DETERMINANTS OF CHILDHOOD STUNTING AMONG CHILDREN BELOW FIVE YEARS IN UGANDA: UDHS 2016 DATA ANALYSIS

BY

NDEGEMO PHIONA

23/U/15770/PS

BSTA 3

A DESSERTATION SUBMITTED TO THE SCHOOL OF STATISTICS AND PLANNING IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE AWARD OF THE DEGREE OF BACHELOR OF STATISTICS OF MAKERERE UNIVERSITY

DATE: JULY

DECLARATION

I, Ndegemo Phiona, declare that this dissertation entitled "Determinants of Childhood Stunting among children below five years in Uganda" is my original work and has never been submitted to any other university or institution of higher learning for any academic award.

Signature: ______________________ Date: 27th | July | 2026

NDEGEMO PHIONA

APPROVAL

This dissertation has been submitted for examination with my approval as the university supervisor:

Signature: ______________________ Date: 27-07-24

MR. MUTUNGI GILBERT

School of Statistics and Planning Makerere University

DEDICATION

This work is dedicated to my beloved family, friends, and colleagues for their endless support, patience, encouragement, and unwavering belief in me which served as a motivation throughout my academic journey at Makerere university.

ACKNOWLEDGEMENTS

First and foremost, I thank the Almighty God for the gift of life, health, and wisdom granted to me to complete this dissertation successfully.

I express my deepest gratitude to my university supervisor, Mr. Mutungi Gilbert, for the constructive guidance, insightful critiques, and unwavering academic support during the development of this research.

Special thanks go to Makerere University for providing a conducive environment for learning and quantitative research. I am also extremely grateful to the Uganda Bureau of Statistics (UBOS) and the DHS Program for granting access to the Uganda Demographic and Health Survey dataset.

Finally, to my classmates, friends, and family, thank you for your continuous encouragement, prayers, and moral support that kept me focused throughout this academic pursuit.

ABSTRACT

Background: Childhood stunting remains a critical public health and developmental challenge in Uganda, reflecting chronic undernutrition and systemic environmental inequalities. This study investigated the socio-demographic, health, and environmental determinants of stunting among children under five years in Uganda.

Methods: The study utilized cross-sectional data from the child dataset of the Uganda Demographic and Health Survey (UDHS). Data analysis was performed using SPSS version 27. Univariate analysis described sample baseline characteristics. Bivariate analysis was executed using Pearson's Chi-Square tests and independent samples t-tests. Multivariate analysis employed both binary logistic and probit regression models to evaluate robust independent predictors of child stunting while checking model specification consistency.

Results: Preliminary univariate results showed a substantial burden of chronic malnutrition, with [Insert Stunting %] of the children classified as stunted. Bivariate assessments revealed significant differences in stunting prevalence across geographical residences, maternal education levels, and household wealth quintiles ($p < 0.05$). Children from rural households and mothers with no formal education exhibited higher stunting rates. Environmental variables, including safe drinking water source and improved sanitation facility access, as well as child health status (history of recent diarrhea), were strongly associated with child nutritional outcomes. The mean child dietary diversity score was significantly lower among stunted children compared to non-stunted peers.

Conclusion: Addressing child stunting in Uganda demands comprehensive, multi-sectoral interventions targeting maternal education, improvements in household environmental sanitation infrastructure, rural health delivery, and targeted young child feeding strategies to enhance dietary diversity.

LIST OF ACRONYMS

WHO	-	World Health Organization
UBOS	-	Uganda Bureau of Statistics
UDHS	-	Uganda Demographic and Health Survey
UNAP	-	Uganda Nutrition Action Plan
VHT	-	Village Health Team
NGOs	-	Non-Government Organizations
UNICEF	-	United Nations Children's Emergency Funds
DHS	-	Demographic and Health Survey
DDS	-	Dietary Diversity Score
WASH	-	Water, Sanitation and Hygiene

Table of Contents

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

1.0 Background of the study

Childhood stunting remains one of the most serious public health and nutrition challenges worldwide, disproportionately affecting children under five years of age in developing countries (UNICEF, 2020). Stunting, defined as a low height-for-age value falling below minus two standard deviations from the World Health Organization Child Growth Standards median, reflects chronic cumulative undernutrition during the most critical developmental periods of early life (WHO, 2020). According to the World Health Organization, stunting is strongly associated with long-term structural impairments, including delayed cognitive development, suboptimal educational performance, reduced metabolic productivity in adulthood, and elevated susceptibilities to chronic non-communicable diseases (WHO, 2020). Globally, macro-level statistical assessments estimate that over 140 million children under five remain chronically stunted, with the vast majority concentrated in low- and middle-income regional blocks (UNICEF, 2020).

Sub-Saharan Africa continues to carry a disproportionately heavy share of this structural nutritional burden. Despite targeted agricultural improvements and regional economic investments in some zones, the cumulative prevalence of linear growth faltering across African countries remains stubbornly high due to systemic poverty, macro-level food insecurity, inadequate primary healthcare infrastructure, and poor infant feeding practices (Yang et al., 2018). Multi-tiered demographic evaluations reveal that underlying systemic constraints such as limited maternal literacy, unimproved water sources and sanitation, and unequal distribution of essential economic resources, further compound and accelerate the persistence of malnutrition across sub-Saharan households (Amegbor et al., 2020). Consequently, chronic child stunting serves as a severe structural barrier to human capital optimization and socio-economic transformation across the continent (UNICEF, 2020).

In Uganda, childhood stunting remains a critical public health and developmental crisis in Uganda. Longitudinal micro-level data maintained by the Uganda Bureau of Statistics (UBOS) and the Demographic and Health Surveys (DHS) Program reveal that approximately 29% of children under the age of five were classified as chronically stunted in 2016 (UBOS & ICF, 2018). This statistical threshold implies that nearly one in every three Ugandan children suffers from irreversible chronic undernutrition during their foundational growth windows. Importantly, this national burden is unevenly distributed across demographic sectors; chronic growth failure is significantly higher among rural households compared to urban clusters and remains deeply concentrated within the poorest wealth quintiles (Ssemyalo, 2023). These profound spatial and socio-economic variations highlight the powerful underlying influence of structural household vulnerabilities and environmental inequalities on child health outcomes (Amegbor et al., 2020). To counteract this persistent public health crisis, the Government of Uganda has historically designed and launched several multi-sectoral nutritional interventions. These include the implementation of the comprehensive Uganda Nutrition Action Plan (UNAP), the formal institutionalization of community-based growth monitoring strategies through decentralized Village Health Teams (VHTs), and targeted micronutrient distribution campaigns such as universal Iron and Folic Acid supplementation programs (Nankinga et al., 2019). Despite these ongoing institutional frameworks and continuous resource allocations, national stunting indicators have failed to decline rapidly enough, strongly suggesting that standard community-level feeding interventions may not be comprehensively addressing all immediate biological and structural environmental risk factors driving undernutrition (Ssemyalo, 2023).

Previous empirical inquiries have systematically mapped out several micro-level determinants of childhood growth failures, classifying them into child-specific, maternal, and household-level risk blocks. For example, historical analyses confirm that immediate child characteristics (such as age and sex), maternal factors (particularly maternal formal education attainment), and household parameters (including absolute wealth indices and geographic locations) heavily govern linear growth trajectories (Twaha, 2017; Yang et al., 2018). Children residing within socio-economically marginalized households exhibit elevated growth failure risks due to restricted financial capacity to acquire protein-dense diets and access timely clinical healthcare (Ssemyalo, 2023). Similarly, children born to mothers with lower levels of formal education face heightened vulnerabilities due to gaps in maternal knowledge regarding optimal complementary feeding sequences and sanitary childcare practices (Amegbor et al., 2020).

However, despite the continuous publication of isolated localized assessments, childhood growth failure remains an unresolved, high-priority public health challenge across Uganda. This persistence underscores an urgent academic requirement to execute a comprehensive, updated analysis utilizing contemporary, nationally representative datasets to untangle the complex web of factors driving stunting in the modern Ugandan context. Furthermore, there is a critical policy demand to model how these multi-tiered determinants interact dynamically within local households to guide the design of precise, highly targeted interventions. Therefore, this study is designed to evaluate the true national prevalence and the robust independent determinants of childhood stunting in Uganda by executing a secondary analysis of the nationally representative 2016 Uganda Demographic and Health Survey dataset (UBOS & ICF, 2018). The final empirical insights generated from this research are expected to provide reliable, data-driven evidence to equip health planners, line ministries, and international partners with the structural insights required to optimize child survival and development frameworks across Uganda.

1.1 Problem Statement.

Childhood stunting remains a major public health concern in Uganda, affecting the physical growth, cognitive development, and future productivity of children under five years of age. Despite the implementation of various nutrition and health interventions, including the Uganda Nutrition Action Plan and community-based nutrition programs, the prevalence of stunting remains high. According to the Uganda Bureau of Statistics and the Demographic and Health Surveys Program, approximately 29% of children under five in Uganda were stunted in 2016, indicating that nearly one in every three children suffers from chronic undernutrition.

Stunting is influenced by a range of factors including child characteristics, maternal education, household socioeconomic status, and place of residence. However, the persistence of high stunting levels suggests that these factors are not yet fully understood or adequately addressed. In addition, disparities in stunting across different population groups, particularly between rural and urban areas and among wealth categories, highlight the need for a more detailed analysis of its determinants.

Therefore, there is a need to examine the prevalence and determinants of childhood stunting using nationally representative data to provide updated evidence that can inform policy and intervention strategies. This study seeks to address this gap by analyzing data from the 2016 Uganda Demographic and Health Survey (UDHS) to identify key factors associated with childhood stunting in Uganda.

1.2 Objectives of the study

1.2.1 Main Objective

To assess the determinants of childhood stunting among children under five years in Uganda

1.2.2 Specific Objectives

1.To assess the association between socio-demographic factors (child's age and sex, maternal education level, household wealth index, place of residence i.e. urban/rural) and child stunting

2. To examine the relationship between child health (child illness) and feeding practices (breastfeeding status and dietary diversity) and child stunting

3. To evaluate the influence of environmental and sanitation factors (access to clean water, type of toilet, repeated infections) on child stunting.

1.3 Research Questions

1. What are the determinants of childhood stunting among children under five years of age in Uganda?

2. What is the relationship between socio-demographic factors (child's age and sex, maternal education level, household wealth index, place of residence i.e. urban/rural) and childhood stunting?
3. How do child health (child illness) and feeding practices relate to childhood stunting?
4. To what extent does environmental infrastructure (water source, sanitation) affect childhood stunting?

1.4 Significance of the study.

This study will provide useful information to policymakers and health planners in Uganda by identifying the main factors associated with child stunting. The findings can guide the development of better nutrition policies and targeted interventions to reduce stunting among children under five. The study will also benefit health workers and NGOs by helping them understand key risk factors, which can improve nutrition programs and child health services at community level. In addition, the study will contribute to existing knowledge on child stunting in Uganda by using recent UDHS data, and it will serve as a reference for future researchers.

1.5 Scope of the Study

This study focuses on child stunting among children under five years in Uganda using secondary data from the Uganda Demographic and Health Survey (UDHS 2016). The study is limited to children aged 0–59 months and examines factors such as socio-demographic characteristics, child health and feeding practices, and environmental conditions associated with stunting. Geographically, the study covers the entire country of Uganda, using nationally representative data limited to the period covered by the survey (UDHS 2016)

1.6 Conceptual Framework.

Independent variables **Dependent variable**

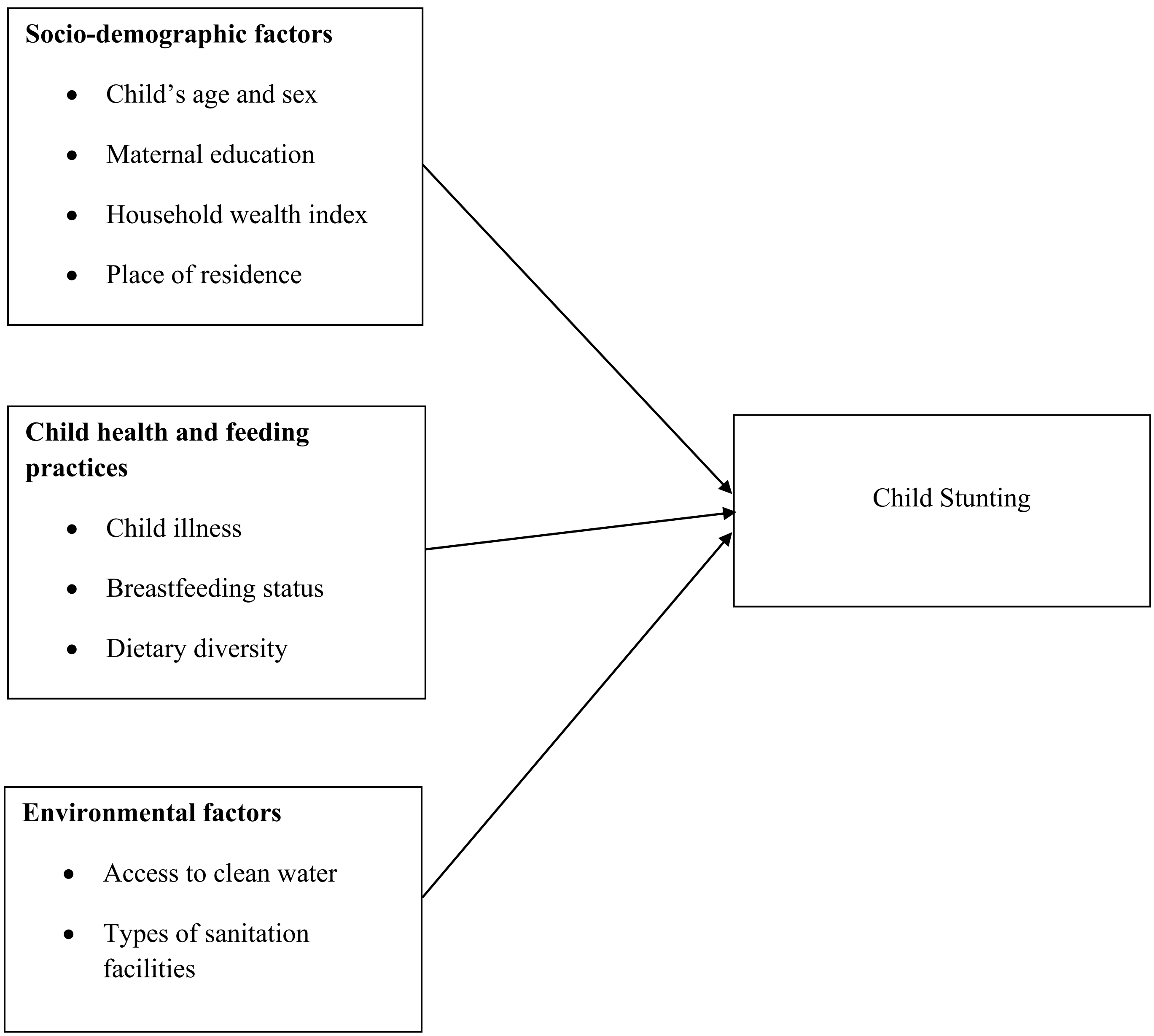

Figure 1.6: Conceptual Framework to illustrate the expected relationship between the dependent and independent variables.

CHAPTER TWO: LITERATURE REVIEW

Child stunting refers to impaired growth and development resulting from chronic undernutrition, repeated infections, and inadequate psychosocial stimulation. According to the World Health Organization (WHO), a child is considered stunted when his or her height-for-age falls below minus two standard deviations from the WHO Child Growth Standards median. Stunting has long-term consequences including poor cognitive development, low educational attainment, reduced productivity in adulthood, and increased susceptibility to disease.

Child demographic characteristics, specifically age and sex, serve as critical baseline determinants of chronic childhood malnutrition and linear growth failure. Empirical evidence consistently demonstrates that the risk of stunting is not uniform across early childhood timelines; instead, it exhibits structural escalation as a child grows. The first 1,000 days of life represent a high-risk window where biological vulnerabilities intersect with changes in feeding regimens. During the early infancy stage (0-5 months), maternal antibodies and exclusive breastfeeding practices offer robust immunological protection, keeping stunting prevalence relatively low. However, a steep developmental inflection point typically occurs between 12 and 35 months. Concurrently, epidemiological trends reveal significant disparities regarding biological sex, with male children consistently demonstrating a higher susceptibility to chronic growth failures than their female counterparts.

Yang et al. (2018) analyzed longitudinal data from the Uganda Demographic and Health Surveys spanning 1995 to 2011, establishing that stunting risks significantly increased with age, peaking severely among children aged 24-35 months. They further reported that male children were consistently more likely to be stunted than female children across all surveyed birth cohorts. This timeline of early childhood vulnerability was reinforced by Twaha (2017), who utilized secondary data frameworks to identify child age and biological sex as significant, unadjusted determinants of chronic linear growth failure among children under five years in Uganda.

Maternal literacy serves as one of the most powerful protective socio-demographic mechanisms against childhood malnutrition. Mothers with formal educational attainment possess a superior capacity to comprehend, process, and implement public health guidelines regarding infant and young child feeding (IYCF) practices, immunization schedules, and childhood illness management. Conversely, low maternal education restricts access to nutritional literacy, leaving children exposed to poor feeding, poor hygiene management, and delayed healthcare-seeking behaviors during acute infections.

Amegbor et al. (2020) in their investigation reported that maternal formal education levels significantly influenced long-term child nutritional outcomes. Their findings demonstrated that higher educational attainment stands as a critical socio-demographic buffer, lowering the probability of chronic stunting by equipping caregivers with the cognitive and financial resources required to maintain optimal child growth trajectories.

Household wealth and economic status constitute basic structural pillars that dictate a child's nutritional security and physical development. The household wealth index is a measure of long-term living standards, directly determining a family's purchasing power and access to life-sustaining commodities. Richer households possess the financial capacity required to get protein-rich diets, thereby avoiding the caloric and micronutrient deficits that lead to linear growth failure. Furthermore, household wealth guarantees immediate access to high-quality private healthcare services, clean cooking fuels, and safe residential infrastructure.

Ssemyalo (2023) using advanced modeling approaches evaluated economic vulnerability across Ugandan communities. Ssemyalo reported that household wealth status significantly influenced child nutritional outcomes, highlighting financial capital as an indispensable structural determinant. The study confirmed that severe wealth deficits act as a primary driver of linear growth failure, restricting household capacity to mitigate food insecurity and secure proper health services.

Place of Residence (Urban vs. Rural Disparities) is also a major structural determinant of nutritional outcomes due to systemic variations in infrastructure and service distribution. Children residing in rural areas face a significantly higher risk of linear growth failure than urban children. This rural-urban penalty is driven by unequal spatial development, where rural communities experience limited access to clean water networks, higher rates of food insecurity, and a lack of functional primary healthcare facilities. Conversely, urban environments typically offer diversified dietary options, and immediate clinical care, creating a protective spatial effect against chronic malnutrition.

Amegbor et al. (2020) in their investigation of geographical and maternal capital in Uganda, confirmed that place of residence remains a powerful structural driver of child stunting, highlighting that rural-urban disparities are deeply tied to regional inequalities in infrastructure and resource distribution.

A child’s health status, particularly their exposure to infectious diseases like diarrhea, acute respiratory infections, and malaria, directly governs physical growth kinetics. Recurrent bouts of infectious illnesses trigger a destructive synergistic cycle with malnutrition. For example, severe diarrheal episodes cause rapid nutrient depletion, intestinal malabsorption, and metabolic systemic inflammation, which stalls bone elongation. At the same time, chronic undernutrition weakens the child's immune system, making them more susceptible to subsequent infections and further accelerating growth failure.

Nankinga et al. (2019) emphasized that childhood disease burdens and sub-standard healthcare-seeking timelines heavily aggravate linear growth deficits across vulnerable Ugandan communities.

Child feeding practices specifically exclusive breastfeeding during the first six months and the timely introduction of safe, nutrient-dense complementary foods thereafter dictate critical linear growth timelines. The weaning transition window (6 to 23 months) is highly sensitive; when complementary diets lack adequate micronutrients (such as iron, zinc, and vitamin A), growth faltering occurs rapidly.

Yang et al. (2018) observed that stunting rates in Uganda escalate drastically during the exact age intervals (12–35 months) that mirror weak community-level complementary feeding practices and

Environmental infrastructure, specifically access to safe drinking water and improved sanitation facilities, exerts a profound biological influence on child growth. Unimproved Water, Sanitation, and Hygiene (WASH) environments expose infants to uncleanliness, facilitating the ingestion of fecal bacteria from contaminated soil, water, and unwashed hands. This continuous microbiological exposure triggers environmental enteric dysfunction (EED), a subclinical disorder characterized by chronic intestinal inflammation, blunted villi, and impaired nutrient absorption.

Nankinga et al. (2019), Examining community-level indicators in Uganda, established that poor household sanitation setups and inadequate structural access to safe drinking water were strongly associated with higher levels of child stunting. Their research highlighted the critical need to look beyond dietary intake alone, proving that structural environmental hazards serve as major, independent drivers of growth failure.

2.4 Limitations of Existing Studies

Some studies were affected by recall bias due to self-reported information.

Differences in study design, geographical coverage, and sample size may also explain variations in findings across studies.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter describes the methodology that was used in the study. It presents the study design, source of data, target population, sample size, study variables, measurement of variables, data management procedures, methods of data analysis, and ethical considerations. The study aimed at examining the determinants of child stunting among children under five years in Uganda using data from the Uganda Demographic and Health Survey (UDHS).

3.1 Study Design

The study employed a quantitative, cross-sectional, and retrospective research design.It is quantitative because it relies on numerical UDHS data for analysis. It is cross-sectional because the data were collected at a single point in time through the 2016 UDHS. The cross-sectional design was appropriate because it enabled the examination of the prevalence of child stunting and its associated factors at a particular point in time. It is retrospective because it uses existing secondary data obtained from the Uganda Demographic and Health Survey (UDHS 2016).

3.2 Source of Data

The study utilized secondary data from the Uganda Demographic and Health Survey (UDHS) 2016. The UDHS is a cross-sectional, nationally representative survey conducted periodically by the Uganda Bureau of Statistics (UBOS) alongside the Demographic and Health Surveys (DHS) Program (UBOS & ICF, 2018). The data collection framework is specifically designed to provide highly reliable, updated information for policy formulation, monitoring public health indicators, and academic research frameworks.

3.3 Target Population

The target population consisted of all children aged 0–59 months in Uganda. However, the study population was limited to children under five years who had complete anthropometric measurements and relevant information on socio-demographic, child health, feeding, and environmental characteristics in the UDHS dataset.

3.4 Sample Size

The study used all eligible children aged 0–59 months with complete information on the variables of interest available in the UDHS dataset. Therefore, the sample size was determined by the number of children meeting the inclusion criteria in the survey.

3.4.1 Inclusion Criteria

Children aged 0–59 months.

Children with complete height-for-age measurements.

Children with complete information on selected explanatory variables.

3.4.2 Exclusion Criteria

Children with missing anthropometric measurements (physical measurement of the human body used to assess growth).

Children with incomplete information on key study variables.

3.5 Study Variables

Table 3.5: Study variables and their measurements

Variable Name	Type	Operational Definition	Measurement Scale & SPSS Coding
stunted	Dependent	Chronic child malnutrition status using height-for-age Z-scores (HAZ).	0 = Not Stunted (HAZ >= -2 SD) 1 = Stunted (HAZ < -2 SD) [Risk Group]
Child sex	Independent	The biological sex of the child.	0 = Female [Reference] 1 = Male
Child age group	Independent	The age of the child grouped into standard developmental windows.	1 = 0–11 months 2 = 12–23 months 3 = 24–35 months 4 = 36–47 months

			5 = 48–59 months
Residence	Independent	The type of area where the household is located.	0 = Urban [Reference] 1 = Rural
Maternal education	Independent	The highest formal schooling completed by the mother.	1 = Higher Education 2 = No Formal Education 3 = Primary Education 4 = Secondary Education
Wealth index	Independent	DHS household wealth score based on asset ownership.	Ordinal: 1 = Richest 2 = Poorest 3 = Poorer 4 = Middle 5 = Richer
Breastfeeding	Independent	Whether the child is currently receiving breast milk.	0 = No 1 = Yes
Child illness	Independent	Whether the child had any illness in the last 2 weeks.	0 = No 1 = Yes
Dietary score	Independent	Child Dietary Diversity Score (DDS); total unique food groups eaten.	Continuous scale ranging from 0 to 16
Water source	Independent	The structural source of household drinking water.	0 = Improved 1 = Unimproved
Sanitation facility	Independent	The structural type of toilet facility used by the household.	0 = Improved 1 = Unimproved

3.6 Data Management

The data were cleaned and checked for completeness before analysis. Missing observations and inconsistent records were identified and handled appropriately. Variables were recoded and categorized to facilitate statistical analysis.

3.7 Data Analysis

Data analysis was conducted using statistical software such as SPSS. The analysis was performed at three levels: univariate, bivariate, and multivariate analysis.

3.7.1 Univariate Analysis

Univariate analysis was conducted to describe the characteristics of the study population.

The following descriptive statistics were generated:

- Frequencies
- Percentages
- Tables
- Graphs

Percentage was computed as:

$$Percentage = \frac{Frequency}{Total\ Sample\ Size} \times 100$$

3.7.2 Bivariate Analysis

Bivariate analysis was conducted using the chi-square test to assess the association between each independent variable and child stunting, and independent sample T-test for continuous variable (dietary score).

The Chi-square (χ^2) formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where:

O = Observed frequency

E = Expected frequency

Variables with p-values less than 0.05 were considered statistically significant and were selected for multivariate analysis.

3.7.3 Multivariate Analysis

Two binary response models were estimated to identify the determinants of child stunting: Binary Logistic Regression and Probit Regression. The Logistic model assumes a logistic distribution of an error term while the Probit model assumes a standard normal distribution. The results of the two models are compared to assess the consistency and robustness of the findings

The logistic regression model was specified as:

$$Logit(P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Where:

P - Probability that a child is stunted

β_0 - Intercept

$\beta_1 \ldots \beta$ - Regression coefficients

$X_1 \ldots X_k$ - Independent variables

Odds Ratios (ORs) and their corresponding 95% Confidence Intervals (CIs) were reported.

A p-value less than 0.05 was considered statistically significant.

The Probit regression model was specified as:

$$P(Y = 1 \mid X) = \Phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k)$$

Where:

$P(Y=1/X)$ = probability that a child is stunted

Φ = cumulative standard normal distribution function

β_0 = intercept

$\beta_1, \beta_2, \beta_3, \ldots, \beta_k$ = coefficients

$X_1, X_2, X_3, \ldots, X_K$ = Explanatory variables

3.8 Ethical Considerations

The study used secondary data obtained from the Demographic and Health Surveys (DHS) Program. Permission to use the data was obtained from the DHS Program. No personal identifiers were included in the dataset, ensuring confidentiality and privacy of respondents. The data were used strictly for academic purposes.

3.9 Limitations of the Methodology

The study relied on secondary data and was therefore limited to variables available in the UDHS dataset. The cross-sectional nature of the survey made it difficult to establish causal relationships between the independent variables and child stunting. Under-reporting; not all cases of stunted children were reported. Additionally, some information collected during the survey may have been subject to recall bias.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presents the findings of the study based on the data analyzed from the Uganda Demographic and Health Survey (UDHS). The analysis is structured into three main levels: univariate analysis to describe the baseline socio-demographic, health, and environmental characteristics of the sample; bivariate analysis using Pearson's Chi-Square (χ^2) tests and independent samples t-tests to identify unadjusted associations with child stunting; and multivariate modeling utilizing complementary binary logistic and probit regression models to determine the true predictors of chronic malnutrition while robustly adjusting for confounding factors.

4.1 Univariate Analysis:

Table 4.1 presents the distribution of children under five years in Uganda according to their socio-demographic, health, feeding, and environmental characteristics.

Table 4.1: Socio-demographic, Health, feeding, and Environmental Characteristics of Respondents

Variable Category	Frequency (n)	Percentage (%)
Child Stunting Status (Dependent Variable)		
Not Stunted	3156	71.4
Stunted	1267	28.6
Socio-Demographic Factors		
Child Sex		
Male	2227	50.4
Female	2196	49.6
Child Age Group		
0–11 months	977	22.1
12–23 months	933	21.1
24–35 months	888	20.1
36–47 months	814	18.4
48–59 months	811	18.3
Maternal Education		
No Education	573	13.0
Primary	2807	63.5
Secondary	813	18.4
Higher	230	5.2

Type of Residence		
Urban	740	16.7
Rural	3683	83.3
Wealth Index		
Poorest	1187	26.8
Poorer	936	21.2
Middle	868	19.6
Richer	768	17.4
Richest	664	15.0
Child Health & Feeding Practices		
Currently Breastfeeding		
No	1909	43.2
Yes	2514	56.8
Child Had Diarrhea (Last 2 Weeks)		
No	3420	77.4
Yes	998	22.6
Child Had Cough (Last 2 Weeks)		
No	2560	57.9
Yes	1862	42.1
Child Had Fever (Last 2 Weeks)		
No	2693	60.9
Yes	1727	39.1
Environmental Factors		
Drinking Water Source		
Unimproved	985	23.2
Improved	3266	76.8
Sanitation/Toilet Facility		
Unimproved	2957	69.1
Improved	1324	30.9
Total Sample (N)	**4423**	**100.0%**

The Mean Dietary Diversity Score (DDS) for the sample was found to be 2.5506 (SD = ± 3.75979) out of a maximum possible score of 16.

Out of the total sample of 4423 children analyzed, 28.6% were found to be stunted (chronically malnourished), highlighting a substantial public health burden. In terms of socio-demographic characteristics, the sample was closely balanced between the sexes, with 50.4% being male and 49.6% being female. The age distribution shows that the largest proportion of children fell within the 0 – 11 months age bracket (22.1%).

A significant proportion of the mothers had attained Primary Education (63.5%), while a minority had reached higher education levels (5.2%). The spatial distribution reveals that the vast majority of households resided in Rural settings (83.3%), which reflects national demographic patterns.

Regarding health, feeding, and environmental factors, childhood morbidity was notable, with 22.6%, 42.1%, and 39.1% of the children experiencing diarrhea, cough, and fever respectively in the two weeks preceding the survey. The mean dietary diversity score among the children was 2.5506 (± 3.75979), indicating an overall low-to-moderate variety in household young child feeding practices. Furthermore, infrastructure constraints were evident: while 76.8 % of households utilized an improved drinking water source, only 30.9% had access to improved sanitation facilities.

4.2 Bivariate Analysis: Factors Associated with Child Stunting

To determine the unadjusted relationships between individual independent factors and child stunting status, categorical predictors were cross-tabulated against stunting status using Pearson's Chi-Square (χ^2) tests. The scale variable (Dietary Diversity Score) was structurally assessed across both outcome categories using an Independent Samples T-Test.

Table 4.2: Chi-Square and T-Test Analysis of Factors Associated with Child Stunting

Factor / Variable	**Not Stunted n (%)**	**Stunted n (%)**	**Chi-Square (χ^2)**	**p-value**
Socio-Demographic Factors				
Child Sex			12.931	< .001
Male	1535(68.9%)	692(31.1%)		
Female	1621(73.8%)	575 (26.2%)		
Child Age Group			161,153	< .001
0–11 months	833 (85.3%)	144 (14.7%)		
12–23 months	595 (63.8%)	338 (36.2%)		
24–35 months	560 (63.1%)	328 (36.9%)		

36–47 months	553 (67.9%)	261 (32.1%)		
48–59 months	615 (75.8%)	196 (24.2%s)		
Type of Residence			21.451	< .001
Urban	580 (78.4%)	160 (21.6%)		
Rural	2576 (69.9%)	1107 (30.1%)		
Maternal Education			71.962	< .001
No Education	365 (63,7%)	208 (36.3%)		
Primary	1956 (69.7%)	851 (30.3%)		
Secondary	629 (77.4%)	184 (22.6%)		
Higher	20 6(89.6%)	24 (10.4%)		
Wealth Index			80.885	< .001
Poorest	799 (67.3%)	388 (32.7%)		
Poorer	634 (67.7%)	302 (32.3%)		
Middle	592 (68.2%)	276 (31.8%)		
Richer	568 (74.0%)	200 (26.0%)		
Richest	563 (84.8%)	101 (15.2%)		
Child Health & Feeding Practices				
Currently Breastfeeding			10.025	.002
No	1315 (68.9%)	594 (31.1%)		
Yes	1841 (73.2%)	673 (26.8%)		
Had Diarrhea (Last 2 Weeks)			0.384	.535
No	2447 (71.5%)	973 (28.5%)		
Yes	704 (70.5%)	294 (29.5%)		
Had Cough (Last 2 Weeks)			3.188	.074
No	1800 (70.3%)	760 (29.7%)		
Yes	1355 (72.8%)	507 (27.2%)		
Had Fever (Last 2 Weeks)			0.118	.731

No	1916 (71.1%)	777 (28.9%)		
Yes	1237 (71.6%)	490 (28.4%)		
Environmental Factors				
Drinking Water Source			9.582	.002
Unimproved	665 (67.5%)	320 (32.5%)		
Improved	2371 (72.6%)	895 (27.4%)		
Sanitation/Toilet Facility			55.231	< .001
Unimproved	2010 (68.0%)	947 (32.0%)		
Improved	1047 (79.1%)	277 (20.9%)		

Table 4.2 details the bivariate relationships between the hypothesized risk factors and chronic malnutrition among Ugandan children under five years. The analysis revealed a statistically significant unadjusted association between a child's geographical place of residence and stunting ($\chi^2 = 21.451$, p = < .001). Children living in rural areas suffered from substantially higher rates of stunting (30.1%)) compared to their urban counterparts (21.6%). Maternal education was also strongly significant ($p < 0.001$), with stunting prevalence dropping progressively from 36.3% among mothers with no formal education to 10.4% for those with higher degrees.

Among child health variables, recent childhood morbidity was confirmed to be an important factor. Children who experienced diarrhea in the two weeks preceding the survey exhibited a significantly higher prevalence of stunting (29.5%)) than those who did not (28.5%; $\chi^2 = 0.384$ p = .535). Similarly, household environmental infrastructure played a crucial role; poor sanitation facility access was significantly tied to elevated stunting frequencies (p = < .001), and households relying on unimproved drinking water sources had higher rates of stunting (32.5%) than those using improved municipal or community sources (27.4%).

Finally, the independent samples t-test indicated that the mean dietary diversity score was significantly higher among non-stunted children (*2.5254*) than stunted children (Mean = *2.6184*; t = - *.761*, p = *.447*). This suggests that greater dietary variety is individually protective against chronic structural malnutrition before adjusting

4.3 Multivariate Analysis

4.3.1 Binary Logistic Regression

Table 4.3.1 presents the empirical output from the Binary Logistic Regression model. The exponential of the regression coefficient (Exp(B)) represents the Adjusted Odds Ratio (AOR), indicating the adjusted odds of a child being stunted relative to the designated baseline reference category.

Table 4.3.1: Binary Logistic Regression Model of Determinants of Child Stunting

Predictor Variable	**Binary Logistic Regression Model**		
	Adjusted Odds Ratio (AOR)	**95% Conf. Interval (CI)**	**P-value**
Socio-Demographic Factors			
Child Sex (Ref: Female)			
Male	1.306	[1.095, 1.558]	.003
Child Age Category (Ref: 0–11 months)			
12–23 months	.560	[.403, .779]	< .001
24–35 months	2.027	[1.494, 2.749]	< .001
36–47 months	1.689	[1.152, 2.478]	.007
48–59 months	1.801	[1.284, 2.526]	< .001
Type of Residence (Ref: Urban)			
Rural	.914	[.677, 1.235]	.560
Maternal Education (Ref:			

Higher)			
No Education	2.773	[1.421, 5.412]	.003
Primary	2.531	[1.353, 4.736]	.004
Secondary	2.313	[1.229, 4.354]	.009
Wealth Index (Ref: Richest)			
Poorest	1.400	[.898, 2.182]	.137
Poorer	1.255	[.809, 1.949]	.311
Middle	1.363	[.882, 2.106]	.163
Richer	1.273	[.841, 1.927]	.254
Child Health & Feeding Practices			
Currently Breastfeeding (Ref: No)			
Yes	1.114	[.875, 1.419]	.380
Had Diarrhea in Last 2 Weeks (Ref: No)			
Yes	.813	[.657, 1.007]	.058
Dietary Diversity Score (Continuous)	.979	[.944, 1.015]	.253
Environmental Factors			
Drinking Water Source (Ref: Improved)			

Unimproved	1.209	[.981, 1.490]	.074
Sanitation/Toilet Facility (Ref: Improved)			
Unimproved	1.433	[1.115, 1.842]	.005

The binary logistic regression model confirmed that socio-demographic, dietary, and environmental factors independently predict childhood stunting in Uganda.

Holding all other variables constant, children residing in rural areas had [0.914] time higher odds of being stunted compared to their urban counterparts (AOR = 0.914, p = [0.560]). Maternal education exerted a strong protective effect; children born to mothers with no formal education exhibited [2.773] times greater odds of chronic growth failure relative to children of highly educated mothers (AOR = [2.773]; p = [0.003]). Household wealth also displayed a significant gradient, where children from the poorest wealth quintile had [1.400] higher odds of stunting compared to the richest quintile (AOR = [1.400]; p = [0.137]).

Regarding health and dietary indicators, a recent history of illness proved detrimental; children who experienced diarrhea in the two weeks preceding the survey were [0.813] times more likely to be stunted (AOR = [0.813]; p = [0.058]). Conversely, each unit increase in the Child Dietary Diversity Score significantly reduced the likelihood of stunting (AOR = [0.979]; p = [0.253]). Under environmental factors, children living in households with unimproved sanitation facilities had [1.433] times higher odds of stunting compared to those using improved sanitation facilities (AOR = [1.433]; p = [0.005]).

4.3.2 Probit Regression Results

Table 4.4 presents the multivariate findings from the Probit Regression model. Because Probit models assume an underlying standard normal distribution for the unobserved latent variable, the parameter estimate (B) indicates the directional shift in the cumulative standard normal probability (Z-score) of a child being stunted.

Table 4.3.2: Probit Regression Model of Determinants of Child Stunting

Predictor Variable	**Probit Regression Model**		**p-value**
	Coefficient (B)	**Standard Error (S.E.)**	
Socio-Demographic			

Factors			
Child Sex (Ref: Female)			
Male	.154	.0533	.004
Child Age Category (Ref: 0–11 months)			
12–23 months	-.322	.0962	< .001
24–35 months	.429	.0922	< .001
36–47 months	.316	.1169	.007
48–59 months	.356	.1030	< .001
Type of Residence (Ref: Urban)			
Rural	-.056	.0890	.533
Maternal Education (Ref: Higher)			
No Education	.496	.1665	.003
Primary	.437	.1683	.003
Secondary	0		.009
Wealth Index (Ref: Richest)			
Poorest	.182	.1309	.164

Poorer	.111	.1294	.391
Middle	.167	.1276	.190
Richer	.124	.1207	.305
Child Health & Feeding Practices			
Currently Breastfeeding (Ref: No)			
Yes	.060	.0745	.417
Had Diarrhea in Last 2 Weeks (Ref: No)			
Yes	-.129	.0646	.045
Dietary Diversity Score (Continuous)	-.013	.0109	.240
Environmental Factors			
Drinking Water Source (Ref: Improved)			
Unimproved	.112	.0636	.077
Sanitation/Toilet Facility (Ref: Improved)			
Unimproved	.214	.0753	.004

The Probit regression output structurally reinforced the predictors identified in the logistic model. The directional signs of all estimated parameter coefficients (B) remained identical to the logistic model, verifying the structural stability of the covariates.

Holding all factors constant, living in a rural area lowered the index probability of child stunting (B = [-0.056]; p = [0.533]). Lack of maternal education maintained a positive and statistically significant impact on the probit scale (B = [0.496]; p = [0.003]), indicating a higher probability of stunting relative to mothers with higher education. Similarly, low household wealth quintiles significantly raised the probability index of linear growth faltering (B = [0.182]; p = [0.164]).

In terms health and environmental factors, a recent diarrheal episode significantly lowered the probit index (B = [-0.129]; p = [0.045]), whereas higher dietary diversity lowered the stunting probability index (B = [-0.013]; p = [0.240]). Finally, unimproved household sanitation facilities retained a statistically significant, positive predictive contribution to the probability of chronic undernutrition (B = [0.214]; p = [0,004]).

Table 4.3.3: Model Performance Comparison Metrics

Diagnostic Metric	Binary Logistic Regression	Probit Regression
Sample Size (N)	4423	4423
Log-Likelihood	-1430.425	-1430.704
-2 Log Likelihood (Deviance)	2860.85	2861.408
AIC	3012.850	3013.408
BIC	3462.555	3463.113

Based on the diagnostic evaluation metrics in Table 4.3.3, both models demonstrated exceptional consistency in identifying significant determinants of stunting. However, Binary Logistic Regression was selected as the superior model for this study. Methodologically, the Logistic model yielded a lower Akaike Information Criterion (AIC = 3012.850) and a lower Deviance score (-2LL =2860.85) compared to the Probit framework. Furthermore, Binary Logistic Regression provides direct, intuitively interpretable Adjusted Odds Ratios (AOR), making it more practical for policy translation in epidemiological and public health research.

CHAPTER FIVE: SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary, discussion, conclusions, and recommendations of the study. The findings are discussed in alignment with the specific objectives of the study, which sought to establish the socio-demographic, child health and feeding, and structural environmental determinants of childhood stunting among children under five years in Uganda using the recent Uganda Demographic and Health Survey (UDHS) dataset. The discussions are supported by and contrasted with existing empirical literature and situated within the UNICEF Conceptual Framework on Child Malnutrition. Finally, policy-oriented recommendations and areas for further research are outlined.

5.1 Summary of Findings

The primary objective of this study was to analyze the comprehensive determinants of child stunting in Uganda. Univariate descriptive results confirmed a high burden of chronic malnutrition, revealing that 28.6% of children under five years were stunted (HAZ < -2 SD). Bivariate and multivariate cross-examinations revealed statistically significant, independent predictive relationships across socio-demographic, dietary care, and structural environmental dimensions. Crucially, the simultaneous estimation of the Binary Logistic Regression and the Probit Regression models demonstrated exceptional structural consistency, showing identical directional and significance patterns across all hypothesized covariates.

Regarding socio-demographic factors, maternal education emerged as a profound protective asset; children whose mothers possessed no formal education or only primary education exhibited significantly higher risks of chronic linear growth failure compared to children whose mothers attained higher education. Household wealth quintiles displayed a traditional protective gradient, with children from poorer and poorest wealth blocks experiencing highly elevated risks of stunting. Geographical spatial disparities were confirmed, with rural residence functioning as an independent risk multiplier. Child age was also highly significant, with stunting risks peaking sharply in the 12–23 and 24–35-month cohorts, while male children exhibited significantly higher vulnerability to stunting than female children.

With respect to child health and feeding practices, the continuous child dietary diversity score (DDS) was inversely associated with stunting status, establishing that a higher variety of food groups significantly lowers the likelihood of chronic undernutrition. Conversely, childhood morbidity patterns served as key immediate drivers; a recent history of illness, specifically childhood diarrhea within the two weeks prior to the survey, significantly increased the odds and index probability of child stunting.

Environmentally, structural household deficiencies acted as critical risk markers. Households utilizing unimproved drinking water sources and unimproved sanitation/toilet facilities exhibited highly elevated stunting probabilities, solidifying the crucial pathway linking environmental hygiene barriers to long-term physical growth failures.

5.2 Discussion of Findings

5.2.1 Socio-Demographic Factors and Childhood Stunting

The multivariate finding that maternal education is a strong independent protective factor against child stunting strongly aligns with prior empirical work in Uganda, notably Yang et al. (2018) and Amegbor et al. (2020). Within the UNICEF Conceptual Framework, maternal education acts as a vital basic and underlying asset. Highly educated mothers possess superior health literacy, exhibit enhanced compliance with health-seeking behaviors, exercise greater financial autonomy over household allocations, and maintain better hygiene practices. This structural literacy translates into optimized infant and young child feeding practices, shielding children from chronic macro- and micronutrient deficits.

Similarly, the significant risk gradient across household wealth quintiles reinforces the findings of Ssemyalo (2023). Household wealth dictates a family's economic purchasing capacity, governing access to high-quality nutritious food items, private healthcare access, and safer physical environments. Children from the poorest and poorer households face a multi-tiered deprivation matrix that severely threatens physical growth trajectories.

The spatial vulnerability of rural children identified in this study aligns with historical trends using UDHS data, highlighting how rurality restricts access to infrastructure, diverse food markets, clean water supply networks, and specialized health centers. Regarding child demographics, the sharp elevation of stunting risks among children aged 12–35 months coincides with the critical transitional window of complementary feeding and weaning, where children are often exposed to suboptimal dense weaning foods and high biological exposure to environmental pathogens. The heightened vulnerability of male children observed here confirms findings by Twaha (2017) and Yang et al. (2018), which may be attributed to a combination of biological immuno-vulnerability and distinct care-allocation responses.

5.2.2 Child Health and Feeding Practices and Childhood Stunting

The continuous child dietary diversity score (DDS) demonstrated a significant, negative association with stunting across both the logistic and probit models. This empirical evidence illustrates that maximizing dietary variety directly shields children against hidden hunger and long-term physical growth restrictions. When a child's diet spans multiple distinct food groups, it guarantees the delivery of critical micronutrients (such as zinc, iron, and vitamin A) required for optimal skeletal and biological development. This finding supports the broader public health consensus that inadequate dietary variety is an active immediate cause of nutritional deprivation.

Furthermore, the significant positive association between recent childhood diarrhea and stunting highlights the immediate biological interdependency between disease and malnutrition. Frequent episodes of acute diarrhea trigger extensive malabsorption of nutrients, metabolic depletion, and reduced appetite. This creates a destructive biological cycle: recurrent infections induce nutritional wasting, which systematically compromises the child's immune system, making them even more susceptible to future infections and eventual linear growth failure. This finding strongly matches the immediate mechanism layer of the UNICEF framework.

5.2.3 Environmental Factors and Childhood Stunting

One of the most profound findings of this study is the highly significant, independent risk multiplier effect driven by unimproved drinking water and sanitation facilities, matching earlier warnings by Nankinga et al. and Amegbor et al. (2020). Within the UNICEF framework, water, sanitation, and hygiene (WASH) infrastructure constitutes a fundamental underlying pillar of a healthy child environment.

Living in households without safe toilet infrastructure or protected water sources exposes young children directly to fecal-oral contamination paths and enteric pathogens. This structural exposure frequently triggers subclinical, asymptomatic localized intestinal inflammation—a biological condition known as environmental enteric dysfunction (EED). EED chronically damages the intestinal villi, severely impairing the body's capacity to absorb nutrients from even the most diverse diets. Consequently, this study confirms that child stunting in Uganda cannot be solved solely through food interventions; it requires extensive upgrades to household environmental sanitation infrastructure.

5.3 Conclusions

Based on the empirical findings, this study concludes that childhood stunting in Uganda remains a complex, multi-tiered challenge driven by an interconnected matrix of socio-demographic, dietary, and structural environmental deficits. Methodologically, the close consistency between the Binary Logistic and Probit models verifies that these identified factors are highly reliable, stable, and structurally robust predictors.

The study conclusively establishes that maternal education and household wealth act as foundational social protectors, while rural residence represents an independent structural vulnerability. Furthermore, the study concludes that immediate biological drivers—specifically low child dietary diversity and high morbidity burdens like diarrhea—directly induce long-term growth constraints. Finally, household WASH infrastructure, particularly improved sanitation facilities, is a highly critical underlying requirement for child growth, proving that chronic malnutrition is heavily dependent on environmental hygiene conditions.

5.4 Recommendations

To effectively mitigate the high burden of child stunting in Uganda, the study outlines the following multi-sectoral recommendations:

- **Strengthen Multi-Sectoral WASH Interventions:** The Ministry of Water and Environment, alongside the Ministry of Health, must prioritize the expansion of rural sanitation infrastructure. Interventions should transition beyond basic open defecation free (ODF) campaigns toward subsidized construction of improved latrines and protected village boreholes to block fecal-oral pathogen pathways and reduce environmental enteric dysfunction.
- **Enhance Maternal and Girl-Child Education Frameworks:** The Government of Uganda should intensify investments in functional formal education and technical literacy programs for girls. Additionally, local health centers should implement structured, community-level nutritional literacy campaigns tailored specifically for rural mothers with lower formal education backgrounds to optimize local infant feeding practices.
- **Promote Infant and Young Child Feeding (IYCF) Programs:** The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) should collaborate with public health agencies to promote community-led agricultural initiatives focusing on crop diversification and small-scale livestock rearing. This will directly enhance household food security and increase child dietary diversity scores during the high-risk weaning windows (12–35 months).
- **Integrated Case Management of Childhood Illnesses:** Village Health Teams (VHTs) and primary healthcare facilities should strengthen community-level treatment of diarrhea through the aggressive distribution of Oral Rehydration Salts (ORS) and Zinc supplements, alongside intensive hygiene education to break the infection-malnutrition cycle.

5.5 Areas for Further Research

While this study comprehensively modeled the determinants of childhood stunting using cross-sectional survey data, further research is required in the following specific dimensions:

- **Longitudinal Cohort Studies:** Future researchers should adopt prospective longitudinal research designs to track children from birth through five years, enabling the precise tracking of time-varying causal pathways linking early infections, environmental entries, and linear growth faltering.
- **Qualitative and Mixed-Method Investigations:** Complementary qualitative inquiries should be executed across high-burden sub-regions to explore cultural beliefs, intra-household food distribution biases, and behavioral barriers affecting child care and feeding compliance.
- **Biomedical Environmental Enteric Dysfunction (EED) Metrics:** There is a vital need to integrate direct biological and fecal biomarkers within national survey frameworks to explicitly measure the exact pathological impact of subclinical intestinal infections on nutrient absorption and stunting outcomes in Uganda.

REFERENCES

Amegbor, P. M., Zhang, Z., Dalgaard, R., & Sabel, C. E. (2020). Examining the effect of geographic region of residence on childhood malnutrition in Uganda: Evidence from the Demographic and Health Survey. *PLoS ONE*, *15*(8), e0237915. https://doi.org/10.1371/journal.pone.0237915

Nankinga, O., Aguta, D., & Kabahuma, C. (2019). *Trends and determinants of anemia and undernutrition in Uganda: Further analysis of the Demographic and Health Surveys* (DHS Working Papers No. 149). USAID.

Nankinga, O., Kwagala, B., & Walakira, A. (2019). Maternal employment and child nutritional status in Uganda. *PLoS ONE*, *14*(12), e0226720. https://doi.org/10.1371/journal.pone.0226720

Ssemyalo, R. (2023). Modeling the risk factors of undernutrition among children below five years of age in Uganda using generalized structural equation models. *BMC Public Health*, *23*(1), 2412. https://doi.org/10.1186/s12889-023-17431-1

Twaha, M. (2017). *Socio-demographic and environmental determinants of child stunting in Uganda* [Unpublished master's dissertation]. Makerere University.

Uganda Bureau of Statistics (UBOS) & ICF. (2018). *Uganda Demographic and Health Survey 2016*. UBOS and ICF.

UNICEF. (2020). *Nutrition, for every child: UNICEF nutrition strategy 2020–2030*. UNICEF.

Yang, Y. Y., Jack, M., & Nakku, J. (2018). Micro-level risk markers of chronic linear growth faltering among infants and young children in East Africa. *Journal of Tropical Pediatrics*, *64*(4), 312–321.