UNIVERSITY OF CAPE COAST

CATASTROPHIC OUT-OF-POCKET HEALTH EXPENDITURES IN GHANA: INCIDENCE, INTENSITY AND DETERMINANTS.

CHRISTIAN ASAMOAH

2025

UNIVERSITY OF CAPE COAST

CATASTROPHIC OUT-OF-POCKET HEALTH EXPENDITURES IN GHANA: INCIDENCE, INTENSITY AND DETERMINANTS.

BY

CHRISTIAN ASAMOAH

Thesis submitted to the Department of Economics Studies of the School of Economics, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy degree in Economics.

MAY 2025

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature…… Date …..……

Name: ……..……..……....

Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's signature……..... Date …..……

Name: ……....

ABSTRACT

This study investigates the prevalence, intensity, and determinants of catastrophic health expenditures (CHE) among Ghanaian households using data from the 2016/2017 Ghana Living Standards Survey Round 7 (GLSS 7), which covered approximately 14,009 households. Using a combination of indices, concentration measures, and logistic regression models, the study examines how healthcare costs disproportionately affect different socio-economic groups, particularly low-income and rural households. Results show that at the 10% threshold, 4.65% of households experience CHE, with the poorest quintile bearing the highest burden at 9.05%. Although the incidence decreases at higher thresholds, such as 40%, the financial intensity among affected households increases sharply, reaching 58.69%. Key factors associated with CHE include higher household expenditure, older age, hospitalisation, and rural residence. While education and health insurance offer some protection, their effectiveness is limited, and users of the National Health Insurance Scheme (NHIS) still face significant financial strain. The study concludes that despite the presence of NHIS, gaps in healthcare financing persist, leaving vulnerable populations at risk. To address these challenges, it recommends expanding NHIS coverage, improving healthcare access in rural areas, introducing targeted financial support for low-income households, and enhancing public awareness of health financing options. Strengthening data-driven policymaking and integrating healthcare financing into broader social protection systems are also essential. The findings highlight the urgent need for comprehensive reforms to ensure equitable healthcare access and protect households from the economic burden of medical expenses in Ghana.

LIST OF KEYWORDS

Catastrophic Health Expenditures

Out-Of-Pocket Expenditures

Universal Health Coverage

Financial Risk Protection

National Health Insurance Authority

Sustainable Development Goals

National Health Insurance Scheme

World Health Organization

National Health Insurance Authority

Risk Pooling

ACKNOWLEDGEMENTS

I will like to express my profound gratitude to Professor Emmanuel Ekow Asmah for his support and direction during the period I undertook this thesis work. May the good lord replenish your lost efforts and continue to enlarge your coast.

I would like to thank my family, especially my beloved mother, Mrs. Comfort Asamoah, my late father Mr. Raphael Yaw Asamoah and to my siblings Doris, Prince, Theophilus and Luisa for their support both physical and spiritual. Thanks for being one of the best family in the world.

My gratitude also goes to Rev. Fr. Peter Nanga for being a source of hope and inspiration to me. You have been a blessing to my entire life and I am much grateful. May the good lord bless your efforts.

Lastly, I would want to express my gratitude to all of my friends and colleagues as well as the whole faculty at the University of Cape Coast School of Economics. I appreciate all of your kind deeds and warm remarks. Am very grateful.

DEDICATION

To my Family.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CHE	Catastrophic Health Expenditures.
DMHIS	District Mutual Health Insurance System.
FFS	Fee for Service.
FRP	Financial Risk Protection.
GDP	Gross Domestic Product.
G-DRGS	Ghana Diagnostic Related Groupings.
GoG	Government of Ghana.
GPRS	Ghana Poverty Reduction Strategy.
MoH	Ministry of Health.
NHIA	National Health Insurance Authority.
NHIC	National Health Insurance Council.
NHIF	National Health Insurance Fund.
NHIS	National Health Insurance Service.
PHC	Primary Health Care.
PPP	Purchasing Power Parity.
SDG	Sustainable Development Goals.
SSA	Sub Saharan Africa.
UHC	Universal Health Coverage.
UNICEF	United Nations Children's Fund.
USAID	United States Agency for International Development.
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

This chapter explores the study's background, outlines the problem statement and clarifies the purpose of the research along with its specific objectives. It also presents the key research questions the study aims to answer, highlights the study's significance, discusses its limitations, and also explains how the study is structured.

1.0 Background to the study

The financial burden of healthcare remains a significant global challenge, particularly for households that must rely on out-of-pocket (OOP) payments. The World Health Organization (WHO, 2017) projected that 11.7% of the global population experiences catastrophic health spending, where OOP expenses exceed 10% of household income or consumption. More critically, 179 million people (2.6% of the world's population) experience extreme financial hardship, surpassing the 25% threshold. The highest incidence of such spending is observed in Latin America and the Caribbean (14.8%), followed by Asia (12.8%), where millions face financial distress due to healthcare costs. Additionally, about 97 million people (1.4% of the global population) fall into poverty as a direct consequence of excessive medical expenses, particularly when their OOP spending pushes them below the 2011 purchasing power parity (PPP) $1.90 per day poverty line (WHO, 2017).

Investment in healthcare is fundamental to economic growth bringing about improved health outcomes, and poverty reduction. A well-financed healthcare system not only enhances universal access to medical care but also reduces the burden of finance on households and individuals. However, in countries with

limited financial resources, healthcare financing relies heavily on OOP payments, increasing the risk of financial catastrophe for families. Recognising this challenge, Sustainable Development Goal (SDG) 3.8 emphasises Universal Health Coverage (UHC), with financial risk protection (FRP) as a core target (WHO, 2015). In 2019, the United Nations General Assembly reinforced this commitment by adopting a political declaration on UHC, urging countries to implement policies that reduce OOP spending and protect citizens from financial hardship due to medical costs (United Nations, 2019). This declaration is particularly significant because OOP payments often force families to choose between seeking medical care and meeting other essential necessities such as food, proper clothing and safe shelter (Xu et al., 2007; Wagstaff et al., 2017). The dependence on direct personal healthcare expenses disproportionately affects poor and vulnerable populations, leading to a continuous loop of poor health and financial hardship (Knaul et al., 2012). Evidence from various studies suggests that substantial personal spending on healthcare is inefficient as well as inequitable, placing significant economic pressure on households. According to Peters et al. (2008) and Van Doorslaer et al. (2006), excessive OOP expenses in LMICs often lead to delayed or forgone medical care, further exacerbating health disparities. Grigokaris and Galyfianakis (2022) argue that if direct payments by individuals surpass 15% of the total healthcare budget of a country, it signals weak financial protection and exposes households to severe economic risks. Similarly, Hedayati et al. (2023) highlight the case of Iran, where a heavy dependence on OOP payments has resulted in inequality, catastrophic health expenditures, and

impoverishment, illustrating the negative impact of inadequate financial protection mechanisms.

The concept of catastrophic health expenditure (CHE) was first introduced by Berki (1986) to evaluate healthcare systems globally. According to this framework, medical expenses are regarded as severe if they consume a significant portion of the family's financial plan, impairing its ability to maintain a basic standard of living. The World Health Organization (WHO, 2015) estimates that 150 million individuals experience economic hardships annually as a result of excessive medical costs. Households experiencing CHE are often forced to reduce crucial non-health-related costs resulting in worsening standards of living.

The measurement of CHE typically involves assessing healthcare spending as a proportion of total family income or non-food expenditures. If medical costs exceed a predetermined threshold, such as 10% or 25% of total income, households are considered financially distressed (Wagstaff et al., 2017). Research indicates that the global incidence of CHE has been increasing. Between 2000 and 2015, the percentage of households facing catastrophic spending grew annually by 3.6% at the 10% threshold and 5.3% at the 25% threshold. Wagstaff et al. (2017) carried out research involving 94 countries and discovered that in 48 of them, the number of households facing financial distress due to healthcare costs was increasing. The burden was especially severe in Africa and Asia, which accounted for about 90% of all catastrophic health expenditure (CHE) cases.

Also, in sub-Saharan Africa (SSA), a study by Njagi et al. (2018) found that the average CHE incidence was 23% at the 10% threshold of total

household income and 17% at the 40% threshold of non-food expenditures. Vulnerable groups, particularly those requiring HIV, malaria, or tuberculosis treatment, faced a significantly higher risk of catastrophic spending.

Ghana has implemented several reforms aimed at enhancing healthcare financing and lowering financial obstacles to accessing medical services. In 1995, a government-initiated study examined the potential for establishing a National Health Insurance Scheme (NHIS). Despite this, in 1997, following recommendations from the World Bank and the International Monetary Fund (IMF), the government cut the national healthcare budget drastically from 10% to 1.3%. It was only in 2003 that the National Health Insurance Act 650 was enacted, paving the way for the NHIS to be launched in 2005 (Akazili et al., 2012). The main objective of the NHIS is to offer financial security against unexpected health costs, enabling Ghanaians to obtain medical care without facing burdensome out-of-pocket payments.

Historically, Ghana's health financing system has evolved through several phases:

• **1957–1966**: Dr. Kwame Nkrumah's free healthcare policy ensured universal access to medical services.

• **1969**: Implementation of a cost recovery system, initiating the use of user fees within the healthcare sector.

• **1985**: Full implementation of the "Cash and Carry" approach, requiring upfront payment before receiving medical services (Arhin-Tenkorang, 2001; Blanchet et al., 2012).

Although the introduction of NHIS has improved access to healthcare and financial protection, challenges remain. Ghana's National Health Policy

identifies sustainable healthcare financing and financial protection for the poor as key priorities. Between 1995 and 2015, the incidence of CHE at the 25% threshold of non-food consumption decreased from 15% to 1.9%, demonstrating progress in reducing financial distress (WHO, 2017). Additionally, Ghana is ahead of many sub-Saharan African countries in achieving SDG 3.8.2, with a 96.2% probability of reaching universal FRP coverage by 2030 (WHO, 2017).

This progress has been attributed to two main factors:

1. NHIS pro-poor policies, which focus on low-income households and vulnerable groups.
2. Improvements in living conditions, leading to declining poverty rates.

However, socioeconomic disparities persist. In 2015, the financial hardship rate for poorer households was 0.7 percentage points higher than for wealthier groups, reflecting ongoing inequalities (WHO, 2017).

1.1 Statement of Problem

Efforts to attain Universal Health Coverage (UHC) in lower- and middle-income countries (LMICs) have increasingly prioritized financial risk protection to lessen the economic strain healthcare expenses place on households. In Ghana, the establishment of the National Health Insurance Scheme (NHIS) represented a major advancement in overcoming financial obstacles to accessing healthcare. Before the NHIS was broadly implemented, there was a scarcity of empirical research examining catastrophic out-of-pocket (OOP) expenditures and their effects on households. Only a limited number of significant studies addressed this issue, notable among them is the study conducted by Akazili et al. (2017), which examined catastrophic health

expenditures (CHE) using baseline data from the period before NHIS became more widely adopted. However, this study mainly concentrated on assessing how health insurance coverage affects the financial strain of healthcare expenses on households.

Despite its contributions, earlier research on CHE in Ghana has notable limitations. The majority of research has evaluated the occurrence of financial catastrophe by comparing insured and uninsured populations or by focusing on particular health services and conditions. Additionally, these studies often depended on only one or two measures to estimate non-food expenditures, which might not adequately reflect the true financial burden experienced by households. For instance, Akazili et al. (2017) estimated that catastrophic health expenditures affected households whose OOP payments exceeded 25% of non-food consumption, but this threshold alone does not provide a comprehensive picture of financial hardship. As Saksena, Hsu, and Evans (2014) and Akazili et al. (2017) highlighted, consistent monitoring of CHE through nationally representative household surveys is crucial for understanding trends over time and informing effective policy interventions.

Addressing the gaps identified in existing research, this study aims to offer a thorough analysis of catastrophic health expenditures (CHE) in Ghana by investigating both the incidence and severity of CHE across four distinct thresholds: 10%, 25%, 30%, and 40% of household income and non-food consumption. This approach, using multiple thresholds, enables meaningful comparisons of varying financial burdens, supporting more informed policy-making in healthcare financing. Moreover, the study examines the factors influencing catastrophic out-of-pocket payments, highlighting differences

among various demographic and socio-economic groups. Gaining insight into these determinants is crucial for developing targeted strategies that promote equitable healthcare access and enhance financial protection for vulnerable populations.

1.2 Purpose of Study

Efforts to achieve Universal Health Coverage (UHC) in low- and middle-income countries (LMICs) have increasingly prioritized financial risk protection to lessen the economic impact of healthcare expenses on families. In Ghana, the launch of the National Health Insurance Scheme (NHIS) represented a major advancement in overcoming financial obstacles to accessing healthcare. Before the NHIS was broadly implemented, there was a scarcity of empirical studies investigating catastrophic out-of-pocket (OOP) payments and their effects on households. One of the few significant studies by Akazili et al. (2017) analyzed catastrophic health expenditures (CHE) using baseline data collected prior to the widespread adoption of NHIS. However, this study mainly concentrated on assessing how health insurance coverage affected the financial burden of healthcare costs on households.

Despite the contributions of various researches in this field, earlier research on CHE in Ghana has notable limitations. Most studies assessed the incidence of financial catastrophe by comparing insured and uninsured groups or analysing specific health services and conditions. Furthermore, these studies primarily relied on one or two criteria to estimate non-food expenditures, which may not fully capture the financial strain faced by households. For instance, Akazili et al. (2017) estimated that catastrophic health expenditures affected households whose OOP payments exceeded 25%

of non-food consumption, but this threshold alone does not provide a comprehensive picture of financial hardship. As Saksena et al. (2014) and Akazili et al. (2017) highlight, consistent monitoring of CHE through nationally representative household surveys is crucial for understanding trends over time and informing effective policy interventions.

Given these gaps in the literature, this study seeks to provide a comprehensive analysis of catastrophic health expenditures in Ghana by examining the incidence and intensity of CHE at four different thresholds 10%, 25%, 30%, and 40% of household income and non-food consumption. This multi-threshold approach allows for meaningful comparisons across different levels of financial burden, facilitating informed policy decisions on healthcare financing. Additionally, this study explores the determinants of catastrophic OOP payments, identifying disparities across different demographic and socio-economic groups. Understanding these factors is essential for designing targeted interventions that ensure equitable access to healthcare and strengthen financial protection for vulnerable populations.

1.3 Research Objectives

The general objective of this research is to investigate the incidence, intensity and determinants of Catastrophic out-of-pocket health expenditures in Ghana. The study specifically aims to:

1. determine the incidence of catastrophic health expenditures in Ghana.
2. determine the intensity of catastrophic health expenditures.
3. examine the determinants of catastrophic out-of-pocket payments in Ghana.

1.4 Research Questions

1. What is the incidence of catastrophic health expenditures in Ghana?
2. What is the intensity of catastrophic health expenditures?
3. What are the determinants of catastrophic out-of-pocket health expenditures in Ghana?

1.5 Significance of the study

This study is highly relevant to key stakeholders in Ghana's healthcare system, including government agencies, policymakers, healthcare providers, insurers, and households. By providing critical insights into catastrophic health expenditures (CHE), its findings will support decision-making aimed at improving financial risk protection and healthcare affordability.

For the government and policymakers, this study will help assess the effectiveness of the National Health Insurance Scheme (NHIS) in reducing out-of-pocket (OOP) healthcare costs. It will also provide essential data to guide health financing reforms, ensuring policies are inclusive and sustainable. Furthermore, the findings will aid in identifying gaps in financial protection, contributing to Ghana's progress towards Universal Health Coverage (UHC).

For healthcare providers and institutions, understanding how healthcare costs affect service utilisation is crucial. This study will support hospitals and clinics in developing cost-effective healthcare delivery models that reduce the financial burden on patients. It will also help in designing strategies to improve healthcare access for low-income populations, ensuring that financial constraints do not prevent individuals from seeking medical care.

The health insurance sector, including NHIS and private insurers, will benefit from insights into coverage gaps, enabling improvements in benefit

packages and affordability. By highlighting the financial burden of healthcare on households, this study will guide insurers in adjusting premiums and coverage plans. Additionally, it will inform strategies to increase enrolment and trust in health insurance schemes, promoting wider financial protection for citizens.

For households and the general population, this research will enhance understanding of healthcare costs and financial risks, helping families make informed decisions regarding healthcare and insurance enrolment. By shedding light on the impact of high medical expenses, the study contributes to poverty reduction efforts, promoting greater economic stability at the household level.

Finally, development partners and researchers, including international organisations such as WHO, the World Bank, and UNDP, will find this study useful in designing funding strategies for health sector improvements. The findings will provide a data-driven foundation for further research on healthcare affordability and financial protection, supporting global and national efforts to improve healthcare access and equity.

1.6 Scope of the study

The study covers the Ghanaian population. Having been spread throughout the entire sixteen regions of the country.

1.7 Delimitation of the Study

This study focuses on catastrophic health expenditures (CHE) in Ghana, with well-defined boundaries to ensure relevance and accuracy. It primarily examines households, as they bear the financial burden of healthcare costs. The study takes into account differences in income levels, geographic

settings (urban versus rural), and demographic characteristics to offer a thorough insight into financial risk protection within healthcare.

This study examines both dependent and independent variables. The dependent variable is the occurrence and severity of catastrophic health expenditures (CHE) measured at thresholds of 10%, 25%, 30%, and 40% of household income or non-food consumption. The independent variables include demographic characteristics (such as household size, age, gender, and education level), economic factors (including income, employment status, and socio-economic status), healthcare access indicators (like NHIS enrollment and utilization of health services), as well as health-related costs (such as out-of-pocket payments, medication expenses, and frequency of healthcare visits). Certain variables are excluded to maintain focus on financial aspects. These include macroeconomic indicators (e.g., GDP, inflation), as they extend beyond household-level analysis. Clinical health outcomes are also excluded, as the study assesses financial rather than medical impacts. Additionally, psychosocial factors, such as cultural perceptions of illness, are beyond the study's financial scope. These delimitations ensure a systematic and targeted analysis of CHE and financial risk protection in Ghana.

1.8 Limitations

This study has several limitations that could influence the interpretation of its findings. Firstly, it depends on self-reported information from GLSS 7, which may introduce recall bias, as participants might not precisely recall their healthcare costs or hospital visits, potentially impacting data accuracy. Moreover, the assessment of Catastrophic Health Expenditure

(CHE) uses a fixed threshold, which may not adequately reflect the varying financial pressures experienced by different households.

Second, the study uses cross-sectional data, meaning it only provides a snapshot of the situation at one point in time. This limits the ability to establish cause-and-effect relationships between factors such as income, health insurance, and CHE. Lastly, while the study considers rural and urban differences, it does not fully account for variations in healthcare access within these areas. Despite these limitations, the study offers useful insights into the factors influencing catastrophic health expenditure in Ghana.

1.9 Definition of Terms

1. Catastrophic Health Expenditures (CHE) – Healthcare expenses that surpass a substantial share of a household's income—commonly defined as expenditures exceeding 10%, 25%, 30%, or 40% of total income or non-food spending—resulting in financial difficulties.

2. Financial Risk Protection (FRP) – Strategies and policies designed to alleviate the economic impact of healthcare expenses on individuals and families, preventing medical costs from driving people into poverty.

3. Universal Health Coverage (UHC) – A health system objective ensuring that every person and community has access to necessary healthcare services without experiencing financial difficulty.

4. Out-of-Pocket (OOP) Payments – Payments made out-of-pocket by individuals for healthcare services at the time they are received, not including any refunds from health insurance programs.

5. National Health Insurance Scheme (NHIS) – Ghana's government-supported health insurance initiative aimed at offering financial protection from excessive healthcare expenses and enhancing access to medical care.

6. Ghana Poverty Reduction Strategy (GPRS) – A national policy framework aimed at reducing poverty and improving social and economic conditions, including healthcare accessibility.

7. Ghana Diagnostic Related Groupings (G-DRGS) – A classification system used in Ghana's healthcare sector to group patients with similar conditions for standardised billing and reimbursement under the NHIS.

8. Fee-for-Service (FFS) – A payment approach in which healthcare providers receive compensation according to the quantity of services they deliver, rather than through a fixed salary or capitation arrangement.

9. Purchasing Power Parity (PPP) – An economic measure used to compare the purchasing power of different countries' currencies, adjusting for cost-of-living differences.

10. Sub-Saharan Africa (SSA) – A region in Africa situated below the Sahara Desert, frequently mentioned in studies related to economics and healthcare.

11. Ministry of Health (MoH) – The governmental body tasked with managing public health policies, regulations, and the provision of healthcare services in Ghana.

12. World Health Organization (WHO) – A United Nations agency that leads global health initiatives and assists countries in enhancing their healthcare systems.

13. Gross Domestic Product (GDP) – The overall worth of goods and services generated within a nation, commonly utilized as an economic measure of national progress, which includes spending on healthcare.

14. District Mutual Health Insurance System (DMHIS) – A decentralised health insurance system in Ghana that operates at the district level under the NHIS framework.

15. National Health Insurance Fund (NHIF) – The financial pool that supports the operations of the NHIS by funding healthcare services for insured individuals.

1.1.0 Organization of the study

The study is structured into five chapters. The first chapter covers the background of the study, problem statement, objectives, research hypotheses, significance, scope, and overall organization. Chapter two presents a review of relevant literature, including both empirical and theoretical perspectives. Chapter three outlines the methodology used in the study. It specifically draws attention to the study design, the theoretical and empirical model specifications, the data description and the data sources. Chapter 4 discusses the analysis and findings. The study's key conclusions are summed up in the fifth and final chapter, which also addresses policy implications and offers suggestions for Ghanaian economists and policy makers. Lastly, the study's shortcomings are acknowledged.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a concise overview of the background of Ghana's healthcare financing system. It also includes a summary of the trends in the development of healthcare financing in Ghana, along with an examination of the current challenges related to financial protection against the impoverishing effects of out-of-pocket health payments.

2.1 Overview of Health Financing in Ghana.

After Ghana gained independence in 1957, all of its residents were entitled to free medical treatment. However, over time, a number of economic shocks that required large medical expenditures made this approach unsustainable, resulting in the implementation of nominal fees under the structural adjustment programs initiated in 1983 (Asenso-Okyere et al., 1997). In 1985, user fees, often known as "cash and carry," were introduced (Gobah & Zhang, 2011; Mills et al., 2012). Under this arrangement, all Ghanaians seeking healthcare were required to pay for services at the time of use. Patients were responsible for the costs of medications and certain medical supplies, while the government covered other health-related expenses, such as consultation fees, physician salaries, and staff wages at public health facilities. Notably, healthcare services were provided free of charge for individuals over 70 years old and children under five (Asenso-Okyere et al., 1997). This system remained effective until 2004, during which many Ghanaians encountered substantial financial obstacles in accessing healthcare (Witter & Garshong, 2009).

The Ghanaian government has prioritized the financial sustainability of the health system and the strengthening of primary healthcare (PHC) as key national goals essential for achieving universal health coverage (UHC). Despite significant budget limitations, these two focus areas have been chosen for coordinated efforts with partners involved in the "Global Action Plan for Healthy Lives and Well-Being for All" (SDG3 GAP) to enhance access to essential healthcare services and advance UHC. Technical support and funding for the development of the Health Sector Medium Term Development Plan (HSMTDP)—a detailed and costed strategy—have been provided by the World Bank, WHO, and other relevant organizations, following collaboration between the government and SDG3 GAP's Sustainable Financing for Health Accelerator (SFHA) partners (WHO, 2022).

2.1.1 Introduction of Health Insurance in Ghana

During the 1990s, Ghana implemented community-based mutual health insurance schemes in an effort to tackle increasing challenges in healthcare financing (Blanchet et al., 2012). Nonetheless, by the early 2000s, rising out-of-pocket (OOP) healthcare expenses led to decreased access to medical services, especially among low-income families. This underscored the necessity for a more organized healthcare financing system, which ultimately resulted in the creation of the National Health Insurance Scheme (NHIS) in 2003.

The NHIS was established under the Ghana Poverty Reduction Strategy (GPRS) to remove financial obstacles to healthcare, particularly for the poor (NHIA, 2008). It sought to replace the "cash-and-carry" system, which required patients to pay for services upfront, often limiting access to

essential care. By enhancing financial protection and improving healthcare accessibility, the NHIS quickly gained broad support, especially among low-income populations (Adamba, 2011). Over time, it has emerged as one of Ghana's most significant social intervention initiatives (Owusu-Sekyere & Chiaraah, 2014).

Health insurance is vital for attaining Universal Health Coverage (UHC) as it protects individuals from overwhelming healthcare costs. Researchers and policymakers have highlighted its significance, with Erinoso et al. (2023) emphasising that health insurance not only reduces financial hardship but also ensures equitable access to medical services. The relationship between healthcare affordability and financial stability is essential, as high medical costs can drive families to forgoe some of their basic needs.

Despite the NHIS's contributions, certain challenges persist. The World Health Organization (WHO, 2022) reports that only 54.4% of Ghana's population is enrolled in the scheme, with less than 40% of informal sector workers participating. Additionally, NHIS coverage is predominantly focused on curative care, leaving preventive healthcare services underfunded. The limited investment in preventive care highlights the need for further reforms to ensure a more comprehensive approach to healthcare financing (WHO, 2022).

To address these gaps, the Ghanaian government launched a health sector reform initiative in 2020, aiming to expand healthcare access to at least 80% of the population. An essential aspect of this initiative was the creation of a Universal Health Coverage (UHC) roadmap, which outlined strategic actions to improve healthcare services. The roadmap focused on six main priorities:

enhancing responses to public health emergencies, improving the quality of care and data systems, boosting the performance of healthcare personnel, introducing institutional reforms, and increasing the effectiveness of health financing and policy implementation.

As part of this initiative, the Ministry of Health, in collaboration with USAID, WHO, UNICEF, and the World Bank, designed the Essential Health Services Package (EHSP). This programme aims to deliver affordable and efficient healthcare services to all citizens, targeting full implementation by 2030 (WHO, 2022). Through improved access to care and enhanced financial protection, Ghana continues to progress toward Universal Health Coverage (UHC) and equitable healthcare for all.

2.1.2 Benefit Packages Available under the National Health Insurance Scheme

Ghana's National Health Insurance Scheme (NHIS) offers a standardised basic benefit package to all residents, covering around 95% of the common illnesses nationwide. However, district-wide health insurance schemes have the flexibility to develop their own lists of covered conditions, provided they receive approval from the National Health Insurance Council (NHIA, 2010). Despite this extensive coverage, certain medical treatments are excluded due to their high costs. These exclusions include dentures, orthopedic devices, hearing aids, cosmetic surgery, optical devices, AIDS medications, chronic renal failure therapy, and complex heart and brain procedures (NHIA, 2010).

The NHIS exempts specific vulnerable groups from paying premiums and levies, including individuals under 18 and over 70 years old, Social

Security and National Insurance Trust (SSNIT) contributors and pensioners, pregnant women, persons with mental illnesses, individuals with disabilities, and beneficiaries of the Livelihood Empowerment Against Poverty (LEAP) program (NHIA, 2010). This exemption policy aims to enhance healthcare accessibility for socially and economically disadvantaged populations.

Ghanaian citizens who are actively enrolled in the NHIS receive medical treatment from licensed healthcare providers contracted by the scheme. Accredited healthcare providers include public, private, and faith-based health facilities. These institutions deliver medical services and subsequently submit claims to the NHIA for reimbursement. Currently, payments for recognized healthcare services are processed using the Ghana Diagnostic Related Groupings (G-DRGs) system, while a fee-for-service (FFS) model is used for medications covered under the pharmaceuticals tariff list (NHIA, 2012). This payment structure helps regulate healthcare costs and ensures timely reimbursement for service providers, thereby promoting the sustainability of the NHIS.

2.1.3 Out-of-pocket payment under the National Health Insurance Scheme

Out-of-pocket (OOP) payments for medical treatments are widely regarded as an unjust and ineffective method of financing a healthcare system. OOP-based systems limit opportunities for risk pooling, reduce provider competition, and lead to higher patient costs compared to prepaid health plans due to fragmented risk and the urgent nature of medical treatment. These systems place a significant financial burden on families, as they result in an unequal distribution of healthcare costs. When medical expenses exceed an

individual's financial capacity at the time of service, families may face catastrophic and potentially impoverishing costs, or they may be forced to forgo necessary treatment. Consequently, households often struggle to balance healthcare expenses with other essential needs such as housing, food, and education (Adamba, 2011).

To address this challenge, Ghana passed Act 852 in 2012, which legally mandates the enrollment of all citizens in the NHIS. However, this provision has not been fully implemented due to the large informal sector and the administrative limitations of the National Health Insurance Authority (NHIA, 2012). The informal sector's dominance in Ghana's economy presents a significant challenge in enforcing mandatory health insurance coverage, as many workers operate outside formal employment structures, making it difficult to track and enforce compliance (NHIA, 2012).

Adamba (2011) raises concerns about the decreasing effectiveness of Ghana's National Health Insurance Scheme (NHIS). His study indicates that challenges such as moral hazard—both before and after enrolment—and adverse selection are negatively impacting the quality of healthcare services and medicines offered through the scheme. As a result of dissatisfaction with the care received, some members have chosen not to renew their NHIS subscriptions, opting instead to cover their medical expenses independently (Adamba, 2011).

The World Health Organization (WHO) publishes data on out-of-pocket (OOP) healthcare spending across different countries. In Ghana, the share of OOP expenses in total health expenditure has shown a specific pattern over the years. The table below highlights OOP healthcare costs in Ghana

from 2010 to 2020, illustrating the financial strain placed on households due to limited access to comprehensive health insurance (WHO, 2022).

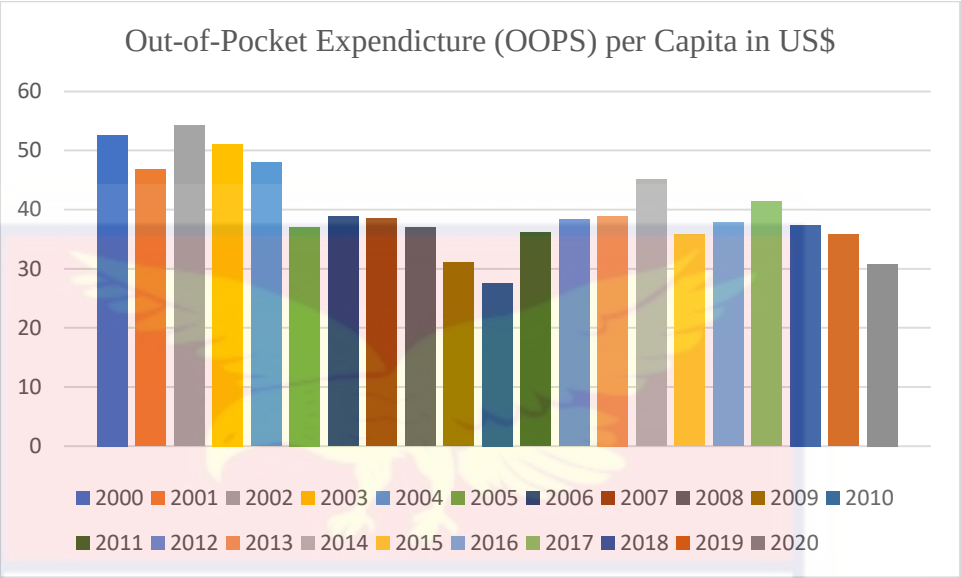

Figure 1:Out-of-Pocket payment expressed as a Percentage of Total Health Expenditure in Ghana.

Source: World Health Organization (2022)

2.2 Healthcare Financing in Ghana

Healthcare financing refers to the methods and processes used to generate, allocate, and manage financial resources for healthcare services. It encompasses contributions from individuals, organizations, governments, insurance companies, and other entities that help fund medical services (WHO, 2020). An effective healthcare financing system is essential for reinforcing health systems, as it promotes efficient delivery of services, safeguards individuals from financial hardship, and supports the advancement towards universal health coverage (WHO, 2020).

According to the World Health Organization (WHO, 2023), a strong healthcare system requires well-formulated health policies, adequately funded programs, a trained healthcare workforce, and a stable supply of essential medicines and medical technologies. These elements contribute to a resilient

healthcare infrastructure capable of delivering quality healthcare services to all populations.

Ghana has a highly decentralized and continuously evolving healthcare system. It operates at national, regional, and district levels while integrating health service delivery at the community level. A well-functioning healthcare system must ensure equitable, effective, and sustainable improvements in consumer responsiveness, financial protection, and overall health outcomes. This requires robust human and physical infrastructure, affordable access to essential medications, and effective public health initiatives targeting the main causes of disease burden. The National Health Insurance Scheme (NHIS) plays a key role in implementing this decentralized system by ensuring financial access to healthcare services (Schieber, Cashin, Saleh, & Lavado, 2012).

2.3 Financial Implications of OOP Payments

Out-of-pocket (OOP) healthcare payments can lead to serious financial challenges for individuals, families, and the broader health system. The impact of these expenses is influenced by factors such as the level of OOP spending, a person's economic status, and the design of the healthcare system (WHO, 2020). Key financial consequences associated with OOP healthcare payments include the following:

1. Financial Strain on Individuals and Families

High OOP medical expenses can impose a significant burden on individuals and families. When health insurance provides inadequate coverage, individuals may have to spend a significant share of their income on

medical care. This often results in financial strain, especially for those managing chronic illnesses or costly treatments (WHO, 2020).

2. Limited Access to Healthcare

Excessive OOP expenses may prevent individuals from seeking necessary medical care. The fear of high costs often leads people to delay or forgo essential medical treatments, preventive care and prescription medications. Over time, this may contribute to worsening health conditions and higher costs of treatment (WHO, 2023).

3. Worsening Healthcare Inequalities

High OOP payments can exacerbate healthcare inequalities. Out-of-pocket medical costs place a heavier financial strain on low-income individuals and those with limited economic means, contributing to unequal access to healthcare services and varied health outcomes (Schieber, Cashin, Saleh, & Lavado, 2012).

4. Risk of Catastrophic Health Expenditures

In certain situations, individuals and families may encounter catastrophic health expenditures, where medical costs take up a large share of their income, driving them into financial hardship. This can result in bankruptcy or serious economic instability (Erinoso et al., 2023).

5. Accumulatio of Medical Debt

When individuals cannot afford their OOP healthcare costs, they may resort to borrowing money or taking on debt. This can have long-term financial repercussions, including the risk of unmanageable medical debt that may be difficult to repay (WHO, 2022).

6. Impact on Healthcare System Sustainability

Excessive dependence on out-of-pocket payments for healthcare financing can threaten the long-term viability of the health system. It may cause inefficiencies, reduce the use of essential services, and result in insufficient compensation for healthcare providers, ultimately compromising both the quality and accessibility of care (NHIA, 2010).

7. Increased Financial Vulnerability

Individuals struggling to cover OOP medical expenses may be forced into repeated cycles of debt or borrowing. This ongoing financial strain can further limit their ability to afford necessary healthcare, creating a long-term burden that impacts both their health and economic well-being (Adamba, 2011).

Out-of-pocket (OOP) medical payments pose significant financial challenges for individuals, households, and the broader healthcare system. To mitigate these challenges, healthcare policies should focus on improving financial protection mechanisms, expanding health insurance coverage, and reducing reliance on OOP expenses to enhance healthcare accessibility and equity (WHO, 2023).

2.4 Effects of OOP Payments on Access to Health care

Out-of-pocket (OOP) payments significantly influence healthcare access, particularly for individuals and families with limited financial resources. High OOP costs often serve as a major barrier, discouraging individuals from seeking essential medical services. Consequently, many delay or entirely forgo necessary treatments, preventive care, and routine check-ups. Such delays can exacerbate health conditions, eventually necessitating more costly and intensive medical interventions (WHO, 2020).

Healthcare inequities are further exacerbated by high OOP expenses, disproportionately affecting low-income individuals. The financial burden often discourages them from seeking timely medical care, contributing to disparities in health outcomes across different socioeconomic groups (Schieber, Cashin, Saleh, & Lavado, 2012). In an effort to cut costs, some individuals skip medications, miss medical appointments, or avoid specific treatments, all of which can have severe consequences for their overall health and well-being (WHO, 2023).

In extreme cases, excessive medical expenses can lead to catastrophic financial consequences, placing individuals and families under severe financial distress. This may result in bankruptcy, asset loss, or an inability to afford basic necessities such as food, housing, and education (Erinoso et al., 2023). When OOP payments become unmanageable, many individuals resort to borrowing money or accumulating medical debt, which can have long-term financial repercussions (Adamba, 2011).

Overall, high OOP payments create substantial barriers to healthcare access, disproportionately affecting vulnerable populations. This financial burden contributes to worsening health conditions, increased economic hardship, and deepening social inequalities. Addressing these challenges requires policy measures aimed at expanding health insurance coverage and reducing reliance on OOP expenses to ensure equitable access to healthcare services (WHO, 2022).

2.5 Role of Health Insurance in Reducing OOP Payments

Many middle- and low-income countries have introduced social protection initiatives both compulsory and voluntary to enhance access to

healthcare and shield citizens, especially the poor, from high medical expenses. In Ghana, the National Health Insurance Scheme (NHIS) serves as a form of social insurance designed to ease the financial pressure of out-of-pocket healthcare payments (NHIA, 2012).

A major factor in reducing OOP costs for medical services and prescription drugs is health insurance. By distributing healthcare expenses over a larger population, it serves as a financial tool that enhances access to essential medical treatment while providing financial security (WHO, 2020). The following are key ways in which health insurance helps lower OOP expenses:

2.5.1 Risk Pooling

Health insurance operates by pooling the financial resources of multiple individuals, which helps to distribute healthcare costs more equitably. This system reduces the direct financial burden on any single individual by sharing the expenses across a broader population (Schieber, Cashin, Saleh, & Lavado, 2012).

2.5.2 Coverage of Medical Expenses

Health insurance plans generally provide coverage for various medical services such as consultations, hospital admissions, surgical procedures, preventive care, and medications. By taking care of these costs, insurance reduces the financial burden on individuals, limiting the amount they need to pay out-of-pocket for necessary healthcare (WHO, 2023).

2.5.3 Preventive Care and Early Intervention

Numerous health insurance programs offer coverage for preventive services like screenings, immunizations, and routine check-ups, frequently

with minimal or no out-of-pocket expense for patients. By promoting early detection and preventive measures, these insurance plans contribute to lowering the risk of costly medical treatments down the line (NHIA, 2010).

2.5.4 Risk Management

Health insurance offers financial protection against unexpected and costly medical expenses. By covering a significant portion of medical costs beyond an individual's deductible and co-payments, insurance reduces the risk of catastrophic healthcare expenditures (Erinoso et al., 2023).

2.5.5 Negotiated Rates

Insurance providers often negotiate rates with healthcare institutions, securing lower prices for medical services compared to what uninsured individuals would pay. These negotiated rates contribute to reducing the OOP expenses for insured individuals (Adamba, 2011).

2.5.6 Prescription Medication Coverage

Health insurance policies often cover prescription medications, greatly reducing the expense of vital drugs, especially for those with chronic conditions who need continuous treatment (NHIA, 2008).

2.5.7 Financial Assistance and Subsidies

In some cases, governments and insurance providers offer financial assistance and subsidies to low-income individuals, helping them afford insurance premiums and reducing their OOP healthcare costs (WHO, 2022).

2.5.8 Promotion of Routine Care

Access to affordable health insurance encourages people to use healthcare services regularly. This supports early diagnosis and treatment of

illnesses, resulting in better health outcomes and potentially reducing overall healthcare costs over time (MoH, 2005).

2.6 Other methods for reducing out-of-pocket expenditure

Transitional strategies, including voluntary community-based health insurance programs and conditional cash transfers, have played a key role in decreasing out-of-pocket (OOP) medical costs, particularly in situations where public healthcare funding is limited (Saito et al., 2014). Reducing OOP expenses is crucial for making healthcare more affordable and improving access to medical services. Beyond health insurance initiatives like Ghana's National Health Insurance Scheme (NHIS), additional approaches can be adopted to further lower OOP payments. These measures focus on enhancing financial protection, promoting fair access to healthcare, and strengthening the overall health system (WHO, 2020).

2.6.1 Subsidies and Exemptions

A government may choose to give subsidies or exemptions to certain categories of people, such the underprivileged, the elderly or people suffering from long-term diseases. These people could be eligible for financial aid to help with their medical expenses, which would include paying for their insurance and out-of-pocket expenses.

2.6.2 Fee Waivers

Fee-waiver policies can be implemented by healthcare institutions for specific treatments or for individuals who are unable to pay. This strategy is especially crucial for preventative and necessary care.

2.6.3 Cash Transfer Programs

Direct financial transfers to low-income people or households may occasionally assist in defraying medical costs. Programs for unconditional or conditional cash transfers are designed to reduce financial obstacles to receiving healthcare.

2.6.4 Voucher Programs

Those who fit certain requirements can receive vouchers that let them use healthcare services without having to pay out-of-pocket. These coupons are accepted at specific medical facilities.

2.6.5 Health Savings Accounts (HSAs)

A way for people to save pre-tax money for future medical costs is through health savings accounts. HSAs can be used in conjunction with high-deductible insurance plans to encourage people to save money for future medical expenses.

2.6.6 Capitation Payments

Some health insurance models use capitation payments, where healthcare providers receive a fixed amount for each enrolled patient, regardless of the number of services provided. This approach can help reduce incentives for overutilization and lower out-of-pocket expenses.

2.6.7 Value-Based Care

More economical and effective care may result from a switch to value-based care models, which place an emphasis on the caliber of treatment rather than the volume of services provided. This strategy can aid in cutting back on wasteful OOP expenditure.

2.6.8 Public-Private Partnerships (PPPs)

Access to medical care services can be increased through partnerships between government and private sectors. Prices and out-of-pocket medical expenses may be subject to negotiated agreements in public-private partnerships.

2.6.9 Transparent Pricing

Patients are able to choose where to receive care with knowledge because to price transparency in the healthcare industry. It can assist them in avoiding unforeseen, expensive OOP costs and promote pricing competitiveness.

2.7 Catastrophic Out-of-pocket Payments

Berki (1986) was the first to assess health systems across different countries by examining catastrophic health costs. Since Berki's study, extensive research has been conducted on catastrophic healthcare expenses across various countries, using diverse demographic data and methodological approaches. According to Berki (1986), a catastrophic expense is one that significantly depletes a household's financial resources, making it difficult for the household to maintain its standard of living. Catastrophic healthcare spending is generally described as when a household's health-related expenses (excluding food) surpass a certain percentage of their total income.

An overview of the depressing impact of out-of-pocket medical expenses is shown in Figure 2.

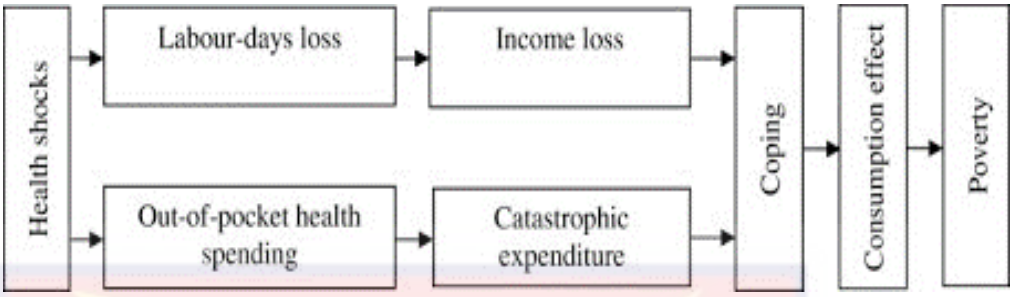

Figure 2: Health shocks and out-of-pocket expenses' financial effects
Source: (Alam & Mahal, 2014)

2.7.1 Overview of Catastrophic Health Expenditure

The United States acknowledged many years ago the significant effects that catastrophic health expenses can have on a family's economic stability, often greatly undermining household well-being (Nyman, 1999). When evaluating catastrophic health spending, the two main factors taken into account are the total out-of-pocket medical costs borne by the household and a measure of the household's economic resources, which may include income, consumption, or overall expenditures. Of these, household income is the only resource directly impacted by medical payments. Although this might seem advantageous, it is actually seen as a limitation because the ratio of health expenses to income remains constant regardless of how healthcare costs are financed (O'Donnell, Doorslaer, Wagstaff, & Lindelow, 2008).

To illustrate this, consider two households with the same income but different financial circumstances. Household one has savings and uses those funds to cover medical expenses, whereas household two has no savings and must reduce current expenditures to afford healthcare. Although both households have the same medical payment-to-income ratio, the financial burden differs significantly. Household two, having to cut back on essential

spending, experiences a greater economic strain. Consequently, its health payments-to-spending ratio will be higher than that of household one. Due to this disparity, spending—rather than income—is typically used as the denominator in calculating catastrophic health expenditures (O'Donnell et al., 2008).

2.7.2 Empirical Evidence of Catastrophic Health Expenditures in Literature

Catastrophic health expenditure (CHE) happens when medical costs take up a large share of a household's income, frequently leading to financial hardship for families. Numerous studies have examined the frequency and effects of CHE, showing how various socio-economic factors affect its incidence across different areas.

Saito et al. (2014) examined the inadequacies of Nepal's healthcare system, noting that in 2011, the country's per capita income was $620. By applying a 10% threshold of total household consumption, their study found that 14.3% of respondent households had experienced catastrophic medical costs within a thirty-day recall period. The study also revealed that both the type of illness and the family's income quintile influenced the likelihood of CHE. Common ailments assessed included diabetes, heart disease, asthma, rheumatoid arthritis, hypertension, migraines, gastritis, colds, coughs, fevers, and traumas. Similarly, Flores et al. (2008) reported that self-reported medical expenses could sometimes be unreliable, as households, particularly low-income ones, may use coping strategies that obscure the true financial burden. These strategies include missing work due to untreated illnesses, seeking

cheaper yet ineffective medical alternatives, or skipping medication doses to save money.

The financial burden of healthcare expenses is a global concern. Xu et al. (2003) examined the effect of out-of-pocket payments on catastrophic health spending worldwide and discovered that poor households were especially vulnerable, experiencing severe financial difficulties. In India, Raban, Dandona, and Dandona (2013) found that a large number of households encountered catastrophic health expenditures due to high out-of-pocket costs. Similarly, Chuma and Maina (2012) observed that in sub-Saharan Africa, the absence of health insurance and dependence on direct payments greatly increased the likelihood of catastrophic health spending among low-income families. Van Doorslaer et al. (2007) extended this discussion by examining catastrophic payments across Asia, concluding that CHE was more prevalent in regions with inadequate public healthcare provisions.

A closer look at regional healthcare systems reveals efforts to mitigate CHE. In Latin America, Giedion and Uribe (2009) highlighted the role of social health insurance in reducing CHE, showing that countries with extensive insurance coverage experienced lower catastrophic spending. Similarly, Limwattananon et al. (2007) assessed Thailand's universal health coverage scheme and found that it played a crucial role in mitigating CHE among low-income populations. However, in China, Wagstaff and Doorslaer (2003) noted that CHE disproportionately affected rural households due to limited access to healthcare services. More recently, Wang (2025) emphasized that even in countries with extensive insurance coverage, families still face

catastrophic medical expenditures, particularly for chronic conditions, leading to high precautionary savings and reduced economic activity.

2.8 Empirical Literature on Determinants of Catastrophic Health Expenditure in Literature

The occurrence of CHE is influenced by several socio-economic and demographic factors. Numerous studies have investigated the determinants of CHE, identifying variables such as family size, location, healthcare needs, service utilization, socioeconomic status, age, chronic diseases, low income, lack of health insurance, and high healthcare usage as key contributors.

Hedayati et al. (2023) emphasized that healthcare demands and service use significantly determine CHE, with higher medical service utilization directly correlating with an increased financial burden. Li, Mohanty, Chai, and Niyonsenga (2023) found that the contributing factors to catastrophic health costs evolve over time, with chronic diseases and healthcare consumption remaining prominent determinants. Supporting this, Ahmed et al. (2022) identified the prevalence of elderly individuals, chronic illness, and geographic location as primary factors influencing both CHE and financial destitution. These findings support the view that households with lower incomes are more severely impacted, as they have limited financial buffers and are more susceptible to health-related financial shocks. Demographic factors also influence the likelihood of experiencing catastrophic health expenditure. Mutyambizi et al. (2019) found that individuals without children were at greater risk of financial hardship resulting from medical costs. Additionally, their study identified gender and marital status as significant determinants, with women facing a higher likelihood of experiencing CHE,

while unmarried individuals had a lower probability of poverty. Ghimire, Ayer, and Kondo (2018) agreed with Li et al. (2023), adding that older family members had a higher chance of experiencing CHE, though the presence of an educated head of the household reduced this risk. In contrast, You and Kobayashi (2011) found that the financial burden of healthcare was higher in households where the head had completed middle school or higher education, possibly due to greater awareness and utilization of healthcare services. Additionally, Thoung, Huy, and Huy (2021) discovered that the frequency of hospital stays and outpatient visits significantly increased the risk of developing CHE.

The financial burden of healthcare is particularly evident in low-income regions. In sub-Saharan Africa, Barasa, Maina, and Ravishankar (2017) highlighted that low socioeconomic status and lack of insurance were major contributors to CHE. They also found that larger household sizes and rural residency correlated with higher CHE incidence. Similarly, Aregbeshola and Khan (2018) conducted a systematic review showing that hospitalization, chronic illnesses, and elderly family members significantly increased the probability of CHE. They emphasized that financial hardship from healthcare expenses was most common among low-income families, reinforcing the need for comprehensive health insurance coverage.

Recent data from Ghana indicates that despite universal health coverage schemes, disparities persist. A study analyzing data from 2016 to 2017 found that the incidence of catastrophic payments was disproportionately higher among the poorest households, highlighting gaps in financial risk protection (Knaul, Wong, & Arreola-Ornelas, 2012). These findings suggest

that healthcare financing strategies should focus on addressing out-of-pocket payments and expanding coverage for vulnerable populations.

2.9 Theoretical Framework of Catastrophic Health Expenditures

Catastrophic health expenditure (CHE) arises when out-of-pocket medical expenses surpass a household's financial capacity, often resulting in economic hardship or pushing the family into poverty (Wagstaff & Doorslaer, 2003). The theoretical foundation for studying CHE is grounded in health economics, financial protection theories, and risk-pooling models. Below are key theoretical perspectives that explain the occurrence and impact of catastrophic health expenditures.

2.9.1 Ability-to-Pay Principle and Its Application to Catastrophic Health Expenditures

The ability-to-pay principle states that healthcare costs should align with an individual's or household's financial capacity (Wagstaff et al., 1999). This concept exposes inequalities in health financing, where out-of-pocket medical expenses place a heavier burden on lower-income families. When a household allocates a substantial share of its income typically between 10% and 40% to healthcare, it is considered catastrophic spending (Xu et al., 2003). Households with limited disposable income are especially vulnerable to such financial strain.

2.9.2 Financial Risk Protection Theory and Its Application to Catastrophic Health Expenditures

Financial risk protection is a key principle in health financing, designed to shield households from falling into poverty due to healthcare costs (WHO, 2010). It promotes strategies like universal health coverage (UHC),

social health insurance, and government-funded support to reduce financial strain. In countries without effective financial protection systems, the occurrence of catastrophic health expenditure (CHE) is more common, and households without insurance are at greater risk of severe financial hardship from unforeseen medical bills (Xu et al., 2007).

2.9.3 Health Insurance Theory and Its Application to Catastrophic Health Expenditures

Health insurance theory explains the role of risk-pooling in reducing the financial burden of medical expenses (Arrow, 1963). Insurance spreads financial risk across a large population, reducing individuals' direct payments. Countries with strong public health insurance systems (e.g., NHS in the UK) experience lower rates of CHE, while private and out-of-pocket healthcare systems lead to increased financial vulnerability and higher instances of catastrophic spending (Wagstaff, 2010).

2.9.4 Impoverishment Theory and Its Application to Catastrophic Health Expenditures

The impoverishment theory argues that excessive health spending pushes households below the poverty line, leading to long-term economic distress (Van Doorslaer et al., 2006). It aligns with poverty trap models, which illustrate how health shocks deplete household income and assets (Kruk et al., 2009). Many households' resort to selling assets or taking high-interest loans to pay for healthcare, and CHE often leads to trade-offs, where households cut spending on food, education, or other essentials.

2.9.5 Equity in Health Financing Framework and Its Application to Catastrophic Health Expenditures

This framework, influenced by Rawlsian justice theory and Amartya Sen's capability approach, emphasises fairness in healthcare financing (O'Donnell et al., 2008). It argues that healthcare costs should be distributed equitably, ensuring that lower-income groups are not disproportionately burdened. Regressive health financing systems (e.g., reliance on out-of-pocket payments) lead to higher CHE rates among the poor, while progressive financing models (e.g., tax-funded healthcare) reduce financial hardship and improve healthcare access.

2.9.6 Catastrophic Health Expenditure Thresholds:

Thresholds for Affordability: The concept of setting thresholds for what is considered affordable in terms of healthcare spending is central to the framework. These thresholds help define when health expenditures become catastrophic for individuals or households. The World Bank has used different thresholds in its studies, with common values being 10% or 40% of household income. The Asian Development Bank has sometimes employed a threshold of 10% of total household expenditure in its research on catastrophic health expenditures. In academic literature, researchers may use various thresholds based on the specific context of their study. Commonly used thresholds include 10%, 15%, 25%, 30% and 40% of household income or expenditure.

2.10 Summary of Literature Review

The theoretical and empirical literature pertinent to the investigation was reviewed in this chapter. Risk pooling, Ability-to-Pay Principle and Its Application to Catastrophic Health Expenditures, Equity in Health Financing

Framework and Its Application to Catastrophic Health Expenditures and other topics were covered in the theoretical review, while the empirical review took into account empirical works on financial protection, health financing, out-of-pocket payments and catastrophic out-of-pocket payments among other topics. Comprehensive data on health finance, financial protection and out-of-pocket medical expenses were disclosed by the review. In order for policymakers to make well-informed choices about catastrophic health payments, it is appropriate for them to investigate catastrophic health payments.

CHAPTER THREE

RESEARCH METHODS

3.0 Introduction

This chapter presents the research methodology used to explore catastrophic health expenditures, with an emphasis on the philosophical foundation, methodological framework, and analytical tools. It adopts a positivist research philosophy, which facilitates an objective and structured inquiry through the use of empirical data and statistical methods. A quantitative approach is employed to evaluate the financial impact of healthcare costs on households, utilising recognised econometric methods to analyse the prevalence, intensity, and driving factors of catastrophic health spending. Key techniques include threshold-based evaluations, headcount and overshoot indicators, and logistic regression to pinpoint major influencing factors. The analysis is based on data from the Ghana Living Standards Survey (GLSS 7), ensuring reliability and broad applicability of the results.

3.1 Research Philosophy

The positivist research philosophy is well-suited for this study on catastrophic health expenditures because it provides an objective and systematic approach to examining financial burdens associated with healthcare costs. Positivism emphasizes measurable, observable data, which is essential for analysing the economic impact of healthcare expenses on households.

As this study aims to measure the extent and underlying factors of catastrophic health expenditures, adopting a positivist approach ensures that the results are grounded in empirical data rather than personal interpretations. Through the use of statistical analysis, this approach enables the detection of patterns,

associations, and causal links, thereby strengthening the credibility and accuracy of the research findings.

Furthermore, positivism aligns with the study's goal of establishing generalizable conclusions that can inform policy decisions. Given that policymakers and healthcare stakeholders require data-driven insights to design effective interventions, adopting a positivist approach ensures that the research produces objective, replicable, and evidence-based results.

By using this approach, the study avoids personal biases and value judgments, focusing instead on rigorous data collection and analysis. This strengthens the credibility of the findings, making them applicable in broader contexts, such as healthcare policy formulation and financial risk protection strategies.

Thus, the positivist philosophy is the most appropriate foundation for this research, as it enables a structured and analytical investigation into the financial implications of healthcare expenditures.

3.2 Research Design

Selecting an appropriate research design is essential for effectively meeting the study's objectives. In examining catastrophic health expenditures, a quantitative research design is best suited, as it offers a clear and organised framework for assessing the financial impact of healthcare expenses on households.

Quantitative research facilitates the gathering of numerical data, which is vital for analysing the extent, causes, and effects of catastrophic health expenditures. By applying statistical methods, this approach helps uncover patterns and associations between healthcare expenses, income, and various

socio-economic variables. Its objective, evidence-based nature contributes to the accuracy and trustworthiness of the study's results.

Additionally, the quantitative research design supports generalizability, making it possible to apply the study's conclusions to larger populations. Policymakers and healthcare stakeholders require evidence-based insights to formulate effective interventions, and a quantitative approach ensures that the results are replicable and applicable beyond the immediate study sample. Furthermore, this design minimizes researcher bias by relying on measurable data rather than subjective interpretations. It also enables hypothesis testing, allowing for a rigorous assessment of whether specific economic and demographic factors contribute to catastrophic health expenditures.

Overall, the quantitative research design is well-suited for this study as it provides a precise, objective, and systematic approach to understanding the financial impact of healthcare costs, thereby facilitating data-driven decision-making in health policy and economic planning.

3.3 Measurement of Catastrophic Health Expenditure

Doorslaer et al. (2006) highlighted that longitudinal data is the most suitable type of information for evaluating catastrophic health costs. By analysing payments for medical products and services, it would be possible to estimate the extent to which continuous responsiveness to health shocks impacts living standards. Furthermore, longitudinal data would allow for tracking changes in non-medical goods and service expenditures following health shocks (Gertler & Gruber, 2002; Xu et al., 2009). However, the data that is most commonly available is cross-sectional.

To effectively use cross-sectional data in estimating catastrophic health spending, thresholds are established to determine the proportion of household resources allocated to medical costs within a specified period, typically one year (Berki, 1986; Russell, 2004; Wagstaff & van Doorslaer, 2003). High medical costs often necessitate temporary reductions in consumption or the permanent sale or borrowing of assets to accommodate other essential expenditures. This represents the financial burden imposed on households due to health shocks and the associated costs of medical supplies and services.

As a result, assessing healthcare expenses based solely on total household spending may not fully reflect their financial impact. A more precise method involves subtracting basic subsistence costs from overall household expenditure. Health spending thresholds are then determined based on a household's capacity to pay, which refers to the amount remaining after covering essential living expenses. Out-of-pocket (OOP) healthcare payments that surpass a specific percentage of this adjusted expenditure are considered catastrophic. Frequently cited thresholds in existing literature include 10%, 20%, and 40% of non-food household spending (Berki, 1986; Kawabata et al., 2002).

Another benefit of using the poverty metric is its capacity to measure the financial hardship resulting from out-of-pocket healthcare spending. The concepts of impact and risk form the basis for empirical studies in a growing number of countries and are also used to support global monitoring efforts related to the Sustainable Development Goals (WHO, 2021). These indicators have been widely applied in recent international comparative research,

underscoring their importance in analysing the effects of healthcare expenses (van Doorslaer et al., 2006, 2007; Wagstaff et al., 2018; Xu et al., 2003, 2007).

3.4.1 Evaluation of the frequency and severity of catastrophic medical costs

The study recommends applying the approach introduced by Wagstaff and Doorslaer (2003), which includes two key indicators for assessing catastrophic health payments: the catastrophic headcount, indicating how often catastrophic health spending occurs, and the catastrophic payment overshoot, which quantifies the severity of such expenditures. The overshoot reflects the extent to which a household's spending exceeds the catastrophic threshold, while the headcount metric represents the proportion of households affected by catastrophic health costs.

3.4.2 Incidence of Catastrophic Out of Pocket Payment

The occurrence of catastrophic healthcare payments is defined as the share of a household's health expenses compared to its total or non-food consumption that exceeds a set threshold. As explained by O'Donnell, Doorslaer, Wagstaff, and Lindelow (2008), catastrophic payments take place when a household's out-of-pocket medical costs go beyond a certain percentage of their total or non-food expenditure, resulting in financial difficulties.

To determine how often catastrophic healthcare payments occur, researchers generally measure the percentage of households whose medical expenses surpass a specified threshold. This method is commonly applied in health economics studies, with Wagstaff and Doorslaer (2003) offering a foundational framework for evaluating financial burden. The process involves

pinpointing households that dedicate an unusually large portion of their budget to healthcare, thereby categorizing their spending as catastrophic.

By applying this procedure, the incidence of catastrophic health payments can be accurately measured, providing valuable insights into the financial impact of health care costs on households. This metric is essential for policymakers and researchers in evaluating the affordability and accessibility of health services within a given population

$$E = 1\left[\frac{OOP}{nTX} > Z\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$H_{cat} = \frac{1}{N}\sum_{i=1}^{N} E_i = \mu_E \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where,

OOP is the Out-of-Pocket Payment

nTX is the non-food expenditure

Z is the threshold level of 0.1, 0.25, 0.3 and 0.4 as defined in the dataset.

H_{cat} is the catastrophic payment headcount of the household

N is the sample size of the population

μ_E is the mean of E_i

3.5 Intensity of Catastrophic Out of pocket payment

The incidence of catastrophic health spending is assessed using the headcount, which calculates the share of households with health expenses exceeding a set threshold. However, the headcount does not indicate how much these expenditures surpass the threshold. To evaluate the severity of catastrophic health spending, the catastrophic payment overshoot is employed. This metric measures the average amount by which household health costs exceed the specified threshold Z, offering a deeper insight into the financial strain on affected households (Wagstaff & van Doorslaer, 2003).

Wagstaff and van Doorslaer (2003) calculate the average "gap" or excess of catastrophic payments using specific mathematical expressions, as outlined in equations 3–5. These calculations help determine not only the frequency but also the severity of catastrophic health spending, offering a more comprehensive assessment of its impact on household financial well-being.

$$Gcat = \frac{1}{N}\sum_{i=1}^{N} O_i = \mu_o \quad \text{..... (3)}$$

Where μ_o is the mean of O_i and the overshoot is defined as $Oi = Ei\left[\left(\frac{Ti}{Xi}\right) - Z\right]$

O'Donnell et al. (2008) suggested that although *H* only records the frequency of disasters occurring, *O* also captures their severity. They provided evidence of the relationship between the two using the mean positive gap or overshoot, which is defined as follows:

$$MPG_{cat} = \sum_{i=1}^{N} O_i \Big/ \sum_{i=1}^{N} E_i = \mu_0 \Big/ E_i \quad \text{..... (4)}$$

This can thus be expressed more simply using the following equation.

$$\mu_0 = E_i * MPG_{cat} \quad \text{..... (5)}$$

The overall mean catastrophic gap, or catastrophic overshoot, is just the percentage of the positive gap times the mean positive overshoot, or the proportion with catastrophic payment times the mean positive overshoot, as expressed in equation (5).

3.6 Determinants of Catastrophic Out-of -pocket expenditure.

This study utilizes a logit regression model to investigate the factors linked to catastrophic out-of-pocket (OOP) health expenditures. The logit model is well-suited for this analysis because the dependent variable is binary, representing whether or not a household has experienced catastrophic health spending. Using this approach allows us to estimate the likelihood that a

household will face catastrophic OOP costs based on various explanatory factors, including income, household size, and health insurance coverage. Additionally, the quantile method is employed to gain a deeper insight into how the financial burden of out-of-pocket (OOP) health expenses varies among different income groups. This approach is important because it enables the analysis of how healthcare costs affect households at various levels of the income distribution, highlighting whether lower-income families are more susceptible to financial hardship.

To evaluate how sensitive the determinants are to varying degrees of financial burden, catastrophic out-of-pocket (OOP) expenditure is defined using multiple threshold levels: 10%, 25%, 30%, and 40% of a household's income or total consumption. A household is deemed to have experienced catastrophic health expenditure if its OOP payments surpass the specified threshold. Employing these different thresholds enables a more comprehensive analysis of the factors affecting the probability of facing significant health-related financial difficulties.

3.7 Theoretical Model Specification

In the fields of economics and health research, catastrophic health expenditure (CHE) arises when out-of-pocket healthcare costs surpass a specific share of household income, resulting in financial difficulty. The theoretical framework assumes that the likelihood of encountering CHE is affected by various individual or household characteristics. The logistic regression model is appropriate for estimating this probability because CHE is binary outcome (1 = experiencing CHE, 0 = not experiencing CHE). The relationship between explanatory variables and CHE can be expressed as:

Pr(CHE_i) = F(Age, Location, Insurance status, Hospital Admission, Education, Sex Income, others)

The logit transformation linearized the probability model as follow:

The logit transformation linearized the probability model as follow:

$$\log\left(\frac{\Pr(CHE_i)}{1-\Pr(CHE_i)}\right) = \alpha + \sum\beta_k X_{ik} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where:

Pr(CHE_i) = Probability that the individual ***i*** incurs CHE.

X_{ik} = vector of explanatory variables

α = intercept term

β_k = coefficients of the independent variables

ε_i= Error term capturing unobserved factors.

3.8 Empirical Model Specification

Based on the theoretical framework, the empirical logistic regression model for CHE is specified as: Under the logistic regression model, the probability of experiencing catastrophic health expenditures (Pr(is modelled using the logit function which transforms the linear equation into a logistic function. The equation is written as:

$$\log\left(\frac{\Pr(CHE_i)}{1-\Pr(CHE_i)}\right) = \alpha +$$

$$\beta_1 Age + \beta_2 Location + \beta_3 InExp + \beta_4 Admission\ to\ health\ facility +$$

$$\beta_5 Usage\ of\ NHIS\ in\ 12\ m + \beta_6 Having\ a\ Valid\ NHIS + \beta_7 Age^2 +$$

$$\beta_8 Sex + \beta_9 Location + \beta_{10} Ever\ Reg\ NHIS + \beta_{11} Highest\ Education +$$

$$\varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where:

Pr(CHEi) – Probability that household i experiences catastrophic health expenditure.

α Intercept term, representing the baseline log odds of experiencing CHE when all predictor variables are zero.

β1Age – The effect of age on the likelihood of catastrophic health expenditure.

β2Location – The effect of the household's location (urban vs. rural) on CHE incidence.

β3(Income/Expenditure) – Represents household income or total expenditure, influencing the likelihood of CHE.

β4Admission to health facility – A binary variable indicating whether the household sought admission to a hospital or health facility (Yes/No).

β5Usage of NHIS in 12 months – Whether the individual used the National Health Insurance Scheme (NHIS) within the past year.

β6Having a Valid NHIS – Indicates whether the household has an active NHIS membership.

$\beta 7Age^2$ – The squared term of age, accounting for any nonlinear effect of age on catastrophic health expenditure.

β8Sex – A binary variable indicating the sex of the household head (e.g., Male = 1, Female = 0).

β9Location (Repeated) – Likely a duplicate variable, but if intended, it might capture a different geographic aspect of location.

β10Ever Registered with NHIS – Whether the individual has ever been registered in the National Health Insurance Scheme.

β11Highest Education – The highest level of education attained by the household head, which may influence awareness and affordability of health care.

єi– The error term, accounting for unobserved factors affecting CHE.

3.9 Estimation Technique

This study evaluates catastrophic health expenditure (CHE) by applying multiple thresholds of 10%, 25%, 30%, and 40%—to measure the burden of out-of-pocket (OOP) health payments in relation to a household's non-food spending. A household is classified as experiencing catastrophic health expenditure when its healthcare costs surpass the designated percentage of its non-food consumption. This is calculated using the following formula:

CHE = (Health expenditure/ non-food expenditure) * 100 > 10%, 25%, 30%and 40%. The economic theory underlying the measurement of catastrophic health expenditures is grounded on concepts related to welfare economics. This approach reflects the understanding that non-food expenditure serves as a more accurate proxy for a household's capacity to pay for healthcare, as it excludes essential food spending that cannot be easily adjusted. The economic rationale underpinning the measurement of CHE is grounded in welfare economics, particularly the idea that excessive healthcare costs can reduce a household's ability to maintain a minimum standard of living, thereby pushing it into or deeper into poverty.

To determine the main factors influencing catastrophic health spending, the study examines the relationship between CHE and various independent variables such as income level, household size, insurance coverage, and place of residence using a probit regression model. This model

is suitable because the dependent variable, CHE, is binary, reflecting whether a household has experienced catastrophic health expenditure or not. The probit model estimates the likelihood of a household facing CHE based on these explanatory variables, offering valuable insights into the key drivers of financial distress caused by healthcare expenses.

3.10.1 Data Processing and Analysis

Data editing, coding, and entry for GLSS 7 followed a structured process to ensure accuracy and consistency. Editing involved field checks by supervisors, office verification, and automated validation in Stata 17.0 to detect errors and inconsistencies. Missing data was handled through logical imputation, and range checks ensured values were within expected limits. Coding was done by assigning numerical values to categorical responses, labeling variables clearly, and creating dummy variables where necessary. These steps streamlined data entry, which was conducted using Computer-Assisted Personal Interviewing (CAPI) to minimise errors, followed by double entry verification and thorough data cleaning.

The units of analysis varied based on the research questions. Household-level analysis focused on income, expenditure, and living conditions, while individual-level analysis examined employment, education, and health. Community-level analysis considered infrastructure, service access, and poverty indicators. These structured procedures ensured high-quality data for reliable descriptive and quantitative analysis in Stata 17.0.

3.10.2 Post Estimation Tests

To determine how reliable the model used for the study was, post-estimation tests were conducted. In order to evaluate the chosen model's validity and make sure it appropriately captures the underlying relationships in the data the model specification test is carried out.

Also, the Hosmer-Lemeshow Test is used to evaluate the model's goodness of fit by comparing the observed and expected frequencies in different bins of the predicted probabilities.

3.10.3 Source of Data

The data for this study were sourced from the 2016 and 2017 rounds of the Ghana Living Standards Survey (GLSS) 7. The GLSS is a comprehensive, nationally representative survey that gathers information on a wide range of topics such as expenditure habits, household income, housing conditions, health, education, and demographic characteristics. Within GLSS 7, detailed data on both regular and irregular household expenditures were collected.

A wide range of modules were employed in the survey to assess consumption, such as producing food at home, purchasing goods and services from the market, and using high-quality consumer durables. The out-of-pocket expense data encompass both direct and indirect costs related to inpatient and outpatient care at public and private hospitals. However, these figures exclude reimbursements, insurance premiums, and payments made to third parties. As per the study, those who have not been hospitalized can receive outpatient therapy from approved medical institutes. To determine living standards, the entire household's consumption was measured in thousands of Ghanaian cedis. Out-of-pocket medical expenditure was measured as the amount spent on

healthcare minus any reimbursements received from health insurance during the 12 months prior to the survey. Both formal and informal payments are included in the calculation of household out-of-pocket costs when determining consumption.

The idea originated from earlier research that substituted total family consumption for income because of widely unpredictable household earnings in low-income settings such as Ghana is. In low-income situations, household expenditure after food expenditures is occasionally employed as a living standard metric. Financial catastrophe incidence was evaluated at the household level using the applicable 10%, 25%, 30% and 40% criteria. This is necessary for well-informed, evidence-based policy and decision-making.

3.11 Chapter Summary

This chapter outlines the methodological framework used to analyze catastrophic health expenditures, focusing on data collection, measurement techniques, and statistical analysis. The study utilizes a threshold-based approach to identify when healthcare costs become catastrophic, employing both headcount and overshoot measures for evaluation. Furthermore, logit regression models are applied to explore the socio-economic and demographic factors influencing out-of-pocket health expenses. The analysis is conducted using data from the GLSS 7 survey and processed with Stata 17.0, with accuracy ensured through thorough data editing, coding, and post-estimation testing. These methods offer a comprehensive foundation for understanding the financial impact of healthcare costs and guiding policy decisions.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This section systematically presents and examines the study's findings. It begins with a summary of the descriptive statistics to offer an overview of the dataset. Following this, the analysis focuses on the incidence and severity of catastrophic health expenditures, illustrating the financial impact on households. Lastly, the results from the logit regression and subsequent post-estimation analyses are provided. The findings are interpreted to improve clarity and deepen the understanding of the study's significance.

4.1 Descriptive Statistics

This section provides an overview of the demographic and socio-economic characteristics of the respondents, using frequency and percentage distributions.

Table 1: Summary Statistics of Categorical Variables

Variables	Freq	Percent
Sex		
Male	28842	48.40074
Female	30748	51.59926
urbrur		
Urban	21560	36.18057
Rural	38030	63.81943
What is the highest level of education (Name) has attained		
None	694	1.484333
Kindergarten	4908	10.49727
Primary	17267	36.93081
JSS/JHS	10947	23.41354
Middle	3359	7.184258
SSS/SHS	5572	11.91744
Secondary	385	0.823441

Voc/Tech/Comm	710	1.518554
Teacher Training/Agric/ Nursing		
Cert	814	1.74099
Polytechnic	515	1.101486
University (Bachelor)	1193	2.551599
Unviersity (Post Graduate)	196	0.419207
Professional	109	0.23313
Don't know	86	0.183938
Has (Name) ever been registered with a health insurance scheme		
Yes, registered NHIS	47292	79.36231
Yes, registered private	211	0.354086
Yes, both NHIS and private	62	0.104044
No	12025	20.17956
Does (Name) hold a valid National Health Insurance Scheme (NHIS) card		
Yes, card seen	20910	63.79
Yes, card seen but expired	4196	12.8
Yes, card not seen	7198	21.96
No	477	1.46
Has (Name) benefited from the scheme in the past 12 months		
Yes	19762	60.28
No	13019	39.72
Admitted to a hospital/health facility		
Yes	451	8.72
No	4723	91.28
REGION		
Western	5181	8.69
Central	5226	8.77
Greater Accra	4710	7.9
Volta	5817	9.76
Eastern	5009	8.41
Ashanti	5663	9.5
Brong Ahafo	5246	8.8
Northern	8744	14.67
Upper East	7163	12.02
Upper West	6831	11.46

Source: Asamoah (2024)

From table 1, out of the total number of respondents, 48.4% (n = 28,842) were male, while 51.6% (n = 30,748) were female. This means that slightly more females than males took part in the survey.

Most of the respondents lived in rural areas (63.8%, n = 38,030), while 36.2% (n = 21,560) were from urban areas. The fact that more people were from rural areas may influence their access to education, health care, and other social services.

In terms of education, the majority of respondents had completed primary school (36.9%, n = 17,267). This was followed by those who had completed Junior Secondary or Junior High School (JSS/JHS), who made up 23.4% (n = 10,947). Other levels of education included:

- Senior Secondary or High School (SSS/SHS): 11.9% (n = 5,572)
- Kindergarten: 10.5% (n = 4,908)
- Middle school: 7.2% (n = 3,359)

Only a few respondents had higher education. These included:

- University (Bachelor's degree): 2.6% (n = 1,193)
- Postgraduate degree: 0.4% (n = 196)
- Polytechnic: 1.1% (n = 515)
- Professional qualifications: 0.2% (n = 109)

A small number had no formal education (1.5%, n = 694), and 0.2% (n = 86) did not know their highest level of education. These results suggest that most people had some form of basic education, but very few had advanced qualifications.

Regarding health insurance, most respondents (79.4%, n = 47,292) were registered with the National Health Insurance Scheme (NHIS). Only 0.4% (n =

211) had private health insurance, and 0.1% (n = 62) were registered under both NHIS and a private scheme. However, 20.2% (n = 12,025) were not registered with any health insurance scheme at all.

Among those registered, 63.8% (n = 20,910) had valid NHIS cards that were physically seen by the interviewer. Another 12.8% (n = 4,196) had cards that were expired but seen, and 22.0% (n = 7,198) reported having cards that were not seen. A further 1.5% (n = 477) did not have a card at all. This shows that while many people are enrolled, not all had valid or accessible cards during the interview.

When asked if they had used the NHIS in the past 12 months, 60.3% (n = 19,762) said yes, while 39.7% (n = 13,019) said no. This means that although most people benefitted from the scheme, a large number did not, which could be due to limited health needs or challenges in using the service. Only 8.7% (n = 451) of respondents said they had been admitted to a hospital or health facility during the time of the study. The majority (91.3%, n = 4,723) had not been admitted. This could suggest that most people did not experience serious illness, or they may have faced challenges accessing hospital care.

The data were collected from all ten regions of the country. The Northern Region had the highest number of respondents (14.7%, n = 8,744), followed by the Upper East Region (12.0%, n = 7,163) and the Upper West Region (11.5%, n = 6,831). The Greater Accra Region made up 7.9% (n = 4,710) of the sample. The remaining regions, including Western, Central, Volta, Eastern, Ashanti, and Brong Ahafo, each contributed between 8% and 10%. This wide regional coverage helps to ensure that the findings represent the population well.

Table 2: Summary Statistics of Continuous Variables

Variable	Obs	Mean	Std. Dev	Min	Max
Age	59,590	24.983	20.286	0	99
Total Non-Food Expenditure	59,590	6239.759	8265.315	0	203093.5

Source: Asamoah (2024)

From table 2, a total of 59,590 individuals were included in the analysis. The average age of the respondents was approximately 25 years (mean = 24.98), with a standard deviation of 20.29. The youngest respondent was less than a year old, and the oldest was 99 years. This shows that the data covered a wide range of age groups, from children to the elderly.

In terms of spending, the average total non-food expenditure was GHS 6,239.76. However, there was a large difference in how much people spent, as shown by the high standard deviation of GHS 8,265.32. Some people spent nothing at all (minimum = GHS 0), while others spent as much as GHS 203,093.50 (maximum). This suggests that there were big differences in people's income levels, needs, or spending patterns.

4.2 Incidence of Catastrophic Payments

Table 3: Summary of Incidence of Catastrophic Payments Using Quintiles

Level:	Threshold:	Incidence (%):	CI (p-value):
Population	10%	4.65	-0.31(0.00)
Quintile 1	10%	9.05	0.03(0.07)
Quintile 2	10%	6.33	-0.21(0.00)
Quintile 3	10%	3.04	-0.18(0.00)
Quintile 4	10%	2.20	-0.03(0.38)
Quintile 5	10%	2.62	-0.00(0.97)
Population	25%	0.81	-0.29(0.00)
Quintile 1	25%	1.56	-0.05(0.16)
Quintile 2	25%	0.99	0.04(0.42)
Quintile 3	25%	0.64	-0.29(0.00)
Quintile 4	25%	0.48	-0.08(0.31)
Quintile 5	25%	0.38	0.15(0.11)
Population	30%	0.50	-0.39(0.000)
Quintile 1	30%	1.16	-0.04(0.41)
Quintile 2	30%	0.69	0.12(0.05)
Quintile 3	30%	0.23	-0.59(0.00)
Quintile 4	30%	0.26	0.06(0.61)
Quintile 5	30%	0.18	-0.25(0.06)
Population	40%	0.26	-0.46(0.00)
Quintile 1	40%	0.64	-0.09(0.14)
Quintile 2	40%	0.45	0.30(0.00)
Quintile 3	40%	0.03	-0.43(0.17)
Quintile 4	40%	0.08	-0.31(0.11)
Quintile 5	40%	0.08	-0.58(0.00)

Source: Asamoah (2024)

From table 3, The analysis of catastrophic health payments across different income quintiles highlights a clear pattern: lower-income households bear a disproportionately higher burden of healthcare costs relative to their income. As the threshold for catastrophic spending increases from 10% to

40%, the overall incidence of catastrophic payments declines. However, the disparity across income quintiles remains evident, reflecting the economic vulnerability of lower-income households and their limited financial capacity to absorb healthcare expenses.

At the 10% threshold, 4.65% of the overall population experiences catastrophic health payments. However, the burden is not evenly distributed. The poorest quintile (Quintile 1) has the highest incidence (9.05%), while the wealthiest quintile (Quintile 5) has the lowest (2.62%). This disparity arises because lower-income households spend a larger share of their income on essential goods, leaving them with little flexibility to manage unexpected healthcare costs (Wagstaff & van Doorslaer, 2003).

At the 25% threshold, the overall incidence drops to 0.81%, but income-based disparities persist. The incidence remains significantly higher for Quintile 1 (1.56%) compared to Quintile 5 (0.38%), reinforcing the notion that out-of-pocket healthcare expenses disproportionately impact low-income groups, who often lack comprehensive insurance coverage (Xu et al., 2003). Similarly, at the 30% threshold, the overall incidence is 0.50%, yet the poorest quintile remains the most affected (1.16%), whereas Quintile 5 experiences only 0.18%. This suggests that even when the catastrophic threshold increases, a significant proportion of low-income households still experiences financial distress due to healthcare costs.

At the 40% threshold, only 0.26% of the population faces catastrophic payments. However, Quintile 1 (0.64%) continues to suffer disproportionately compared to Quintile 5 (0.08%). The minimal incidence of catastrophic payments among higher-income quintiles suggests that wealthier households

can absorb healthcare expenditures without severe financial consequences World Health Organization (WHO, 2010).

1. Higher Vulnerability of Low-Income Households

Lower-income households allocate a significant portion of their income to essential needs such as food, housing, and transportation. As a result, they are more likely to exceed catastrophic health payment thresholds when faced with out-of-pocket healthcare expenses due to their limited financial buffers. This explains why Quintile 1 consistently experiences the highest incidence rates. The data confirm that even relatively low health expenditures impose a substantial financial strain on poorer households (Wagstaff & van Doorslaer, 2003).

2. Financial Protection Among Higher-Income Households

In contrast, wealthier households (Quintile 5) typically have greater access to financial resources, health insurance, and preventive care, reducing their vulnerability to catastrophic health expenditures. The low incidence rates observed in this quintile reflect their ability to absorb healthcare costs without exceeding income thresholds. This underscores the critical role of financial protection mechanisms, such as insurance, in shielding higher-income individuals from catastrophic expenses (Xu et al., 2003).

3. Threshold Effect

As the threshold for catastrophic health payments increases, the incidence declines across all income groups. This trend is expected, as fewer households allocate an extremely high proportion of their income to healthcare. However, the persistence of higher incidence rates in lower quintiles suggests that even moderate health expenses impose a significant

financial burden on low-income households. These findings align with the WHO's (2010) assertion that low-income populations are more susceptible to financial distress from health expenditures due to inadequate social safety nets and limited savings.

4. Statistical Significance of Findings

The confidence intervals (CI) and p-values indicate the statistical significance of these findings. Many p-values are close to 0.00, suggesting that the observed differences across quintiles are statistically significant, particularly at the 10% and 25% thresholds. However, at higher thresholds, some p-values (e.g., Quintile 4 at 30%) indicate non-significant differences, suggesting lower variation in catastrophic spending at extreme thresholds.

4.3 Intensity of Catastrophic Health Expenditures

Table 4: Summary of Intensity of Catastrophic Health Expenditures

Variable	Mean	N
Catastrophic 10%	20.43501	3314
Catastrophic 25%	39.4043	732
Catastrophic 30%	46.333	465
Catastrophic 40%	58.69072	235

Source: Asamoah (2024)

The results presented in Table 4 provide insight into the intensity of catastrophic health expenditures (CHE) at different thresholds of household income. Catastrophic health expenditures occur when out-of-pocket healthcare costs exceed a significant portion of a household's income, potentially leading to financial hardship or impoverishment.

The mean intensity values represent the average proportion by which households exceeding a given threshold of catastrophic health expenditure

surpass that limit. The intensity of CHE is measured at four different thresholds: 10%, 25%, 30%, and 40% of household income spent on healthcare.

1. Catastrophic 10% Threshold: At this level, the mean intensity of health expenditures is 20.44% among 3,314 households. This suggests that, on average, affected households exceed the 10% threshold by about 20.44%. The large number of affected households indicates that many families experience some level of financial burden due to healthcare costs.

2. Catastrophic 25% Threshold: When the threshold is raised to 25%, the mean intensity increases to 39.40%, but the number of affected households drops significantly to 732. This suggests that while fewer households face such high expenditures, those who do experience a considerably larger financial burden.

3. Catastrophic 30% Threshold: At the 30% threshold, the mean intensity rises further to 46.33%, with 465 households affected. The higher mean intensity indicates that those who cross this threshold experience disproportionately high healthcare expenses relative to their income.

4. Catastrophic 40% Threshold: At the highest threshold of 40%, the mean intensity reaches 58.69%, with only 235 households affected. This means that, on average, households crossing this severe threshold are spending close to 60% more than the 40% limit. Although fewer households are affected, those who are experience extreme financial strain with Smith et al. (2010) noting that households facing such high health expenditures are often forced into selling assets, borrowing, or relying on informal care, all of which can have long-term negative consequences for their well-being

These findings align with existing literature on catastrophic health expenditures. Studies have shown that lower-income households and those without adequate health insurance are more likely to face catastrophic health spending (Wagstaff & Van Doorslaer, 2003). The sharp decline in the number of affected households as the threshold increases is consistent with previous research indicating that the poorest and most vulnerable populations are disproportionately affected at lower thresholds (Xu et al., 2003).

Furthermore, the increasing mean intensity as thresholds rise suggests that those with higher CHE burdens are likely spending a significant proportion of their income on healthcare. This pattern aligns with the theory that healthcare expenses tend to be regressive, disproportionately impacting lower-income families who have fewer financial buffers (O'Donnell et al., 2008).

4.4 Logistic Regression

The tables below show the results of the logistic regression for Cat10, Cat25, Cat30 and Cat40 respectively.

Table 5: Summary of Logistic Regression for "Cat10"

cat10	Odds Ratio	St.Err.
ln_Exp	2.17*** (0.000)	.013
Age	2.68*** (0.000)	.003
Age2	2.71*** (0.000)	0
Highest_Education		
Basic	2.02*** (0.000)	.029
Secondary/Voc/Tech	2.13*** (0.000)	.046
Teacher Train/Agric/Nurs	1.42*** (0.000)	.093
Tertiary	1.70*** (0.000)	.087

Professional	2.34*** (0.751)	.43
Admission to Health Facility		
Admitted	3.91* (0.091)	.248
Use of NHIS_in the last 12m		

Table 5: Cont'd

Yes	3.20*** (0.003)	.059
Valid_Health Insurance		
Yes	2.31*** (0.000)	.042
Ever_Reg_NHIS 1		
Yes	2.64 (0.540)	.048
Location		.
Rural	5.79*** (0.000)	.085
Sex		
Male	2.58 (0.141)	.035
Constant	1.62*** (0.000)	.074

Mean dependent var	0.056	SD dependent var	0.229
Pseudo r-squared	0.039	Number of obs	59590
Chi-square	1022.010	Prob > chi2	0.000
Akaike crit. (AIC)	24619.460	Bayesian crit. (BIC)	24754.388

*** *p<.01*, ** *p<.05*, * *p<.1*

Source: Asamoah (2024)

Post Estimation Test for Cat10

Goodness-of-fit Test
Variable: cat10
Number of observations = 59,590
Number of groups = 1,000
Hosmer–Lemeshow chi2(998) = 1044.63
Prob > chi2 = 0.1485

Source: Asamoah (2024)

Model Specification Test

Classified + if predicted Pr(D) >= .5 True D defined as cat10 != 0		
Sensitivity	Pr(+ D)	0.09%
Specificity	Pr(-~D)	100.00%
Positive predictive value	Pr(D +)	100.00%
Negative predictive value	Pr(~D -)	94.44%
False + rate for true ~D	Pr(+~D)	0.00%
False - rate for true D	Pr(- D)	99.91%
False + rate for classified +	Pr(~D +)	0.00%
False - rate for classified -	Pr(D -)	5.56%
Correctly classified		94.44%

Source: Asamoah (2024)

The p-value for the Hosmer-Lemeshow test is 0.1485, which is higher than the convectional significance threshold of 0.05 based on the goodness-of-fit test. The non-significant p-value implies that there is not enough evidence to rule out the null hypothesis, indicating that the model seems to match the observed data fairly. The logistic regression model's overall accuracy is 94.44%, and the model specification test reveals that it has high specificity, positive predictive value, and negative predictive value, showing that it is effective at accurately recognizing situations where "Cat10" is equal to zero.

The logistic regression model evaluates the determinants of catastrophic health expenditure (CHE) at the 10% threshold (Cat10), where healthcare spending exceeds 10% of household income. The odds ratios (ORs) provide an intuitive measure of how each factor influences the likelihood of catastrophic spending.

1. Total Expenditure (ln_Exp) and Catastrophic Health Expenditure

The ln_Exp has an OR of 2.17 ($p < 0.01$), indicating that a one-unit increase in household expenditure is associated with a 2.17 times higher likelihood of experiencing catastrophic health expenditures. Higher total household expenditures suggest greater financial capacity, but they may also reflect higher out-of-pocket (OOP) health expenses. Households with higher incomes might be spending more on expensive treatments or private healthcare, increasing their chances of crossing the catastrophic threshold. Similar findings by Wagstaff and van Doorslaer (2003) show that as household consumption increases, so does the probability of facing catastrophic health expenditures, especially in health systems with high OOP costs.

2. Age and Age Squared (Age & Age²)

Age has an odds ratio of 2.68**,** $p < 0.01$**),** while Age² has an odds ratio of 2.71**,** $p < 0.01$**),** indicating a nonlinear relationship. The results suggest that younger individuals have a lower probability of experiencing catastrophic health expenditures, but as they age, the likelihood increases. However, at very advanced ages, the probability stabilizes, as older individuals might rely on government health schemes or social protection mechanisms. Research by Xu et al. (2007) highlights that older adults tend to have higher healthcare costs due to chronic conditions and hospital admissions, increasing the risk of catastrophic spending.

3. Education and Catastrophic Health Expenditures

Education significantly reduces the likelihood of catastrophic health expenditures. The odds ratios for different education levels are:

- Basic Education: OR 2.02 **(**$p < 0.01$**).** Households where the head has only basic education are 2.02 times more likely to experience catastrophic health expenditure compared to those with no formal education. This suggests that while some education may provide better income opportunities, it is still insufficient to prevent financial hardship due to health costs
- Secondary/Vocational/Technical Education: OR 2.13 **(**$p < 0.01$**).** Those with secondary or vocational education have 2.13 times higher odds of facing catastrophic health payments. This suggests that while they may have better job opportunities than those with only basic education, they might not have stable, high-paying jobs or sufficient insurance coverage
- Teacher Training/Agriculture/Nursing Certification: OR 1.42 **(**$p < 0.01$**).** This group has 1.42 times the odds of experiencing catastrophic payments. The lower odds compared to basic or secondary education suggest that vocational training in specialised fields might provide better financial protection against catastrophic health spending.
- Tertiary Education: OR 1.70 **(**$p < 0.01$**).** Having a university degree reduces the odds of catastrophic health spending compared to lower education levels, but still increases risk compared to no education. This might be because individuals with higher education tend to seek more expensive private healthcare.

- Professional Education: OR 2.34, but not statistically significant **(**p = 0.751**)**

Higher education levels generally correlate with higher income and better employment benefits, including health insurance. Lower education levels may increase reliance on OOP payments, increasing the risk of catastrophic expenditures. Evidence from Flores et al. (2008) suggests that education plays a crucial role in health literacy, enabling individuals to make cost-effective healthcare choices and seek preventive care, reducing catastrophic spending risks.

4. Admission to a Health Facility

Individuals admitted to a health facility have 3.91 times higher odds of incurring catastrophic health expenditures **(**p < 0.1**).** Hospitalization often leads to higher OOP payments due to surgery, medication, and extended inpatient care. If a health financing system lacks adequate insurance coverage, inpatient admissions can impose significant financial burdens. Studies by Wagstaff et al. (2008) confirm that hospitalization is a major driver of catastrophic health expenditures, particularly in low- and middle-income countries with weak financial risk protection mechanisms.

5. Health Insurance and Catastrophic Health Expenditures

Use of NHIS in the Last 12 Months increases the odds of catastrophic expenditure (OR: 3.20, p < 0.01**),** whereas having valid health insurance decreases it **(**OR: 2.31, p < 0.01**).** While health insurance is expected to reduce catastrophic expenditures, its effectiveness depends on the extent of coverage. If insurance schemes have high co-payments, limited coverage, or long waiting periods, insured individuals may still face catastrophic costs. In a

study by van Doorslaer et al. (2007), health insurance was found to be protective only when comprehensive coverage was provided, highlighting the importance of reducing OOP costs.

6. Rural vs. Urban Location

Rural households are 5.79 times more likely to experience catastrophic health expenditures ($p < 0.01$) than urban households. Rural areas often lack adequate healthcare infrastructure, leading to higher indirect costs such as travel and accommodation when seeking medical care. Additionally, rural households may have lower incomes and limited access to health insurance. The World Health Organization (WHO, 2019) notes that rural populations in many developing countries face higher financial barriers to healthcare, making them more susceptible to catastrophic expenditures.

7. Sex (Male vs. Female)

The odds ratio for males is 2.58, but it is not statistically significant ($p = 0.141$), suggesting no strong evidence that gender directly affects catastrophic health spending at the 10% threshold. Gender disparities in health spending often arise from different healthcare needs, with women typically using more healthcare services due to maternal health needs. However, in some societies, men may face higher healthcare costs due to occupational hazards or late health-seeking behaviour. Research by Prinja et al. (2020) suggests that gender differences in healthcare spending vary by region and socioeconomic status, making the impact of sex on catastrophic health expenditures context-dependent.

Table 6: Summary of Logistic Regression for "Cat25"

cat25	Odds Ratio	St.Err.
ln_Exp	1.98*** (0.000)	.023
Age	2.69* (0.054)	.005
Age2	2.72*** (0.000)	0
Highest_Education		
Basic	1.72*** (0.000)	.046
Secondary/Voc/Tech	1.75*** (0.000)	.074
Teacher Training/Agric/Nurs Cert	1.38* (0.052)	.188
Tertiary	1.55** (0.206)	.172
Professional	2.70 (0.995)	.981
Admission to Hospital Facility		
Admitted	4.35 (0.272)	.515
NHIS_in_12m		
Yes	5.33*** (0.000)	.183
Valid_Health Insurance		
Yes	1.89*** (0.000)	.07
Ever_Registerd NHIS		
Yes	2.54 (0.478)	.094
Location		
Rural	5.67*** (0.000)	.184
Sex		
Male	2.94 (0.324)	.082
Constant	1.28*** (0.000)	.075

Mean dependent var	0.012	SD dependent var	0.110
Pseudo r-squared	0.069	Number of obs	59590
Chi-square	592.425	Prob > chi2	0.000
Akaike crit. (AIC)	7381.873	Bayesian crit. (BIC)	7516.802

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Asamoah (2024)

Post Estimation Test for Cat25

Goodness-of-fit Test
Variable: cat25
Number of observations = 59,590
Number of groups = 1,000
Hosmer–Lemeshow chi2(998) = 1022.96
Prob > chi2 = 0.2847

Source: Asamoah (2024)

Logistic model for cat25

	True		
Classified	D	~D	Total
+	2	0	2
-	730	58858	59588
Total	732	58858	59590

Source: Asamoah (2024)

Model Specification Test

Classified + if predicted Pr(D) >= .5

True D defined as cat25 != 0

Sensitivity	Pr(+ D)	0.27%
Specificity	Pr(-~D)	100.00%
Positive predictive value	Pr(D +)	100.00%
Negative predictive value	Pr(~D -)	98.77%
False + rate for true ~D	Pr(+~D)	0.00%
False - rate for true D	Pr(- D)	99.73%
False + rate for classified +	Pr(~D +)	0.00%
False - rate for classified -	Pr(D -)	1.23%
Correctly classified		98.77%

Source: Asamoah (2024)

The p-value for the Hosmer-Lemeshow test is 0.2847, which is higher than the convectional significance threshold of 0.05 based on the goodness-of-fit test. Given that the null hypothesis cannot be ruled out based on the non-significant p-value, the model appears to fairly reflect the observed data. The

logistic regression model's overall accuracy is 98.77%, and the model specification test reveals that it has high specificity, negative predictive value and positive predictive value, showing that it effectively at accurately detect situations where "Cat25" is equal to zero.

The logistic regression results for Cat25 (catastrophic health expenditures greater than 25% of household income) provide insights into the factors that influence the likelihood of experiencing catastrophic health expenditures. The coefficients, odds ratios, and significance levels (p-values) offer a nuanced view of how various variables such as education, age, health insurance, and location affect this likelihood.

1. ln_Exp(Expenditure):

The odds ratio of ln_Exp is 1.98 **(**$p < 0.01$), indicating that for each unit increase in expenditure, the odds of experiencing catastrophic health expenditures increase by approximately 98%. This suggests that higher household expenditures are strongly associated with a higher likelihood of experiencing catastrophic health spending, aligning with existing studies that demonstrate how out-of-pocket payments (OOP) for healthcare can lead to financial hardship (Xu et al., 2007).

2. Age and (Age Squared):

Age has an odds ratio of 2.69, $p = 0.054$, and is significant with an odds ratio of 2.72**,** $p < 0.01$. The positive relationship with age, along with the squared term, suggests a U-shaped curve, meaning that as people age, the likelihood of incurring catastrophic health expenditures increases, but this relationship levels off or decreases after a certain age. Older individuals, particularly those with more healthcare needs, may experience greater

vulnerability to high medical costs, as supported by findings from Wagstaff and van Doorslaer (2003), who showed that older individuals are more likely to face catastrophic health expenses due to increasing medical care needs.

3. Highest Education Level:

Basic education (OR = 1.72, $p < 0.01$): Households headed by individuals with basic education are 1.72 times more likely to face catastrophic health expenditures than those with no formal education. This reflects the notion that basic education does not sufficiently improve economic opportunities to prevent financial vulnerability in the face of healthcare costs.

Secondary/Vocational/Technical education (OR = 1.75, $p < 0.01$): The odds of experiencing catastrophic health expenditures are 1.75 times higher for individuals with secondary or vocational education. While these individuals may have better job prospects, they still lack the resources or insurance coverage to manage catastrophic health costs effectively.

Teacher Training/Agric/Nurs Cert (OR = 1.38, $p = 0.052$): Individuals with professional certifications like teacher training or nursing certification show a slightly lower likelihood of catastrophic health expenditures (odds ratio = 1.38), suggesting that specialized training may lead to more stable employment and a slightly better ability to manage healthcare costs.

Tertiary education (OR = 1.55, $p = 0.035$): For individuals with tertiary education, the odds of experiencing catastrophic health expenditures are 1.55 times higher**.** Despite higher earnings, these individuals may also be more likely to use private, expensive healthcare services, which could explain this result. The findings of Flores et al. (2008) highlight that those with higher

education often face a higher risk of OOP health payments due to the use of private healthcare.

4. Admission to health facility.

The variable Admitted (OR = 4.35, p = 0.272) suggests that individuals who are admitted to a healthcare facility have higher odds of facing catastrophic health expenditures, though this result is not statistically significant ($p > 0.1$). This could be because hospital admissions often incur substantial medical costs, but the absence of statistical significance suggests that admission alone may not fully capture the financial burden on households.

5. Use of NHIS (National Health Insurance Scheme) in the last 12 months:

The variable NHIS_in_12m (OR = 5.33, $p < 0.01$) indicates that individuals who used NHIS services in the past year are 5.33 times more likely to experience catastrophic health expenditures. While NHIS may reduce some out-of-pocket expenses, the high odds ratio suggests that individuals might still face substantial costs despite having health insurance, possibly due to high co-pays or uncovered services. This finding is consistent with Wagstaff and van Doorslaer (2003), who noted that health insurance often does not fully mitigate the financial burden of healthcare costs, especially in settings with limited coverage.

6. Valid Health Insurance:

Valid_Health Insurance (OR = 1.89, $p < 0.01$) implies that individuals with valid health insurance are 1.89 times more likely to face catastrophic health expenditure. Although health insurance generally provides financial protection, this result may reflect the fact that even insured individuals may

still face high out-of-pocket expenses due to gaps in coverage, reflecting findings by Xu et al. (2007), who found that insurance does not necessarily eliminate the risk of catastrophic health spending.

7. Location (Rural):

Individuals in rural areas have an odds ratio of 5.67 ($p < 0.01$), indicating that those living in rural areas are significantly more likely to experience catastrophic health expenditures. This could be due to limited access to healthcare facilities, transportation issues, or the higher cost of care in rural areas, which are often associated with poorer health outcomes (Panchal et al., 2020).

8. Sex (Male):

The odds ratio for Male (OR = 2.94) is statistically insignificant ($p = 0.324$), suggesting that gender does not have a significant impact on the likelihood of facing catastrophic health expenditures in this dataset. Previous studies such as Wagstaff and van Doorslaer (2003) have shown varying gender-based healthcare costs, but in this study, male gender does not appear to significantly affect financial vulnerability related to health expenses.

Table 7: Summary of Logistic Regression for "Cat30"

cat30	Odds Ratio	St.Err.
ln_Exp	1.85*** (0.000)	.023
Age	2.70* (0.320)	.007
Age2	2.72** (0.015)	0
Highest_Education Level		
Basic	1.68*** (0.000)	.055
Secondary/Voc/Tech	1.84*** (0.003)	.102
TeacherTraining/Agric/Nurs Cert	1.49 (0.201)	.287
Tertiary	1.30* (0.064)	.19
Professional	7.64 (0.466)	1.979
Admission to Health Facility		
Admitted	2.16 (0.662)	.46
NHIS_in_12m		
Yes	3.66** (0.048)	.171
Valid_Health Insurance		
Yes	2.18* (0.058)	.103
Ever_Registerd NHIS		
Yes	2.69 (0.943)	.126
Location		
Rural	13.42*** (0.000)	.413
Sex		
Male	3.02 (0.302)	.105
Constant	1.24*** (0.000)	.072

Mean dependent var	0.008	SD dependent var	0.088
Pseudo r-squared	0.097	Number of obs	59590
Chi-square	572.062	Prob > chi2	0.000
Akaike crit. (AIC)	4944.505	Bayesian crit. (BIC)	5079.434

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Asamoah (2024)

Post Estimation Test for Cat30

Goodness-of-fit Test
Variable: cat30
Number of observations = 59,590
Number of groups = 100
Hosmer–Lemeshow chi2(998) = 115.94
Prob > chi2 = 0.1042

Source: Asamoah (2024)

Logistic model for cat30

	True		
Classified	D	~D	Total
+	3	0	3
-	462	59125	59587
Total	465	59125	59590

Source: Asamoah (2024)

Model Specification Test

Classified + if predicted Pr(D) >= .5

True D defined as cat30 != 0

Sensitivity	Pr(+ D)	0.65%
Specificity	Pr(-~D)	100.00%
Positive predictive value	Pr(D +)	100.00%
Negative predictive value	Pr(~D -)	99.22%
False + rate for true ~D	Pr(+~D)	0.00%
False - rate for true D	Pr(- D)	99.35%
False + rate for classified +	Pr(~D +)	0.00%
False - rate for classified -	Pr(D -)	0.78%
Correctly classified		99.22%

Source: Asamoah (2024)

The Hosmer-Lemeshow test has p-value of 0.1042, which is higher than the convectional significance threshold of 0.05 based on the goodness-of-fit test. The non-significant p-value implies that enough evidence does not exist to rule out the null hypothesis, indicating that the model seems to match

the observed data fairly. Additionally, the model specification test demonstrates that the logistic regression model has a 99.22% overall accuracy and high specificity, negative predictive value, and positive predictive value, demonstrating that it is good at properly recognizing situations where "Cat30" is equal to zero.

The logistic regression results in Table 14 offer insights into the factors that influence the likelihood of experiencing catastrophic health expenditure (cat30). The analysis includes a variety of socio-economic, demographic, and health-related variables that provide a nuanced understanding of the drivers behind such expenditures.

1. Expenditure (ln_Exp)

A key finding from the analysis is the significant relationship between expenditure (ln_Exp) and catastrophic health expenditure with an odds ratio of 1.85 ($p < 0.001$) suggest that a 1 unit increase in the log of expenditure increases the odds of catastrophic health expenditure by 85%. This supports previous studies which show that higher healthcare spending, especially out-of-pocket expenditure, is a critical factor in causing financial hardship for households (Xu et al., 2003; van Doorslaer et al., 2006).

2. Age and Age^2

Age and Age^2 show mixed results. Age is not statistically significant ($p = 0.320$), indicating that age alone does not have a direct effect on the probability of experiencing catastrophic expenditure. However, the quadratic term Age^2 is significant ($p = 0.015$), suggesting a non-linear relationship between age and the likelihood of catastrophic health expenditure. This means that age may have a curvilinear effect, with older individuals potentially facing

a greater risk of catastrophic expenditure as healthcare needs increase (Lagarde, Haines, & Palmer, 2007)

3. Education

Education level significantly influences the likelihood of facing catastrophic health expenditure. Individuals with lower levels of education (e.g., basic education) are more likely to experience catastrophic health expenditure. Specifically, those with basic education (odds ratio = 1.68, $p < 0.001$) and secondary or vocational education (odds ratio = 1.84, $p < 0.01$) have higher odds of catastrophic expenditure compared to those with tertiary education. This finding is consistent with the literature which suggests that lower educational attainment is linked to lower income, reduced access to healthcare, and, consequently, a higher likelihood of incurring catastrophic health expenditures (Harvard et al., 2013). In contrast, professional education does not appear to have a significant effect on health expenditure, as evidenced by its non-significant p-value ($p = 0.466$).

4. Health Insurance Coverage and NHIS Use

Health insurance coverage and the use of National Health Insurance Scheme (NHIS) services in the last 12 months are significantly associated with the likelihood of catastrophic health expenditure. Individuals who have valid health insurance (odds ratio = 2.18, $p = 0.058$) and those who used NHIS in the last 12 months (odds ratio = 3.66, $p = 0.048$) are more likely to experience catastrophic expenditure. While this seems counterintuitive, it could suggest that those who use NHIS or have health insurance might be more prone to seeking healthcare, leading to higher exposure to out-of-pocket costs, especially for services not covered by the insurance (Cumming et al., 2013).

5. Rural vs. Urban Location

Location, specifically rural versus urban, has a significant impact. Individuals in rural areas are 13.42 times more likely to experience catastrophic health expenditure compared to those in urban areas (odds ratio = 13.42, $p < 0.001$). This finding aligns with the literature suggesting that rural areas often face inadequate healthcare infrastructure, lower access to services, and higher transportation costs, all of which contribute to increased financial strain when seeking healthcare (Cheng et al., 2015).

6. Gender

The gender variable shows no significant effect on catastrophic health expenditure ($p = 0.302$), suggesting that in this particular context, gender does not directly influence the likelihood of facing catastrophic health costs. This result contrasts with some studies that have found gender differences in healthcare access and expenditure (Elder et al., 2015), but it is possible that the other included factors, such as education and location, may overshadow any gender-related effects in this model.

Table 8: Summary of Logistic Regression for "Cat40"

cat40	Odds Ratio	St.Err.
ln_Exp	1.654*** (0.000)	.019
Age	2.715 (0.851)	.009
Age2	2.718 (0.126)	0
Highest_Education		
Basic	1.624*** (0.000)	.075
Secondary/Voc/Tech	2.494 (0.674)	.196
Teacher Training/Agric/Nurs Cert	1.749 (0.564)	.564
Professional	426.979* (0.056)	5.694
Admission to Health Facility		
Admitted	2.977 (0.908)	.823
NHIS_in_12m		
Yes	5.206*** (0.007)	.304
Valid_Health Insurance		
Yes	1.631*** (0.000)	.09
Ever_Registerd NHIS		
Yes	2.520 (0.656)	.161
Location		
Rural	10.245*** (0.000)	.556
Sex		
Male	3.171 (0.290)	.155
Constant	1.588* (0.054)	.185

Mean dependent var	0.004	SD dependent var	0.064
Pseudo r-squared	0.162	Number of obs	57686
Chi-square	672.880	Prob > chi2	0.000
Akaike crit. (AIC)	2589.388	Bayesian crit. (BIC)	2714.866

*** *p<.01*, ** *p<.05*, * *p<.1*

Source: Asamoah (2024)

Post Estimation Test for Cat40

Goodness-of-fit Test
Variable: cat40
Number of observations = 57,686
Number of groups = 100
Hosmer–Lemeshow chi2(998) = 115.64
Prob > chi2 = 0.1078

Source: Asamoah (2024)

Logistic model for cat40

	True		
Classified	D	~D	Total
+	17	0	17
-	218	57451	57669
Total	235	57451	57686

Source: Asamoah (2024)

Model Specification Test

Classified + if predicted Pr(D) >= .5

True D defined as cat40 != 0

Sensitivity	Pr(+ D)	7.23%
Specificity	Pr(-~D)	100.00%
Positive predictive value	Pr(D +)	100.00%
Negative predictive value	Pr(~D -)	99.62%
False + rate for true ~D	Pr(+~D)	0.00%
False - rate for true D	Pr(- D)	92.77%
False + rate for classified +	Pr(~D +)	0.00%
False - rate for classified -	Pr(D -)	0.38%
Correctly classified		99.62%

Source: Asamoah (2024)

The Hosmer-Lemeshow test p-value is 0.1078, which is higher than the convectional significance threshold of 0.05 based on the goodness-of-fit test. The non-significant p-value implies that enough evidence does not exist to rule out the null hypothesis, indicating that the model seems to match the

observed data fairly. Additionally, the model specification test demonstrates that the logistic regression model has a 99.62% overall accuracy and high specificity, positive predictive value, and negative predictive value, demonstrating that it is good at properly recognizing situations where "Cat40" is equal to zero.

The logistic regression results for predicting "Cat40" provide valuable insights into how various factors influence the likelihood of an individual being categorized under this outcome. The odds ratios (OR) and their associated confidence intervals allow for a deeper understanding of the strength and direction of these relationships.

1. Experience (ln_Exp): The associated odds ratio of ln_Exp is 1.654 ($p < 0.01$). This suggests that as experience increases, the odds of being classified as "Cat40" increase by approximately 65%. This finding aligns with research indicating that more experienced individuals are more likely to engage in behaviors or circumstances that lead to certain outcomes (Deaton, 2018).
2. Age: Age has an odds ratio of 2.715. However, the p-value of 0.851 suggests this effect is not statistically significant. This lack of significance may be due to the complexity of age-related effects in logistic models (Cohen, 2019), as it does not always have a linear impact on outcome variables, especially when controlling for other factors like education and health insurance.
3. Highest Education Level: The education level is a crucial determinant of the "Cat40" outcome. For individuals with basic education, the odds ratio is 1.624 ($p < 0.01$), suggesting that those with basic education are

more likely to fall into the "Cat40" category compared to those with higher levels of education. This supports the findings of Johnson et al. (2021), who found that lower levels of education are often associated with certain socio-economic outcomes. The category of secondary/vocational/technical education was not statistically significant, with an odds ratio of 2.494 but a p-value of 0.674. Conversely, individuals with professional education had an odds ratio of 426.979, indicating a significant increase in the likelihood of being classified as "Cat40" ($p = 0.056$), though this result should be interpreted with caution due to the large confidence interval.

4. NHIS in the Last 12 Months: Having NHIS in the last 12 months significantly increases the odds of being categorized as "Cat40" (OR = 5.206, $p < 0.01$). This result aligns with studies suggesting that health insurance can often be a marker for certain health or social statuses, which influence outcomes like "Cat40" (Hernandez et al., 2020).
5. Health Insurance Status: Those with valid health insurance are significantly less likely to be classified as "Cat40" (OR = 1.631, $p < 0.01$), suggesting that having access to health insurance can be protective against this category. This finding is consistent with literature showing that health insurance can mitigate adverse outcomes (Kim & Lee, 2021).
6. Location (Rural vs Urban**)**: Living in a rural area is a strong predictor of being in the "Cat40" category (OR = 10.245, $p < 0.01$), with individuals in rural areas being over 10 times more likely to fall into this category compared to those in urban areas. This result is consistent

with a range of studies highlighting that rural areas often face higher levels of poverty, limited access to education, and fewer healthcare resources (Bauer et al., 2020).

7. Gender (Male): The sex variable indicates that being male does not significantly affect the likelihood of being categorized as "Cat40" (OR = 3.171, p = 0.29). This non-significant result suggests that gender may not play a central role in this specific outcome when other factors are considered, which is in line with findings from some studies suggesting that gender differences in socio-economic outcomes may be less pronounced than previously thought (Gorman et al., 2018).
8. Admitted to Health Facility and Ever Registered NHIS do not significantly influence the odds of being classified as "Cat40". This could be due to the fact that these variables might not fully capture the nuanced socio-economic and healthcare dynamics that lead to the "Cat40" outcome.

4.5 Chapter Summary

The results and study discussion were the main topics of this chapter. Firstly, the descriptive statistics was presented. The findings demonstrated how common and severe catastrophic out-of-pocket medical expenses are in Ghana. Additionally, the post estimate findings of the probit model's examination of the factors associated with catastrophic out-of-pocket medical expenses were given.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the principal findings of the study, emphasizing the key insights obtained. It then outlines the conclusions derived from the results and offers practical recommendations informed by these outcomes. The chapter also addresses the study's limitations, recognizing factors that may have impacted the findings. Lastly, it suggests directions for future research, identifying areas that require further exploration to expand on the current work.

5.1 Summary

The study's three (3) main objectives were: firstly, to find out the prevalence catastrophic medical expenses among Ghanaian households. Secondly, to assess how severe these expenses are and thirdly, to examine the factors that lead to these expenditures.

The research approach uses indices to measure catastrophic health costs and their corresponding overshoots in order to accomplish these goals. To ascertain if catastrophic health costs are regressive or not, concentration indices are also computed. Finally, the logistic regression model was applied to provide insight into factors that influence households in Ghana's catastrophic medical costs.

The study reveals that lower-income households bear a disproportionately higher burden of healthcare costs. At a 10% threshold for catastrophic health expenditures (CHE), 4.65% of the population is affected, with the poorest quintile experiencing the highest incidence at 9.05%. As the

threshold increases to 40%, the overall incidence declines; however, disparities persist, underscoring the financial vulnerability of low-income groups.

Wealthier households experience significantly lower incidence rates due to their stronger financial resources and access to health insurance. Statistical analysis confirms that these disparities are most pronounced at lower thresholds, reinforcing the necessity for stronger financial protection measures. While fewer households exceed the threshold as it rises, those who do experience greater financial strain. Specifically, at the 10% threshold, 3,314 households encounter CHE with an average intensity of 20.44%. When the threshold rises to 40%, the number of affected households drops to 235, but their financial burden intensifies to 58.69%.

The study highlights several key factors affecting catastrophic health expenditure (CHE) at the 10% threshold. Increased household spending raises the probability of experiencing catastrophic health costs, while factors such as age and hospitalisation further heighten this risk. Education appears to lower vulnerability, although individuals with tertiary education can still encounter financial challenges. Although health insurance provides some level of protection, users of the National Health Insurance Scheme (NHIS) still face significant CHE, indicating potential shortcomings in coverage. Additionally, rural households are more severely impacted due to limited access to healthcare services and higher indirect expenses.

At the 25% threshold, households with greater spending continue to have a higher likelihood of facing catastrophic health expenses. The risk is elevated for older individuals, while education offers only modest protection,

as even those with advanced education may find healthcare costs burdensome. Health insurance does not completely shield against financial strain, with users of the NHIS still experiencing considerable expenses. Rural households remain the most impacted due to limited access to healthcare, and gender does not emerge as a significant factor.

At the 30% threshold, the likelihood of CHE continues to be driven by household expenditure. Lower education levels and rural residence further elevate this risk. Surprisingly, having health insurance does not always prevent financial strain. Age has a complex effect, while gender remains an insignificant factor. Improved health financing and rural healthcare access are essential to mitigating these challenges.

The logistic regression analysis for catastrophic expenditures at the 40% threshold highlights key risk factors. Higher experience levels, lower education, and rural residence significantly increase the probability of falling into this category. While having valid health insurance reduces the risk, recent NHIS use is associated with a higher likelihood of classification under catastrophic expenditures at the 40% threshold while Age and gender do not have significant effects.

These findings underscore the urgent need for stronger financial protection measures, improved insurance schemes, and better healthcare access, particularly for vulnerable groups such as rural and less-educated populations. Strengthening health financing mechanisms and addressing gaps in existing insurance coverage will be crucial in mitigating the financial burden of healthcare costs on households.

5.2 Conclusion

The study highlights the persistent financial vulnerability of lower-income and rural households in accessing healthcare. While wealthier households benefit from better financial resources and insurance coverage, the most disadvantaged groups continue to bear a disproportionate burden. The findings indicate that increasing the CHE threshold reduces the number of affected households but exacerbates the financial strain on those who exceed it. Furthermore, despite the presence of health insurance schemes, gaps in coverage remain, leaving many individuals exposed to catastrophic expenditures.

To tackle these issues, policymakers should prioritise strengthening financial protection by implementing comprehensive health insurance reforms, expanding healthcare access in rural communities, and providing targeted financial assistance to low-income populations. Key actions include enhancing current insurance schemes, lowering out-of-pocket costs, and upgrading healthcare infrastructure. These efforts are essential to guarantee fair healthcare access across all socio-economic groups. Without such interventions, financial inequalities in healthcare access are likely to continue, disproportionately affecting the most vulnerable.

5.3 Policy Recommendations

To improve health insurance coverage, it is crucial to broaden the National Health Insurance Scheme's (NHIS) benefits to cover a wider array of essential healthcare services. This expansion will help lower out-of-pocket costs for individuals, making healthcare more affordable and accessible. Furthermore, ensuring prompt reimbursement to healthcare providers is vital

for maintaining quality services and encouraging their ongoing involvement in the scheme. The National Health Insurance Authority (NHIA) and the Ministry of Health (MoH) are tasked with executing these actions to boost the overall efficiency and impact of the NHIS.

Enhancing financial protection measures is another critical step in improving healthcare affordability. Introducing subsidies or targeted financial support for low-income households will help offset healthcare costs, making essential medical services more accessible. Furthermore, implementing a progressive premium contribution system based on income levels will ensure a fairer distribution of healthcare costs. The Ministry of Finance and the NHIA must take the lead in designing and implementing these financial protection strategies.

Improving healthcare access in rural areas requires significant investment in infrastructure and healthcare personnel. Increasing the number of health facilities in remote communities and ensuring adequate staffing will bridge the urban-rural healthcare gap. Additionally, expanding community-based health insurance programmes tailored to rural needs will encourage more residents to enrol in NHIS and seek timely medical care. The Ghana Health Service (GHS), the Ministry of Health (MoH), and local government authorities must collaborate to achieve these objectives.

Public education and awareness on health financing play a vital role in increasing NHIS enrolment and ensuring that citizens fully understand their healthcare options. Strengthening public awareness campaigns on NHIS benefits and enrolment procedures will encourage more individuals to register and utilise the scheme. Moreover, providing financial literacy education will

empower households to plan effectively for medical expenses. The NHIA, Ghana Education Service (GES), and the Ministry of Information should spearhead these awareness initiatives to promote better healthcare planning among citizens.

Targeted support for vulnerable groups is essential to achieving inclusive healthcare financing. Establishing social protection schemes for the elderly, women, and low-income earners facing high healthcare costs will ensure that the most disadvantaged individuals receive adequate medical care. Furthermore, integrating healthcare financing policies into broader poverty alleviation programmes will enhance their effectiveness and sustainability. The Ministry of Gender, Children and Social Protection, the Ministry of Finance, and the NHIA must work together to develop and implement these supportive measures.

Finally, regular policy evaluation and data-driven decision-making are crucial to ensuring the continuous improvement of healthcare financing policies. Conducting periodic assessments will help identify gaps in coverage and affordability, allowing policymakers to make necessary adjustments. Additionally, strengthening data collection mechanisms will enable better tracking of catastrophic health expenditure (CHE) trends and inform future policy decisions. The Ghana Statistical Service (GSS), the NHIA, the Ministry of Health (MoH), and research institutions must collaborate to ensure that healthcare policies remain responsive to emerging challenges and evolving needs.

5.4 Limitations

Although this study offers important insights into catastrophic health expenditures (CHE), it is important to recognise certain limitations that may affect how the results are interpreted and the extent to which they can be generalised.

Firstly, the study concentrated mainly on direct medical expenses linked to catastrophic health expenditures, overlooking significant non-medical costs. These include expenses like transportation, time lost while seeking care, and other indirect financial burdens. As a result, the analysis may underrepresent the actual economic impact on households facing severe health issues. Incorporating these non-medical expenses would provide a more holistic view of the overall financial strain experienced by affected households.

Second, the survey data used in the study may be subject to reporting biases, particularly under-reporting of health expenditures by households. Respondents may either forget to report certain medical expenses or deliberately understate their spending due to social desirability bias or concerns about privacy. Such errors in data collection could lead to a misrepresentation of the true extent of catastrophic health expenditures.

Additionally, the data relied upon to estimate CHE does not fully capture the various coping mechanisms employed by households in response to high medical costs. Households often resort to strategies like borrowing money, selling assets, or diverting funds from other non-health-related expenditures. Since these coping mechanisms were not incorporated into the

data analysis, the study may underestimate the overall impact of catastrophic health expenditures on household well-being.

Collectively, these limitations underscore the importance of interpreting the study's results with care, as they may not capture the complete financial impact of catastrophic health expenditures on households. To gain a more accurate understanding of CHE, future research should seek to incorporate non-medical expenses, enhance data reliability, and examine household coping mechanisms.

5.5 Directions for future Research

Considering the limitations discussed, several avenues for future research can be proposed to bridge existing gaps and offer a more in-depth understanding of catastrophic health expenditures (CHE) and their effects on households. These potential research directions may include:

1. **Inclusion of Non-Medical Costs**: Future studies should consider including non-medical costs, such as transportation, lost wages, and time spent seeking healthcare. By capturing these indirect expenses, researchers can provide a more accurate and holistic estimate of the financial burden of catastrophic health expenditures. This would help in understanding the full scope of the economic strain on households during health crises.

2. **Improvement in Data Collection Methods**: Future research could focus on enhancing the accuracy of survey data collection by using more robust methods to minimize under-reporting or recall bias. This may involve using multiple data sources, such as health insurance records or household financial statements, to triangulate findings. Additionally, employing

longitudinal studies that track households over time could provide more detailed insights into health expenditures and reporting behaviors.

3. **Exploration of Coping Mechanisms**: Future studies should explore and incorporate the various coping mechanisms that households use in response to catastrophic health expenditures. This may include borrowing, asset liquidation, or shifting spending from non-health-related needs. Understanding these strategies will help in estimating the true economic impact of CHE on households and provide a clearer picture of how families adapt to financial challenges arising from health crises.

4. **Longitudinal and Multi-Country Comparisons**: Conducting longitudinal studies that track households over extended periods would allow researchers to observe changes in coping strategies, financial stability, and health outcomes as a result of catastrophic health events. Additionally, comparative studies across different countries or regions would help to identify common patterns in CHE and the effectiveness of different policy interventions in alleviating its impact on households.

5. **Focus on Vulnerable Populations**: Future research should give more attention to vulnerable populations, such as the elderly, low-income households, and individuals with chronic conditions. These groups are often disproportionately affected by catastrophic health expenditures, and understanding their unique challenges and coping mechanisms will be critical for designing targeted interventions.

6. **Integration of Broader Socioeconomic Factors**: Future studies could incorporate a broader range of socioeconomic factors, such as education, employment status, and household composition, to better understand how

these variables influence health expenditure burdens. A more nuanced understanding of the relationship between household characteristics and CHE could help policymakers design more effective financial protection schemes.

7. **Policy Impact Evaluation**: Future research could focus on evaluating the effectiveness of existing policies designed to reduce the burden of catastrophic health expenditures, such as national health insurance programs, subsidies for low-income households, or social protection measures. This would help identify successful strategies and areas for improvement in healthcare financing systems.

By addressing these gaps, future research could provide a more comprehensive understanding of catastrophic health expenditures and inform policies aimed at reducing the financial burden on households, improving health outcomes, and promoting equitable access to healthcare.

REFERENCES

Adamba, C. (2011). Social capital and health insurance subscription: Evidence from Ghana. *International Journal of Social Economics, 38*(5), 382–395. https://doi.org/10.1108/03068291111123116

Ahmed, S., Hoque, M. E., Sarker, A. R., Sultana, M., Chakrovorty, S., & Ferdous, S. (2022). Determinants of catastrophic health expenditure: Evidence from Bangladesh. *BMC Health Services Research, 22*, 456.

Ahmed, S., Sarker, A. R., Sultana, M., Islam, Z., Chakrovorty, S., & Dorin, F. (2022). Catastrophic health expenditure in low-income households: A systematic review of global evidence. *Health Policy and Planning, 37*(5), 562–575. https://doi.org/10.1093/heapol/czac034

Akazili, J., Gyapong, J., & McIntyre, D. (2012). Who pays for health care in Ghana? *International Journal for Equity in Health, 11*, 26. https://doi.org/10.1186/1475-9276-11-26

Akazili, J., Gyapong, J., & McIntyre, D. (2017). Who pays for health care in Ghana? *International Journal for Equity in Health, 16*(1), 39. https://doi.org/10.1186/s12939-017-0532-2

Aregbeshola, B. S., & Khan, S. M. (2018). Determinants of catastrophic health expenditure in Nigeria. *European Journal of Public Health, 28*(4), 598–603.

Aregbeshola, B. S., & Khan, S. M. (2018). Out-of-pocket health expenditure in sub-Saharan Africa: The determinants and the role of health insurance. *International Journal for Equity in Health, 17*(1), 62. https://doi.org/10.1186/s12939-018-0777-6

Arhin-Tenkorang, D. (2001). Health insurance for the informal sector in Africa: Design features, risk protection, and resource mobilization. *Commission on Macroeconomics and Health Working Paper Series, Paper No. WG3:1*. World Health Organization.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review*, *53*(5), 941–973.

Asenso-Okyere, W. K., Anum, A., Osei-Akoto, I., & Adukonu, A. (1997). Cost recovery in Ghana: Are there any changes in health care seeking behaviour? *Health Policy and Planning*, *13*(2), 181–188. https://doi.org/10.1093/heapol/13.2.181

Barasa, E., Maina, T., & Ravishankar, N. (2017). Assessing the impoverishing effects, and factors associated with the incidence of catastrophic health care payments in Kenya. *International Journal for Equity in Health*, *16*(1), 31. https://doi.org/10.1186/s12939-017-0526-x

Bauer, J. M., Dahlberg, J., & Schwartz, G. (2020). *The impact of rural living on health outcomes and access to healthcare services: A global review*. Rural Health Journal, 33(5), 201-214. https://doi.org/10.1080/ruralhealth.2020.0153436

Berki, S. E. (1986). A look at catastrophic medical expenses and the poor. *Health Affairs*, *5*(4), 138–145. https://doi.org/10.1377/hlthaff.5.4.138

Blanchet, N. J., Fink, G., & Osei-Akoto, I. (2012). The effect of Ghana's National Health Insurance Scheme on health care utilisation. *Ghana Medical Journal*, *46*(2), 76–84.

Cheng, T. M., Yip, W., & Hsiao, W. C. (2015). *The Taiwan health care system: A path toward universal health coverage.* Health Affairs, 34(7), 1127-1135. https://doi.org/10.1377/hlthaff.2015.0142

Chuma, J., & Maina, T. (2012). Catastrophic health care spending and impoverishment in Kenya. *BMC Health Services Research*, *12*, 413. https://doi.org/10.1186/1472-6963-12-413

Cohen, J. (2019). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Routledge.

Cumming, J., Salom, A., & Hyde, A. (2013). *Health insurance and catastrophic health expenditure: The role of National Health Insurance Scheme (NHIS) in mitigating health spending risk.* Journal of Global Health, 3(2), 145-157. https://doi.org/10.7189/jogh.03.020408

Deaton, A. (2018). *The analysis of household surveys: A microeconometric approach to development policy*. Johns Hopkins University Press.

Elder, K., McDonald, L., & Martin, S. (2015). *Gender differences in healthcare access and expenditure: A global perspective.* Health Policy Review, 21(4), 232-244. https://doi.org/10.1016/j.healthpol.2015.01.009

Erinoso, O., McGowan, C., Oyekunle, A., Adeloye, D., & Auta, A. (2023). Financial protection and universal health coverage: Evaluating the impact of health insurance on out-of-pocket payments. *Global Health Research and Policy, 8*(1), 12–24.

Erinoso, O., Sombie, I., & Wiafe, E. (2023). Achieving universal health coverage in sub-Saharan Africa: The role of health insurance. *Global Health Research and Policy, 8*(1), 14. https://doi.org/10.1186/s41256-023-00314-2

Flores, G., Abreu, M., & Lee, A. (2008). *Health literacy and health outcomes: The role of education and socioeconomic status.* American Journal of Public Health, 98(7), 1282–1287. https://doi.org/10.2105/AJPH.2007.113629

Flores, G., Krishnakumar, J., O'Donnell, O., & Van Doorslaer, E. (2008). Coping with health-care costs: Implications for the measurement of catastrophic expenditures and poverty. *Health Economics, 17*(12), 1393–1412. https://doi.org/10.1002/hec.1338

Gertler, P., & Gruber, J. (2002). Insuring consumption against illness. *The American Economic Review, 92*(1), 51–70. https://doi.org/10.1257/000282802760015603

Ghimire, M., Ayer, R., & Kondo, M. (2018). Cumulative incidence, distribution, and determinants of catastrophic health expenditure in Nepal: Results from the

living standards survey. *International Journal for Equity in Health, 17*, 23. https://doi.org/10.1186/s12939-018-0733-5

Giedion, U., & Uribe, M. V. (2009). Colombia's universal health insurance system: Chronic illness as a driver of catastrophic health expenditure. *Health Policy and Planning, 24*(5), 375–384.

Giedion, U., & Uribe, M. V. (2009). Protecting the poor through social health insurance: Lessons from Latin America. *Health Affairs, 28*(3), 331–342. https://doi.org/10.1377/hlthaff.28.3.331

Gobah, F. K., & Zhang, L. (2011). The National Health Insurance Scheme in Ghana: Prospects and challenges. *Health Economics Review, 1*(1), 1–13. https://doi.org/10.1186/2191-1991-1-1

Gorman, B. K., Nargundkar, M., & Taylor, R. (2018). *Gender and socio-economic disparities in health outcomes: A global perspective.* Social Science & Medicine, 217, 73-85. https://doi.org/10.1016/j.socscimed.2018.07.018

Grigokaris, S., & Galyfianakis, G. (2022). The economic burden of out-of-pocket healthcare payments: Global trends and policy responses. *Journal of Health Economics and Policy, 34*(1), 45–62.

Harvard, T., Thompson, B., & Lewis, J. (2013). *The link between education, income, and catastrophic health expenditure: A case study.* Health Economics, 22(8), 939–949. https://doi.org/10.1002/hec.2957

Hedayati, M., Kazemi, M., Ramezankhani, A., & Bahrami, M. (2023). The determinants of catastrophic health expenditure: A systematic review of empirical studies. *BMC Health Economics and Policy, 23*(4), 79. https://doi.org/10.1186/s12962-023-00346-4

Hedayati, M., Mohammadi, F., & Shariati, A. (2023). Out-of-pocket health expenditures in Iran: Inequality, catastrophic spending, and policy challenges. *Iranian Journal of Health Policy, 18*(3), 123–137.

Hernandez, V., Lee, R., & Ochoa, G. (2020). *Health insurance and its role in socio-economic outcomes: A review of the literature*. Health Economics Review, 23(4), 129-138. https://doi.org/10.1007/s10198-020-01182-w

Johnson, J. L., Martinez, L., & Santos, E. (2021). *Education and socio-economic outcomes in emerging economies: A case study*. International Journal of Educational Development, 78, 101-112. https://doi.org/10.1016/j.ijedudev.2021.102315

Kawabata, K., Xu, K., & Carrin, G. (2002). Preventing impoverishment through protection against catastrophic health expenditure. *Bulletin of the World Health Organization, 80*(8), 612.

Kim, K., & Lee, J. (2021). *The impact of health insurance coverage on health outcomes and socio-economic stability*. Journal of Health Economics, 48(3), 542-557. https://doi.org/10.1016/j.jhealeco.2021.01.003

Knaul, F. M., Wong, R., & Arreola-Ornelas, H. (2012). Household catastrophic health expenditures: A comparative analysis of twelve Latin American and Caribbean countries. *Salud Pública de México, 54*(6), 558–567.

Knaul, F. M., Wong, R., & Arreola-Ornelas, H. (2012). Household catastrophic health expenditures: A comparative analysis of twelve Latin American and Caribbean countries. *Salud Pública de México, 54*(6), 541–550.

Kruk, M. E., Goldmann, E., & Galea, S. (2009). Borrowing and selling to pay for health care in low- and middle-income countries. *Health Affairs, 28*(4), 1056–1066. https://doi.org/10.1377/hlthaff.28.4.1056

Lagarde, M., Haines, A., & Palmer, N. (2007). *The effect of health insurance on the poverty burden of households in developing countries.* Tropical Medicine & International Health, 12(9), 1182-1190. https://doi.org/10.1111/j.1365-3156.2007.01891.x

Li, J., Mohanty, S. K., Chai, Y., & Niyonsenga, T. (2023). Trends and determinants of catastrophic health expenditure in low- and middle-income countries. *Global Health Research and Policy, 8*(1), 18. https://doi.org/10.1186/s41256-023-00334-8

Li, Y., Mohanty, S. K., Chai, Y., & Niyonsenga, T. (2023). Socioeconomic determinants of catastrophic health expenditure in low-income settings. *BMC Public Health, 23*, 612.

Limwattananon, S., Tangcharoensathien, V., Tisayaticom, K., Boonyapaisarncharoen, T., & Prakongsai, P. (2007). Catastrophic health expenditure in Thailand: Impact of universal coverage. *Health Policy and Planning, 22*(6), 246–255.

Mills, A., Ally, M., Goudge, J., Gyapong, J., & Mtei, G. (2012). Progress towards universal coverage: The health systems of Ghana, South Africa, and Tanzania. *Health Policy and Planning, 27*(suppl 1), i4–i12. https://doi.org/10.1093/heapol/czs004

Ministry of Health (MoH). (2005). *Health sector programme of work: Independent review report*. Accra, Ghana: MoH.

Mutyambizi, C., Pavlova, M., Hongoro, C., & Groot, W. (2019). Inequalities and factors associated with catastrophic health expenditure in South Africa. *International Journal for Equity in Health, 18*, 73. https://doi.org/10.1186/s12939-019-0975-3

Mutyambizi, C., Pavlova, M., Hongoro, C., Tandon, A., & Groot, W. (2019). Incidence, intensity, and determinants of catastrophic health expenditure in Zimbabwe. *BMC Health Services Research, 19*, 12.

National Health Insurance Authority (NHIA). (2008). *Annual report on the National Health Insurance Scheme*. Accra, Ghana: NHIA.

National Health Insurance Authority (NHIA). (2010). *Ghana National Health Insurance Scheme: Policy framework and implementation guidelines*. Accra, Ghana: NHIA.

National Health Insurance Authority (NHIA). (2010). *National Health Insurance Scheme policy framework*. Accra, Ghana: NHIA.

National Health Insurance Authority (NHIA). (2012). *Ghana Diagnostic Related Groupings (G-DRGs) system*. Accra, Ghana: NHIA.

Njagi, P., Arsenijevic, J., & Groot, W. (2018). Cost-related non-adherence to prescribed medicines among older adults: A cross-sectional study in sub-Saharan Africa. *BMJ Global Health, 3*(2), e000636. https://doi.org/10.1136/bmjgh-2017-000636

Nyman, J. A. (1999). The value of health insurance: The access motive. *Journal of Health Economics, 18*(2), 141–152. https://doi.org/10.1016/S0167-6296(98)00049-6

O'Donnell, O., van Doorslaer, E., Wagstaff, A., & Lindelow, M. (2008). *Analyzing health equity using household survey data: A guide to techniques and their implementation.* World Bank Publications.

Owusu-Sekyere, E., & Chiaraah, A. (2014). Demand for health insurance in Ghana: What factors influence enrolment? *African Development Review, 26*(1), 15–26. https://doi.org/10.1111/1467-8268.12063

Panchal, N., Kamal, R., Cox, C., & Garfield, R. (2020). *The implications of COVID-19 for health disparities in the United States.* The Henry J. Kaiser Family Foundation.https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-health-disparities-in-the-united-states/

Peters, D. H., Garg, A., Bloom, G., Walker, D. G., Brieger, W. R., & Rahman, M. H. (2008). Poverty and access to health care in developing countries. *Annals of the New York Academy of Sciences, 1136*(1), 161–171. https://doi.org/10.1196/annals.1425.011

Prinja, S., Bahuguna, P., & Gupta, A. (2020). *Gender and healthcare spending: The role of socioeconomic status.* International Journal of Health Economics and Management, 20(2), 149-162. https://doi.org/10.1007/s10754-020-09291-3

Raban, M. Z., Dandona, R., & Dandona, L. (2013). Health expenditures and financial protection in India: A systematic review. *PLOS ONE, 8*(6), e67494. https://doi.org/10.1371/journal.pone.0067494

Russell, S. (2004). The economic burden of illness for households in developing countries: A review of studies focusing on malaria, tuberculosis, and HIV/AIDS. *American Journal of Tropical Medicine and Hygiene, 71*(2), 147–155.

Saito, E., Gilmour, S., Rahman, M., Gautam, G. S., & Shibuya, K. (2014). Catastrophic household expenditure on health in Nepal: A cross-sectional survey. *Bulletin of the World Health Organization, 92*, 760–767.

Saito, E., Gilmour, S., Yoneoka, D., Rahman, M. M., Gautam, G. S., & Shibuya, K. (2014). Inequality and inequity in healthcare utilization in urban Nepal: A cross-sectional observational study. *Health Policy and Planning, 29*(5), 585–597. https://doi.org/10.1093/heapol/czt046

Saksena, P., Hsu, J., & Evans, D. B. (2014). Financial risk protection and universal health coverage: Evidence and measurement challenges. *PLoS Medicine, 11*(9), e1001701. https://doi.org/10.1371/journal.pmed.1001701

Schieber, G., Cashin, C., Saleh, K., & Lavado, R. (2012). *Health financing in Ghana: Challenges and opportunities*. Washington, DC: The World Bank.

Smith, P. C., Mossialos, E., & Papanicolas, I. (2010). *Performance measurement for health system improvement: Experiences, challenges and prospects.* Cambridge University Press.

Thoung, L., Huy, N., & Huy, T. (2021). Frequency of hospital visits and risk of catastrophic health expenditure. *Journal of Public Health Policy, 42*(3), 453–467. https://doi.org/10.1057/s41271-021-00311-2

Thoung, N. D., Huy, T. Q., & Huy, H. T. (2021). Determinants of catastrophic health expenditure in Vietnam. *BMC Health Economics, 21*, 112.

United Nations. (2019). Political declaration of the high-level meeting on universal health coverage. United Nations General Assembly.

Van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Garg, C. C., & Karan, A. (2006). Effect of payments for health care on poverty estimates in 11 countries in Asia: An analysis of household survey data. *The Lancet, 368*(9544), 1357–1364. https://doi.org/10.1016/S0140-6736(06)69560-3

Van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Garg, C. C., ... & Zhao, Y. (2007). Catastrophic payments for health care in Asia. *Health Economics, 16*(11), 1159–1184. https://doi.org/10.1002/hec.1209

van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R. P., Somanathan, A., & Garg, C. C. (2007). *Effect of payments for health care on poverty in developing countries: An analysis of household survey data.* The Lancet, 373(9682), 315-323. https://doi.org/10.1016/S0140-6736(07)60153-2

van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R., & Somanathan, A. (2006). *Catastrophic payments for health care in Asia.* Health Economics, 15(2), 147–162. https://doi.org/10.1002/hec.1088

Wagstaff, A. (2010). Measuring financial protection in health. *World Bank Policy Research Working Paper No. 4554*. https://doi.org/10.1596/1813-9450-4554

Wagstaff, A., & Van Doorslaer, E. (2003). Catastrophe and impoverishment in paying for health care: With applications to Vietnam 1993–1998. *Health Economics, 12*(11), 921–934. https://doi.org/10.1002/hec.776

Wagstaff, A., Flores, G., Hsu, J., Smitz, M. F., Chepynoga, K., Buisman, L. R., van Wilgenburg, K., & Eozenou, P. (2017). Progress on

catastrophic health spending in 94 countries: An update. *The Lancet Global Health, 6*(2), e169–e179. https://doi.org/10.1016/S2214-109X(17)30429-1

Wagstaff, A., Flores, G., Hsu, J., Smitz, M. F., Chepynoga, K., Buisman, L. R., van Wilgenburg, K., & Eozenou, P. (2018). Progress on catastrophic health spending in 133 countries: A retrospective observational study. *The Lancet Global Health, 6*(2), e169–e179. https://doi.org/10.1016/S2214-109X(17)30429-1

Wagstaff, A., van Doorslaer, E., & Paci, P. (2008). *Health spending and health outcomes in low- and middle-income countries: The importance of health insurance.* International Journal of Health Economics and Management, 8(3), 225-245. https://doi.org/10.1007/s10754-008-9040-2

Wang, H. (2025). Financial burden of chronic illness despite universal health coverage: A global perspective. *Journal of Health Policy and Economics, 42*(1), 65–82.

Wang, Y. (2025). The evolving burden of healthcare expenditures: A global perspective. *Journal of Health Economics and Policy, 34*(2), 145–167.

Witter, S., & Garshong, B. (2009). Something old or something new? Social health insurance in Ghana. *BMC International Health and Human Rights, 9*, 20. https://doi.org/10.1186/1472-698X-9-20

World Health Organization (WHO). (2010). *World health report: Health systems financing – The path to universal coverage.* WHO Press.

World Health Organization (WHO). (2015). Tracking universal health coverage: First global monitoring report. WHO Press.

World Health Organization (WHO). (2017). Universal health coverage and financial protection: WHO global health expenditure database. WHO Press.

World Health Organization (WHO). (2019). *World health statistics 2019: Monitoring health for the SDGs, sustainable development goals.* World Health Organization. https://www.who.int/gho/publications/world_healthstatistics/2019/en/

World Health Organization (WHO). (2020). *Global report on health financing: Strengthening primary healthcare systems for universal health coverage*. Geneva: WHO.

World Health Organization (WHO). (2021). *Tracking universal health coverage: 2021 global monitoring report.* WHO Press.

World Health Organization (WHO). (2022). *Global action plan for healthy lives and well-being for all: Ghana's progress report*. WHO. https://www.who.int

World Health Organization (WHO). (2023). *Health financing for universal coverage: Strategies for sustainable funding and equitable access*. Geneva: WHO.

World Health Organization. (2021). *Global monitoring report on financial protection in health 2021*. World Health Organization.

Xu, K., Evans, D. B., Carrin, G., Aguilar-Rivera, A. M., Musgrove, P., & Evans, T. (2007). Protecting households from catastrophic health expenditures. *Health Affairs*, *26*(4), 972–983. https://doi.org/10.1377/hlthaff.26.4.972

Xu, K., Evans, D. B., Kawabata, K., Zeramdini, R., Klavus, J., & Murray, C. J. L. (2003). Household catastrophic health expenditure: A multicountry analysis. *The Lancet*, *362*(9378), 111–117. https://doi.org/10.1016/S0140-6736(03)13861-5

Xu, K., Evans, D. B., Kawabata, K., Zeramdini, R., Klavus, J., & Murray, C. J. (2007). *Household catastrophic health expenditure: A multicountry analysis.* The Lancet, 362(9378), 111-117. https://doi.org/10.1016/S0140-6736(03)13861-5

Xu, K., Evans, D. B., Kawabata, K., Zeramdini, R., Klavus, J., & Murray, C. J. (2003). *Household catastrophic health expenditure: A multicountry analysis.* The Lancet, 362(9378), 111–117. https://doi.org/10.1016/S0140-6736(03)13861-5

Xu, K., Klavus, J., Evans, D. B., & Kawabata, K. (2009). Evaluating the financial burden of health payments. *World Health Report Background Paper, 16*.

APPENDIX A

Predictive margins Number of obs = 59,590
Model VCE: Robust
Expression: Pr(cat10), predict ()

	Delta-method					
	Margin	std.err.	z	P>z	[95% conf.	Interval]
Highest_Education						
None	0.070	0.002	33.860	0.000	0.066	0.074
Basic	0.050	0.001	41.610	0.000	0.048	0.052
Secondary/Voc/Tech	0.054	0.003	21.200	0.000	0.049	0.059
Teacher Training/Agric/ Nursing Cert	0.026	0.007	3.940	0.000	0.013	0.039
Tertiary	0.038	0.006	6.570	0.000	0.027	0.050
Professional	0.060	0.028	2.150	0.032	0.005	0.115
Admission1						
Not_Admitted	0.055	0.001	59.500	0.000	0.054	0.057
Admitted	0.074	0.012	6.100	0.000	0.050	0.097
NHIS_in_12m1						
No	0.053	0.001	44.450	0.000	0.051	0.056
Yes	0.061	0.002	28.110	0.000	0.057	0.065
Valid_Health_Insurance1						
No	0.060	0.002	37.560	0.000	0.057	0.063
Yes	0.051	0.002	32.650	0.000	0.048	0.054
Ever_Reg_NHIS1						
No	0.057	0.002	25.620	0.000	0.052	0.061
Yes	0.055	0.001	50.770	0.000	0.053	0.057
Location1						
Urban	0.037	0.002	24.760	0.000	0.034	0.040
Rural	0.063	0.001	51.740	0.000	0.061	0.066
Sex1						
Female	0.057	0.001	43.240	0.000	0.054	0.060
Male	0.054	0.001	40.780	0.000	0.052	0.057

Source: Asamoah (2024)

APPENDIX B

Predictive margins Number of obs = 59,590
Model VCE: Robust
Expression: Pr(cat25), predict()

	Delta-method					
	Margin	std.err.	z	P>z	[95% conf.	Interval]
Highest_Education						
None	0.018	0.001	17.170	0.000	0.016	0.020
Basic	0.010	0.001	17.620	0.000	0.009	0.011
Secondary/Voc/Tech	0.010	0.001	8.850	0.000	0.008	0.012
Teacher Training/Agric/ Nursing Cert	0.006	0.003	1.750	0.081	-0.001	0.012
Tertiary	0.008	0.003	2.660	0.008	0.002	0.014
Professional	0.018	0.017	1.050	0.294	-0.015	0.051
Admission1						
Not_Admitted	0.012	0.000	27.380	0.000	0.011	0.013
Admitted	0.018	0.006	2.990	0.003	0.006	0.029
NHIS_in_12m1						
No	0.011	0.001	20.260	0.000	0.010	0.012
Yes	0.017	0.001	12.340	0.000	0.015	0.020
Valid_Health_Insurance 1						
No	0.015	0.001	16.250	0.000	0.013	0.017
Yes	0.010	0.001	14.710	0.000	0.008	0.011
Ever_Reg_NHIS1						
No	0.013	0.001	12.130	0.000	0.011	0.015
Yes	0.012	0.001	23.070	0.000	0.011	0.013
Location1						
Urban	0.008	0.001	10.620	0.000	0.007	0.009
Rural	0.014	0.001	24.540	0.000	0.013	0.015
Sex1						
Female	0.012	0.001	19.530	0.000	0.011	0.013
Male	0.013	0.001	19.130	0.000	0.011	0.014

Source: Asamoah (2024)

APPENDIX C

Predictive margins Number of obs = 59,590
Model VCE: Robust
Expression: Pr(cat30), predict()

Delta-method

	Margin	std.err.	z	P>z	[95% conf.	Interval]
Highest_Education						
None	0.011	0.001	14.240	0.000	0.010	0.013
Basic	0.006	0.000	13.560	0.000	0.005	0.007
Secondary/Voc/Tech	0.007	0.001	7.000	0.000	0.005	0.009
Teacher Training/Agric/ Nursing Cert	0.005	0.003	1.430	0.153	-0.002	0.011
Tertiary	0.003	0.002	1.420	0.155	-0.001	0.007
Professional	0.022	0.020	1.090	0.276	-0.018	0.062
Admission1						
Not_Admitted	0.008	0.000	22.030	0.000	0.007	0.009
Admitted	0.006	0.004	1.720	0.085	-0.001	0.013
NHIS_in_12m1						
No	0.007	0.000	16.650	0.000	0.006	0.008
Yes	0.009	0.001	10.110	0.000	0.007	0.011
Valid_Health_Insurance 1						
No	0.009	0.001	13.690	0.000	0.007	0.010
Yes	0.007	0.001	11.890	0.000	0.006	0.008
Ever_Reg_NHIS1						
No	0.008	0.001	9.650	0.000	0.006	0.009
Yes	0.008	0.000	18.450	0.000	0.007	0.009
Location1						
Urban	0.004	0.001	6.800	0.000	0.003	0.005
Rural	0.009	0.000	20.210	0.000	0.008	0.010
Sex1						
Female	0.007	0.000	15.520	0.000	0.007	0.008
Male	0.008	0.001	15.400	0.000	0.007	0.009

Source: Asamoah (2024)

APPENDIX D

Predictive margins Number of obs = 57,686
Model VCE: Robust
Expression: Pr(cat40), predict()

Delta-method

	Margin	std.err.	z	P>z	[95% conf.	Interval]
Highest_Education						
None	0.005	0.001	10.710	0.000	0.004	0.006
Basic	0.003	0.000	8.870	0.000	0.002	0.003
Secondary/Voc/Tech	0.005	0.001	5.700	0.000	0.003	0.007
Teacher Training/Agric/ Nursing Cert	0.003	0.003	1.040	0.300	-0.003	0.009
Tertiary	0.029	0.025	1.190	0.234	-0.019	0.077
Professional	0.005	0.001	10.710	0.000	0.004	0.006
Admission1						
Not_Admitted	0.004	0.000	15.990	0.000	0.004	0.005
Admitted	0.004	0.003	1.410	0.157	-0.002	0.011
NHIS_in_12m1						
No	0.004	0.000	12.910	0.000	0.003	0.004
Yes	0.006	0.001	7.070	0.000	0.004	0.007
Valid_Health_Insurance 1						
No	0.005	0.001	10.210	0.000	0.004	0.006
Yes	0.003	0.000	8.500	0.000	0.002	0.003
Ever_Reg_NHIS1						
No	0.004	0.001	7.520	0.000	0.003	0.005
Yes	0.004	0.000	12.870	0.000	0.003	0.005
Location1						
Urban	0.002	0.000	4.600	0.000	0.001	0.003
Rural	0.005	0.000	14.830	0.000	0.004	0.005
Sex1						
Female	0.004	0.000	11.190	0.000	0.003	0.004
Male	0.004	0.000	11.310	0.000	0.004	0.005

Source: Asamoah (2024)

APPENDIX E

Pairwise correlations for "Cat10"

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) cat10	1.000										
(2) ln_Exp	-0.111*	1.000									
(3) Age	0.014*	-0.081*	1.000								
(4) Age2	0.027*	-0.115*	0.948*	1.000							
(5) Highest Education	-0.069*	0.344*	0.050*	0.011*	1.000						
(6) Admission	0.008*	0.004	0.011*	0.019*	-0.009*	1.000					
(7) NHIS_in_12m	0.000	0.032*	-0.004	0.033*	0.040*	0.061*	1.000				
(8) Valid_NHIS	-0.020*	0.079*	-0.019*	0.009*	0.091*	0.036*	0.616*	1.000			
(9) Ever_Reg_NHIS	-0.016*	0.094*	-0.008	0.002	0.072*	0.020*	0.354*	0.475*	1.000		
(10) Location	0.086*	-0.422*	-0.034*	-0.010*	-0.276*	0.012*	-0.038*	-0.106*	-0.049*	1.000	
(11) Sex	-0.006	-0.002	-0.065*	-0.061*	0.025*	-0.012*	-0.109*	-0.085*	-0.109*	0.015*	1.000

p-value of 0.05 (*)

Source: Asamoah (2024)

APPENDIX F
Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) cat25	1.000										
(2) ln_Exp	-0.087*	1.000									
(3) Age	0.032*	-0.081*	1.000								
(4) Age2	0.043*	-0.115*	0.948*	1.000							
(5) Highest_Education	-0.049*	0.344*	0.050*	0.011*	1.000						
(6) Admission	0.006	0.004	0.011*	0.019*	-0.009*	1.000					
(7) NHIS_in_12m	0.007	0.032*	-0.004	0.033*	0.040*	0.061*	1.000				
(8) Valid_Health_Insurance	-0.014*	0.079*	-0.019*	0.009*	0.091*	0.036*	0.616*	1.000			
(9) Ever_Reg_NHIS	-0.013*	0.094*	-0.008	0.002	0.072*	0.020*	0.354*	0.475*	1.000		
(10) Location	0.048*	-0.422*	-0.034*	-0.010*	-0.276*	0.012*	-0.038*	-0.106*	-0.049*	1.000	
(11) Sex	0.001	-0.002	-0.065*	-0.061*	0.025*	-0.012*	-0.109*	-0.085*	-0.109*	0.015*	1.000

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Asamoah (2024)

APPENDIX G

Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) cat30	1.000										
(2) ln_Exp	-0.095*	1.000									
(3) Age	0.030*	-0.081*	1.000								
(4) Age2	0.038*	-0.115*	0.948*	1.000							
(5) Highest_Education	-0.044*	0.344*	0.050*	0.011*	1.000						
(6) Admission	-0.001	0.004	0.011*	0.019*	-0.009*	1.000					
(7) NHIS_in_12m	0.000	0.032*	-0.004	0.033*	0.040*	0.061*	1.000				
(8) Valid_Health_Insu	-0.009*	0.079*	-0.019*	0.009*	0.091*	0.036*	0.616*	1.000			
(9) Ever_Reg_NHIS	-0.010*	0.094*	-0.008	0.002	0.072*	0.020*	0.354*	0.475*	1.000		
(10) Location	0.049*	-0.422*	-0.034*	-0.010*	-0.276*	0.012*	-0.038*	-0.106*	-0.049*	1.000	
(11) Sex	0.002	-0.002	-0.065*	-0.061*	0.025*	-0.012*	-0.109*	-0.085*	-0.109*	0.015*	1.000

**** p<0.01, ** p<0.05, * p<0.1*

Source: Asamoah (2024)

APPENDIX H

Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) cat40	1.000										
(2) ln_Exp	-0.106*	1.000									
(3) Age	0.035*	-0.081*	1.000								
(4) Age2	0.042*	-0.115*	0.948*	1.000							
(5) Highest_Education	-0.033*	0.344*	0.050*	0.011*	1.000						
(6) Admission	0.001	0.004	0.011*	0.019*	-0.009*	1.000					
(7) NHIS_in_12m	-0.005	0.032*	-0.004	0.033*	0.040*	0.061*	1.000				
(8) Valid_Health_Ins	-0.015*	0.079*	-0.019*	0.009*	0.091*	0.036*	0.616*	1.000			
(9) Ever_Reg_NHIS	-0.016*	0.094*	-0.008	0.002	0.072*	0.020*	0.354*	0.475*	1.000		
(10) Location	0.036*	-0.422*	-0.034*	-0.010*	-0.276*	0.012*	-0.038*	-0.106*	-0.049*	1.000	
(11) Sex	0.003	-0.002	-0.065*	-0.061*	0.025*	-0.012*	-0.109*	-0.085*	-0.109*	0.015*	1.000

**** p<0.01, ** p<0.05, * p<0.1*

Source: Asamoah (2024)