence of financial catastrophe. In Nigeria, the incidence of financial catastrophe at the 10% household expenditure threshold was 47.64% (Edeh, 2022a). In Togo, catastrophic health expenditure reached 33% at the 10% consumption expenditure threshold (Sanoussi et al., 2023). In Ghana, the catastrophic headcount, when measured using household expenditure, ranged from 2.5% at the 20% threshold to 11% at the 5% threshold. When measured using non-food

expenditure, it ranged from 2.43% at the 40% threshold to 10.7% at the 10% threshold, indicating a lower incidence compared to household expenditure-based assessments (Akazili, 2010). Similar patterns were observed in Kenya (Chuma & Maina, 2012). In Uganda, the catastrophic headcount varied from 22.8% at the 10% household expenditure threshold to 6.7% at the 25% threshold (Kwesiga et al., 2015). In Swaziland, the incidence of catastrophic health spending at the 10% household expenditure threshold was 9.6% (Ngcamphalala, 2016). It is evident from this data that healthcare costs in sub-Saharan Africa are significant, especially in countries with high out-of-pocket expenses.

Households can experience impoverishment from OOP health payments that amount to less than 1% of their income. This highlights a limitation in the catastrophic health expenditure measurement approach, as it only partially captures the impact of out-of-pocket medical costs (Goudge et al., 2009). Estimating the poverty linked to out-of-pocket payments is therefore essential. Therefore, estimating the poverty caused by out-of-pocket payments is crucial.

3.5.4 Impoverishment resulting from out-of-pocket health payments

Medical care expenditures can drive households into poverty, forcing them to sacrifice basic needs such as food, clothing, and shelter to afford healthcare. According to Wagstaff and Doorslaer (2003), paying for healthcare should not push individuals into poverty or further worsen their financial situation. OOP medical expenses are considered impoverishing if they lower a household's standard of living below the poverty line or deepen the poverty of those already living below it (Wagstaff, 2008). The impoverishing effects of health spending are assessed by comparing the poverty headcount and the poverty gap before and after healthcare payments (Wagstaff & Doorslaer, 2003). The poverty headcount measures the number of individuals living in poverty, while the poverty gap quantifies the total shortfall from the poverty line.

Both national and international poverty lines can be used to evaluate impoverishment due to OOP payments. The World Bank recommends using international poverty lines of \$1.90 per day, \$2.15 per day and \$3.10 per day (at 2011 Purchasing Power Parity [PPP] values) for cross-country comparisons of poverty levels (Wagstaff, Flores, Smits, et al., 2018). These standardized poverty lines enable consistent measurement of poverty and facilitate international comparisons.

A multicountry study covering 122 countries revealed a decline in global poverty between 2000 and 2010, based on the \$1.90 per day poverty line (Wagstaff, Flores, Smitz, et al., 2018). During this period, the number of people living in poverty decreased from 131 million (2.1% of the global population) to 97 million (1.4%). Among the 122 countries, the population-weighted median increase in the poverty gap due to OOP health expenditures was \$122 per capita at the \$1.90 /day poverty line and \$374 per capita at the \$3.10/day poverty line (Wagstaff, Flores, Smitz, et al., 2018). A separate study conducted in Southeast Asia showed that OOP health payments pushed 58.2 million people below the poverty line when using the \$1.90 per day poverty line and 64.2 million people when using the \$3.10/day poverty line. India and Bangladesh recorded the highest proportion of their populations impoverished by healthcare expenses.

3.5.5 Summary of Literature Review

A review of the literature indicates that OOP health payments are catastrophic and impoverishing for households. To determine if countries are progressing toward universal health coverage, it is critical to evaluate these impacts. The global catastrophe health expenditures have been rising despite a decline in poverty worldwide, according to literature.

3.6 Methodology and Analysis

Data Source

The 2015/2016 Botswana Multitopic Household Survey (BMTHS) data will be used for this study. This is a nationally representative survey conducted by Statistics Botswana (SB). The data was collected from November 2015 to October 2016. The survey employed a two-stage stratified sampling design. This approach was facilitated by the stratification of 27 census districts, each exhibiting heterogeneity and aligning with administrative districts. Under this framework, the census districts were categorized into three groups: cities/towns, urban villages, and rural areas. The survey covered households across all districts and sub-districts. In the first stage, enumeration areas (EAs) were selected as primary sampling units. In the second stage, households were systematically selected as secondary sampling units, yielding a total of 7049 households and 25 130 individuals (Statistics Botswana 2018).

Out of pocket payments

All household health costs paid to healthcare providers that are not reimbursed by any third party or prepayment plan will be included in the OOP health payment data.

From the Botswana Multitopic Household 2015/16 Survey OOP payments included consultations with private doctors or traditional healers, diagnostic services, dental treatment, surgery, and the purchase of drugs or medicines. These are payments done by households who utilized healthcare (defined as whether individuals accessed any form of health care in the survey). OOP payments also include user fees, which are the formal fees that medical professionals charge at the point of service for consultations or treatments. In this case, user fees fall under the larger category of OOP expenses that were recorded in the survey, especially for services that are not covered by medical insurance.

Living Standard measurement.

Household income is commonly measured using total consumption expenditure, which also serves as a key indicator of living standards (Wagstaff et al., 2007) . Total consumption expenditures are adjusted to adult equivalents to account for variations in household size and composition (Deaton & Zaidi, 2002) In this modification, we acknowledge that different members of a household have different consumption requirements and that sharing resources leads to economies of scale. Adult equivalent (AE) is estimated as:

$$AE_i = (A_i + \alpha K)^\theta$$

In a household, A represents the number of adults (over 18 years), K represents the number of children (under 18 years), α represents the cost of children, and θ represents economies of scale (Deaton & Zaidi, 2002). Given the significant proportion of subsistence food consumption in developing countries, Deaton and Zaidi (2002) suggested values for α ranging from 0.3 to -0.5 in developing nations (with higher values observed in developed countries) and a value close to unity for θ , reflecting the higher share of subsistence food consumption in these regions. Adult equivalent was estimated as: $AE_i = (A_i + 0.5K)^{0.75}$

Measuring catastrophic healthcare expenditure

OOP health expenditures are considered catastrophic if they surpass a predetermined threshold (z%) of household income (Wagstaff & Doorslaer, 2003; Wagstaff, Flores, Hsu, et al., 2018)

or capacity to pay (Xu et al., 2007; Xu et al., 2003) within a specific period. Financial catastrophe can be measured using a uniform threshold, which remains consistent for all households regardless of their income level (Wagstaff & Doorslaer, 2003; Wagstaff, Flores, Hsu, et al., 2018), or a variable (rank-dependent) threshold, which increases with household income suggesting that the threshold should vary based on a household's socioeconomic level, increasing with household income (Ataguba, 2012; Edeh, 2022a; Onoka et al., 2011). In addition, small out-of-pocket expenses can be particularly harmful to individuals who are already living in poverty. Therefore, this paper utilizes the rank-dependent threshold to evaluate financial catastrophe in Botswana.

If household income is represented by y_i , household out of pocket is represented by T_i and Z_{cat} is an initial threshold, then a rank dependent threshold (Z'_{cat}) is defined as;

$$Z'_{cat} = w(p; y) * Z_{cat}$$

In this analysis:

- P represents the household income percentile.
- $\gamma \in (0, 1)$ is the inequality aversion parameter

The rank dependent weight is defined as:

$$w(p; \gamma) = (1 - p)^{\gamma-1} \quad \text{for } \gamma \in (0, 1)$$

This implies that when $\gamma = 1$, the rank dependent threshold (Z'_{cat}) becomes equal to the standard catastrophic threshold (Z_{cat}), aligning with the approach used by Wagstaff and Doorslaer (2003). In this study, the inequality aversion parameter is set to $\gamma = 0.8$ and the initial catastrophic thresholds are as follows:

- For total consumption expenditure: 5%, 10%, 20% and 25%
- For total household non-food expenditure: 20%, 25%, 30% and 40%

The rank dependent headcount

This measure indicates the proportion of households whose out-of-pocket payments, relative to their income, exceed the rank-dependent threshold (Ataguba, 2012; Kwesiga et al., 2015; Ngcamphalala & Ataguba, 2018). Let O'_i represent the rank dependent catastrophic overshoot, which indicates the extent to which a household i exceeds the threshold (Z'_{cat}).

Let:

- y_i represent total consumption expenditure or non -food expenditure
- T_i represent total household OOP health payments

The rank dependent overshoot (O'_i) for each household is defined as:

$$O'_i = \max (0, T_i / y_i) - Z'_{cat}$$

Next, define an indicator variable E'_i such that

$E'_i = 1$ when $O'_i > 0$, indicating that the household exceeded the rank-dependent threshold, $E'_i=0$ otherwise.

The rank- dependent catastrophic headcount ratio (H'_{cat}) is then given by:

$$H'_{cat} = \frac{1}{N} (\sum_{i=1}^N E'_i) = \mu'_{E'}$$

Where:

- $\mu'_{E'}$ is the mean of E'
- N is the total number of households.

The rank dependent catastrophic Gap

This measure quantifies the deviations from the catastrophic threshold (Z'_{cat}) representing the difference between (T_i / y_i) and (Z'_{cat}) for each household where $E'_i = 1$ (Ataguba, 2012; Kwesiga et al., 2015; Ngcamphalala & Ataguba, 2018). It is calculated as follows: is

$$G'_{cat} = \frac{1}{N} (\sum_{i=1}^N O'_i) = \mu'_{O'}$$

Where $\mu'_{O'}$ denotes the mean of overshoots (O'_i)

The mean positive rank dependent gap (MPG'_{cat})

The Mean Positive Gap measures the average extent by which households experiencing financial catastrophe exceed the threshold (Z'_{cat}) (Ataguba, 2012; Ngcamphalala & Ataguba, 2018). It reflects the intensity of financial catastrophe and is calculated as follows:

$$MPG'_{cat} = \frac{(\sum_{i=1}^N O'_i)}{(\sum_{i=1}^N E'_i)} = \frac{\mu'_{O'}}{\mu'_{E'}}$$

Assessing impoverishment due to out-of-pocket healthcare expenditure

The extent to which individuals are driven below the poverty line (or pushed deeper into poverty) due to OOP payments for healthcare is used to assess the impoverishing impact of such expenditures.(Wagstaff & Doorslaer, 2003; Xu et al., 2003). In measuring impoverishing OOP payments and following similar methodology by (Wagstaff & Doorslaer, 2003)

Poverty headcount

The poverty headcount reflects the proportion of the population living below the poverty line(Wagstaff & Doorslaer, 2003).

Let:

- If PL_0 represents the poverty line
- Y_i denotes individual prepayment adult equivalent household consumption expenditure

An individual is classified as poor before OOP health payments if :

$$Y_i < PL_0$$

This condition defines prepayment poverty (P_i^{pre}).

The prepayment poverty headcount is computed as:

$$H_{pov}^{pre} = \frac{\sum_{i=1}^N P_i^{pre}}{N} = \mu_{p^{pre}}$$

Where N represents the sample population.

Prepayment poverty Gap

This measure indicates the average extent to which individuals fall below the poverty line.

Let:

g_i^{pre} represents the shortfall from the poverty line for individual I

The shortfall is defined as :

$$g_i^{pre} = P_i^{pre} (PL_0 - Y_i)$$

Where:

- PL_0 is the poverty line
- Y_i is the individual's prepayment adult-equivalent household consumption expenditure
- P_i^{pre} is an indicator that equals 1 if the individual is below the poverty line and 0 otherwise

The prepayment poverty Gap (G_{pov}^{pre}) is calculated as:

$$G_{pov}^{pre} = \frac{1}{N} \sum_{i=1}^N g_i^{pre} = \mu_{g^{pre}}$$

Where:

- $\mu_{g^{pre}}$ is the mean shortfall from the poverty line
- N is the total number of individuals

Normalised Poverty Gap

It represents the weighted sum of poverty gaps (expressed as a proportion of the poverty line), where the weight corresponds to the fraction of the poverty line (Akazili, Ataguba, et al., 2017).

It is calculated as:

$$NG_{pov}^{pre} = G_{pov}^{pre} / PL_0$$

Where:

- NG_{pov}^{pre} is the normalized prepayment poverty gap.
- G_{pov}^{pre} is the prepayment poverty gap
- PL_0 is the poverty line

To derive the post payment poverty indices, the superscript 'pre' is replaced with 'post'

- Post payment poverty headcount H_{pov}^{pos} ,
- Post payment poverty gap G_{pov}^{pos}
- Normalized post payment poverty gap NG_{pov}^{pos}

Impoverishment due to OOP health payments is determined by the difference between prepayment and post payment measures as shown below:

Poverty Headcount Impact

- $PI^H = H_{pov}^{post} - H_{pov}^{pre}$

Where PI^H reflects the change in the proportion of individuals living below the poverty line due to OOP health costs.

Poverty Gap

- $PI^G = G_{pov}^{post} - G_{pov}^{pre}$

Where PI^G indicates the change in the average shortfall from the poverty line resulting from OOP health expenditures.

Normalised Poverty Gap

- $PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}$

3.7 Poverty Line

The International poverty line and Botswana's national poverty line will be used to determine poverty headcount and gap measurements to evaluate the poverty impact of OOP payments. The international poverty line is \$1.90 /day with Botswana Purchasing Power Parity (PPP) estimated at 3.764 in 2011 (World Bank, 2020). Additionally , Botswana's national poverty line is P1014.00/ month (Statistics Botswana 2018).

3.8 Data Analysis

The data will be analyzed using Stata 17 (StataCorp, 2017). Continuous variables will be summarized using means or medians, while categorical variables will be reported as counts and proportions. To produce population-level estimates, all calculations and standard errors will be adjusted for the sampling design and weighted using survey weights provided by Statistics Botswana.

Catastrophic healthcare expenditure and impoverishment will be evaluated by comparing OOP health payments with total consumption expenditure, Botswana's national poverty line (BWP1014/month), and international poverty line(\$1.90/day). The analysis will be performed at both the individual and household levels.

3.9 Ethical Considerations

This study uses secondary household survey data that was collected by Statistics Botswana. An ethics approval will be obtained from the Health Research Ethical Committee (HREC) of the University of Cape Town and The Ministry of Health (Botswana) Health Research ethics prior to the start of the study. To ensure privacy and confidentiality the survey data has no personal or information by which the respondents could be identified. The survey data have been kept into a password protected laptop and only accessible to the principal investigator. There are no risks posed by this study. The survey data will be solely used for the intended purposes of this study.

3.10 Dissemination

The Study findings will be published through a manuscript and a policy brief as is necessary for the required (Health Economics) mini-Dissertation or Thesis. In addition, the findings will be published on a peer – reviewed journal and presented at suitable domestic and international conferences, as well as in-country stakeholder forums.

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UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 404 7682
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

23 November 2022

HREC REF: 741/2022

Dr A Obse

Health Economics Division
Public Health & Family Medicine
Email: ag.obse@uct.ac.za
Student: skwban005@myuct.ac.za

Dear Dr Obse

PROJECT TITLE: ASSESSING CATASTROPHIC AND IMPOVERISHING HEALTH EXPENDITURE FROM OUT-OF-POCKET PAYMENTS IN BOTSWANA (MASTER OF PUBLIC HEALTH (HEALTH ECONOMICS) - MS BANYANA SEKWATI)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th November 2023.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student Ms B Sekwati will be involved in this study.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.



FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☒ Approved	Annual progress report	Approved until/next renewal date	28.02.2025
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	7/2/24

Note: Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown.

Please use the latest form found on our website:

<http://www.health.uct.ac.za/fhs/research/humanethics/forms>

HUMAN RESEARCH
ETHICS COMMITTEE

- 7 FEB 2024

Comments to PI from the HREC

HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

Thank you for your Study
Deviation

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	28 November 2023		
HREC REF Number	741\2022	Current Ethics Approval was granted until	30/11/2023
Protocol title	Assessing Catastrophic and Impoverishing Health Expenditure From Out-of-pocket payments in Botswana		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	☐ Yes	☒ No	
If yes, could you please provide the HREC Reference number for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.			
Principal Investigator	Dr Olufunke Alaba		
Department / Office Internal Mail Address	Olufunke.alaba@uct.ac.za		

HREC Chair Signature

Date: 7/2/24

1.1 Does this protocol receive US Federal funding?

☐ Yes

☒ No



1.2 If the study receives US Federal Funding, does the annual report require full committee approval?		☐ Yes	☒ No
Note: Any annual approvals for Full Committee review MUST be submitted on the monthly HREC submission dates. (Please send electronic copy for full committee review to hrec-submission@uct.ac.za)			
If yes in 1.2 please complete section 1.3 below for invoicing purposes			
1.3 Ethics Renewal Fee			
Please (tick ✓) appropriate box for billing purposes:			
<u>Submission Type</u>	<u>Description</u>	<u>New fee (Vat Incl.)</u>	<u>tick ✓</u>
Research funded solely from UCT departmental/divisional/group budget	Annual evaluation of research progress report for re-certification	R0,00	☐
Non-sponsored student research for degree purposes at UCT/Other Universities & Colleges	Annual evaluation of research progress report for re-certification	R0,00	☒
Annual re-certification / Progress report (FHS016 Form)	Clinical Trial & International Grant Funded Research - Annual evaluation of research progress report for re-certification for Full Committee Approval	R7000,00	☐
Annual re-certification / Progress report (FHS016 Form)	Clinical Trial & International Grant Funded Research - Annual evaluation of research progress report for re-certification for Expedited review	R3 710.00	☐
Annual re-certification / Progress report (FHS016 Form)	National grant funded research - Annual evaluation of research progress report for re-certification for Full Committee Approval	R6000.00	☐
Annual re-certification / Progress report (FHS016 Form)	National Grant funded research for Annual evaluation of research progress report for re-certification for Expedited review	R1 500,00	☐
NB: Protocols funded by UCT (e.g. departmental funding / student research) and by certain grant funding organizations (e.g. MRC, NRF, CANSA,) are exempt from these charges.			
Please provide details for Invoicing, either complete section 1 or 2 :			
1. Invoice billing – Directly to Sponsor			
Sponsor's name	Government of Botswana – Ministry of Health		
Billing Address of Sponsor:	P/Bag 0038, Gaborone		
Vat Number:			
Contact person	Morena Mosalagae		
Telephone number	+267 2411		
Email Address	mmosalagae@gov.bw		



2. Internal Journal Billing:	
Fund Number:	
Cost Centre Number:	
Account Holder Name:	
Division of Account Holder:	

2. List of documentation for approval

Protocol

3. Protocol status (tick ✓)

☐	Open Enrolment
☐	Closed to enrolment (tick ✓)
☐	Research-related activities are ongoing
☐	Research-related activities are complete, long-term follow-up only
☒	Research-related activities are complete, data analysis only
☐	Main study is complete but sub-study research-related activities are ongoing
☐	Study is closed → Please submit a Study Closure Form (FHS010)

4. Enrolment

Number of participants enrolled to date	-
Number of participants enrolled, since last HREC Progress report (continuing review)	-
Additional number of participants still required	-

5. Refusals

Total number of refusals (participants invited to join the study, but refused to take part)	-
---	---

6. Cumulative summary of participants

Total number of participants who provided consent	-
Number of participants determined to be ineligible (i.e. after screening)	-



Number of participants currently active on the study	-
Number of participants completed study (without events leading to withdrawal)	-
Number of participants withdrawn at participants' request (i.e. changed their mind)	-
Number of participants withdrawn by PI due to toxicity or adverse events	-
Number of participants withdrawn by PI for other reasons (e.g. pregnancy, poor compliance)	-
Number of participants lost to follow-up. Please comment below on reasons for loss of follow-up.	-
-	
Number of participants no longer taking part for reasons not listed above. Please provide reasons below:	-

7. Progress of study

Please provide a brief summary of the research to date including the overall progress and the progress since the last annual report as well as any relevant comments/issues you would like to report to the HREC:
Protocol was approved last year November. Since its approval, all chapters (literature review, and Data Analysis for the dissertation have been developed. Engagements are currently ongoing on finalising the chapters .

8. Protocol violations and exceptions (tick ✓ all that apply)

☒	No prior violations or exceptions have occurred since the original approval
☐	Prior violations or exceptions have been reported since the last review and have already been acknowledged or approved
☐	Unreported minor violations that have occurred since the last review, as well as significant deviations not yet reported, are attached for review

9. Amendments (tick ✓ all that apply)

☒	No Prior amendments have been made since the original approval
☐	Prior amendments have been reported since the last review and have already been approved
☐	New protocol changes/ amendments are requested as part of this continuing review (See note below)

Note: If new protocol changes are being requested in this review, please complete an amendment form (FHS006).

Specific changes in the amended protocol and consent/assent forms must be **bolded**, *italicised* or tracked and all changes must include a rationale.

10. Adverse events

10.1 Please provide below or attach a narrative summary of serious adverse events and/ or unanticipated problems since the last progress report. Please indicate changes made to the protocol and informed consent document(s) as a result (if not already reported to the HREC). Please comment on whether causality to any study procedure or intervention could be established.
-

10.2 Have participants received appropriate treatment/ follow-up/ referral when indicated (e.g. in the case of abnormal or incidental clinical findings, distress or anxiety)?		
☐ Yes	☐ No	☒ Not applicable
If yes, please describe:		
-		

11. Summary of Monitoring and Audit Activities (tick ✓)

11.1 Was this study monitored or audited by an external agency (e.g. SAHPRA, FDA)?		
☐ Yes	☐ No	☒ Not applicable
11.2 Did a Data and Safety Monitoring Board publish a report?		
☐ Yes	☐ No	☒ Not applicable

11.3 If yes, please identify the agency and attach a summary of the findings.					
Agency Name		Report attached	☐ Yes	☐ No	☒ Not applicable
		DSMB report attached	☐ Yes	☐ No	☒ Not applicable

11.4 Has there been any agency, institutional or other inquiry into non-compliance in this study, or any finding of non-compliance concerning a member of the research team?	
☐ Yes	☒ No
If yes, please explain:	

12. Level of risk (tick ✓)

12.1 In light of your experience of this research, please indicate whether the level of risk to participants has:	
☐	Increased
☐	Decreased



☒	Shown no change
If there has been a change, please explain:	
The data is secondary data	

12.2 Please provide a narrative summary of recent relevant literature that may have a bearing on the level of risk.

13. Insurance

Please confirm that valid no fault insurance is still in place? (tick ✓)			
☐ Yes	☐ No	☒ Not Applicable – N/A	
If yes, please complete the following:			
Insurer's name:			
Policy no.		*Coverage Period:	
For UCT sponsored studies please liaise the Insurance office via fhs.sponsorship@uct.ac.za regarding the required documentation and information required obtain a renewed UCT No-fault Insurance Certificate.			

14. Statement of conflict of interest

Has there been any change in the conflict-of-interest status of this protocol since the original approval? (tick ✓)	
☐ Yes	☒ No
If yes, please explain and if necessary, attach a revised conflict of interest statement (Section #7 in the New Protocol Application Form FHS013):	

15. Signature

My signature certifies that the above is complete and correct.			
Signature of PI		Date	6.12.2023



Form FHS011: Study deviation

HREC office use only (FWA00001637; IRB00001938)

This serves as acknowledgement of a protocol deviation as described below.

Chairperson of the HREC
signature/ Designee



Date

7/2/24

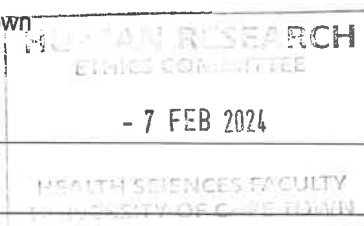
Note: Please note that incomplete submissions will not be reviewed.
Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	25/01/2024
HREC REF Number	741/ 2022
Project Title	Assessing Catastrophic and Impoverishing Health Expenditure from Out-of-Pocket Payments in Botswana
Protocol number (if applicable)	N/A
Principal Investigator	Dr Olufunke Alaba
Department / Office Internal Mail Address	Olufunke.alaba@uct.ac.za



2. Protocol deviation description

Please describe the deviation below, including the reason why the deviation occurred.

Working under an expired professional license. I am using secondary data (Household dataset) for my analysis which was collected by Statistics Botswana , During the lapse The study was on analysis stage.

3. Follow-up actions

3.1 Please describe any follow-up action(s) taken or planned as a result of this deviation e.g. DSMB reporting, report to sponsor, informing participants.



The thesis makes use of open-access secondary data. The candidate just needs to complete the analysis and write-up.

3.2 Please describe what action(s) have or will be taken to prevent similar deviations in future.

The candidate is expected to submit the thesis before the February deadline

4. Principal Investigator's acknowledgement of responsibility

This signature indicates the PI has reviewed the deviation, taken appropriate follow-up action, and implemented or plans to implement preventative steps where possible.

Signature of PI		Date	24/1/2024
-----------------	--	------	-----------

7. Statement of conflict of interest

The PI is expected to declare any existing or potential conflict of interest that may affect the scientific integrity and ethical conduct of this research. For purposes of this section, 'immediate family' means the PI's spouse or domestic partner and dependent children. Please tick ✓ all that apply.	
7.1 No conflict of interest declared:	
I, or any member of my immediate family, do not have any interest related to this research (e.g. financial interest in the sponsor of the research or intervention being tested.)	✓
I, or any member of my immediate family, do not have a proprietary interest in the product being tested in this research (e.g. patent, trademark, copyright, licensing agreement).	✓
I, or any member of my immediate family, do not have any relationships related to this research (e.g. board membership, consultative, executive, employment) or any entity with an ownership interest in the research other than the relationship of sponsor-investigator.	✓
I, or any member of my family or business partnerships, will not receive any payment for enrolling participants in this study.	✓
7.2 Conflict of interest declared:	
As Principal Investigator of this research I am aware of a potential conflict of interest. Please describe and provide a plan to manage the conflict of interest in the space below:	
N/A	

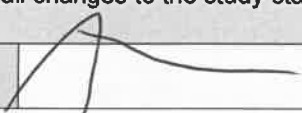
8. Declarations and Signatures

Note: For multidisciplinary and interdepartmental research, the signing DRC Chairperson need to confirm that there has been appropriate consultation with the DRC from the relevant departments.

8.3 Principal Investigator			
My signature confirms that:			
i. Information in this application is true and accurate. ii. I will begin the research only after written HREC approval is obtained. iii. I accept full responsibility for the conduct of this research and the protection of participants' rights and welfare. iv. I will conduct the research according to all ethical, regulatory and legal requirements stipulated in the HREC's Standard Operating Procedures; as well as national and international guidelines/regulations. v. I will provide annual progress reports to the HREC as requested, including a final closing report at the end of the research. vi. I will notify the HREC in writing if any change to the research is proposed and await approval before proceeding with the proposed change except when urgently necessary to protect participants' safety. vii. I will notify the HREC in writing immediately if any adverse event or unanticipated problem occurs during the research. viii. I will allow an audit of my research if requested by the HREC. ix. I have the time, training, experience and resources to oversee this research. x. I will endeavour to publish and disseminate the findings of the study.			
Signature of Principal Investigator		Date	29/1/2024
Print name	Olufunke Alaba		



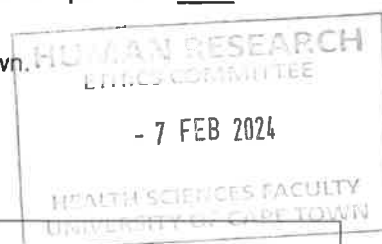
Form FHS007: Amendment – study staff

HREC office use only (FWA00001637; IRB00001938)			
☒ Approved			
This serves as notification that all changes to the study staff and documentation described below are approved.			
Chairperson of the HREC signature/ Designee		Date	7/2/2024

Note: Please note that incomplete amendment submissions will not be reviewed.

Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown.



Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	29/01/2024		
HREC REF Number	741/2022		
Protocol title	Assessing Catastrophic and Impoverishing Health Expenditure from Out-of-pocket payments in Botswana		
Protocol number (if applicable)			
Principal Investigator	Dr Olufunke Alaba		
Department / Office Internal Mail Address	Olufunke.alaba@uct.ac.za		
1.1 Does this protocol receive US Federal funding?	☐ Yes	☒ No	

2.1 Staff changes (tick ✓)

Are new personnel being added to this research?	Yes	No
Are current personnel being removed from this research?	Yes	☐ No
Is the principal investigator for this research being changed?	☒ Yes	☐ No
If yes, please attach revised conflict of interest and PI declaration statements. (Refer: sections 7 and 8.3 in the New Protocol Application Form - FHS013)		



Do the consent and assent forms need modification to reflect these staff changes? If yes, please attach copies of the revised forms, with all changes highlighted or tracked and listed in the documents for approval.	☐ Yes	☒ No
---	------------------------------	--

2.2 Amended study staff details

Title, first name, surname	Department/Division	E-mail	Role of new staff member
Dr Olufunke Alaba	Health Economics	Olufunke.alaba@uct.ac.za	Principal Investigator

3. List of documentation for approval

Please list below all staff documentation such as CVs, declarations, GCP certificates and revised consent forms which need approval. This information must correspond to all 'yes' answers in 2.1 above. This form will be signed and returned to the PI as notification of approval. Please add extra pages if necessary.

N/A

I am taking over as PI because the contract of the former PI is no more a university staff

4. Signature

My signature certifies that I will maintain the anonymity and/ or confidentiality of information collected in this research. If at any time I want to share or re-use the information for purposes other than those disclosed in the original approval, I will seek further approval from the HREC.

Signature of PI		Date	29/1/2024
-----------------	---	------	-----------

Preparing your manuscript

The information below details the section headings that you should include in your manuscript and what information should be within each section.

Please note that your manuscript must include a 'Declarations' section including all of the subheadings (please see below for more information).

Title page

The title page should:

- present a title that includes, if appropriate, the study design e.g.:
 - "A versus B in the treatment of C: a randomized controlled trial", "X is a risk factor for Y: a case control study", "What is the impact of factor X on subject Y: A systematic review"
 - or for non-clinical or non-research studies a description of what the article reports
- list the full names and institutional addresses for all authors
 - if a collaboration group should be listed as an author, please list the Group name as an author. If you would like the names of the individual members of the Group to be searchable through their individual PubMed records, please include this information in the "Acknowledgements" section in accordance with the instructions below
 - Large Language Models (LLMs), such as [ChatGPT](#), do not currently satisfy our [authorship criteria](#). Notably an attribution of authorship carries with it accountability for the work, which cannot be effectively applied to LLMs. Use of an LLM should be properly documented in the Methods section (and if a Methods section is not available, in a suitable alternative part) of the manuscript.
- indicate the corresponding author

Abstract

The Abstract should not exceed 350 words. Please minimize the use of abbreviations and do not cite references in the abstract. Reports of randomized controlled trials should follow the [CONSORT](#) extension for abstracts. The abstract must include the following separate sections:

- **Background:** the context and purpose of the study
- **Methods:** how the study was performed and statistical tests used

- **Results:** the main findings
- **Conclusions:** brief summary and potential implications
- **Trial registration:** If your article reports the results of a health care intervention on human participants, it must be registered in an appropriate registry and the registration number and date of registration should be stated in this section. If it was not registered prospectively (before enrollment of the first participant), you should include the words 'retrospectively registered'. See our [editorial policies](#) for more information on trial registration

Keywords

Three to ten keywords representing the main content of the article.

Background

The Background section should explain the background to the study, its aims, a summary of the existing literature and why this study was necessary or its contribution to the field.

Methods

The methods section should include:

- the aim, design and setting of the study
- the characteristics of participants or description of materials
- a clear description of all processes, interventions and comparisons. Generic drug names should generally be used. When proprietary brands are used in research, include the brand names in parentheses
- the type of statistical analysis used, including a power calculation if appropriate

Results

This should include the findings of the study including, if appropriate, results of statistical analysis which must be included either in the text or as tables and figures.

Discussion

This section should discuss the implications of the findings in context of existing research and highlight limitations of the study.

Conclusions

This should state clearly the main conclusions and provide an explanation of the importance and relevance of the study reported.

List of abbreviations

If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

Declarations

All manuscripts must contain the following sections under the heading 'Declarations':

- Ethics approval and consent to participate
- Consent for publication
- Availability of data and materials
- Competing interests
- Funding
- Authors' contributions
- Acknowledgements
- Authors' information (optional)

Please see below for details on the information to be included in these sections.

If any of the sections are not relevant to your manuscript, please include the heading and write 'Not applicable' for that section.

Ethics approval and consent to participate

Manuscripts reporting studies involving human participants, human data or human tissue must:

- include a statement on ethics approval and consent (even where the need for approval was waived)
- include the name of the ethics committee that approved the study and the committee's reference number if appropriate

Studies involving animals must include a statement on ethics approval and for experimental studies involving client-owned animals, authors must also include a statement on informed consent from the client or owner.

See our [editorial policies](#) for more information.

If your manuscript does not report on or involve the use of any animal or human data or tissue, please state “Not applicable” in this section.

Consent for publication

If your manuscript contains any individual person’s data in any form (including any individual details, images or videos), consent for publication must be obtained from that person, or in the case of children, their parent or legal guardian. All presentations of case reports must have consent for publication.

You can use your institutional consent form or our [consent form](#) if you prefer. You should not send the form to us on submission, but we may request to see a copy at any stage (including after publication).

See our [editorial policies](#) for more information on consent for publication.

If your manuscript does not contain data from any individual person, please state “Not applicable” in this section.

Availability of data and materials

All manuscripts must include an ‘Availability of data and materials’ statement. Data availability statements should include information on where data supporting the results reported in the article can be found including, where applicable, hyperlinks to publicly archived datasets analysed or generated during the study. By data we mean the minimal dataset that would be necessary to interpret, replicate and build upon the findings reported in the article. We recognise it is not always possible to share research data publicly, for instance when individual privacy could be compromised, and in such instances data availability should still be stated in the manuscript along with any conditions for access.

Authors are also encouraged to preserve search strings on searchRxiv <https://searchrxiv.org/>, an archive to support researchers to report, store and share their searches consistently and to enable them to review and re-use existing searches. searchRxiv enables researchers to obtain a digital object identifier (DOI) for their search, allowing it to be cited.

Data availability statements can take one of the following forms (or a combination of more than one if required for multiple datasets):

- The datasets generated and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS]
- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
- All data generated or analysed during this study are included in this published article [and its supplementary information files].
- The datasets generated and/or analysed during the current study are not publicly available due [REASON WHY DATA ARE NOT PUBLIC] but are available from the corresponding author on reasonable request.
- Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.
- The data that support the findings of this study are available from [third party name] but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of [third party name].
- Not applicable. If your manuscript does not contain any data, please state 'Not applicable' in this section.

More examples of template data availability statements, which include examples of openly available and restricted access datasets, are available [here](#).

BioMed Central strongly encourages the citation of any publicly available data on which the conclusions of the paper rely in the manuscript. Data citations should include a persistent identifier (such as a DOI) and should ideally be included in the reference list. Citations of datasets, when they appear in the reference list, should include the minimum information recommended by DataCite and follow journal style. Dataset identifiers including DOIs should be expressed as full URLs. For example:

Hao Z, AghaKouchak A, Nakhjiri N, Farahmand A. Global integrated drought monitoring and prediction system (GIDMaPS) data sets. figshare. 2014. <http://dx.doi.org/10.6084/m9.figshare.853801>

With the corresponding text in the Availability of data and materials statement:

The datasets generated during and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS].^[Reference number]

If you wish to co-submit a data note describing your data to be published in [BMC Research Notes](#), you can do so by visiting our [submission portal](#). Data notes support [open data](#) and help authors to comply with funder policies on data sharing. Co-published data notes will be linked to the research article the data support ([example](#)).

Competing interests

All financial and non-financial competing interests must be declared in this section.

See our [editorial policies](#) for a full explanation of competing interests. If you are unsure whether you or any of your co-authors have a competing interest please contact the editorial office.

Please use the authors initials to refer to each authors' competing interests in this section.

If you do not have any competing interests, please state "The authors declare that they have no competing interests" in this section.

Funding

All sources of funding for the research reported should be declared. If the funder has a specific role in the conceptualization, design, data collection, analysis, decision to publish, or preparation of the manuscript, this should be declared.

Authors' contributions

The individual contributions of authors to the manuscript should be specified in this section. Guidance and criteria for authorship can be found in our [editorial policies](#).

Please use initials to refer to each author's contribution in this section, for example: "FC analyzed and interpreted the patient data regarding the hematological disease and the transplant. RH performed the histological examination of the kidney, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript."

Acknowledgements

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