EXAMINING THE EFFECTS OF UNDER-FIVE CHILD NUTRITIONAL STATUS ON HOUSEHOLD CATASTROPHIC HEALTH EXPENDITURES IN KENYA

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A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF ECONOMICS, UNIVERSITY OF NAIROBI IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE MASTER OF SCIENCE IN HEALTH ECONOMICS.

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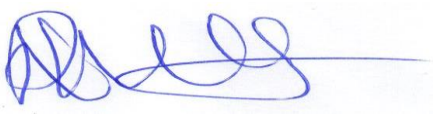
DECLARATION

This research project is my original work and has never been submitted for an award of a degree in any other university.

Signed:  **Date: 11/23/2023**

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This research project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

To my family, whose encouragement and understanding have been a source of strength throughout this academic journey, I dedicate this project to you. Your patience and belief in the importance of this research have been my driving force.

AKNOWLEDGEMENT

I thank my supervisor Proff. Urbanus Kioko for the expert guidance throughout the research period. To my colleagues, I am grateful for their understanding, encouragement, and stimulating discussions that have kept me motivated throughout the research process. Heartfelt thanks to my family for their unwavering support, patience, and understanding during the challenges and triumphs of this academic endeavor. Your belief in me has been a constant source of strength.

ABSTRACT

Malnutrition has been shown to have a significant impact on household health expenditures, leading to catastrophic health expenditures (CHE). Given the higher prevalence of under-five malnutrition in Kenya, there is a need for empirical research to examine the effects of malnutrition on household health expenditures in Kenya. This study thus studied the effects of under-five child nutritional status on household CHE in Kenya. The purpose of the study was to determine the impact of the household head's socioeconomic characteristics on the nutritional status of under-five children and household catastrophic health expenditures, as well as to analyze the nutritional status of under-five children in Kenya. Due to the binary nature of the variables, the logit model was used in this investigation. Secondary data from the 2018 Kenya Household Health Expenditure and Utilization Survey were used in the study. According to the study, stunting, wasting, and underweight among children under five are more common in rural than in urban regions. Second, the study found a strong correlation between the risk of incurring catastrophic medical costs and the under-five child nutritional status indicators (wasting, stunting, and underweight). Thirdly, the study revealed the influence of socioeconomic factors on household catastrophic health expenditures. Female-headed households faced higher healthcare burden and an increased risk of CHE. Based on the findings, there is generally a need for a multi-faceted approach that combines nutrition-focused interventions with healthcare system strengthening and social protection measures. By addressing the determinants of child malnutrition and improving healthcare affordability and access, the burden of catastrophic health expenditure can be mitigated, leading to improved child nutrition and overall well-being.

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LIST OF ABBREVIATIONS AND ACRONYMS

2 SD	Two Standard Deviations
BFCI	Baby-Friendly Community Initiative
CDF	Cumulative Density Function
CHE	Catastrophic Health Expenditures
CHS	Community Health Strategy
HAZ	Height-For-Age Z Score
HBM	Health Belief Model
IYCF	Infant and Young Child Feeding
KALRO	Kenya Agricultural and Livestock Research Organization
KDHS	Kenya Demographic Health Survey
KHHEUS	Kenya Household Health Expenditure and Utilization Survey
KM	Kilometers
LMICs	Low- and Middle-Income Countries
NSMNP	National School Meals and Nutrition Program
RUTF	Ready-to-Use Therapeutic Foods
SAM	Severe Acute Malnutrition
SPSS	Statistical package for Social Sciences
UNICEF	United Nations Children's Fund
WAZ	Weight-For-Age Z Score

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The 2018 Global Nutrition Report highlights malnutrition as a widespread issue, posing a universal challenge. The global concern of the double burden of malnutrition in children has become a significant public health challenge, particularly observable in regions like SEA, as illustrated in Figure 1.1. This visual depiction emphasizes the substantial percentage of children facing stunted growth, as brought to light by De Onis and Branc (2018). Alarming statistics from the (WHO) in 2017 reveal that over 155 million children suffer from stunted growth, 52 million experience wasting, and 41 million grapple with overweight challenges. The prevalence of stunting, wasting, and underweight conditions remains notably elevated among children under the age of five in (LMICs). Specifically, in 2018, the prevalence of stunting, a widely-utilized metric for malnutrition, surpassed 30% among children under five in South Asia and Sub-Saharan Africa. This rate is significantly higher compared to other WHO regions, such as Latin America and the Caribbean, where the prevalence is reported at 9% by the (UNICEF), (WHO), and World Bank (WB) in 2019. The persistence of these nutritional challenges underscores the urgent necessity for targeted interventions and global cooperation to address malnutrition and its diverse manifestations among young children.

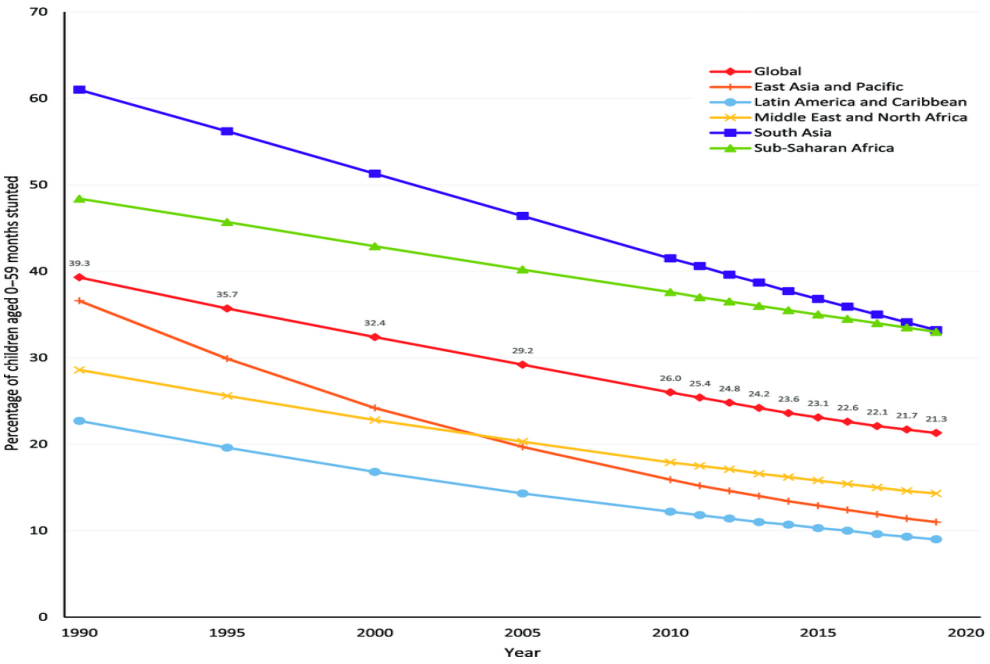

Figure 1.1: Global and Regional Trends in Stunting Prevalence, 1990-2019.

Despite some progress, stunting in under-five children in Africa remains high. According to the most recent report from UNICEF about the condition of children around the world, it is stated that stunting in under-five children in Africa has declined slightly but still remains high (UNICEF, 2021). As of 2021, approximately 36.6% of children aged below five in Africa were stunted, which is a decrease from 38.3% in 2000 (UNICEF, 2021). However, this number is still significantly higher than the global average of 22.2% in 2017. It was also approximated that 7.1% of children aged below five in Africa were affected by wasting in 2021 (UNICEF, 2021)

In Kenya, the hurdles of stunting, wasting, and underweight in children below the age of five endure, albeit with a noticeable reduction in their prevalence over time. The 2022 (KDHS) reveals a noteworthy decrease in cases of stunting, dropping from 26% in 2014 to 18% in 2022 (KDHS, 2022). Throughout this period, changes in the prevalence of wasting and overweight have been marginal, though both are reported to be at their lowest points since 1993. Wasting experienced a slight increase from 4% in 2014 to 5% in 2022, while overweight declined from 4% in 2014 to 3% in 2022 (as depicted in Figure 1.2).

The survey findings further emphasize disparities in child nutrition influenced by geographical and socio-economic factors. Children in rural areas exhibit a higher susceptibility to stunting, with a prevalence of 20%, in contrast to their urban counterparts at 12% (KDHS, 2022). Additionally, the prevalence of stunting tend to reduce as the wealth of household increases with the range of 9% for highest quantile and 28% for lowest quantile (KDHS, 2022). These insights underscore the crucial need for targeted interventions, particularly in rural and economically disadvantaged communities, to effectively address and alleviate the persistent challenges of child malnutrition in Kenya.

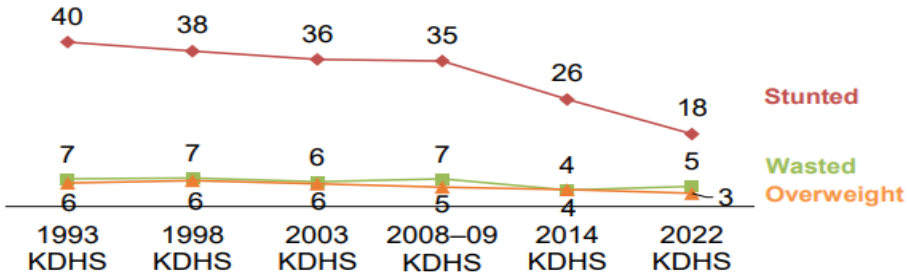

Figure 1.2: Percentage of children in Kenya under 5 who are malnourished

The KDHS (2022) report emphasizes the crucial role of maternal education in addressing malnutrition in children below five. Findings reveal a higher prevalence of malnutrition (22%) among children born to mothers with no education compared to those with mothers educated beyond the secondary level (9%). Regional disparities in malnutrition are evident, with Kilifi, West Pokot, and Samburu reporting the highest percentages (37%, 34%, and 31%, respectively), while Kisumu and Garissa report the lowest rates (9% each) (KDHS, 2022). These statistics underscore the persistent challenge of undernutrition in Kenya, posing a significant hurdle to achieving the country's goal of reducing stunting in under five by 40% by 2025. This highlights the urgent need for comprehensive measures to address malnutrition effectively.

In response to this challenge, the Kenyan government has implemented various interventions and policies. The expansion of the CHS is a key initiative, focusing on rural areas and emphasizing maternal and child health (Ministry of Health, 2018). The CHS program integrates nutrition interventions, including the promotion of exclusive breastfeeding, complementary feeding, and vitamin A supplementation. Additionally, the government has adopted RUTF to manage SAM among under-five children in health facilities nationwide (Ministry of Health, 2018). RUTF, a nutrient-rich paste, plays a crucial role in weight gain and recovery.

To improve overall nutrition, the government actively promotes the cultivation and consumption of biofortified crops, such as iron-rich beans, zinc-rich maize, and vitamin A-rich

sweet potatoes (KALRO, 2020). Collaborative efforts between the Ministry of Agriculture and the Kenya Agricultural and Livestock Research Organization (KALRO) aim to enhance the nutritional status of vulnerable groups, particularly children below the age of five. The National School Meals and Nutrition Program (NSMNP) further contributes by providing nutritious meals to primary schools in food-insecure arid and semi-arid regions, specifically targeting children in grades 1-3 (Ministry of Education, 2017). The inclusion of essential nutrients in these meals aims to improve the overall nutritional well-being of participating children.

In fostering ideal feeding practices for infant and young child, the government engages in collaborative efforts with development partners, exemplified by initiatives such as the Baby-Friendly Community Initiative (BFCI) and the Infant and Young Child Feeding (IYCF) program (UNICEF, 2019). These endeavors prioritize key practices, including exclusive breastfeeding for the initial six months, sustained breastfeeding, and appropriate complementary feeding. Moreover, the government of Kenya have several policies implemented aimed at ensuring proper nutrition.

One notable policy is the Breastfeeding Policy, launched in 2017 by the Ministry of Health, which endeavors to promote and safeguard breastfeeding through diverse strategies (Ministry of Health, 2017). This policy underscores the significance of breastfeeding in the early stages of a child's life. Another crucial guideline is the Kenya National Guidelines for Management of Acute Malnutrition, introduced in 2018. These guidelines provide comprehensive direction on preventing and treating acute malnutrition in children under five years (Ministry of Health, 2018). Together, these policies and initiatives form a concerted effort to enhance child nutrition and well-being in Kenya. Among the pertinent policies fostering holistic well-being, the Kenya National School Health Policy (Ministry of Education, 2018) plays a crucial role. This policy ensures a comprehensive approach to health within the school environment, emphasizing the importance of a healthy and nurturing setting for optimal child development. Additionally, the Kenya National Agriculture and Nutrition Action Plan (Ministry of Agriculture, Livestock, Fisheries, and Irrigation, 2018) represents a concerted effort to integrate agriculture and nutrition strategies. By aligning agricultural practices with nutritional goals, this plan addresses the multifaceted aspects of food production and consumption.

Moreover, the Kenya Food and Nutrition Security Policy and the Kenya Food Fortification and Micronutrient Policy (Ministry of Agriculture, 2019; Ministry of Health, 2019) collectively contribute to enhancing food security and nutritional quality. These policies prioritize measures to fortify food with essential micronutrients, ensuring a well-rounded approach to addressing nutritional challenges. A recent addition to this policy landscape is the Agricultural Policy - 2021 developed by the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives. This policy underscores the importance of sustainable agriculture, food security, and combatting malnutrition (Ministry of Agriculture, Livestock, Fisheries, and Cooperatives). It emphasizes the need for diverse and nutritious food production and consumption, access to clean water, and comprehensive nutrition education and awareness campaigns. Together, these policies reflect a comprehensive and integrated approach to promoting health and nutrition across various sectors in Kenya.

These interventions and policies demonstrate the government's commitment to addressing the issue of malnutrition and ensuring proper nutrition for the population. However, despite these efforts, malnutrition in children under five can have significant impacts on household health expenditures, leading to catastrophic health expenses, particularly affecting those who are economically disadvantaged, residing in rural areas, and headed by the elderly (Ndung'u et al., 2018). The consequences of catastrophic health expenditures on households include pushing them further into poverty, reducing essential spending on education, food, and clothing, and compelling households to forgo necessary healthcare services because of financial constraints (Mwabu et al., 2018).

Numerous studies have indicated that malnutrition in children under five can lead to increased healthcare costs and expenditures for households. A study conducted in Indonesia demonstrated that malnutrition in children under five heightened the likelihood of hospitalization and outpatient visits, leading to increased healthcare expenditures for households (Sari et al., 2016). Similarly, research in Bangladesh indicated that households with malnourished children under five years faced higher healthcare expenses compared to households with well-nourished children (Rabbani et al., 2019). In a parallel study in India, households with malnourished children not only incurred higher healthcare costs but were also more susceptible to experiencing CHE (Debnath et al., 2020).

In the African region, the challenge of under-five child malnutrition resulting in catastrophic health expenditures is particularly pronounced. While the pooled incidence initially decreased between 2000 and 2019, it subsequently increased between 2010–2014 and 2015–2019 (Figure 1.3). In Nigeria, for example, malnutrition in children under five was associated with heightened healthcare expenditures for households, with the cost of treatment being the most significant contributor to the overall healthcare expenditure (Uwemedimo et al., 2018). Similarly, in Uganda, households with malnourished under-five children experienced higher healthcare expenditures compared to households with well-nourished children, with the cost of treatment being the largest contributor to the total healthcare expenditure (Tumilowicz et al., 2017). In Ethiopia, it was established that malnutrition in children under five was linked to increased healthcare expenditures, often resulting in catastrophic health expenditures for households (Assefa et al., 2018).

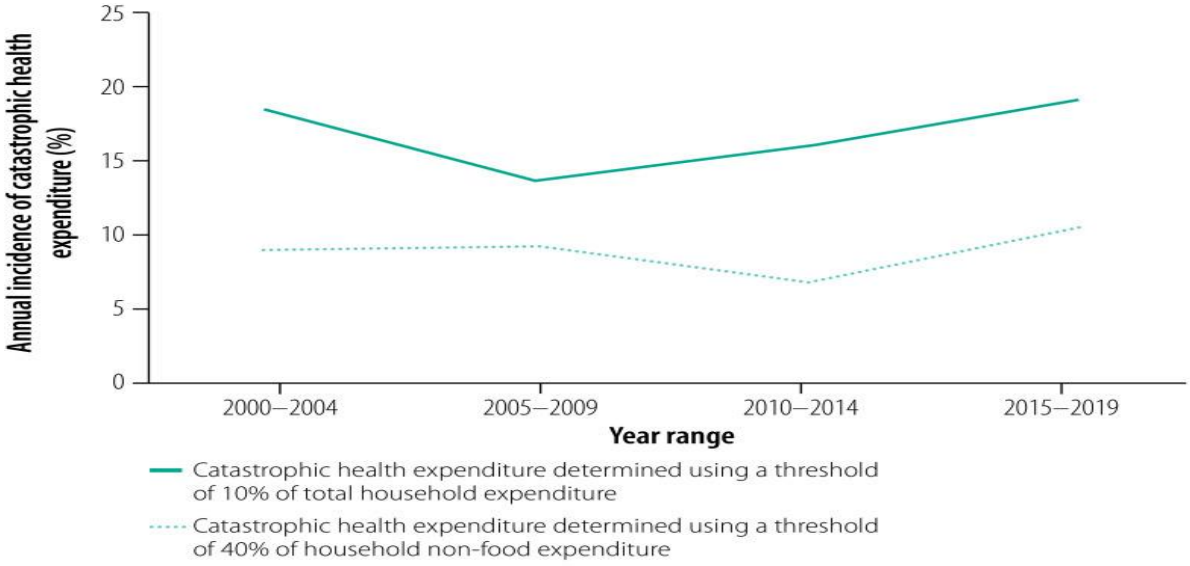

Figure 1.3: Trends in the incidence of catastrophic health expenditure in sub-Saharan Africa, 2000–2019

In Kenya, as in many African nations, the persistent challenge of malnutrition leading to catastrophic health expenditures remains a significant concern. According to Salari et al. (2019), a noteworthy 7.1% of Kenyan population in 2018 experienced CHE. The Kenya Health Accounts report further emphasizes the financial burden on households, revealing that 36.9% of the country's health expenditures in 2018, equivalent to 40% of the household budget, were attributed to out-of-pocket expenses (Ministry of Health, 2021). Analyzing data from the 2007

(KHHEUS), Chuma and Maina (2012) reported that 16% of the patients use cash to cater for their bills, reaching the threshold of 10% of the household budget. Notably, the poorest households faced a 66% higher likelihood of suffering CHE in comparison to their wealthier counterparts.

Examining the trend over time, the data illustrates a consistent rise in the percentage of households confronting CHE, as depicted in Figure 1.4. The graphical representation further underscores the disparities in healthcare spending between socioeconomic strata. In both 2007 and 2013, households with lower economic status allocated a greater proportion of their expenditure to healthcare services compared to wealthier households.

Additionally, Mutua et al. (2021) underscored the vulnerability of households with undernourished children to incurring catastrophic healthcare expenses, potentially leading to a descent into poverty. This emphasizes the interconnected challenges of malnutrition and healthcare affordability, highlighting the need for comprehensive interventions to address both aspects and alleviate the associated economic burdens on households.

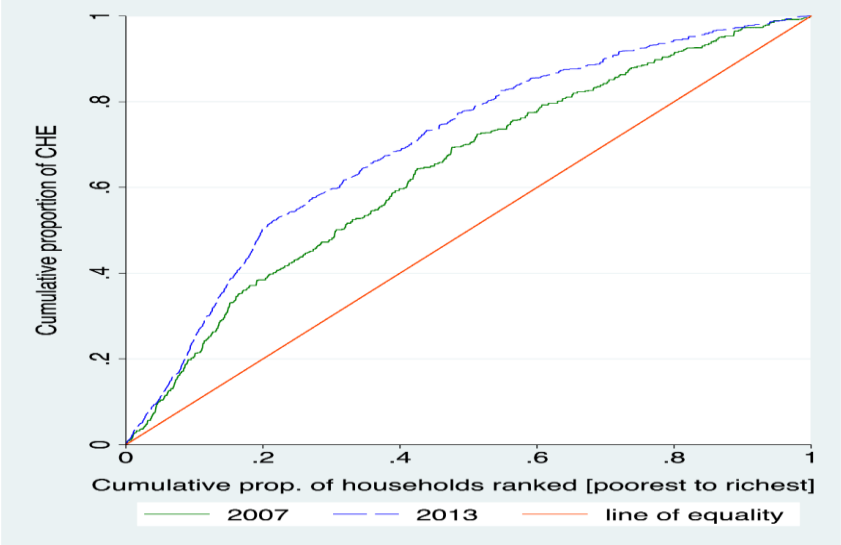

Figure 1.4: Concentration curves for catastrophic health expenditure, 2007 and 2013 in Kenya

Source: Njagi, Arsenijevic and Groot, (2020)

Catastrophic healthcare expenditures can have devastating consequences for households, pushing them into poverty, compromising essential spending on education, food, clothing, and

even forcing them to forgo necessary healthcare services due to financial constraints (WHO, 2019). It is crucial to examine how under-five nutrition status and catastrophic health expenditures in Kenya relate and identify effective policies and interventions to address this issue.

Socioeconomic factors have been identified to significantly shape household resources and priorities regarding child nutrition and healthcare (Nube et al., 2019). Higher income levels have been linked to lower risk of CHE since it allows households have better financial capacity to absorb healthcare costs (Kruk et al., 2019). Education level influences catastrophic health expenditures, with higher education leading to improved health knowledge and informed healthcare decisions (Lu et al., 2019). Occupation type and employment status can impact catastrophic health expenditures, as formal employment often provides access to health insurance or employer-sponsored healthcare coverage (Ghiasvand et al., 2019). Household wealth index, reflecting economic status, is linked positively with lower risk of CHE, as wealthier households have more financial buffers (Dong et al., 2021). Health insurance coverage lowers significantly the likelihood of facing CHE (Wagstaff et al., 2018). Moreover, urban residence is often linked with a reduced risk of catastrophic health expenditures due to better access to healthcare facilities and insurance coverage (Witter et al., 2020). Given the importance of socioeconomic factors in influencing catastrophic health expenditures, this study aimed to assess the effects of socioeconomic factors of the household head on household catastrophic health expenditure.

1.2 Problem Statement

Statistics show that, 18% of children below five years are stunted , 5% are wasted, and 3% were overweight. This indicates a high prevalence of malnutrition, particularly chronic malnutrition among children in Kenya (UNICEF, 2019). These high rates of malnutrition are worrisome, given the well-documented negative effects of malnutrition on child health and development. Furthermore, these statistics suggest that achieving Kenya's goal of reducing stunting among children under five by 40% by 2025 may be challenging.

Malnutrition has been shown to significantly impact household spending on health, leading to CHE that can have negative consequences on households. Households with under-five children are particularly vulnerable to CHE due to the high costs of healthcare and the frequent need

for medical attention (Abuya et al., 2018). According to a report by the World Bank (2019), 5.5% of Kenyan households experienced catastrophic health expenditure in 2018, with health expenditure pushing them below the poverty line. This is consistent with findings Mutua et al. (2021) study, that 18% of Kenya's households had catastrophic health expenditures, with 64% of these due to outpatient care. Furthermore, the study showed that households with undernourished children were more vulnerable to experiencing catastrophic health expenditures compared to those with well-nourished children.

Previous studies have demonstrated that households with malnourished children were highly likely to experience CHE compared to those with well-nourished children. For instance, Ouma et al. (2018) found that households with malnourished children were more likely to experience CHE compared to those with well-nourished children. Additionally, Goudet et al. (2018) showed that households with malnourished children have a higher likelihood of facing CHE, with up to 60% of households in the study experiencing CHE. Furthermore, Mutua *et al.* (2017) reported that malnutrition was significantly associated with higher healthcare costs among households with under-five children. Households with malnourished children spent approximately 40% more on healthcare compared to those with well-nourished children. Despite the significant health and economic implications of malnutrition and CHE in Kenya, there are limited empirical studies that have examined the relationship between under-five child nutritional status and household catastrophic health expenditures.

1.3 Research Objectives

This study sought to examine the effects of under-five child nutritional status on household catastrophic health expenditures in Kenya. Specifically, the study seeks to:

i. To assess the nutritional status of under-five children in Kenya.
ii. To establish the effects of socioeconomic factors of the household head on nutritional status of under-five children and household catastrophic health expenditure.
iii. To examine the relationship between under-five child nutritional status and household catastrophic health expenditures in Kenya.
iv. To identify effective policies and interventions to mitigate the impact of malnutrition on household catastrophic health expenditures in Kenya.

1.4 Research Questions

The study sought to answer the following research questions;

i. What is the nutritional status of under-five children in Kenya?
ii. How does socioeconomic factors of the household head affect nutritional status of under-five children and household catastrophic health expenditure?
iii. What is the relationship between under-five child nutritional status and household catastrophic health expenditures in Kenya?
iv. What are the effective policies and interventions to mitigate the impact of malnutrition on household catastrophic health expenditures in Kenya?

1.5 Significance of the study

Malnutrition contributes to a substantial economic burden, particularly for households with limited resources, through increased healthcare costs such as catastrophic health expenditures (Mutua *et al.,* 2017). Despite the significant health and economic implications of malnutrition and catastrophic health expenditures in Kenya, limited studies exist on the relationship between under-five child nutritional status and household catastrophic health expenditure.

WHO (2019) found that food insecurity was associated with higher rates of malnutrition among children, which in turn increases the probability of household CHEs. Wang'ombe et al. (2018) and Mutua et al. (2021) similarly found that child malnutrition was a significant predictor of CHE in Kenya. However, there may still be gaps in the literature that need to be addressed, such as the need for more recent data and a more comprehensive analysis of the factors that contribute to household catastrophic health expenditure in relation to under-five child malnutrition in Kenya. Therefore, by empirically examining the effects of under-five child nutritional status on household CHE in Kenya this study sought to fill this gap

Further, the study has significant implications for various stakeholders such as policymakers, healthcare planners, and academics. Firstly, policymakers and healthcare planners could benefit from the study's findings as it informs the development of interventions and policies aimed at lowering the incidence of under-five child malnutrition and household catastrophic health expenditure in Kenya. For instance, the study's results could help in designing programs

that promote proper nutrition and healthcare for children under five years, particularly those from vulnerable households.

It is also useful in informing policymakers on the much-needed nutrition investments and influence the relevant factors such as governments, development partners, donors to renew their commitments towards addressing under-five child undernutrition. Overall, the study's findings could potentially lead to improved health outcomes for under-five children in Kenya and help to lower the financial burden of healthcare on households.

1.6 Organization of the Study

The study project is divided into five chapters to provide a well-structured framework for the research. Chapter one introduces the research by presenting the background, problem statement, research objectives, research questions, and an overview of the study's organization. Chapter two focuses on conducting a literature review, which includes both theoretical and empirical review, providing a comprehensive understanding of the existing knowledge and identifying gaps in the literature. Chapter three outlines the research methodology, covering aspects such as the research model, sample and sampling techniques, data sources, variable measurement, and diagnostic tests. Chapter four presented study findings guided by research objective and finally chapter five presented summary of findings, conclusions drawn from the findings and recommendations made there-to.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Human Capital Theory

Gary Becker came up with the theory in (1962). He discussed set of skills needed to increase efficiency among employees and directly impact the process of production. According to the theory, desire for tangible and intangible assets like education, health, and skills is what drives human behavior. He examined the incentives for companies and workers to invest in education, training, and health, arguing that such investments are necessary to maximize a person's lifetime worth. The optimal time to invest in human capital is during one's prime working years. Although investing in these areas will reduce immediate earnings as a result of direct costs and lost opportunity of employment, it will ultimately increase net earnings in the future by boosting worker productivity (Becker, 1962).

The theory of human capital, first introduced by Becker in 1962, was later extended to addiction by Becker and Murphy in 1988. They proposed that addiction can be viewed as a rational strategy to maximize an individual's long-term utility. Bolin *et al.* (2002) applied this theory to examine the role of the family in healthcare demand. The family model emphasizes the interactions between family members and their contributions to maintaining overall health within the household. This model suggests that a person's ability to maintain good health depends not only on their personal income but also on the combined resources of their family. Although a person's family structure may change over time, their living arrangements can still have an impact on their decisions and actions regarding health.

Grossman (1972) formulated a new theory that was still grounded in the human capital theory but integrated medical care as an endogenous factor. In this approach, individuals invest in the health sector by utilizing healthcare services. Grossman (1972) illustrated that every individual has a combination of various goods and services that could generate value using a standard demand function. The premise is that individuals will optimize utility while taking into consideration various constraints, such as income. Hence, an individual's productivity and income increase in the future when they invest in their knowledge stock. The person will consequently be able to acquire more goods and services with their high earnings, increasing their utility. Furthermore, Grossman (2004) explains that aside from affecting productivity of

individuals, improvement in health also affects markets and household productivity. He suggests that good health increases the amount of time individuals and households can devote to production and reduces the need for caregivers to work overtime. Therefore, Grossman emphasizes the importance of considering health as an integral part of human capital and argues that investments in healthcare can have a significant impact on productivity and economic growth.

2.1.2 Health Belief Model

In the 1950s, HBM was introduced and has since been applied in various public health settings as an expectancy-value model (Rosenstock, 1974). The HBM is a psychological theory that suggests that the perception of an individual on the probability of goal achievement and the significance they attach to that goal are important factors in determining their behavior. The HBM posits that an individual is more inclined to take preventative action if they perceive a threat from an illness, which is indicated by how susceptible they are to disease, how severe the condition is, and what is perceived as benefits of taking preventive action outweighing any potential obstacles (Deshpande, Basil, & Basil, 2019). Burke (2010) argued that an individual's perception of their vulnerability to negative health outcomes is linked to their understanding of such vulnerability. The individual's knowledge and beliefs about their health directly influence their behavior and the outcomes of that behavior.

2.2 Empirical Review

Falconi and Bernabe (2018) conducted research on factors determining CHE in Peru, using data from the 2016 national household survey and applying the logistic regression model. Their findings indicated that households that were impoverished, had larger sizes, and resided in rural areas were more likely to experience CHE. In separate research, Das et al. (2018) investigated how malnutrition on household impacts expenditures in India. Data applied was from National Family Health Survey. Their findings showed that malnourishment in children under the age of five was linked to higher out-of-pocket healthcare expenses for families, particularly in rural regions. Additionally, malnourished children were likely to experience catastrophic health expenditures.

Wang et al. (2019) conducted research identifying factors that contribute to CHE in Chinese households. It revealed that older adults, low-income households, and households lacking

health insurance had a higher likelihood of experiencing CHE. It was also found that education and area of residence affects vulnerability to CHE.

Dofonsou et al. (2018) conducted a study in Benin that sought to establish what factors are linked to catastrophic health expenditure. The research revealed that households with lower income, larger family sizes, and residing in rural areas were more susceptible to CHE. However, households with formal employment and health insurance coverage had a lower chance of experiencing CHE. Meanwhile, Mariana et al. (2018) conducted a study in Brazil to explore the factors that determine CHE. It was evident that households with lower income, larger family sizes, and living in rural areas were more prone to CHE. However, the research also found that households with higher education levels and health insurance coverage had lower chances of experiencing CHE.

Research by Goryakin et al. (2018) in Russia sought to establish the factors contributing to catastrophic health expenditures. The research revealed that low-income households, larger family sizes, and those living in the rural have higher likelihood of experiencing CHE, while highly educated households and with health insurance coverage had higher chance of facing CHE. In Nigeria, Adisa (2015) conducted a study on poorly insured elderly households and the determinants of CHE. By utilizing data from the Nigeria General Household Survey of 2010, the study concluded that urban elderly households with higher educational qualifications and without health cover had a higher likelihood of incurring CHE. Furthermore, the study found that households with higher income, female-headed households, and those with larger family sizes have lower likelihood to experience higher CHE in urban areas. A study in Nigeria conducted by Aregbeshola and Khan (2018) aimed to determine he factors that are linked to CHE. Dat aused in the study was from 2009/10 HNLSS and applied both bivariate and multivariate logistic regression analyses. The study revealed that individuals with secondary education or less, those with no health coverage, and those who visited private health facilities had higher odds of experiencing catastrophic health expenditures.

Mohamed et al. (2017) explored how malnutrition and poverty at the household level in Ethiopia are related. According to the study, households with malnourished children were low low-income in comparison to households with well-nourished children. Additionally, households with malnutrition were more likely to incur catastrophic healthcare expenditures.

Tadesse et al. (2019) conducted a similar study in Ethiopia on the factors linked to CHE. It was found that lowly educated, large sized families in the rural had more likelihood of experiencing CHE. The study also revealed that formal employment and health insurance coverage were associated with a lower likelihood of CHE.

Kimani et al. (2016) conducted a study in Kenya to investigate how improverishment is related to CHE. Data used in the study was from KHHEUS survey 2007. By utilizing descriptive and logistic regression techniques and applying the methodology of Xu (2005) and Wagstaff and van Doorslaer (2002), the study found that the poor were the most vulnerable to CHE. Also, a rise in income levels was linked to a decline in CHE risk, while an increase in poverty led to a higher chance of experiencing CHE.

Similarly, Buigut et al. (2015) study in Kenya to on factors that are related to CHE in slum communities, specifically the Viwandani, Korogocho, Dandora, and Mukuru, Obunga, and Nyalenda slums in Nairobi and Kisumu. The study indicated that likelihood of households experiencing CHE was reduced with the increase in number of working households and being a member of social safety program. However, the study also found that risk of CHE increased with seeking healthcare in either public or private hospital.

In another study in Kenya by Abuya *et al.* (2018), the authors link between malnutrition and catastrophic healthcare expenditures. The study revealed that households with under-five children who were malnourished had a higher likelihood of incurring catastrophic healthcare expenditures compared to their counterparts with well-nourished children. The study also found that malnutrition increased the likelihood of households experiencing poverty. Mutua *et al.* (2017) also examined the relationship between malnutrition and healthcare costs among households with under-five children. The study found that households with malnourished children incurred higher healthcare costs compared to those with well-nourished children.

2.3 Overview of the Literature Review

Reviewed literature explored various studies that investigate the factors that contribute to catastrophic health expenditures (CHE) in different countries. The studies used different methodologies and find that households with lower income, larger family sizes, and those living in rural areas are likely to experience CHE. Alternatively, households with higher levels

of education and those covered by health insurance had lower chances of incurring CHEs. Malnutrition is identified as a risk factor for CHE in some studies. Additionally, older adults, visiting a private health facility and not having insurance coverage are identified as risk factors for CHE in some studies. However, the reviewed literature failed to include the status of nutrition for under-five child as a determinant of CHE. The study aimed to fill this gap and estimate the effects of under-five nutritional child status on catastrophic health expenditures in Kenya.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter delineates the methodology employed to assess the influence of the nutritional status of children under the age of five on the incidence of catastrophic healthcare expenditures. Furthermore, it presents both the theoretical and analytical models employed for the evaluation of CHE.

3.1 Theoretical Model

Theoretically, there are two prevalent approaches are used to measure CHE. The first method, proposed by Wagstaff and Van Doorslaer (2002), is based on the household's budget share.

Xu *et al.* (2005) proposed a method for estimating catastrophic health expenditures. This method involves calculating the amount used for food (*fdes*), which is determined by dividing the expenditures on food (*hfde*) by their total expenditures (*Te*). It's important to note that the household's expenditures on food only include food consumed at home and do not account for food consumed outside the home, such as alcohol in hotels. According to Xu *et al*., (2005), estimation of catastrophic health expenditure can be expressed as:

$$fdes = \frac{hfde}{Te} \tag{1}$$

To compare households with different sizes and compositions, Xu *et al.* (2005) suggest developing an equivalence household size. This is computed using equation 2, where the superscript *s* is the correcting scale for the household expenditures.

$$Equivalence\ householf = householdsize^{s} \tag{2}$$

The equivalent household size is then used to calculate the equivalent expenditures on food (computed using equation 3).

$$Equivalent\ expenditures\ on\ food = \frac{fdes}{Equivalence\ householf} \tag{3}$$

According to Xu *et al.* (2005), a household's expenditure on health becomes catastrophic when the expenditure on health is either equal to or surpasses 40% of the total expenditures of the household. However, he noted that this can be adjusted depending on the situation of the

country in question. This study modelled the variable of the catastrophic expenditure equal or exceeding 40 percent of the total expenditures by the households.

3.2 Model Specification

To test study objective, the logit model was employed. The logit model is frequently utilized for modeling binary outcomes, such as the probability of an event occurring or not occurring (Cameron & Trivedi, 2005). In this instance, the logit model proves suitable for analyzing the effects of under-five child nutritional status on household health expenditures. It calculates the probability of a household experiencing catastrophic health expenditure (CHE) based on a set of explanatory variables.

The logit model can be expressed as follows:

$$Pr(Yi=1|X) = F(Xi\beta) \quad \ldots\ldots (4)$$

In this equation, Pr(Yi=1|X) is probability of a household experiencing CHE given a vector of regressors X. F(Xiβ) is the logistic cumulative distribution function (CDF) for the logit model, and Xiβ refers to the linear combination of independent variables with their respective coefficients.

The observed dependent variable Yi is a binary indicator variable that captures whether the household's health expenditure is above the catastrophic threshold or not. If Yi=0, then the household's health expenditure is below the threshold, while Yi=1 indicates that it is above or equal to the threshold.

To estimate the logit model, the log-likelihood function is used, which is expressed as:

$$Ln = \Sigma t=1^N [Yt \log(F(Xt\beta)) + (1-Yt) \log(1-F(Xt\beta))] \quad \ldots\ldots (5)$$

In equation (5), N represents the number of observations in the dataset, Yt is the binary dependent variable for observation t, Xt is the vector of explanatory variables for observation t, β denotes the parameter estimates, F(Xtβ) is the logistic CDF, and ln represents the natural logarithm.

The specific explanatory variables included in the logit model can be stated as follows: child nutritional status (stunting, wasting, and underweight), household size, insurance coverage,

household head gender, household head age, distance to the health facility, residence, and presence of chronic illness.

The logit model allows us to estimate the probability of a household experiencing CHE based on the child's nutritional status and other relevant factors. The coefficients obtained from the model provide information on the direction and significance of the relationships between the independent variables and the probability of CHE.

Therefore, the final econometric model is expressed as;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10}\varepsilon$$

Where:

Y = Ln(CHExi), the natural logarithm of catastrophic health expenditures for household i

X_1 = Stunting for household

X_2 = Wasting for household

X_3 = Underweight for household

X_4 = household size for household

X_5 = insurance cover for household

X_6 = household head gender for household

X_7 = household head age for household

X_8 =distance to the health facility for household

X_9 = residence for household

X_{10} =presence of chronic illness for household

β_0 is the intercept term

The term ε serves as the error term, accounting for unobserved factors influencing Y.

The model enables the estimation of the impact of each independent variable on the natural logarithm. The computations for this model were performed using the SPSS, and the results are presented in tables and figures.

3.3 Data Type and Sources

The (KDHS) was incorporated to furnish additional information that could complement the KHHEUS data. The KDHS collects data on various health and demographic indicators, including child health and nutrition. The survey provides detailed information on state of nutrition for children aged below 5 years, including indicators such as stunting, wasting, and underweight. This information was used to supplement the data on child nutritional status obtained from the KHHEUS. Additionally, the KDHS collects information on household income and expenditures, which can be used to validate the information obtained from the KHHEUS on household expenditures and catastrophic health expenditures. By using data from both surveys, the study obtained a more comprehensive understanding of factors that determine CHE in Kenya including the effects of under-five child nutritional status.

3.4 Sample Size and Sampling Technique

The sampling technique employed in the KHHEUS 2018 survey involved selecting clusters as the primary sampling unit. Clusters typically encompass one or more enumeration areas and consist of approximately 100 households. For this particular survey, a total of 1,500 clusters were chosen, covering both urban and rural regions. Among these clusters, 577 were located in urban areas, while 923 were situated in rural regions. Out of which 31,655 households responded to the questionnaire representing a response rate of 95 percent. Therefore, the target population for our study was 31,655 households who participated in the survey. The households were distributed in all the 47 counties and were grouped as either urban or rural. By utilizing the KHHEUS 2018 survey data, this study can draw upon the extensive information collected from a large sample of households across the country. The dataset enabled the researcher to examine the relationship between under-five child nutritional status and household health expenditures at a national and county-level scale.

3.5 Measurements of Variables

Table 3.1: Variables, Measurements, and Expected Signs

Variable	Definitions and Measurement	Expected Effects
Catastrophic health expenditure	Household's expenditure on health becomes catastrophic if it is more than 40% of total household expenditure. The nature of the data is binary, coded as 1 if catastrophic expenditures, 0 otherwise	
Independent variables		
Under-five Child Nutritional status (Stunting)	Age z score was used to represent those kids with growth issues. This shows that the Kids had less than two SD from the mean. This shows that 1 was for growth issues and 0 was for otherwise *HAZ=* $\frac{Child's\ height\ (in\ centimeters) - Median\ height\ of\ reference\ population\ for\ same\ age\ and\ se}{Standard\ deviation\ of\ height\ for\ reference\ population\ for\ same\ age\ and\ sex}$	Negative/positive
Under-five Child Nutritional status (Wasting)	The weight-for-height index characterizes acute undernutrition. Children are deemed wasted if their z score is below minus two standard deviations (−2 SD) from the median of the reference population. Consequently, WHZ takes on a value of 1 if the child is wasted and 0 otherwise. *WHZ=* $\frac{Child's\ weight\ (in\ kilograms) - Median\ weight\ of\ reference\ population\ for\ the\ same\ height,a}{Standard\ deviation\ of\ weight\ for\ reference\ population\ for\ same\ age\ and\ sex}$	Negative/positive
Under-five Child Nutritional status (Underweight)	W/A was used to measure both weight and the height of the Kids. For those kids falling below 2 SD, it meant that they had both growth issues and height issues hence revealing that 1 was for kids with height and weight issues and 0 was for other cases *WAZ=* $\frac{Child's\ weight\ (in\ kilograms) - Median\ weight\ of\ reference\ population\ for\ the\ same\ age,and}{Standard\ deviation\ of\ height\ for\ reference\ population\ for\ same\ age\ and\ sex}$	Negative/positive
Household head gender	If male it takes 1, otherwise 0	Negative/positive
Household head Age	This is measured as a continuous variable in the study.	Negative/positive
Insurance cover	1f has insurance cover, takes 1 otherwise 0	Negative/positive
Household size	Total household members	Negative
Distance to the health facility	Distance in KM to nearest health provider	Negative/positive
Area of residence (rural/urban)	I if residing in urban and 0 if in rural or otherwise	Negative/positive
Presence of Chronic Illness	Captures if household member has chronic sickness. A disease is chronic if it lasts for 3 or more months. 1 if present, 0 otherwise	Positive

3.6 Diagnostic Tests

3.6.1 Multicollinearity Test

Addressing multicollinearity may involves removing one of the correlated variables, combining them, or using regularization techniques like ridge regression or lasso regression. It may be challenging to determine the actual relevance of each variable due to the exaggerated standard errors of the regression coefficients caused by this predictor connection. In this study, the test was conducted using VIF (Bergmann & Hohenboken, 2015).

3.6.2 Normality Test

This is method used to assess whether a given dataset follows a normal distribution, which is a symmetric, bell-shaped distribution characterized by the mean, median, and mode being equal. Normality is a crucial assumption for many statistical techniques, such as parametric hypothesis tests and regression analysis, as they often assume, data is from a population that follows a normal distribution. Shapiro-Wilk test was applied for this study.

3.6.3 Heteroskedastic Test

If either the Breusch-Pagan or White Test suggests the presence of heteroskedasticity, researchers may need to consider using heteroskedasticity-robust standard errors or explore transformations to stabilize the variance. Addressing heteroskedasticity is crucial for obtaining accurate and reliable statistical inferences from regression analysis (Sazali, Hashida, Jegak & Raduan, 2019).

3.6.4 Linearity Test

A linearity test examines whether independent variable(s) and the dependent variable have approximately linear relationship. The assumption of linearity is essential for many regression models, as they are based on the premise that changes in the independent variable(s) are associated with a constant change in the dependent variable. One way to assess linearity is by using Pearson's Product Moment Correlation Coefficient (r).

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

The primary aim was to investigate the impact of under-five child nutritional status on household catastrophic health expenditures in Kenya. Both descriptive and inferential statistics were employed for the quantitative data analysis, and the outcomes are visually represented through tables and figures.

4.2 Descriptive Analysis

In this section, the study provides a comprehensive analysis of the collected data, shedding light on the general characteristics of the selected respondents. The data collected primarily focuses on the under-five child nutritional status, including indicators such as stunting, wasting, and underweight. Additionally, other important variables were examined, namely household head gender, age of the household head, insurance coverage, household size, distance to the nearest health facility, area of residence (rural or urban), and the presence of chronic illness. By presenting and discussing the findings in subsequent sub-sections, a deeper understanding of the data is gained.

4.2.1 Nutritional Status of Under-Five Children in Kenya

The findings in Table 4.1 presents descriptive statistics on stunting, wasting and underweight.

Table 4.1: Prevalence of Stunting, Wasting and Underweight Among Under 5 in Kenya

		Stunting		**Total**
		Stunted	Not-Stunted	
Type of place of residence	Urban	1900	4853	6753
	Rural	2981	11849	14830
Total		4881	16702	21583
		Wasting		Total
		Wasted	Not-Wasted	
Type of place of residence	Urban	3602	3151	6753
	Rural	6925	7905	14830
Total		10527	11056	21583
		Underweight		Total
		Underweight	Not-Underweight	
Type of place of residence	Urban	2421	4332	6753
	Rural	3850	10980	14830
Total		6271	15312	21583

4.2.1.1 Stunting

From findings, a total of 21,639 children were surveyed from both rural and urban setups. Among the children included in the study, there were 4,881 in urban areas and 16,702 in rural areas. In urban areas, 1,900 (8.8%) were classified as stunted, while in rural areas, 2,981 (13.81%) were identified as stunted. These findings suggest high stunting prevalence in rural areas than in urban, with 13.81% of rural children being affected compared to 8.8% of urban children.

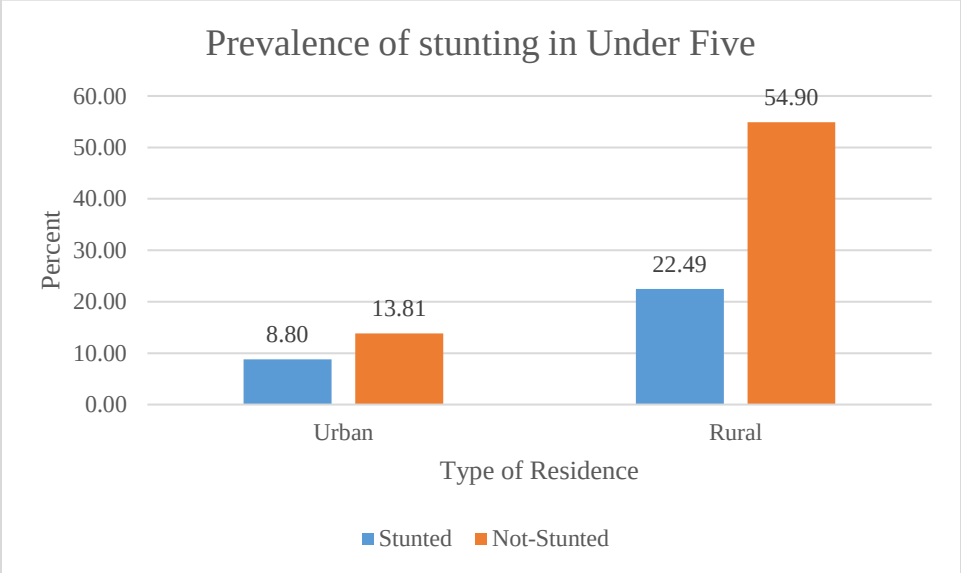

Figure 4.1: Prevalence of Stunting Among Under 5 in Kenya

4.2.1.2 Wasting

The study also assessed the prevalence of wasting in Kenya. In urban areas, 3,602 (16.69%) were classified as wasted, while in rural areas, 6,925 (32.09%) were identified as wasted. The findings indicate higher prevalence of wasting in rural areas at 32.09% in comparison to urban areas at 16.69%. Wasting has been associated with poor maternal education, limited healthcare access, and food insecurity. These factors are likely to be relevant to the wasting prevalence observed in rural areas of Kenya.

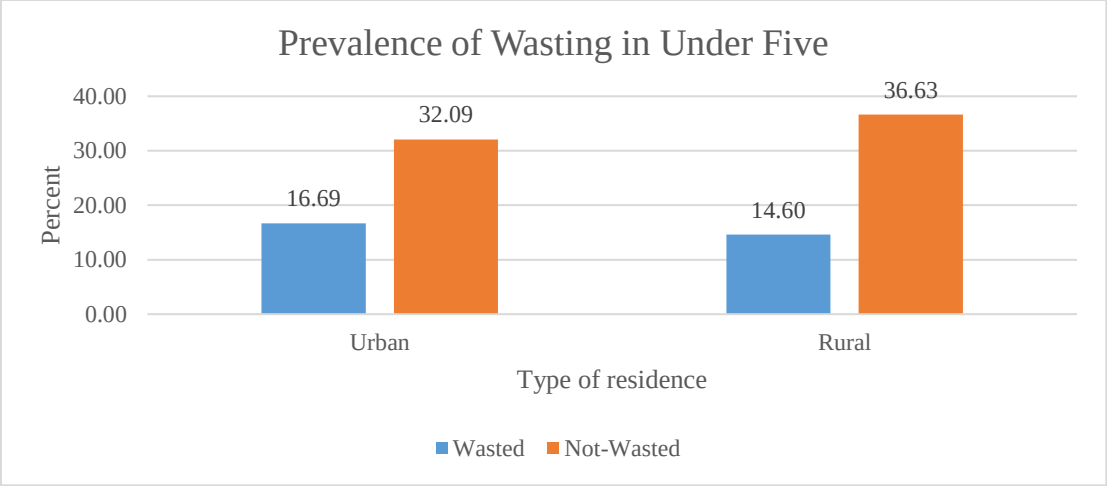

Figure 4.2: Prevalence of Wasting Among Under 5 in Kenya

4.2.1.3 Underweight

From figure 4.3, in urban areas, 2,421(11.22%) were classified as underweight, while in rural areas, 3,850 (17.84%) were identified as underweight. These findings indicate that underweight prevalence among under-five children is also a concern in both urban and rural areas of Kenya. In urban areas, 11.22% of under-five children were classified as underweight, while in rural areas, the prevalence was higher at 17.84%. Multifaceted nature of underweight among children in rural areas of Kenya, emphasizes the significance of factors such as maternal education, maternal nutrition, and access to healthcare services in mitigating underweight prevalence.

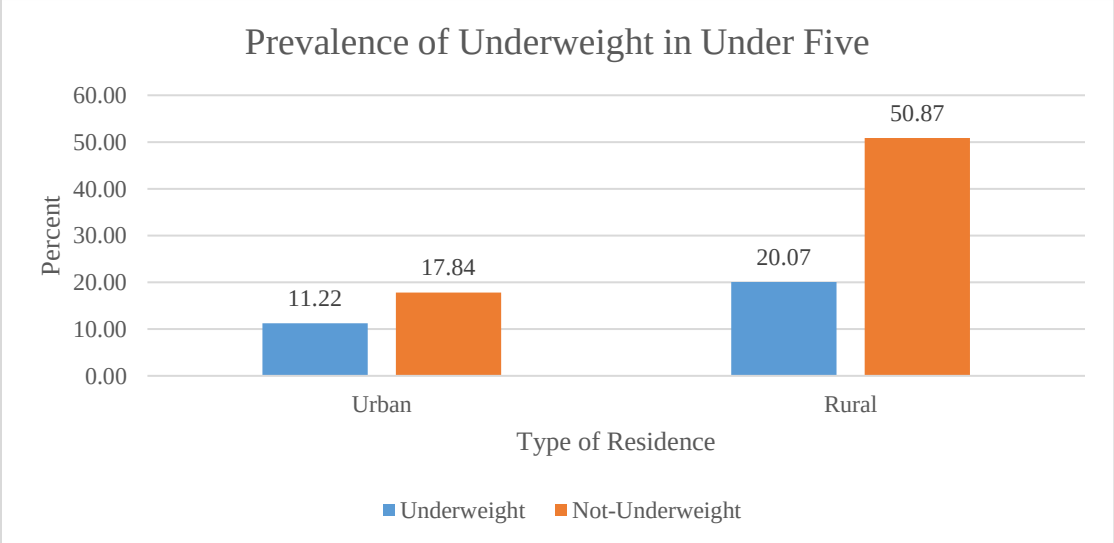

Figure 4.3: Prevalence of Underweight Among Under 5 in Kenya

4.2.2 Socioeconomic Factors of Household Heads

In order to comprehensively examine the relationship between under-five child nutritional status, and catastrophic health expenditure, it is essential to understand the general profile of household heads and the socioeconomic factors that may impact the health and well-being of under-five children. This section aims to provide an overview of the characteristics and socioeconomic factors of household heads, shedding light on their potential influence on child nutrition outcomes and healthcare expenditure. Table 4.4 presents the summary of findings.

Table 4.2: Descriptive Statistics (Socioeconomic factors of household heads)

		Frequency	Percent
Household head			
	Male headed	20968	66.2
	Female headed	10687	33.8
	Total	31655	100.0
Access to health insurance			
	No	24350	76.9
	Yes	7305	23.1
	Total	31655	100.0
Distance to health facility			
	Less than 1 KM	2901	14.3
	1 - 3	9157	45.1
	4 - 5	2760	13.6
	6 - 9	1594	7.8
	10+	3900	19.2
	Total	20312	100.0
Residence			
	Rural	19855	62.7
	Urban	11800	37.3
	Total	31655	100.0
Presence of Chronic Illness			
	No Chronic Condition	24419	77.1
	Has Chronic Condition	7236	22.9
	Total	31655	100.0
Catastrophic Health Expenditure			
	Otherwise	2149	52.9
	Catastrophic Health Expenditure	1912	47.1
	Total	4061	100.0

Variable	N	Mean	Std. Deviation	Min.	Max.
Age in years	31655	48.38	18.354	20	99
Household Size	31655	4.46	2.505	1	30
Health Spending	4061	22563.6880	62854.77484	390.00	1248000.00
CHE (in %)	4061	45.3737	37.56051	.00	104.84

Household Head Gender

Among the total sample, 66.2% of the households are headed by males, while 33.8% are headed by females. Household head gender is a significant socioeconomic factor that influences household dynamics, decision-making processes, and resource allocation. Previous studies like that of Wagstaff et al., (2018) found gender disparities in health expenditures, with female-headed households often facing higher healthcare burdens and increased risk of CHE.

Access to Health Insurance

Among the total sample, 76.9% of households do not have health insurance coverage, while 23.1% have access to health insurance. Access to health insurance can significantly impact healthcare affordability and the risk of CHE. Insured households may have greater financial protection and reduced out-of-pocket payments, which can positively affect under-five child nutritional status. Kruk et al., (2019) in their study found that health insurance influences health outcome.

Distance to Health Facility

The findings reveals that that 14.3% of households are located within a distance of less than 1 kilometer, 45.1% are within a range of 1-3 kilometers, 13.6% are within 4-5 kilometers, 7.8% are within 6-9 kilometers, and 19.2% are located at a distance of 10 kilometers or more. Distance to the health facility is a critical determinant of healthcare access and utilization. Longer distances may pose challenges in accessing timely and appropriate healthcare services, potentially affecting under-five child nutritional status. Previous research by Gabrysch et al., (2019) identified geographical barriers, such as distance influence health results

Residence

Among the total sample, 62.7% of households resided in rural areas, while 37.3% resided in urban areas. Residence is an important socioeconomic factor that can influence healthcare access, availability of resources, and healthcare-seeking behavior. Rural households often face unique challenges, such as limited access to healthcare facilities and higher transportation costs, which can impact healthcare utilization and financial burden. Studies such as that of Akombi et al., (2019) have shown that rural residence is linked with high rates of CHE and

poorer child nutrition outcomes which is what this study seek to establish whether it's the case in Kenya.

Presence of Chronic Illness

From the findings in Table 4.4, 22.9% of households reported the presence of a chronic illness, while 77.1% do not have any chronic condition. The presence of chronic illness within households can significantly impact healthcare needs, healthcare-seeking behavior, and financial burden. Households with a member suffering from a chronic illness may be more vulnerable to catastrophic health expenditure and face challenges in maintaining optimal nutrition for under-five children. The study by has Wagstaff et al., (2018) showed that chronic illness within households is associated with increased healthcare expenditures.

Age in years

The mean age of the household heads in the sample is 48.4 years, with a standard deviation of 18.4. The age range varies from 20 to 99 years. These findings provide insights into the demographic composition of the households and the potential influence of age-related factors on health-seeking behavior and decision-making processes. Previous study by Smith (2017) highlighted the association between household head age and health expenditures, indicating that older household heads may be more vulnerable to financial burden due to increased healthcare needs.

Household Size

The average household size is 4.5, with a standard deviation of 2.5. The range of household size varies from 1 to 30 members. Household size is an important determinant of healthcare utilization and expenditure. Larger households may face greater financial strain in meeting healthcare needs for each member. Study by Lu et al., (2017) found that large sized households are linked to increased healthcare expenditures and higher risk of CHE.

Health Spending and Catastrophic Health Expenditure (CHE in %)

Among the subset of households with available data, the mean annual health spending was Ksh. 22,563.7. The minimum health spending observed was Ksh.390, while the maximum was

Ksh.1,248,000. Health spending provides insights into the specific financial resources allocated to healthcare within households. Higher health spending may indicate a greater emphasis on healthcare utilization and potential vulnerability to CHE. Further, the mean percentage of expenditure on health was 45.37% and the finding further showed that 47.1% of the households experienced catastrophic health expenditure.

4.3 Diagnostic Tests

4.3.1 Multicollinearity Test

This correlation among predictors can lead to inflated standard errors of the regression coefficients, making it difficult to assess the true significance of each variable. The Variance Inflation Factor (VIF) is a common diagnostic measure used to assess multicollinearity. From the results all variable had VIF which is less than 5 hence no Multicollinearity

Table 4.3: Multicollinearity Test Statistics

Variables	Collinearity Statistics	
	Tolerance	VIF
Stunting	.681	1.468
Wasting	.709	1.410
Underweight	.517	1.936
Gender	.984	1.016
Age in years	.866	1.154
Access to health insurance	.966	1.035
Household Size	.959	1.042
Distance to health facility	.989	1.011
Residence	.942	1.062
Presence of Chronic Illness	.896	1.116

4.3.2 Normality Test

This is a crucial assumption for many statistical techniques, such as parametric hypothesis tests and regression analysis, as they often assume that the data . The Shapiro-Wilk test is one of the statistical tests used for assessing normality. It is specifically designed for small to moderately sized samples. As shown in Table 4.6, the p-values were greater than 0.05 an indication that normality assumption has been met.

Table 4.4: Tests of Normality

	Shapiro-Wilk	
Variables	Statistic	Sig.
Stunting	.520	.478

Wasting	.636	.351
Underweight	.564	.452
Gender	.635	.361
Age in years	.969	.071
Access to health insurance	.520	.478
Household Size	.931	.120
Distance to health facility	.829	.299
Residence	.590	.432
Presence of Chronic Illness	.623	.392

4.3.3 Heteroskedastic Test

This research preferred the Breusch-Pagan test. The test is named after Trevor Breusch and Adrian Pagan, who introduced it (Sazali, Hashida, Jegak & Raduan, 2019). From the results, the Chi-squared = 1. 21487 has p-value of (0.1832) which is greater than 0.05 hence no heteroscedasticity.

Table 4.5: Breusch-Pagan

Ho: Constant variance			
Statistics	Df	Stat value	p-value
Chi-squared	10	1.21487	0.1832

4.3.4 Linearity Test

The assumption of linearity is essential for many regression models, as they are based on the premise that changes in the independent variable(s) are associated with a constant change in the dependent variable. As shown in Figure 4.4, there was a linear structure relationship with the dependent variable and the independent variables.

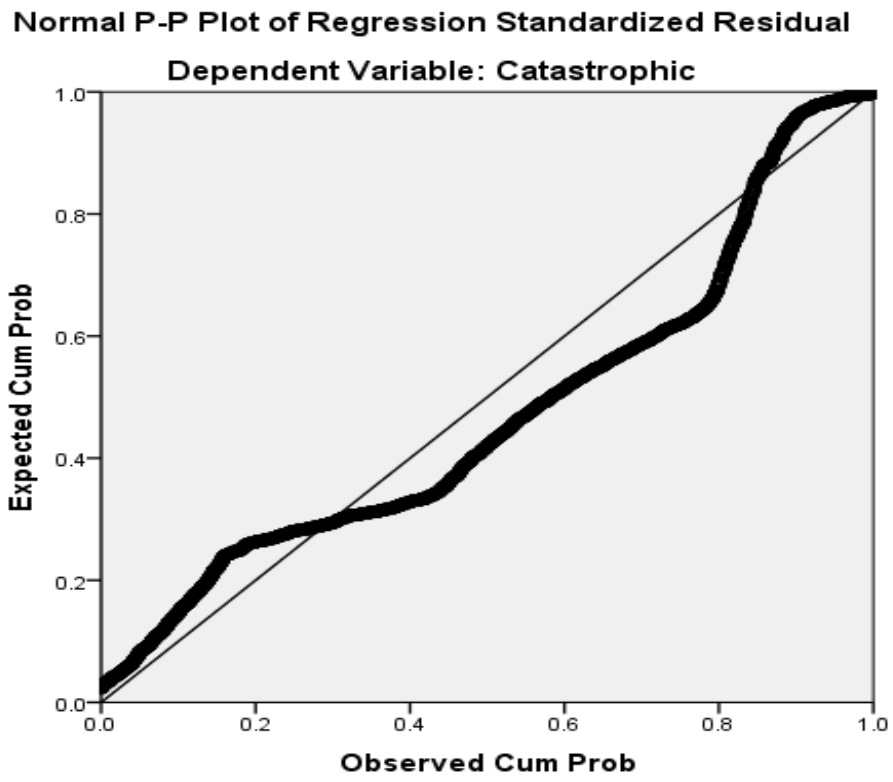

Figure 4.4: Scatter Plot for Linearity Test

4.4 Effects of Socioeconomic Factors and Nutritional Status of Under-Five Children on Household Catastrophic Health Expenditure

The -2 Log likelihood value serves as a metric for assessing how fit the model is, indicating how well the model aligns with the observed data. A lower -2 Log likelihood value generally suggests a more favorable fit, indicating that the model's predictions closely correspond to the actual outcomes. In this instance, the -2 Log likelihood value stands at 69.951, indicating a reasonably good fit of the model to the observed data on household catastrophic health expenditures.

The study's Cox & Snell R Square of 0.750 indicates that the independent variables account for 75% of the variability in the nutritional status of under-five children, which is the outcome variable.

With a Nagelkerke R Square of 0.638, the model's predictor variables can explain roughly 63.8% of the variation in household catastrophic health costs. Based on the included predictor variables, these R-squared values indicate that the model has a reasonable ability to predict and explain under five nutritional status. However, it is important to recognize that the nutritional status of children under five may be influenced by other factors or variables that were not taken into account in the model.

Table 4. 6: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	69.951[a]	.750	.638

It is essential to underscore that the significance values act as indicators of whether the coefficients bear statistical significance. A value below the chosen significance level (0.05) implies that the variable demonstrates a significant association with the outcome. In general, the probabilities of the outcome are higher when Exp(B) is more than 1, and they are lower when Exp(B) is less than 1. The degree of correlation between the predictor variable and the result is shown by the magnitude of the Exp(B) value.

The findings indicate that for each unit increase in the "Stunting" variable, the odds of experiencing CHE increase by 0.296 units (p-value = .021). Higher values of stunting correspond to a heightened likelihood of encountering catastrophic health expenditures. Regarding "Underweight," each unit increase in the variable is linked to a 0.229 unit increase in the odds of experiencing CHE (p-value = .021). Elevated values of "Underweight" signify an increased likelihood of facing CHE. Lastly, in "Wasting," each unit increase is associated with a 0.008 significant rise in the odds of experiencing CHE (p-value = .001). Higher values of "Wasting" indicate a slightly elevated likelihood of facing catastrophic health expenditures.

The results also highlight that females demonstrate significantly higher odds (p=0.048) of 0.163 units in experiencing catastrophic health expenditure compared to males, suggesting females have an elevated likelihood of facing CHE. Additionally, with each additional year in age, the odds of experiencing CHE significantly increase (p=0.001) by 0.208 units, indicating

that older individuals have a slightly higher likelihood of facing catastrophic health expenditures.

Moreover, having insurance coverage is significantly (p=0.020) associated with 0.23 lower odds of experiencing CHE compared to not having insurance. This implies that individuals lacking insurance are at a heightened risk of encountering catastrophic health expenditures. Additionally, with each incremental rise in household size, there is a noteworthy increase (p=0.000) of 0.084 units in the odds of experiencing catastrophic health expenditure. This indicates that larger household sizes are correlated with a slightly elevated likelihood of facing substantial health-related financial burdens.

The results also indicate that the likelihood of incurring catastrophic medical costs tends to grow with the distance to the health facility. A statistically significant correlation has been found between the distance to the facility (1-3 KM) and catastrophic health expense. The probability of suffering CHE increases by 0.067 units with increasing distance from the health facility, according to the positive coefficient for the 1-3 KM category (0.067), which is statistically significant at the 5% level (p = 0.000). In the same way, the positive coefficient (0.095) for the 4-5 KM category is statistically significant at the 5% level (0.015), meaning that the likelihood of encountering catastrophic health outcomes increases as one gets farther away from the medical institution within the range of 4 to 5 KM, the odds of experiencing catastrophic health expenditure increase by about 0.095 units. Additionally, the positive coefficient for the category 6-9 KM (0.293) is significant (p= 0.021), and for the category 10+ KM (0.274), it is significant (p= 0.007). This suggests that as the distance from the health facility increases beyond 10 KM, the odds of experiencing catastrophic health expenditure increase by 0.274 units.

The study uncovered that individuals living in rural areas face 0.477 times higher odds of encountering CHE (p-value = 0.025) compared to their urban counterparts, signifying an association between residing in a rural setting and an elevated likelihood of experiencing significant health-related financial burdens. In terms of chronic illness, the research indicated that individuals with a chronic condition have 0.400 times higher odds of undergoing CHE (p-value = 0.000) compared to those without a chronic illness, suggesting that the presence of a

chronic ailment amplifies the probability of facing substantial health-related financial challenges.

Table 4.7: Catastrophic Health Expenditure

Catastrophic health expenditure		B	S.E.	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Under-five Child Nutritional status	Stunting	.296*	.128	.021	.744	.579	.955
	Underweight	.229*	.099	.021	1.257	1.036	1.526
	Wasting	.008*	.002	.001	1.008	1.003	1.013
Gender	Male				1		
	Female	.163*	.082	.048	1.177	1.001	1.383
Age	Age in years	.208*	.002	.001	1.003	1.003	1.013
Have Insurance cover	No				1		
	Yes	-.230*	.099	.020	-1.259	1.037	1.528
Household size	HH_Size	-.084*	.017	.000	-.919	.889	.950
Distance to the health facility	Less than 1 KM			.001			
	1 - 3	.067*	.018	.000	.935	.903	.968
	4 - 5	.095*	.146	.015	.909	.682	1.211
	6 - 9	.293*	.128	.021	.746	.581	.958
	10+	.274*	.101	.007	.760	.623	.928
Area of residence	Urban				1		
	Rural	.477*	.213	.025	1.612	1.003	1.013
Presence of Chronic Illness	No				1		
	Yes	.400*	.087	.000	1.492	1.257	1.771
	Constant	.783*	.220	.000	2.189		

a. Variable(s) entered on step 1: Stunting, Underweight, Wasting, Gender, Age, Insurance, HH_Size, distance, Residence, chronic.

* Significant at the 5% level of significance

4.6 Discussion of the Results

The investigation delved into the impact of under-five child nutritional status on household catastrophic health expenditures in Kenya, specifically focusing on stunting, wasting, and underweight. The results indicated that stunting in rural areas is much higher than in the urban, with 13.81% of rural children affected as opposed to 8.8% in urban areas. This mirrors previous research findings that consistently identify higher rates of stunting among children residing in rural settings (Khan et al., 2020; Smith et al., 2019). Factors such as limited access to healthcare services, insufficient nutrition, inadequate sanitation infrastructure, and socioeconomic disparities are contributors to the elevated levels of stunting in rural communities.

Likewise, the investigation noted a greater incidence of wasting in rural areas (32.09%) in contrast to urban areas (16.69%). This mirrors earlier research findings that emphasize the

correlation between wasting and determinants such as inadequate maternal education, restricted access to healthcare, and food insecurity (Mwaniki et al., 2019; Wamani et al., 2018). These intertwined factors collectively contribute to the identified prevalence of wasting in both urban and rural regions of Kenya.

The research revealed a notable prevalence of underweight among children below the age of five in both urban and rural regions of Kenya. In urban areas, 11.22% of children were identified as underweight, whereas the prevalence was even higher in rural areas, reaching 17.84%. This points to a heightened occurrence of underweight in rural settings compared to urban environments. This observation aligns with prior studies that underscore the significance of factors such as maternal education, maternal nutrition, and accessibility of healthcare services in addressing the elevated prevalence of underweight, particularly in rural areas (Ngaruiya et al., 2020; Abuya et al., 2019).

Also, socioeconomic aspects of household heads and their potential impact on child nutritional status and household catastrophic health expenditures was explored. It was found that majority of household heads (66.2%) were male. Previous research, such as that conducted by Wagstaff et al. (2018), has identified disparities in health expenditures based on the gender of the household head, with female-headed households facing higher healthcare burdens and an elevated risk of catastrophic health expenditures. This is an indication that gender of household head plays a role in shaping household healthcare dynamics and resource allocation, indirectly influencing the nutritional status of under-five children.

The examination of access to health insurance coverage revealed that 76.9% of households did not have health insurance, while 23.1% had coverage. Regression findings further indicated that having health insurance is significantly ($p=0.020$) associated with 0.23 lower odds of experiencing catastrophic health expenditures compared to not having insurance. This implies that individuals lacking insurance are more susceptible to facing catastrophic health expenditures. Health insurance typically covers a substantial portion of medical costs, mitigating the financial burden on individuals and households. Consequently, insured individuals are less likely to encounter overwhelming expenses when in need of healthcare services. Therefore, households without health insurance face a heightened risk of experiencing catastrophic health expenditures as they are more prone to significant healthcare

costs that may exceed their financial capacity. This finding aligns with prior research emphasizing the positive association between health insurance coverage and reduced catastrophic health expenditures, along with improved health outcomes (Kruk et al., 2019).

The study further explored the relationship between under-five child nutritional status and household catastrophic health expenditures. The findings revealed significant associations between nutritional status indicators (stunting, wasting, and underweight) and the likelihood of experiencing CHE. The odds of experiencing CHE increased by 29.6% for each unit increase in stunting. Stunting can weaken a child's immune system, leading to frequent and severe health issues. As a result, families with stunted children may incur higher healthcare expenses, which, when coupled with their already limited resources, increases the risk of experiencing CHE. This underscores the importance of addressing child undernutrition not only for the sake of children's health but also as a vital step in reducing the financial strain on vulnerable households caused by healthcare costs.

Similarly, each unit increase in underweight was associated with a 22.9% increase in the odds of experiencing catastrophic health expenditure. Underweight children often suffer from poor nutrition, making them more susceptible to various health issues. This vulnerability can result in more frequent and severe health episodes, leading to increased healthcare costs for their families. Furthermore, households with underweight children may already face economic challenges, and the additional healthcare expenses further elevate the risk of encountering catastrophic health expenditure. Therefore, addressing child undernutrition not only improves child health but also helps mitigate the financial burden of healthcare costs on vulnerable households. These results concur with the findings of Das *et al*. (2018) who showed that showed that malnourishment in children under the age of five was linked to higher out-of-pocket healthcare expenses for families, particularly in rural regions. Additionally, malnourished children were likely to experience CHE.

These findings indicate that poor nutritional status among under-five children is linked with a higher risk of household CHE. These findings align with by Wagstaff et al. (2018) and Kruk et al. (2019) who have highlighted the link between malnutrition and increased healthcare burdens, higher out-of-pocket payments, and a greater risk of CHE. These findings emphasize

the need for interventions and policies aimed at improving child nutrition to reduce the financial burden on households.

Regarding the relationship between socioeconomic factors and catastrophic health expenditures, the study found several significant relationships. The study revealed that females have a 16.3% higher likelihood of experiencing CHE compared to males. This finding aligns Smith (2017) that women often face unique health challenges, including reproductive healthcare expenses, which can contribute to their higher odds of facing catastrophic health expenditures. The study also identified age as a significant factor associated with catastrophic health expenditure. As individuals age, their health needs tend to increase, leading to higher healthcare costs. This agrees with Johnson et al., (2019) who highlight the positive relationship between age and healthcare expenditures, especially in the context of chronic diseases and age-related health conditions.

In addition, the presence of insurance coverage was significantly related with 23% lower odds of experiencing catastrophic health expenditure. This finding is supported by Cutler and Zeckhauser (2020) that health insurance acts as a financial buffer against high healthcare costs and reduces the risk of catastrophic expenses. Additionally, the study demonstrates that larger household sizes are linked to a slightly higher likelihood of facing CHE. This agrees with Wagstaff et al., (2017) who suggested that larger families may have increased healthcare needs and expenses, resulting to a higher risk of experiencing catastrophic health costs.

The study also investigated the effect of distance to health facilities on CHE. It found that as the distance to the facility increases, the odds of facing CHE tend to increase. This finding is supported by previous research by World Health Organization (2019) that highlight the challenges individuals in remote areas face in accessing healthcare services, leading to potential delays in seeking care and higher healthcare costs. Furthermore, the study highlighted the disparities between rural and urban areas concerning CHE. Individuals residing in rural had higher odds of experiencing CHE. Finally, the presence of a chronic illness is significantly linked with a high likelihood of facing CHE. According to Garcia-Altés et al., (2017) chronic illnesses often require ongoing and costly medical interventions, which can push individuals and families into catastrophic health spending.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This study sought to examine the effects of under-five child nutritional status on household catastrophic health expenditures in Kenya. Specifically, this section presents the summary conclusions and recommendations to policy makers.

5.2 Summary of the Study Findings

The study conducted an in-depth examination of the impact of under-five child nutritional status on household catastrophic health expenditures in Kenya. The descriptive analysis yielded significant insights into the nutritional well-being of under-five children and the socioeconomic characteristics of household heads.

Stunting exhibited a higher prevalence in rural areas (13.81%) compared to urban areas (8.8%), indicating a greater prevalence of this condition in rural communities. Factors such as limited healthcare access, inadequate nutrition, poor sanitation, and socioeconomic disparities were identified as contributors to this rural-urban discrepancy. Similarly, wasting was more prevalent in rural areas (32.09%) than in urban areas (16.69%), with contributing factors including poor maternal education, limited healthcare access, and food insecurity. Underweight emerged as a concern in both urban (11.22%) and rural (17.84%) areas, underscoring the complex nature of underweight in rural settings. Maternal education, maternal nutrition, and healthcare access were identified as crucial factors in mitigating underweight prevalence.

Socioeconomic factors were also explored, revealing that the majority of household heads were male (66.2%). Gender disparities in health expenditures were noted, with female-headed households facing increased healthcare burdens and a high risks of CHE. Access to health insurance was limited, with 76.9% of households lacking coverage. The study highlighted the positive association between health insurance coverage and reduced catastrophic health expenditures, emphasizing its role in improving overall health outcomes.

Furthermore, the distribution of distances to the nearest health facility revealed challenges, particularly in rural areas where longer distances hindered healthcare access. Residence in rural

areas was associated with higher rates of catastrophic health expenditures and poorer child nutrition outcomes. The presence of chronic illnesses within households amplified the risk of CHE, emphasizing the need for comprehensive support for households facing chronic health challenges.

5.3 Conclusions

The study showed that among children under five, stunting, wasting, and underweight were more common in rural than in urban regions. This implies an elevated vulnerability of children in rural settings to poor nutritional outcomes, potentially leading to increased rates of household catastrophic health expenditures.

Furthermore, the study unveiled substantial associations between indicators of under-five child nutritional status (stunting, wasting, and underweight) and the likelihood of encountering catastrophic health expenditures. Each unit increase in stunting and underweight corresponded to heightened odds of facing CHE. This underscores the imperative role of addressing nutritional status as a pivotal element in mitigating the risk of household CHE.

In addition, the research brought to light the impact of socioeconomic factors on household catastrophic health expenditures. Female-headed households grappled with increased healthcare burdens and a heightened risk of CHE. Limited access to health insurance coverage emerged as a significant challenge, with a majority of households lacking this protective coverage. Moreover, prolonged distances to health facilities and residence in rural areas were linked to elevated rates of catastrophic health expenditure and poorer nutritional outcomes for children.

5.4 Policy Recommendations

The results allow for the identification of efficient policies and initiatives to lessen the negative effects of malnutrition on Kenyan households' catastrophic health costs. First and foremost, it is critical to implement interventions aimed at enhancing child nutrition in both urban and rural regions. This may entail putting in place nutrition-sensitive initiatives that target the root causes of malnutrition, like expanding mother education on nutrition, encouraging breastfeeding, and expanding access to wholesome food.

Additionally, there is need for efforts to mitigate catastrophic health expenditure (CHE) through interventions like expanding health insurance coverage and reducing out-of-pocket payments are closely aligned with the broader goal of achieving Universal Health Coverage (UHC). This can be achieved through encouraging people to take up insurance covers as well NHIF to cover health expenses. By increasing health insurance coverage and implementing targeted subsidies for vulnerable populations, governments can make healthcare more affordable and accessible to all. This not only safeguards households from the crippling financial impact of healthcare costs but also contributes to the foundational principles of UHC, where equitable access to healthcare is a fundamental right, and no one should be forced into poverty due to medical expenses. These measures synergize with current government reform efforts, fostering progress toward a more inclusive and comprehensive healthcare system under the umbrella of UHC.

In addition to enhancing healthcare infrastructure, a multifaceted approach to reduce geographical barriers, especially in rural areas, should be pursued. While improving the availability and accessibility of healthcare facilities is essential, complementary measures such as deploying community health promoters can play a pivotal role. Community health promoters, who are often local residents, can bridge the gap between healthcare facilities and communities by providing health education, preventive services, and basic healthcare within the community itself. By empowering and training these community health workers, we not only extend healthcare services to underserved areas but also promote early intervention and health awareness. This comprehensive strategy ensures that timely and appropriate healthcare services reach children and families, thereby positively impacting child nutrition outcomes and ultimately reducing healthcare expenditures. It acknowledges that healthcare is not solely about infrastructure but also about fostering community-based solutions that effectively address the challenges posed by geographical distance.

5.5 Areas for Further Studies

Future studies can focus on evaluating the effects of household food budget shares on child nutritional status. By examining the allocation of resources within households and its impact

on children's health outcomes, researchers can gain a deeper understanding of the relationship between household food expenditure and child nutrition.

To enhance understanding, there is need for studies to be conducted in individual counties across Kenya, to identify areas with dire need and thus allow for individualized policy recommendations and interventions. Examining the levels of financial burden faced by households in various regions can provide insights into the affordability of healthcare services and its implications for child health outcomes.

Furthermore, future studies can delve into the determinants of household spending for child health outcomes, particularly in the context of the national framework on nutrition. Understanding the factors that influence household spending decisions can inform the development of targeted policies and interventions aimed at improving child health outcomes and ensuring the effective utilization of resources.

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APPENDICES

Appendix I: Target Population

		Proportion (%)	
County	**Population**	**Rural**	**Urban**
Mombasa	655	0.0	100.0
Kwale	688	75.1	24.9
Kilifi	745	65.1	34.9
Tana River	657	79.7	20.3
Lamu	639	81.0	19.0
Taita/Taveta	671	80.7	19.3
Garissa	675	65.3	34.7
Wajir	736	76.0	24.0
Mandera	775	69.3	30.7
Marsabit	607	73.5	26.5
Isiolo	695	47.4	52.6
Meru	768	91.7	8.3
Tharaka-Nithi	718	75.4	24.6
Embu	727	85.1	14.9
Kitui	710	84.4	15.6
Machakos	758	38.4	61.6
Makueni	714	86.2	13.8
Nyandarua	740	82.2	17.8
Nyeri	752	68.7	31.3
Kirinyaga	727	83.1	16.9
Murang'a	736	85.4	14.6
Kiambu	744	30.9	69.1
Turkana	739	62.9	37.1
West Pokot	693	91.6	8.4
Samburu	623	81.6	18.4
Trans Nzoia	676	80.1	19.9
Uasin Gishu	741	57.3	42.7
Elgeyo/Marakwet	688	85.3	14.7
Nandi	716	86.4	13.6
Baringo	653	84.4	15.6
Laikipia	690	83.7	16.3
Nakuru	740	56.6	43.4
Narok	641	89.1	10.9
Kajiado	670	50.1	49.9
Kericho	710	66.7	33.3
Bomet	765	90.0	10.0
Kakamega	759	87.7	12.3
Vihiga	751	60.5	39.5
Bungoma	731	87.0	13.0
Busia	736	89.8	10.2
Siaya	677	88.3	11.7
Kisumu	642	43.9	56.1
Migori	709	67.7	32.3
Homa Bay	747	85.9	14.1
Kisii	720	79.1	20.9
Nyamira	713	84.5	15.5
Nairobi City	719	0.0	100.0
Total	**33286**		

Appendix II: Correlation Matrix for Linearity Test

		Stunting	Wasting	Underweight	Gender	Age in years	Access to health insurance	Household Size	Distance to health facility	Residence	Presence of Chronic Illness
Stunting	Pearson Correlation	1									
Wasting	Pearson Correlation	.099	1								
Underweight	Pearson Correlation	.146	.287	1							
Gender	Pearson Correlation	.005	.001	.001	1						
Age in years	Pearson Correlation	.014	.005	.014	-.075	1					
Access to health insurance	Pearson Correlation	-.011	-.004	-.007	.072	-.056	1				
Household Size	Pearson Correlation	-.003	-.008	-.002	-.007	.057	-.123	1			
Distance to health facility	Pearson Correlation	-.006	.014	.007	-.011	-.015	.043	-.033	1		
Residence	Pearson Correlation	-.017	.027	-.006	.020	-.171	.156	-.173	.088	1	
Presence of Chronic Illness	Pearson Correlation	-.006	.017	.010	-.140	.224	.007	-.006	.015	-.018	1