
# ADDIS ABABA UNIVERSITY

## COLLEGE OF DEVELOPMENT STUDIES

## CENTER FOR POPULATION STUDIES

**EXPLAINING URBAN-RURAL DISPARITY IN PREVALENCE OF STUNTING AND WEALTH RELATED INEQUALITY IN ETHIOPIA: A DECOMPOSITION ANALYSIS**

BY

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## *ABSTRACT*

***Background:*** *Stunting is a global health concern. It has consequences on child survival, growth, and development. The absolute level of stunting has been decreasing in Ethiopia although the prevalence is still high varying across socioeconomic determinants and geographical location with a larger burden among the disadvantaged group and the rural areas. The objective of the study was to explain the rural-urban disparity in the prevalence of stunting and explore the level and determinants of wealth related inequality in stunting in Ethiopia.*

***Method:*** *Data were drawn from the 2016 Ethiopian Demographic and Health Survey. The dependent variables were stunting and wealth related inequality in stunting. A multivariate decomposition analysis was employed to decompose the urban-rural disparity in the prevalence of stunting into meaningful components. A concentration index was used to quantify the magnitude of inequalities in stunting and multilevel linear regression model was used to identify determinants of socioeconomic inequality in stunting. STATA version 14 software was used for data management and analysis.*

***Result:*** *Differences in observed characteristics of children, maternal characteristics, their household and environment explained 82.8% of the gap in the prevalence of stunting between rural and urban areas. A further decomposition of the gap in stunting showed that differences in maternal characteristics contributed to 36.7% of the gap in stunting, variation in household characteristics explained 31.7% of the gap and 13.6% of the gap in stunting was due to differences in child characteristics in the two areas. The study also found a significant pro-poor wealth related absolute inequality in stunting (-0.133). Age of child, maternal education level, maternal age and place of residence were found to be significantly associated with socioeconomic inequality in stunting.*

***Conclusion:*** *Rural-urban disparities in child stunting need to focus principally on bridging gaps in socio-economic situations of rural and urban women and households and improving the quality of rural infrastructure. Health policy makers should work together across sectors and develop strategies for effective inter sectoral actions to adequately address the social determinants of inequity and reduce inequalities in stunting.*

*KEYWORDS*

*Ethiopia, children, inequality, Disparity, stunting*

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AARR | Average Annual Reduction Rate |
| BMI | Body Mass Index |
| CI | Concentration index |
| CSA | Central Statistics Agency |
| EA | Enumeration Area |
| EDHS | Ethiopia Demographic Health Survey |
| EPHC | Ethiopian Population and Housing Census |
| EPHI | Ethiopian Public Health Institute |
| FMoH | Federal Ministry of Health |
| HAZ | Height for Age Z score |
| IFPRI | International Food Policy Research Institute |
| NNC | National Nutrition Coordination |
| PSNP | Productive Safety Net Program |
| SD | Standard Deviation |
| SES | Socio-Economic Status |
| UNICEF | United Nations Children's Fund |
| WFP | World Food Program |
| WHA | World Health Assembly |
| WHO | World Health Organization |

# CHAPTER 1: INTRODUCTION

## 1.1. Background of the Study

Malnutrition is a major health problem in most developing countries. According to the World Health Organization (WHO), malnutrition refers to any disorder of nutrition whether it is due to dietary deficiency or to excess diet which can result from an imbalance between the needs of the body and intake of nutrients. Under nutrition is a general term for a medical condition caused by an insufficient diet. It is any physical condition resulting either from an inappropriate diet or from a physical inability to absorb or metabolize nutrients(UNICEF, WHO/World Bank Group, 2018). Good nutrition allows children to survive, grow, develop, learn, play, participate and contribute, while malnutrition robs children of their futures and leaves young lives hanging in the balance (UNICEF, WHO/World Bank Group, 2018).

Child stunting is a public health nutrition problem that hinders the development of future generations, not only physiologically but also potentially deprives their cognitive function and productivity. Stunting represents poor linear growth during a critical period and is diagnosed as a height for age less than -2 standard deviations from the World Health Organization (WHO) child growth standards median(WHO, 2006). Globally, approximately 149 million children under 5 suffer from stunting (Unicef/ WHO/The World Bank 2019).

Stunted children begin their lives at a marked disadvantage: they face learning difficulties in school, earn less as adults, and face barriers to participation in their communities. More than 90% of the world's stunted children live in Africa and Asia. More than 37% suffering from stunting are found concentrated in Eastern Africa. Although the prevalence of stunting is decreasing in all regions of the world, Africa is the only region with a rising number of stunted children. In view of this, the absolute number of stunted children in Africa is expected to increase from 56 million in 2010 to 61 million by the year 2025 (Unicef/ WHO/The World Bank 2019).

The devastating effects of stunting can last a lifetime and even affect the next generation and is strongly associated with numerous short term and long term conditions. These conditions include increased morbidity and mortality, delayed growth, poor children's well being and social inequalities and long term educational and economic consequences. Thus, the prevention of stunting has been adopted as one of the six main global nutrition targets for the period until 2025 (Amare, Ahmed, and Mehari 2019). Despite concrete progress made against child stunting in the past decade Ethiopia remains among countries with the highest number of stunted under-five children in the World (FDRE 2016; WHO 2017). The trend, however, shows that the prevalence of stunting has decreased from 58% in 2000 to 37% in 2019, which is an average decline of more than 1% annually, but the problem is still high. Results from the 2019 EMDHS show that 37% of children under 5 are short for their age or stunted, and 12% are severely stunted (below -3 SD). There are some regional variations in stunting, which ranges from a high of 49% in Tigray to a low of 14% in Addis Ababa(EMDHS 2019). This shows that up to the present time, the country has fallen behind expectations with regards to addressing stunting prevalence.

## 1.2. Statements of the Problem

Globally, over one third of children in rural households are stunted compared to one quarter in urban households. Child stunting in developing countries have been characterized by large rural-urban disparities over the last few decades(Van de Poel, O'Donnell, and Van Doorslaer 2007). Children in the poorest households are also more likely to be stunted as compared to children in the richest households (Anwar, Debnath, and Ali 2019).In Ethiopia, stunting among children is greater in rural areas (41%) than in urban areas (26%) with 15% differences between urban and rural resident children. Stunting among the poorest and the richest socioeconomic categories was 45.1% and 26.9%, respectively, with an 18% stunting gap between the richest and the poorest socioeconomic categories(EMDHS 2019).

Several studies in developing countries have shown that socioeconomic inequality is liked to stunting, such that communities with high socioeconomic inequality carry a disproportionately high burden of stunting (Poel et al. 2008). Urban children generally have better nutritional status than rural children, and a number of studies have attempted to explain this difference in stunting between rural and urban children. Differences in the levels of socio-economic characteristics such as maternal education, spouse's education and the wealth index contribute a major share of rural-urban disparities in child stunting. Differences in the strength of association between socio-economic characteristics and child stunting account for less than a quarter of rural-urban disparities at the lower end of the HAZ score distribution(Garrett and Ruel 1999; Van de Poel, O'Donnell, & Van Doorslaer, 2007; Hirvonen, 2016; C. S. Srinivasan, Zanello, & Shankar, 2013; S. and Y. A. Tadesse, 2015; Smith, Ruel, & Ndiaye, 2004; Van de Poel et al., 2007).

Caregivers education status was the main contributor, accounting alone for (33%) of the socioeconomic inequality in stunting, followed by region of residence (11%) and birth size (6%) (Mohammed et al. 2019). Income inequality between urban and rural households explains most of the stunting gap (Sharaf and Rashad 2015). Few studies had investigated the urban-rural disparity and related inequality in stunting among under 5 children in Ethiopia (Takele et al., 2019; S.Mohammed et al., 2019 ;Tadesse, 2015; Degarege et al., 2015;Hirvonen, 2016). But, the level of the inequality, determinants associated with inequality in stunting and the contribution of the driving factors to the stunting variation, have not yet been enough documented in the case of Ethiopia. Specially, the decomposition of the rural-urban differences based on key socioeconomic variables is not common in case of Ethiopia. Understanding the nature and the causes of this urban-rural and wealth related inequality is essential in planning child health and improving the gap in child health outcome in urban and rural areas. The present study, therefore attempts to investigate the contribution of different factors to the urban-rural gap in stunting and identify the determinants of stunting inequality in Ethiopia.

## 1.3. Research Objectives

### 1.3.1 General Objective

The general objective of the study was to decompose the rural-urban disparity in the prevalence of stunting and to explore the level and determinants of inequality in stunting in Ethiopia.

### 1.3.2 Specific Objectives of the Study

The specific objectives of the study which should be accomplished to achieve the general objective stated above are:

i. Decompose rural-urban disparity in stunting,
ii. Explore the level of inequality in stunting, and
iii. Identify determinants of inequality in stunting

## 1.4. Research Question

This research tries to answer the following questions:

i. What is the level of inequality in stunting in Ethiopia?
ii. What explains the inequality in stunting in Ethiopia?
iii. What contributes to the urban- rural gap in stunting in Ethiopia?

## 1.5. Significance of the Study

Malnutrition is one of the major public health emergency problems of the developed and developing nations but under nutrition in the form of stunting is the primary problem of developing countries. Different global initiatives have been endorsed to tackle stunting and other forms of malnutrition, and Ethiopia has also endorsed major global and national commitments and envisioned to see children free from under nutrition including stunting. According to the global progress report, Ethiopia requires a 6 percent average annual reduction rate (AARR) to achieve the WHA 2025 target of 26.8 percent prevalence. But the current reduction rate is only at 2.8 percent which is far below the expected annual reduction rate (Unicef/ WHO/The World Bank 2019). Thus, Ethiopia is off-track to reach the United Nations sustainable development goals of ending child malnutrition by (WHO, 2019).

Exploring level of inequality in stunting and identifying its determinant used to formulate appropriate health strategies and policies that can be used to meet the United Nations sustainable development goal (SDG) of reducing under-five stunting to 26.8% by 2025 (Unicef/ WHO/The World Bank 2019). It can also be used to take more cost-effective interventions and policies to reducing child stunting and to improving the health of the society. Specifically, the finding of this study will help stakeholders in the planning, formulation and implementation of policies concerning the reduction of under-five stunting and provide information about the determinants and trends of under-five stunting to stakeholders. Also the result of this study may be help the local government and NGOs in understanding inequalities in stunting and disparities among urban-rural in child stunting clearly and to plan a new strategy to come up with a solution and implementation of different child stunting categories. This study will also help as a baseline data for those who are interested in carrying out further research.

## 1.6. Scope of the Study

The study considered children below five years living in urban and rural Ethiopia. This is because children under-five years are normally the most at risk of stunting within households and communities in Ethiopia. Also the study investigated the level of inequality in stunting and explains the rural-urban disparity in the prevalence of stunting in Ethiopia using demographic health survey of Ethiopian, a cross sectional survey conducted in 2016 by CSA and ministry of health in collaboration. Totally 9588 children under 5 years of age included in the dataset and with complete information on the variables of interest.

# CHAPTER 2: LITERATURE REVIEW

This chapter deals with review of related literature under the following sub-headings: conceptual literature review, theoretical literature review and empirical literature review on inequalities and rural-urban disparities in stunting. Relevant studies in both developing and developed countries are reviewed giving a special emphasis on the findings and methodological issue in developing countries. Conceptual framework and synthesis of the literature were also indicated.

## 2.1. Conceptual Literature Review

Linear growth is the best overall indicator of children's well-being and provides an accurate marker of inequalities in human development. This is tragically reflected in the millions of children worldwide who not only fail to achieve their linear growth potential because of suboptimal health conditions and inadequate nutrition and care; they also suffer the severe irreversible physical and cognitive damage that accompanies stunted growth (Onis and Branca 2016). Stunting often goes unrecognized in communities where short stature is so common that it is considered normal. The difficulty in visually identifying stunted children and the lack of routine assessment of linear growth in primary health care services explain why it has taken so long to recognize the magnitude of this hidden scourge. Stunting results from a complex interaction of household, environmental, socioeconomic and cultural influences that are described in the World Health Organization (WHO) Conceptual Framework on Childhood Stunting (Wirth et al. 2017).

Stunted children have lowered resistance to infection; therefore, they are more likely to die from common childhood ailments such as diarrheal diseases and respiratory infections. In addition, stunted children that survive are likely to suffer from frequent illness, which adversely affects their nutritional status and locks them into a vicious cycle of recurring sickness, faltering growth and diminished learning ability.

Studies in a few developing countries have shown that urban children have better health outcomes than rural children. Income inequality between urban and rural households explains most of the malnutrition gap.

Rural households, are less educated, have lower access to satisfactory sanitation and improved drinking water, and lower access to healthcare than urban households (Sharaf and Rashad 2016). No fundamental differences in the characteristics that determine child stunting in urban and rural areas.

Differences in the levels of a limited number of socio-economic characteristics maternal education, spouse's education and the wealth index (incorporating household asset ownership and access to drinking water and sanitation) contribute a major share of rural-urban disparities in child stunting(C. Srinivasan and Shankar 2014).

Typically, in low and middle income countries, stunting is more common in low-socioeconomic groups. Several studies have shown that children from higher socioeconomic status (SES) have lesser risk of stunting compared to their lower SES counterparts(Huda et al. 2018). Inequalities in stunting among different socioeconomic strata of the population remain one of the mainchallenges for public health throughout the world.

Although inequalities in stunting can result from differential access to food and health care and/or differences in healthseeking behaviors, there is ample evidence in the literature that suggests other social determinants of health play an important role in determining child nutritional status (Jayawardena 2017; Fenske et al. 2013; Huda et al. 2018).The UNICEF conceptual framework of undernutrition has identified poverty and food insecurity, maternal and child care practices, limited access to health services, poor health environment (water, sanitation, and hygiene), gender inequities, and limited education as the underlying determinants of undernutrition(UNICEF, 2009). The complex interaction between these underlying factors makes it very challenging to control stunting despite being considered as a preventable condition.

In order to mitigate socioeconomic inequalities in stunting and overall child health, a key step is to first identify those factors that make the greatest contributions towards the observed inequalities and urban-rural disparities. Determinants of socioeconomic inequalities in stunting are less well studied. There is increasing interest in understanding the underlying causes of inequalities in stunting, to know whether determinants of stunting are distributed differently by wealth or socioeconomic status of the households.

## 2.2. Empirical Literature Review

According to WHO prevalence threshold classification, a prevalence rate that exceeds 30 percent is labeled as very high, where Ethiopia is included(Unicef/ WHO/The World Bank 2019).Understanding the causes of inequalities in child stunting and exploring the level of inequalities provides important public health insights(Wirth et al. 2017). The causes of stunting are multisectoral and multifactorial, including food, health care practices, and are classified as underlying (maternal, household and regional characteristics), intermediate (individual/household level) and immediate (individual level)(Fenske et al. 2013).

Garrett and Ruel [1999] examined whether the socio-economic determinants of children nutritional status differ between urban and rural regions and found that such difference arises from the difference in the nature of characteristics that shapes urban and rural living. They found that rural regions are characterized by more dependence on agriculture activities, less involvement of women in outdoors income generation activities, less female-headed household, and larger household size. Furthermore, rural regions are characterized by lower access to electricity, sanitation and healthcare. Accordingly, the determinants of children malnutrition could differ due to this difference in the living environment. However, they found no support for the difference in the main socio-economic determinants of child nutritional status between urban and rural regions. They concluded that health disparities between urban-rural children exist because of the gap in the level of the key determinants, as urban regions have more favorable living environment(Garrett and Ruel 1999).

Poel et al (2007) used data from the Ghana 2003 DHs to examine malnutrition and the disproportional burden on the poor in case of Ghana by using concentration index and decomposition approach. The findings of their study revealed that malnutrition is related to poverty, maternal education, health care and family planning and regional characteristics. Socioeconomic inequality in malnutrition is mainly associated with poverty, health care use and regional disparities(Poel et al. 2007).

Mohammed et al (2019) used data from the 2016 Demographic and Health Survey of Ethiopia to examine the socioeconomic inequality in stunting among under five children. Their study used the Blinder Oaxaca decomposition approach to decompose the inequality in stunting between the poorest and richest socioeconomic groups into its contributing social factors. The finding of their study revealed that caregiver's education status was the main contributor of the socioeconomic inequality in stunting, followed by region of residence and birth(Mohammed et al. 2019).

Stunting in developing countries has been characterized by large rural-urban disparities over the last few decades. A substantial body of empirical studies shows that average Stunting in urban areas are significantly better than in rural areas in a large cross-section of developing countries(C. S. Srinivasan, Zanello, and Shankar 2013).

Srinivasan et al (2013) used data from Demographic and Health Survey of Bangladesh and Nepal to examine Rural-urban disparities in child nutrition in Bangladesh and Nepal , they apply quantile regression-based counterfactual decomposition methods to quantify the contribution of the differences in levels of socio-economic determinants and the differences in the strength of association between socio-economic determinants and child stunting to the observed rural-urban disparities in child stunting. The finding of their study revealed that there are no fundamental differences in the characteristics that determine child stunting in urban and rural areas. Differences in the levels of a limited number of socio-economic characteristics maternal education, spouse's education and the wealth index (incorporating household asset ownership and access to drinking water and sanitation) contribute a major share of rural-urban disparities in the lowest quantiles of child nutrition outcomes.

Differences in the strength of association between socio-economic characteristics and child nutrition outcomes account for less than a quarter of rural-urban disparities at the lower end of the HAZ score distribution(C. Srinivasan and Shankar 2014).

Kia et al (2019) used data from Iran's Multiple-Indicator Demographic and Health Survey 2010 to examine the inequality in malnutrition among under-five children by using a regression-based decomposition approach, the study revealed that socioeconomic inequality in stunting was statistically significant.

More than 50% of the inequalities in stunting were influenced by socioeconomic status. Furthermore, maternal education was associated with inequality in stunting(Kia, Goodarzi, and Asadi 2019).

Smith et al (2004) used Demographic and Health Survey data from 36 developing countries to address the question of whether the socioeconomic determinants of child nutritional status differ across urban and rural areas and to answer the question of why child malnutrition rates are lower in urban areas. By using the study documented marked differences in the levels of socioeconomic determinants in favor of urban areas. The study also found large gaps in favor of urban areas in the levels of key proximate determinants of child nutritional status, especially maternal prenatal and birth care, quality of complementary feeding, and immunization of children(Smith, Ruel, and Ndiaye 2004).

Van de Poel et al (2007) using DHS data from 47 developing countries have attempted to quantify the contribution of wealth and other socio-economic characteristics to child nutrition outcomes by examining how rural-urban relative risk ratios for stunting/child mortality change as these characteristics are successively controlled for. They find that on average, rural-urban relative risk ratios fall by 53% when household wealth is controlled for and by a further 23% when other socio economic variables are controlled for(Van de Poel, O'Donnell, and Van Doorslaer 2007).

Mussa (2011) used data from the 2006 multiple indicator cluster survey of Malawi to Explain the Rural-Urban Malnutrition Inequality by using concentration index of the height-for-age z-scores (HAZ) and decomposition approach. The findings of his study revealed that the rural-urban difference in parental education and economic status is a major driver of the malnutrition inequality differential. Further to that, he found that it is the difference in the education elasticity rather than the difference in education inequality that accounts for the bulk of the gap associated with education.

Garrett and Ruel (2004) investigated the determinants of the large rural-urban differentials in stunting in Mozambique using cross-sectional household survey data in a regression framework modeling mean HAZ. They concluded that the explanation predominantly lay in differing levels of key determinants (covariate effects) rather than differences in the strength of influence of covariates on stunting (coefficient effects).

Smith et al (2004) examined DHS data from 36 developing countries, again in a (mean) regression framework, and found significant rural-urban differences in the socio-economic and proximate determinants of child nutrition. The study also found very few significant differences in coefficient effects in urban and rural settings and concluded that rural-urban disparities could be predominantly attributed to differences in levels of socio-economic characteristics.

Abhishek Kumar et al (2014) using data from multi-waves of the National Family Health Survey conducted in India between 1992 and 2006 and examines the pattern of rural–urban differentials in childhood malnutrition in India over time. Furthermore, it identifies the factors responsible for the rural–urban gap in childhood malnutrition and quantifies their contribution. The result shows a considerable and widening gap in childhood malnutrition across rural–urban residence in the country over the study period. The economic status of the household and parental education was the most significant contributors to the rural–urban gap in childhood malnutrition in India. Based on the findings, they concluded that to reduce the rural–urban gap in childhood malnutrition, focus should be given to the rural poor (Abhishek Kumar et al, 2014)

Ali and Norheim (2014) investigated the inequalities in Child Health in Ethiopia using data obtained from the 2000, 2005 and 2011 Ethiopian Demographic and Health Surveys and by decomposition of concentration index. Their study found that significant pro-rich inequalities for all indicators except treatment for suspected pneumonia and significant regional inequality for most indicators. Their study also found that the factor contributing the most to the observed inequalities was different levels of wealth and conclude that there is an unequal socioeconomic and geographic distribution of health and access to key services in Ethiopia(Ali and Norheim 2014).

Uthman (2009) investigated the socioeconomic inequality in chronic childhood malnutrition in case of Nigeria using extended concentration and achievement indices and data from Nigeria 2003 Demographic and Health Survey. Their study found that there are considerable pro-rich inequalities in the distribution of stunting and there are significant differences in under five child malnutrition that favour the better-off of society as a whole and all geopolitical regions. Thus, there is a need for evaluating policies not only in terms of improvements in averages, but also improvements in distribution(Uthman 2009).

## 2.3. Theoretical Frame Work

This study utilizes the United Nations Children's Fund's framework for the causes of child malnutrition as theoretical framework. It is comprehensive, incorporating both biological and socio-economic causes of child malnutrition and it encompasses causes at both macro and micro levels. There are three levels of causality corresponding immediate, underlying and basic determinants of child malnutrition(UNICEF 1992). The basic determinants of a child's nutritional status are potential resources in the environment, technology and people, socio-cultural environment, political and economic structure, which lead to poverty.

In developing countries, gaps in health-related outcomes between the rich and the poor are large (Pradhan and Arokiasamy 2010).These gaps limit poor peoples' potential to contribute to the economy by reducing their capacity to function and live life to the fullest. For the quantitative analysis of this paper the study also used an economic perspective based on a household utility maximization framework. This follows the tradition established by Becker (1981) which views a household as maximizing a utility function which depends on leisure, market purchased goods and home-produced goods such as child nutrition. The maximization is done subject to a budget constraint, a time constraint and a (biological) nutrition production function. The production of nutrition depends on a set of inputs such as food (or nutrients), caring practices and the utilization of health services; a series of exogenous individual characteristics including those of children and a vector of household characteristics such as the education of the parents and community characteristics.

## 2.4. Synthesis of the Reviewed Literature

Literature on inequalities and urban-rural disparity in stunting under empirical literature review show that there were in inequalities in prevalence of stunting among the poorest and richest socioeconomic categories and also shows that there is disparity among urban-rural in stunting. Most of the reviewed literature shows that the observed rural-urban differences in child stunting may arise because of rural-urban differences in the levels of determinants of stunting, which may be termed as 'covariate' effects or rural-urban differences in the strength of association between particular determinants and stunting which may be termed as coefficient effects.

On the other hand the main contributor of the inequality in stunting was Caregivers' education status, followed by region of residence and birth size. And also there are similarities in the characteristics that determine stunting in urban and rural areas. Conceptual framework related to the topic was also reviewed.

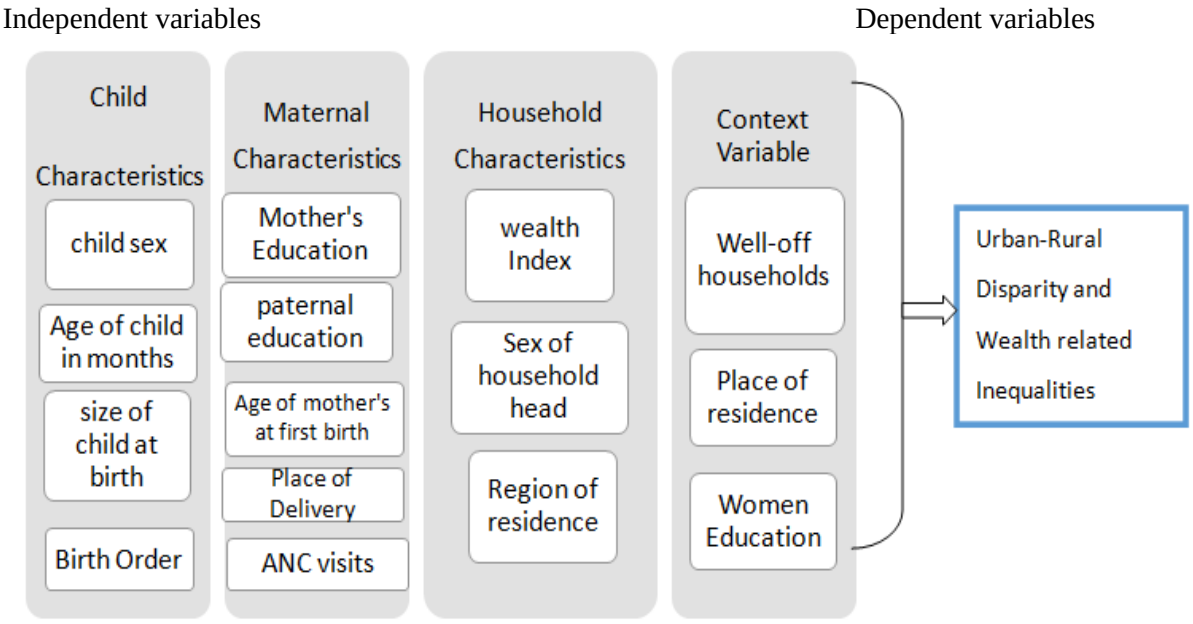
The conceptual framework for this study was developed from WHO (2017) report and UNICEF framework outlining the causes of malnutrition with some modification. The framework shows child characteristics, maternal characteristics and household characteristics are interrelated. Theoretical literature related to the topic was reviewed. The theoretical literature shows that child under nutrition and economic growths are not always at par across the globe.

The review of literature further showed that no known study has been carried out on inequality and urban-rural disparity in stunting in Ethiopia using demographic health survey data. Only a few studies have attempted to quantify the contribution of socio-economic or ecological variables, individually or in the aggregate, to rural-urban differences in child nutrition outcomes. Whilst these studies have provided valuable insights into the determination of urban-rural stunting differentials and inequality in stunting, their results only throw light on the mean of the outcome variable. Also, their approaches do not yield the contributions of individual covariates to child stunting. Hence gaps were identified that this study intends to bridge the gap and this study aimed to explore urban-rural disparity in stunting and wealth related inequalities in stunting using Ethiopian Demographic Health Survey data of 2016.

Exploring level of inequality in stunting and identifying its determinant will help to formulate appropriate health strategies and policies that will help to reducing under-five stunting. It can also be used to take more cost-effective interventions and policies to reducing child stunting and to improving the health of the society. Specifically, the finding of this study will help stakeholders in the planning, formulation and implementation of policies concerning the reduction of under-five stunting and also provide information about the determinants and trends of under-five stunting to stakeholder

## 2.5. Conceptual Framework

The conceptual framework of this study (Figure 1) was developed from the related literature, including a report on the causes and consequences of stunted growth published by WHO(WHO 2017) and UNICEF framework(UNICEF 1992). The study used children's characteristics (age of child in months, sex of child, birth order number and size of child at birth), maternal characteristics (age at first birth, educational level, maternal working status and maternal body mass index) and household characteristics (sex of household head, place of residence, region of residence and household wealth) as determinant factors.




*Source: Adapted from UNICEF/WHO child stunting framework by Author*

*Figure 1. Conceptual Framework*

# CHAPTER 3: METHODS AND MATERIALS

This chapter explains the data and methods used in the study. It is discussed under the following subheadings: Research approach, area of the study, design of the study, the population of the study, Sample Size and Sampling Strategy and method of data analysis.

## 3.1. Study Context

Ethiopia is situated in the Horn of Africa, between 3 and 15 degrees north latitude and 33 and 48 degrees east longitude. The country occupies an area of approximately 1,127,127 square kilometers with about 109 million people (2018). The second most populous country of Africa, next to Nigeria, with an annual population growth rate of about 2·6%. About 19.77% of the households are in urban areas (ECSA 2007). Other than Addis Ababa, which is predominantly urban, the percentage of urban areas varies greatly from 11.84% in the SNNP Region to 71.02% in Dire Dawa. Administratively, Ethiopia is a Federal Democratic Republic with nine autonomous Regional States and two cities administration, each divided into zones, districts and sub-districts/ kebeles.

Over the last few decades, Ethiopia's economy has grown at an annual rate of approximately 11% but nearly a third of its population still lives below the poverty line(UNDP 2015). It is also one of the poorest, with a per capita income of $790. Ethiopia aims to reach lower-middle-income status by 2025. Higher economic growth brought with it positive trends in poverty reduction in both urban and rural areas. Agriculture has been the main driver for the fast- growing Ethiopian economy and is also responsible for 85% of total employment. Ethiopia is one of the developing countries where child stunting is prevalent.

Despite a remarkable decline in the last few years, child under nutrition has long been a major public health concern (Amare, Ahmed, and Mehari 2019). At the policy and program level, Ethiopia has many strategies and programs to reduce levels of malnutrition as part of its national development agenda.

Some of the major strategies and programs include: the growth and transformation plan (GTP), National Nutrition Plan (NNP), The seqota Declaration, National Food Security Strategy, Nutrition Sensitive Agriculture Strategy, School Health and Nutrition strategy, Productive Safety Net Program and Food Safety and Quality related regulatory activities (FDRE 2016). The seqota declaration adopted Sustainable Development Goal 2 (SDG 2), with the aim to end hunger, achieve food security, and improve nutrition and promote sustainable agriculture by 2030 ( Seqota declaration 2016) (FDRE 2016).

## 3.2. Research Approach

This research approach was quantitative in nature and data were obtained from the Ethiopia demographic and health survey 2016.

## 3.3. Research Design

A survey data was utilized for the purpose of this study. The survey had a cross-sectional design by its nature and was employed to provide estimate at national and regional level.

## 3.4. Population and Data Source

The data for this study was obtained from Ethiopia Demography and Health Surveys (EDHSs) conducted in 2016. The 2016 Ethiopia Demographic and Health Survey (EDHS) were implemented by the Central Statistical Agency (CSA). By virtue of its mandate, the CSA has conducted the surveys in collaboration with the Federal Ministry of Health (FMoH) and the Ethiopian Public Health Institute (EPHI) with technical assistance from ICF international, and financial as well as technical support from development partners. The 2016 survey was conducted from January 18, 2016, to June 27, 2016, based on a nationally representative sample. The 2016 Ethiopian Demographic and Health Surveys, were designed to provide estimates for the health and demographic variables of interest for the following domains: Ethiopia as a whole; urban and rural areas (each as a separate domain); and 11 geographic administrative regions (nine regions namely: Tigray, Affar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples, Gambela and Harari regional states and two city administrations :(Addis Ababa and Dire Dawa) (EDHS 2016). DHS surveys are one of the most cited databases globally and have been conducted in over 90 countries since 1984(EDHS 2016). All children included in the survey were below 5 years of age.

## 3.5. Sample Size and Sampling Strategy

The sampling frame used for the 2016 EDHS data is the Ethiopian Population and Housing Census (EPHC) conducted in 2007 by the Central Statistical Agency (CSA). The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata. Samples of EAs were selected independently in each stratum in two stages. In the first stage, a total of 645 EAs (202 in urban areas and 443 in rural areas) were selected with probability proportional to EA size (based on the 2007 EPHC) and with independent selection in each sampling stratum. In the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing. All women age 15-49 and all men age 15-59 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed. In all of the selected households, height and weight measurements were collected from children age 0-59 months. For this study, a total of 10,006 children less than 59 months were identified in the households of selected clusters. Among whom, the complete height-for-age record was collected from 9588 children and 640 clusters. The remaining 418 children and 5 clusters had missing values on height-forage records. Thus, the analysis of this study was based on the 9588 under five children(EDHS 2016).

## 3.6. Inclusion and Exclusion Criteria

The main inclusion criteria for this study were age 0 to 59 months, and data on height (length), and wealth index measured and indexed with the child profile. Exclusion criteria were incomplete data on age, length (height), wealth category, and implausible height-for-age (HFA) Z-score values. Implausible HFA Z score values was defined by HFA Z- score $< -6$ or $> 6$, according to the WHO 2006 child growth standards(EDHS 2016).

## 3.7. Description of the Variables in the Study

The independent variables that were considered to influence under-five mortality were selected based on findings of available similar studies and the available data on the subject.

### 3.7.1 The Response Variable

The outcome variable was modeled in two different ways. Firstly, the study used stunting as a binary variable that indicated whether or not the child was stunted (i.e., two standard deviations or more below the mean of the WHO reference population). Secondly, the study used HAZ scores in their continuous form to model the determinants for socioeconomic inequalities in stunting that is inequality in Stunting as dependent variable. The length of children under-2 years of age was measured in a recumbent position and the height of those 2 years and above was measured in standing position. Using the length height, and age data, length-for-age (LFA Z- score) was calculated for children under-2 years of age and height-for-age (HFA) Z-score for those 2 years and above. The WHO 2006 child growth standard was used as a reference in the calculation of both LFA and HFA Z-scores(EDHS 2016). Except for the age group, both LFA and HFA Z-score refer to the linear growth status of children as compared with the median of the reference population. As HFA is more familiar and commonly used in nutrition reports, HFA is used in the subsequent sections of this report to refer to both LFA and HFA Z-scores. Stunting, or linear growth failure, is defined when HFA is below -2 Z-scores (Unicef/ WHO/The World Bank 2019).The study used height-for-age z-scores to measure the contribution of each determinant to the urban-rural disparity in stunting and concentration index to indentify determinants of inequality in stunting (van Doorslaer and O'Donnell 2011).

### 3.7.2 Explanatory Variables

The explanatory variables included in this study are based on the related literature including

report on the causes and consequences of stunted growth published by WHO (2017) and the widely applied UNICEF framework(UNICEF 1992) outlining the causes of stunting with some modification and also these determinants of child stunting were obtained from the available similar studies reviewed above and available data on the subject.

The study used children's characteristics (age of child in months, sex of child, birth order number and size of child at birth) maternal characteristics (place of delivery, partner's/husband education level, age at first birth, maternal education status, Religion of mother's, maternal working status and body mass index) and household characteristics (sex of household head, region of residence and wealth index) as determinants factors. Postnatal care service utilization and ANC are excluded in the entire analysis due to the missing value.

## 3.8. Methods of Data Analysis

All analyses were done taking into account the complex design of the survey. Thus, all estimates reported were based on the weighted sample (n= 9588), not on the unweighted sample (n=8855). The weighting was done to adjust for the inequality in sampling probability due to the over representation of small states (region) (EDHS 2016). Adjustment for design effect was also done to account for the variance inflation due to the cluster sampling strategy. All analysis was conducted using STATA 14 software, with statistical significance determined at $\leq 0.05$. The analysis starts with an analysis of the individual variables separately. The purpose of this was to examine the proportion of respondents with specific characteristics including the dependent variable, child stunting. Frequencies including the number of respondents' with particular characteristics and corresponding percentages were used in the analysis. Bivariate analysis was done to determine the relationship between the socioeconomic variables and urban-rural disparity in stunting. Socioeconomic inequality was measured using an alternative concentration index that avoids problems with dependence on the mean level of stunting (Poel et al. 2008).

Concentration index is a relative measure of inequality that indicates the extent to which a health indicator is concentrated among the disadvantaged or the advantaged. Given that a population is ranked by increasing socioeconomic status: Concentration index has a negative value when the health indicator is concentrated among the disadvantaged. Concentration index has a positive value when the health indicator is concentrated among the advantaged.

The gap in stunting between the urban and rural groups was decomposed into its contributing determinants, following the Blinder Oaxaca decomposition approach, specifically the multivariate decomposition for linear regression models. A Blinder-Oaxaca decomposition analysis will be conducted to decompose the rural-urban differences in stunting into two components; one that is explained by differences in the level of the determinants (covariate effects), another component that is explained by differences in the effect of the determinants on the child stunting status (coefficient effects). The decomposition method developed by Blinder (1973) and Oaxaca (1973), and generalized by Neumark (1988) and Oaxaca and Ransom (1988, 1994), allows the decomposition of outcome variables between two groups into a part that is explained by differences in observed characteristics and a part attributable to differences in the estimated coefficients(Sinning, Hahn, and Bauer 2008).

### 3.8.1 Econometric Analysis

The econometric analysis was performed at three levels; first concentration curves for the child stunting variables were constructed. Second, the concentration indices for these variables were computed to augment the concentration curves. The final analysis was done to identify the determinants of the inequality in stunting and to identify factors that contribute to inequality in child stunting.

The concentration curve gives a pictorial view of the pattern and magnitude of inequality in child stunting. The curve is a plot of the cumulative percentage of child stunting on the y-axis and wealth status ranked by cumulative percentage of the population on the x-axis. The concentration curves depict inequality against the poor if it lies above the line of equality ($45^0$line). On the other hand, inequality against the rich exists if the curve lies below the line of equality. In a situation where there exists perfect equality in child stunting, irrespective of wealth status, the concentration curve is a straight line equal to the $45^0$ line. The magnitude of inequality is depicted by how far the curve lies away from the line of equality. For instance, if the magnitude of inequality infavour of the rich is higher, the farther the curve will be above the line of equality.

To ascertain the magnitude and nature of socioeconomic-related inequality in child stunting, the concentration indices (CI) were computed. This approach of measuring inequality has been widely used and recognized as a standard tool. The Concentration index summarizes the information contained in each concentration curves and is twice the area between concentration curves and equity line(van Doorslaer and O'Donnell 2011). Concentration indexes were calculated to measure the gap between the concentration curves and the equity line. If the curves lie below the equity line, stunting would be more concentrated among people in the upper socioeconomic strata, and the value of concentration indices would be positive. Moreover, a value of 0 (zero) signifies perfect equality, i.e., there is no socioeconomic related inequity for child stunting.

A convenient simple computational formula (Jayawardena 2017)for the concentration index can be written as $$CI = \frac{2}{\mu} Cov(h_i, r_i)$$

Where CI is the concentration index, $h_i$ refers to the stunting measure of the $i^{th}$ individual and $r_i$ is its respective fractional rank in terms of the index of household socio-economic status; μ is the mean of the stunting measure and cov denotes the covariance. The value of the CI lies between −1 and +1 (i.e., $-1 \leq CI \leq +1$), where negative refers to the case where stunting is fully concentrated among the poorest quintile, and positive refers to the case where stunting is fully concentrated among the richest quintile. The relationship between the factors and the inequality in stunting was done to identify the determinants of inequality in stunting by using multi level linear regression models.

### 3.8.2 Multivariate Decomposition

A multivariate decomposition analysis was used to decompose the urban-rural disparity in stunting. The decomposition technique separates the contribution of characteristics of respondents and their environment as well as characteristics of children, endowment effect, in one hand and the contribution of response to behavior, coefficient effect, on the other.

## 3.9. Operational Definitions

***Anthropometry:*** Measurement of the variation of physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition height-for-age.

**Disparity**: The quantity that separates a group from a reference point on a particular measure of characteristics that is expressed in terms of a rate, proportion, mean, or some other quantitative measure. Differences in the characteristics that determine stunting in urban and rural areas. Differences in the levels of a limited number of socio-economic characteristics among urban and rural areas.

**Inequality:** Uneven distribution of stunting across socioeconomic determinants is termed as inequalities in stunting. Inequalities (the gap between the poor and rich) in stunting are unjust as they result from the unfair distribution of resources, have spillover effects.

***Height-for-age:*** An index used for assessing stunting (chronic malnutrition in children).

***Wealth index:*** A composite measure of a household's cumulative living standard. The wealth index is calculated using principal component analysis based on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities.

**Z-scores**: Z-scores are commonly used in anthropometry to evaluate growth measurements. It refers to how far and in what direction an anthropometric measure deviates from a standard healthy reference called the median (meaning “middle” value). Thus, Z-scores referred to as standard deviations or SD. Negative Z-scores mean that the growth of a child is less than that of the reference healthy population. Negative Z-scores are used to classify children into categories of malnutrition.

## 3.10. Ethical Clearance

This study was mainly based on a secondary data analysis of anonymous public use data; the data is available from CSA (Central Statistic Agency). Ethical clearance was obtained from Center for Population Studies of College of Development Studies of Addis Ababa University.

# CHAPTER 4: RESULT AND DISCUSSION

## 4.1. Result

### 4.1.1 Background Characteristics

A total of 9588 weighted cases of under five children were utilized for the present analysis, 1048 from urban and 8540 from rural areas of Ethiopia. More than half, 54.2% in urban and 58.6% in rural areas were children of at least 24 months of age. The proportion of male children in both urban and rural areas were a little higher than female children and a quarter of the births were small sized at birth (25.9%), 19.2% in urban and 26.8% in rural. While births of higher order (6 or more) are common in rural areas (29.1% in rural versus 9.9% in urban), first births are more common in urban than rural areas (31.8% against 16.6%).Similarly, births of order 2-3 are more prevalent in urban areas (42.5%) than rural areas (29.4%); but, birth orders of 4-5 are more prevalent in rural areas (24.9%) than urban areas (15.9). The majority of urban children (79.9%) were born in a health facility whereas 78.3% of the rural children were delivered at home. The proportion of estimated size of children at birth in rural areas for about a quarter of them was smaller sizes (26.8%) in urban areas the proportion was one in five (19.2%) (*Table 1* )

*Table 1: Percent distribution of child related characteristics by place of residence, EDHS 2016*

| Variables and categories | Place of residence | | |
|---|---|---|---|
| | Urban (n=1048) | Rural (n=8540) | Total (n=9588) |
| Child age in months | | | |
| <6 | 12.02 | 11.23 | 11.32 |
| 6-11 | 13.05 | 10.41 | 10.70 |
| 12-23 | 20.74 | 19.78 | 19.88 |
| 24-59 | 54.19 | 58.58 | 58.10 |
| Child's sex | | | |
| Male | 51.88 | 50.93 | 51.03 |
| Female | 48.12 | 49.07 | 48.97 |
| Size of baby at birth | | | |
| Otherwise | 80.85 | 73.23 | 74.06 |
| Small | 19.15 | 26.77 | 25.94 |
| Birth order | | | |
| First | 31.77 | 16.63 | 18.29 |
| 2-3 | 42.47 | 29.38 | 30.81 |
| 4-5 | 15.86 | 24.89 | 23.90 |
| 6 and above | 9.90 | 29.09 | 26.99 |
| Place of delivery | | | |
| Home | 20.06 | 78.33 | 71.96 |
| Health Facility | 79.94 | 21.67 | 28.04 |

Maternal characteristics are also summarized and the result is shown in the table below. A total of 6972 mothers, 869 in urban and 6103 in rural areas, were included in the analysis. Teenage mothers prevailed in rural areas with a very high magnitude (66.4%) than urban areas (45.0%). In rural areas, more than two-third (68.9%) of the mothers had no formal schooling and mothers having a secondary and above level of education were very limited (3.5%). Contrarily, in urban areas, a quarter of the mothers had no formal schooling (24.0%) and two in five of them had an above primary level of educational achievement (42.6%). Three quarter of the women in rural areas (74.7%) were not engaged in paid work whereas about half of the women of urban areas (48.1%) were working at the time of the survey (Table 2).

In urban areas, the proportions of mothers of age 25-34 were 62.9% having a wider percentage point difference with that of rural area (49.4%). Again, in urban areas the share of Christian religion was 76.6% and about a quarter of the mothers (23.0%) were Muslim. The share of Muslim religion was much higher in rural area (39.4%) and shrank the share of Christian religion (58.3%) than the urban counterpart. As for partner's education, more than half (52.8%) of the partners of urban women had an above primary level of education while 51.1% of partners of women of rural areas had no formal schooling. Underweight was common among rural women (21.1%) than urban women (10.1%). Contrarily, overweight and obesity was a characteristic of urban women (19.8% overweight and 6.6% obese) than rural women (3.4% and 0.5%) (Table 2 & Table 3).

Table 2: Percent distribution of maternal characteristics by place of residence, EDHS 2016

| Variables and categories | Place of residence | | |
|---|---|---|---|
| | Urban (n=869) | Rural (n=6103) | Total (n=6972) |
| Age at first birth | | | |
| 20+ | 55.05 | 33.60 | 36.27 |
| <20 | 44.95 | 66.40 | 63.73 |
| Maternal education | | | |
| No education | 24.00 | 68.88 | 63.29 |
| Primary | 33.46 | 27.63 | 28.35 |
| Secondary+ | 42.55 | 3.49 | 8.36 |
| Current age of mother | | | |
| 15-24 | 18.67 | 24.23 | 23.53 |
| 25-34 | 62.91 | 49.42 | 51.10 |
| 35+ | 18.42 | 26.35 | 25.36 |
| Current work status | | | |
| No | 51.88 | 74.69 | 71.85 |
| Yes | 48.12 | 25.31 | 28.15 |
| Religion | | | |
| Christian | 76.61 | 58.31 | 60.59 |
| Muslim | 23.04 | 39.38 | 37.34 |
| Others | 0.34 | 2.31 | 2.06 |
| BMI of Mothers* | *n=859* | *n=6043* | *n=6901* |
| Underweight | 10.10 | 21.14 | 19.77 |
| Normal | 63.49 | 74.97 | 73.54 |
| Overweight | 19.81 | 3.42 | 5.46 |
| Obese | 6.60 | 0.47 | 1.23 |
| Partner's education* | *n=785* | *n=5722* | *n=6507* |
| No education | 16.96 | 51.06 | 46.94 |
| Primary | 30.26 | 40.59 | 39.35 |
| Secondary | 25.90 | 6.30 | 8.67 |
| Tertiary | 26.88 | 2.05 | 5.05 |

** These characteristics have missing observations*

A total of 6879 households were interviewed for the under five children survey, 857 in urban and 6022 in rural areas. A quarter of the households in urban areas were female headed (25.4%) and 12.5% of the rural households were headed by women. An almost equal proportion of households were interviewed in the each of the wealth categories by residence.

The largest urban household shares were from Amhara (23.4%), Oromia (21.3%) and SNNP (15.2%) and Addis Ababa (20.2%). On the other hand, Oromia contributed the largest share of households in the rural area (43.8%) followed by SNNP (22.1%) and Amhara (21.8%) (Table 3).

Table 3: Percent distribution of household characteristics by place of residence, EDHS 2016

| | Place of residence | | |
|---|---|---|---|
| Variables and categories | Urban (n=857) | Rural (n=6022) | Total (n=6879) |
| Sex of the household head | | | |
| Female | 25.44 | 12.50 | 14.12 |
| Male | 74.56 | 87.50 | 85.88 |
| Region | | | |
| Tigray | 10.66 | 6.69 | 7.19 |
| Afar | 1.29 | 0.80 | 0.86 |
| Amhara | 23.42 | 21.75 | 21.96 |
| Oromia | 21.28 | 43.77 | 40.97 |
| Somali | 4.28 | 3.27 | 3.39 |
| Benishangul Gumuz | 0.68 | 1.09 | 1.04 |
| SNNPR | 15.19 | 22.08 | 21.22 |
| Gambela | 0.83 | 0.17 | 0.25 |
| Harari | 0.64 | 0.15 | 0.21 |
| Addis Ababa | 20.17 | NA | 2.51 |
| Dire Dawa | 1.57 | 0.23 | 0.39 |
| Household wealth | | | |
| Poorest | 22.02 | 20.58 | 20.76 |
| Poor | 19.77 | 22.03 | 21.75 |
| Middle | 23.48 | 20.71 | 21.06 |
| Richer | 19.76 | 19.02 | 19.11 |
| Richest | 14.97 | 17.66 | 17.32 |

NA= Not Applicable

### 4.1.2 Differentials of Stunting

Prevalence of stunting across selected child characteristics by place of residence is shown in the table below. The prevalence of stunting showed a progressive increase across the age of the child in both areas. Sex of the baby did not show differences on stunting in both urban and rural areas, that is, a significant difference was not observed between the sexes within the two residences. Small size births in urban areas exhibited a higher rate of stunting (33.4%) than otherwise (21.8%).

In rural areas, though the magnitude of stunting is higher than urban areas, the risk difference in stunting between small sized births (43.9%) and non-small sized births (37.3%) is very small. The prevalence of stunting among home delivered babies in both areas is nearly the same, 37.0% in urban and 40.5% in rural. However, health facility delivery had a differential impact on stunting in urban areas (20.7%) and rural areas (34.8%). The analysis also revealed that birth order had no observable influence over stunting in rural areas; but, in urban areas, higher birth ordered children were highly affected by stunting as shown by the jump in the prevalence from around 20% for smaller birth orders to 30% among higher ordered births (Table 4).

Table 4: Prevalence of stunting by child characteristics disaggregated by place of residence, EDHS 2016

| Characteristics and categories | Residence | |
|---|---|---|
| Child age in months | Urban (n=1048) | Rural (n=8540) |
| <6 | .079 | .141 |
| 6-11 | .092 | .171 |
| 12-23 | .268 | .413 |
| 24-59 | .293 | .470 |
| Child's sex | | |
| Male | .259 | .407 |
| Female | .220 | .376 |
| Size of baby at birth | | |
| Otherwise | .218 | .373 |
| Small | .334 | .439 |
| Birth order | | |
| First | .225 | .378 |
| 2-3 | .206 | .382 |
| 4-5 | .311 | .404 |
| 6+ | .319 | .400 |
| Place of delivery | | |
| At Home | .370 | .405 |
| Health Facility | .207 | .348 |
| Prevalence | .260 | .410 |

Children born to teenage mothers have a tendency of being stunted. The contrast in prevalence of stunting between teenage mothers and non-teenage mothers in urban areas is higher (27.1% versus 21.6%) as opposed to their rural counterparts (40.1% versus 37.4%). Maternal education greatly benefited their children in that the likelihood of being stunted reduces with the level of maternal education in both areas. Partner's education has also shown a positive influence on the likelihood of stunting as shown in the progressive decline of the rate of stunting with the increase in the level of education. Underweight mothers have a tendency of bearing stunted children while overweight and obese mothers have a reduced likelihood of having a stunted child (Table 5).

Table 5: Prevalence of stunting by maternal characteristics disaggregated by place of residence.

| Variables and categories | Residence | |
|---|---|---|
| | Urban (n=1048) | Rural (n=8540) |
| Age at first birth | | |
| 20+ | .216 | .374 |
| <20 | .271 | .401 |
| Maternal education | | |
| No education | .33 | .41 |
| Primary | .252 | .364 |
| Secondary+ | .162 | .253 |
| Current age of mother | | |
| 15-24 | .256 | .362 |
| 25-34 | .228 | .394 |
| 35+ | .255 | .418 |
| Current work status | | |
| No | .239 | .384 |
| Yes | .241 | .416 |
| Religion | | |
| Christian | .216 | .391 |
| Muslim | .274 | .391 |
| Others | .375 | .445 |
| BMI of Mothers* | | |
| Underweight | .364 | .413 |
| Normal | .26 | .389 |
| Overweight | .145 | .309 |
| Obese | .148 | .25 |
| Partner's education* | | |
| No education | .361 | .418 |
| Primary | .263 | .369 |
| Secondary | .213 | .334 |
| Tertiary | .144 | .283 |
| Prevalence | .260 | .410 |

Sex of the household head does not seem to have a sizeable influence over the likelihood of stunting in both residences. The progressive decline in the prevalence of stunting with an advance in household wealth in both urban and rural areas is an indication of the presence of inequality in stunting in both areas. In Somali region, the prevalence of stunting is nearly the same over residences (25.5% in urban and 27.7% in rural).

In Dire Dawa, the magnitude in rural areas is nearly double as compared to the level in urban area (51.5% versus 25.9%). In urban areas, the magnitude of stunting is the highest in urban areas of Amhara region (38.3%) and the least in urban Oromia (11.5%). In rural areas, the least prevalence is observed in Somali region and the maximum in Dire Dawa (Table 6).

Table 6: Prevalence of stunting by household characteristics disaggregated by place of residence, EDHS 2016

| Variables and categories | | |
|---|---|---|
| Sex of the household head | Urban (n=1048) | Rural (n=8540) |
| Female | .256 | .383 |
| Male | .233 | .394 |
| Region | | |
| Tigray | .338 | .409 |
| Afar | .36 | .446 |
| Amhara | .383 | .476 |
| Oromia | .115 | .371 |
| Somali | .255 | .277 |
| Benishangul Gumuz | .333 | .447 |
| SNNPR | .329 | .39 |
| Gambela | .203 | .28 |
| Harari | .215 | .365 |
| Addis Ababa | .146 | *NA* |
| Dire Dawa | .259 | .515 |
| Household wealth | | |
| Poorest | .456 | .406 |
| Poor | .342 | .436 |
| Middle | .316 | .375 |
| Richer | .312 | .337 |
| Richest | .217 | .297 |
| Prevalence | .260 | .410 |

NA= Not Applicable

### 4.1.3 Inequality in Stunting

As is shown in the graph below (Panel (A)), the absolute inequality in stunting is a negative quantity indicating a pro-poor inequality. That is child stunting is more concentrated among the poor socioeconomic groups. The wealth related inequality in stunting is the worst among births to mothers having a secondary and above level of education (Panel (C)). In addition, analysis of inequality showed that the gap in the level of stunting between affluent households and the poor is much wider in urban areas than rural households (Panel (B)). Addis Ababa is hard hit by the wealth related absolute inequality in stunting. However, the inequality is absent in three regions, that is, Afar, Somali, and Gambela (Panel (D) (Figure 2).

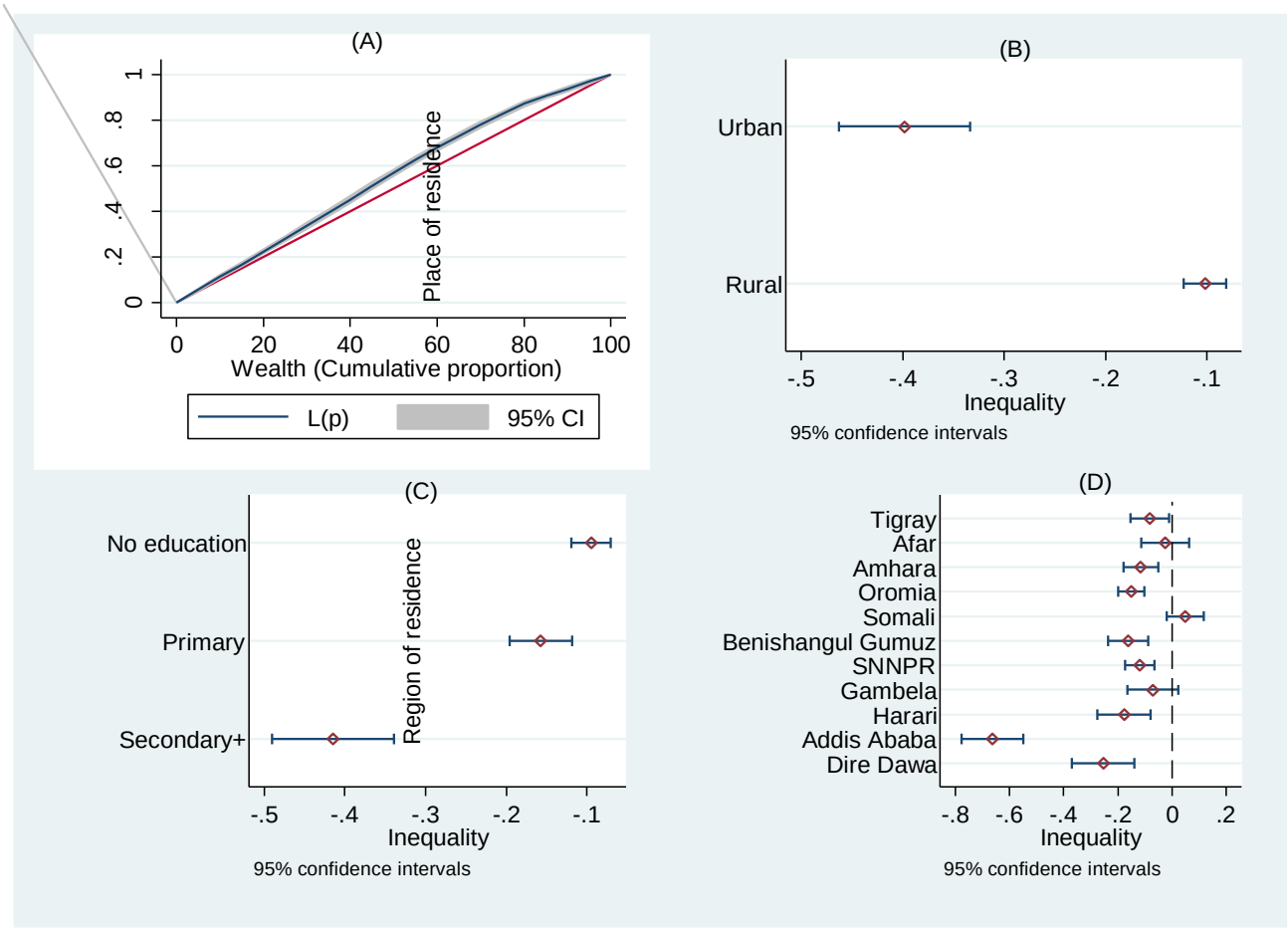



**Figure 2**: Inequality in stunting plots-(A) Erreygers index, (B) CI Plot by place of residence, (C) CI Plot by maternal education, (D) CI Plot by region.

### 4.1.4 Decomposition Analysis

The urban rural gap in the prevalence of stunting (13.7%) is decomposed into endowment and coefficient effects. The result of the decomposition analysis is displayed in the table below. The multivariate decomposition analysis revealed that a significant proportion of the gap in stunting (11.3%) is explained by compositional effects (82.8%). Differential effects of characteristics in urban and rural areas accounted 17.2%, that is, a 2.4 percentage point difference. As the decomposition result for the coefficient effects is not significant, only the result for endowment effects are displayed (Table 7).

Table 7: Multivariate decomposition analysis result for gap in prevalence of stunting between rural and urban children, EDHS 2016

| Contribution | Value | P-Value | [95%conf.Interval] | | % |
|---|---|---|---|---|---|
| | | | LL | UL | |
| Endowment | 11.3 | 0.000 | 5.5 | 17.1 | 82.8 |
| Coefficient | 2.4 | 0.500 | -4.5 | 9.2 | 17.2 |
| Difference in prevalence of stunting (Rural-Urban) | 13.7 | 0.000 | 9.9 | 17.5 | 100.0 |

CI=Confidence Interval LL=Lower Limit UL=Upper Limit

According to the detailed decomposition displayed in the table below, compositional differences in child and maternal characteristics accounted for 13.6% and 36.7% of the gap in the prevalence of stunting between rural and urban children, respectively. Differences in educational achievement of rural and urban women was the prime maternal related characteristics that contributed to 26.7% of the gap in stunting. Trailing behind maternal education, differences in partner's education (7.1%) and BMI of mothers (6.3%) also contributed to the gap in prevalence of stunting the two areas. Child age composition (7.9%) and differences in the birth order of urban rural children (3.7%) are the child related characteristics that would result in the reduction of the gap in the prevalence of stunting in the two residences.

Contrarily, if the religious composition of women of rural area were to be similar to that of women of urban area, the gap in prevalence of stunting would increase benefiting rural children (note the percent contribution to the gap is -4.7%). Similarly, facility delivery, however small the contribution (-1.6%), would widen the gap in stunting.

On the other hand, the analysis suggested that equalizing the wealth distribution of rural households to that of urban households alone would be expected to reduce the rural-urban gap in the prevalence of stunting by about 32%. Generally, it has been observed that it is not only child and maternal characteristics but also context variables contributed to the gap in the prevalence of stunting in the two areas.

Table 8: Detailed multivariate decomposition of stunting-endowment Effect, EDHS 2016

| ***Variables and categories*** | ***Coef.*** | ***P-Value*** | ***95% CI*** | | ***%*** |
|---|---|---|---|---|---|
| | | | ***LL*** | ***UL*** | |
| *Child related characteristics* | | | | | ***13.6*** |
| *Child age (in months)* | | | | | ***7.9*** |
| *<6* | *0.076* | *0.000* | *0.053* | *0.099* | *0.555* |
| *6-11* | *0.434* | *0.000* | *0.294* | *0.574* | *3.171* |
| *12-23* | *-0.155* | *0.000* | *-0.194* | *-0.116* | *-1.133* |
| *24-59* | *0.727* | *0.000* | *0.611* | *0.843* | *5.316* |
| *Birth order* | | | | | ***3.7*** |
| *First* | *0.219* | *0.495* | *-0.409* | *0.846* | *1.597* |
| *2-3* | *-0.007* | *0.966* | *-0.338* | *.32396* | *-.052885* |
| *4-5* | *-0.024* | *0.844* | *-0.262* | *0.214* | *-0.175* |
| *6+* | *0.322* | *0.349* | *-0.352* | *0.995* | *2.351* |
| *Female children* | *-0.055* | *0.003* | *-0.091* | *-0.019* | ***-0.402*** |
| *Small size births* | *0.536* | *0.000* | *0.320* | *0.752* | ***3.918*** |
| *Facility delivery* | *-0.216* | *0.841* | *-2.324* | *1.892* | ***-1.578*** |
| *Maternal characteristics* | | | | | ***36.7*** |
| *Age at first birth* | *0.041* | *0.906* | *-0.647* | *0.729* | ***0.302*** |
| *Maternal education* | | | | | ***26.7*** |
| *None* | *1.535* | *0.066* | *-0.104* | *3.173* | *11.218* |
| *Primary* | *-0.191* | *0.140* | *-0.444* | *0.062* | *-1.395* |
| *Secondary+* | *2.305* | *0.055* | *-0.046* | *4.657* | *16.855* |
| *Maternal age* | | | | | ***1.0*** |
| *15-24* | *0.148* | *0.086* | *-0.021* | *0.316* | *1.079* |
| *25-34* | *0.118* | *0.326* | *-0.117* | *0.352* | *0.859* |
| *35+* | *-0.132* | *0.212* | *-0.339* | *0.075* | *-0.964* |
| *Religion of the mother* | | | | | ***-4.7*** |
| *Christian* | *0.110* | *0.795* | *-0.722* | *0.943* | *0.808* |
| *Muslim* | *-0.853* | *0.027* | *-1.608* | *-0.098* | *-6.237* |

| *Variables and categories* | *Coef.* | *P-Value* | *95% CI* | | *%* |
|---|---|---|---|---|---|
| | | | *LL* | *UL* | |
| *Others* | *0.102* | *0.174* | *-0.045* | *0.248* | *0.743* |
| *BMI of the mother* | | | | | ***6.3*** |
| *Underweight* | *0.120* | *0.721* | *-0.539* | *0.780* | *0.880* |
| *Normal* | *0.074* | *0.781* | *-0.451* | *0.600* | *0.544* |
| *Overweight* | *0.901* | *0.124* | *-0.247* | *2.049* | *6.588* |
| *Obese* | *-0.233* | *0.607* | *-1.124* | *0.657* | *-1.707* |
| *Partner's education* | | | | | ***7.1*** |
| *None* | *0.711* | *0.224* | *-0.435* | *1.858* | *5.200* |
| *Primary* | *-0.117* | *0.532* | *-0.484* | *0.250* | *-0.856* |
| *Secondary* | *-0.374* | *0.435* | *-1.314* | *0.565* | *-2.736* |
| *Tertiary* | *0.756* | *0.440* | *-1.162* | *2.674* | *5.529* |
| *Context variables* | | | | | ***31.9*** |
| *Household wealth* | | | | | ***31.9*** |
| *Poorest* | *0.624* | *0.023* | *0.087* | *1.160* | *4.559* |
| *Poor* | *0.913* | *0.007* | *0.249* | *1.578* | *6.678* |
| *Middle* | *-0.063* | *0.839* | *-0.665* | *0.540* | *-0.458* |
| *Richer* | *-0.395* | *0.094* | *-0.857* | *0.067* | *-2.885* |
| *Richest* | *3.280* | *0.118* | *-0.834* | *7.395* | *23.981* |

CI=Confidence Interval LL=Lower Limit UL=Upper Limit

### 4.1.5 Determinants of Inequality in Stunting

The determinants of wealth related inequality in stunting were identified using a multilevel linear regression model. Three different models were fit: model 1 was fit for child and maternal characteristics, model 2 for context variables, and model 3 is the final model fit only for variables that have shown association with the inequality at 20% level of significance. The result is displayed in the table shown under (Table 9).

Among the first level variables, age of child and the mother and maternal education were found to have a contribution to the wealth related pro-poor inequality in stunting. From among the context variables, it is only residence that predicted the inequality. After controlling the influence of level one characteristics, the pro-poor inequality was found to be wider in among urban children (β=-0.164) as opposed to rural children. The pro-poor inequality in stunting is higher among older infants (6-11 months) and children of age above 1 year as opposed to young infants (<6 month) as evidenced by the negative significant coefficient (*Model 3*-Table 9).

The pro-poor wealth related inequality in stunting is visibly seen among children born to older women than younger mothers (β=-0.101). Moreover, children born to educated women (secondary and above) were severely affected by the inequality in stunting than children of uneducated women (β=-0.221).

It has also been confirmed that maternal education also played a role in widening the gap in prevalence of stunting between urban and rural areas (Table 8&*Model 3*-**Table** 9).

Table 9: Multilevel linear regression model for wealth related inequality in stunting, EDHS 2016

| Variables and categories | Model 1 | | Model 2 | | Model 3 | | | |
|---|---|---|---|---|---|---|---|---|
| | Coef. | P-value | Coef. | P-value | Coef. | St.Err. | P-value | Sig |
| Child age (<6 [*ref*]) | | | | | | | | |
| 6-11 | -0.155 | 0.001 | | | -0.149 | 0.043 | 0.001 | *** |
| 12-23 | -0.171 | 0.000 | | | -0.170 | 0.045 | 0.000 | *** |
| 24-59 | -0.165 | 0.000 | | | -0.170 | 0.043 | 0.000 | *** |
| Female child | 0.019 | 0.402 | | | | | | |
| Birth order (1st [*ref*]) | | | | | | | | |
| 2-3 | 0.013 | 0.718 | | | -0.001 | 0.035 | 0.987 | |
| 4-5 | 0.101 | 0.025 | | | 0.066 | 0.045 | 0.143 | |
| 6+ | 0.108 | 0.025 | | | 0.058 | 0.048 | 0.228 | |
| Maternal education (None[*ref*]) | | | | | | | | |
| Primary | -0.079 | 0.010 | | | -0.040 | 0.031 | 0.191 | |
| Secondary + | -0.340 | 0.000 | | | -0.221 | 0.055 | 0.000 | *** |
| Religion of the mother | 0.000 | . | | | | | | |
| Muslim | -0.007 | 0.822 | | | | | | |
| Others | -0.020 | 0.852 | | | | | | |
| Working mother | -0.029 | 0.283 | | | | | | |
| Maternal age (15-24 [*ref*]) | | | | | | | | |
| 25-34 | -0.094 | 0.008 | | | -0.057 | 0.035 | 0.110 | |
| 35+ | -0.156 | 0.001 | | | -0.101 | 0.050 | 0.042 | ** |
| Urban | | | -0.169 | 0.019 | -0.164 | 0.072 | 0.022 | ** |
| Women education | | | -0.269 | 0.064 | -0.036 | 0.149 | 0.809 | |
| Well-off households | | | -0.127 | 0.104 | -0.111 | 0.078 | 0.158 | |

The Intraclass correlation (ICC) report (Table 10) one intra class correlation for this three-level mixed model. The level on first model intra class correlation, correlation between child characteristics and maternal characteristics. There is not a strong correlation between child characteristics and maternal characteristics included in the model.

Table 10: Intra class correlation coefficients test

| Level | ICC | Std.Err. | [95% Conf.Interval] | |
|---|---|---|---|---|
| Clusters | 0.048 | 0.026 | 0.017 | 0.132 |

## 4. 2. Discussion

The study demonstrated explaining urban-rural disparity in prevalence of stunting and related inequality among children under 5 years of age in Ethiopia based on nationally representative data of the year 2016. Consequently, Descriptive statistics, concentration index, multilevel linear regression model and multivariate decomposition data analyses were employed. The results of the study shows that rural households have lower access to place of delivery than urban households and child born in rural household have lower size at birth than urban children. Rural mothers are less educated, less an employed, have lower access to satisfactory sanitation and improved drinking water than urban households. This is also supported by several studies that have reported large urban and rural differences in socioeconomic conditions (Sharaf & Rashad, 2016; C. Srinivasan & Shankar, 2014).The results of the study also show that in rural areas there are very high magnitudes of teenagers mothers than urban areas. The study shows that underweight was common among rural women than urban. Nearly half of the rural households were in the poorest and poorer wealth quintiles.

This study found that age of the child significantly affected the child's stunting status that is risk of stunting increased along with increase in the age of a child in both areas. Recent studies were reported similar finding in Bangladesh (Mostafa Kamal, 2011), Madagascar (Rakotomanana, Gates, Hildebrand, & Stoecker, 2017) and Malawi (Ntenda & Chuang, 2018).

It could be due to the inappropriate and late introduction of low nutritional quality supplementary food ((Dasgupta, Parthasarathi, Ram Prabhakar, Biswas, & Geethanjali, 2014)), and a large portion of guardian in rural areas are ignoring to meet their children's optimal food requirements as the age of the child increases (Fantay Gebru, Mekonnen Haileselassie, Haftom Temesgen, Oumer Seid, & Afework Mulugeta, 2019).

The study further indicated that among Ethiopian under-five children, males rather than females were more likely to be stunted, but a significant difference was not observed between the sexes within the two residences.

This is similar to previous study reported in Ethiopia (Fantay Gebru et al. 2019) and Sub-Sahara Africa (Magadi 2011). Children perceived small birth weight at birth were more likely to be stunted compared with non-small in both urban and rural areas. In rural areas, though the magnitude of stunting is higher than urban areas, the risk difference in stunting between small sized births (43.9%) and non-small sized births (37.3%) is very small.

Place of delivery is found to be influential on child stunting in both urban and rural areas. The study indicates that children born in health facilities were less likely to be stunted compared to the children born at home with the help of traditional birth attendants. Health facility delivery had a differential impact on stunting in urban and rural. The study found increased risk of stunting in children under 5 years of teenage mothers suggesting an increased risk of child stunting with young maternal age in both urban and rural areas. Child born from teenage mothers are more likely to be of low birth weight with the risk of associated long term effects. Children of teenage mothers compared to those of adult mothers were at least three times more likely to be stunted (Wemakor et al. 2018).

This study identified Maternal education greatly benefited their children in that the likelihood of being stunted reduces with the level of maternal education in both areas. The child stunting was found to be inversely related to the mother's level of education. Compared with a child with higher maternal education, a child with lower maternal education has more risk of being in a worse stunting.

Children whose mothers have higher education were less likely to be stunted as compared with children whose mother had lower or no education. As educated mothers have better knowledge of child health and nutrition, they are more conscious of their child's health and look after their children better. This is supported with reports of previous finding from Ethiopia (Mohammed et al. 2019; Fantay Gebru et al. 2019), India (Singh, Srivastava, and Upadhyay 2019) and Sirlanka (Jayawardena 2017).

This finding shows the importance of the education of girls as alternative strategy to beat the burden of child stunting. Not only maternal education but also father's education has significant impact on child stunting, and children whose father attended formal education had less chance of being stunting in both urban and rural areas. Fathers with formal education know better about proper child feeding and hygiene practices, which contribute positively to preventing child stunting.

The study also found maternal BMI has significant influence over the likelihood of stunting, compared to a child born from a normal or obese mother, a child from a thin mother is more likely to have a worse stunting in both urban and rural areas. As Maternal BMI is influenced by maternal nutrition, in order to improve child growth, proper nutrition is essential for the mothers during the prenatal and postnatal period. Healthier mothers have less risk of having stunting children (Sarma, Khan, and Tarannum 2019). This is also supported by the study conducted in Ethiopia (Fantay Gebru et al. 2019) and Colombia school children (Abrams and Selvin 1995).

Sex of the household head does not seem to have a sizeable influence over the likelihood of stunting in both residences. The study indicates that household wealth has significant influence on child stunting. Children from the poorest households are more likely to be stunted than those from middle, richer, and richest households both urban and rural areas. The progressive decline in the prevalence of stunting with an advance in household wealth in both urban and rural areas is an indication of the presence of inequality in stunting in both areas. This study also found that region of residence has a significant influence on child stunting. Amhara, Benishangul-Gumuz, Affar, and Dire Dawa are most highly affected by child stunting (41-46%).

A child living in Tigray has a higher risk of child stunting compared to a child in Addis Ababa, Oromia, Somali, SNNP and Gambella. Region of residence did not show a differential impact on stunting in both urban and rural areas, that is, a significant difference was not observed between the regions within the two residences.

There was a significant difference in the proportion of stunted children across the five socioeconomic categories. The inequality was pro-poor socioeconomic inequality, such that the lower socioeconomic groups were more likely to be stunted and carry a higher burden of the problem than the higher socioeconomic groups. The findings were consistent with the reports of previous studies done in similar settings, Studies that were done in Ethiopia (Mohammed et al. 2019), in India(Singh, Srivastava, and Upadhyay 2019), and Iran(Singh, Srivastava, and Upadhyay 2019) also reported a pro-poor socioeconomic inequality in stunting among under-5 children. Generally, stunting is pro-poor condition particularly in developing countries (Poel et al. 2008).

They suggested that socioeconomic inequality has significant negative impact on child stunting. The wealth related inequality in stunting is the worst among births to mothers having a secondary and above level of education.

The study found that socioeconomic inequality in stunting in terms of the area of residence urban children in the lowest socioeconomic groups were suffering from greater burden of stunting compared to the rural ones, that is the gap in the level of stunting between affluent households and the poor is much wider in urban areas than rural households. The results of this study have revealed that socioeconomic inequality in stunting varied across the regions of Ethiopia. The inequality is absent in three regions, that is, Afar, Somali, and Gambela. Addis Ababa is hard hit by the wealth related absolute inequality in stunting.

The results of the decomposition analysis shows that urban rural gap in the prevalence of stunting (13.7%) is decomposed into endowment and coefficient effects.

The multivariate decomposition analysis revealed that a significant proportion of the gap in stunting (11.3%) is explained by compositional effects (82.8%). Differential effects of characteristics in urban and rural areas accounted 17.2%, that is, a 2.4 percentage point difference.

That is differences in observed characteristics (or endowments) explain about 82.8% of the difference in children's stunting gaps between rural and urban areas and difference in the effect of the coefficients (coefficients effect) explain about 17.2% of the gaps, of which 36.7% maternal characteristics, 31.7% household characteristics and 13.6% child characteristics which is done by normalization of characteristics into three groups (Maternal, household and child characteristics).

This is consistent with the reports of previous studies in Bangladesh and Nepal(C. S. Srinivasan, Zanello, and Shankar 2013),in Ethiopia (S. Tadesse and Alemu 2015) and in Egypt, Jordan and Yemen(Sharaf and Rashad 2015).

The detailed decomposition result shows that the rural-urban gap is mostly explained by wealth differences 31.9%. Moreover, differences in maternal education 26.7% and Partner's education7.1%, Child age7.9%, Birth order and BMI of the mother 6.3**%** also have strong influences on this divide. Other determinants including mother's age, Religion of the mother, birth order, Sex of the household head, and Age at first birth had minimal or no contribution to the inequality in stunting prevalence.

The quantification of the contribution of individual socio-economic determinants to rural-urban disparities can be used to assess the returns to different types of interventions. Rural-urban gaps largely accounted for by differing levels of covariates, suggesting that bridging rural-urban inequality in stunting a matter of equalizing endowments of the determinants of nutrition. Our results also suggest that much of this can be achieved by focusing on wealth index, maternal education, child age and spouse's education.

The multilevel linear regression model result shows that age of child in month, maternal education, maternal age and place of residence were significantly associated to wealth related pro-poor inequality in stunting in Ethiopia.

Finding from this study are consistent with previous studies conducted in Nigeria (Id et al. 2019), Indonesia(Fikru and Doorslaer 2019) and Bangladesh(Huda, Hayes, and Dibley 2020). The findings of this study further show that Among the first level variables age of child and the mother and maternal education were found to have a contribution to the wealth related pro-poor inequality in stunting. From among the context variables it is only place of residence that predicted the inequality in stunting. Pro poor child inequality in stunting was found to be wider in among urban children than rural children. The risk of inequality in stunting is higher among older infants (6-11 months) and children of age above 1 year as opposed to young infants (<6 month). Wealth related inequality in child stunting was more explained by child born to older women than younger mothers. Children born to educated women secondary and above were severely affected by the inequality in stunting than children of uneducated women.

# CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

In this chapter, the draw conclusions and forward recommendations based on the results obtained are discussed.

## 5.1. Conclusion

The methodology employed in this paper allows us to determine level of inequality in stunting and its determinants and also decompose rural-urban differences in child stunting into covariate and coefficient effects and further enables us to quantify the contribution of individual explanatory variables (socioeconomic characteristics) to rural-urban differences.

The findings from this study confirm the existence of socioeconomic inequality in stunting in Ethiopia. Findings of this study suggest that child stunting was mainly concentrate among the poor socioeconomic groups. The study found a significant pro-poor socioeconomic inequality in stunting among under five children in Ethiopia, with an 18% stunting gap between the richest and the poorest socioeconomic groups. Maternal education status, age of child in months and mother's age at first birth were significantly associated factors to the inequality in stunting between the richest and the poorest socioeconomic groups.

The decomposition of rural-urban differences into covariate and coefficient effects shows that the covariate effect is dominant. A core set of determinants wealth index (which incorporates ownership of assets and access to sanitation and drinking water), maternal education and spouse's education accounts for a very large proportion of the covariate effects. This suggests that there are no fundamental differences in the socioeconomic determinants of child stunting in rural and urban areas. Rural urban disparities in child stunting are primarily attributable to the difference in levels of critical determinants. Our analysis suggests that public health interventions aimed at overcoming rural-urban disparities in child stunting need to focus principally on bridging gaps in socioeconomic endowments and improving the quality of rural infrastructure. Stunting disproportionately affected the rural and the poorest socioeconomic groups in Ethiopia.

Accordingly, intervention measures that entail redistribution of wealth, and improving access to healthcare, clean water and sanitation in rural areas would be effective to reduce the urban rural inequalities in child stunting.

Further research is needed in this area. This paper provides the foundation for policymakers to facilitate and support multi sectoral approaches in tackling stunting and achieving equity oriented universal health coverage.

## 5.2. Recommendations

In order to formulate policies to control the child stunting in Ethiopia, it is important not only to understand the incidence of stunting among the children, but also how it differs with geographical categories, demographic and socioeconomic characteristics. In response to this challenge, this study suggests the following possible solutions to reduce child stunting more in Ethiopia.

- Policies that promote parental education, maternal and child care, facilities like source of drinking water and sanitation should be promoted.
- Any intervention by governmental and non-governmental organizations that aim at improving under-five children nutritional status should consider the economic classification of the society and geographical categories independently so as to avert under-coverage of the areas that deserve it.
- Further studies, should be conducted to identify other determinants and level of inequality in stunting among under-five children to make the declining fast enough.

## 5.3. Strength and Limitations of the Study

### 5.3.1 Strength

Demographic health survey uses a well established methodology that is used in many countries and subject to good quality assurance procedures. This study was based on a large nationally representative population based survey whose findings are relevant for comprehensive national policy initiatives. Therefore, the major strength of this study was that it utilized nationally representative data and the findings are generalizable for the Under-5 stunting in Ethiopia.

### 5.3.2 Limitation

All the determinants of stunting were not included in this analysis, which might have limited the comprehensiveness of the findings. The 2016 EDHS data were collected retrospectively and may be associated with recall bias.

Secondly, this study only evaluated the effects of those variables whose data were collected and measured in the survey, while socio-economic inequality in stunting may be affected by other variables such as exposure to diseases, food intake, cultural influences and psychological factors.

Thirdly, the economic status of the households in this study was measured through the wealth index based on the household assets. Therefore, the contribution of the economic status in malnutrition inequality might be different from the situation in which the economic status of the households is measured by their income, expenditures or consumption levels. Nevertheless, the information collected on the studied variables is valid, and important.

## REFERENCES


Abrams, B, and S Selvin. 1995. "Maternal Weight Gain Pattern and Birth Weight." *Obstetrics and gynecology* 86(2): 163–69.

Ali, Merima, and Ole Frithjof Norheim. 2014. "Understanding Inequalities in Child Health in Ethiopia : Health Achievements Are Improving in the Period 2000 – 2011." 9(8).

Amare, Zerihun Yohannes, Mossa Endris Ahmed, and Adey Belete Mehari. 2019. "Determinants of Nutritional Status among Children under Age 5 in Ethiopia : Further Analysis of the 2016 Ethiopia Demographic and Health Survey." : 1–11.

Anwar, Tarique, Paramita Debnath, and Balhasan Ali. 2019. "Decomposing Socio-Economic Inequalities in Nutritional Status among Siblings in High and Low Fertility States of India: International Journal of Health Sciences and Research." 9(September): 183–93.

Boco, Adébiyi Germain, and I C F Macro. 2010. "Health Surveys in Sub-Saharan Africa." (September).

CSA. 2007. "Summary and Statistical Report of the 2007 Population and Housing Census of Ethiopia."

van Doorslaer, Eddy, and Owen O'Donnell. 2011. Health Inequality and Development *Measurement and Explanation of Inequality in Health and Health Care in Low-Income Settings*.

EDHS. 2016. *Ethiopia Demographic and Health Survey 2016*.

EMDHS. 2019. *Ethiopia Mini Demographic and Health Survey*.

Fantay Gebru, K. et al. 2019. "Determinants of Stunting among Under-Five Children in Ethiopia: A Multilevel Mixed-Effects Analysis of 2016 Ethiopian Demographic and Health Survey Data." *BMC Pediatrics* 19(1): 1–13.

FDRE. 2016. "FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA NATIONAL NUTRITION." (July 2016).

Fenske, Nora, Jacob Burns, Torsten Hothorn, and Eva A. Rehfuess. 2013. "Understanding Child Stunting in India: A Comprehensive Analysis of Socio-Economic, Nutritional and Environmental Determinants Using Additive Quantile Regression." *PLoS ONE* 8(11).

Fikru, Muhammad, and Eddy Van Doorslaer. 2019. "SSM - Population Health Explaining the Fall of Socioeconomic Inequality in Childhood Stunting in Indonesia." *SSM - Population Health* 9:

100469. https://doi.org/10.1016/j.ssmph.2019.100469.

Garrett, James L., and Marie T. Ruel. 1999. “Are Determinants of Rural and Urban Food Security and Nutritional Status Different? Some Insights from Mozambique.” *World Development* 27(11): 1955–75.

Hirvonen, Kalle. 2016. “Rural-Urban Differences in Children ’ s Dietary Diversity in Ethiopia A Poisson Decomposition Analysis.” (May).

Huda, Tanvir M., Alison Hayes, Shams El Arifeen, and Michael J. Dibley. 2018. “Social Determinants of Inequalities in Child Undernutrition in Bangladesh: A Decomposition Analysis.” *Maternal and Child Nutrition* 14(1): 1–12.

Huda, Tanvir M, Alison Hayes, and Michael J Dibley. 2020. “Social Determinants of Inequalities in Child Undernutrition in Bangladesh : A Decomposition Analysis.” (August 2016): 1–12.

Id, Blessing J Akombi et al. 2019. “Trends in Socioeconomic Inequalities in Child Undernutrition : Evidence from Nigeria Demographic and Health Survey ( 2003 – 2013 ).” : 1–13.

Jayawardena, Priyanka. 2017. “SOCIO-ECONOMIC DETERMINANTS AND INEQUALITIES IN CHILD SOCIO-ECONOMIC DETERMINANTS AND INEQUALITIES.” (May).

Kia, Abdollah Almasian, Sahar Goodarzi, and Heshmatollah Asadi. 2019. “A Decomposition Analysis of Inequality in Malnutrition among under Five Children in Iran : Findings from Multiple Indicator Demographic and Health Survey , 2010.” 48(4): 748–57.

Magadi, Monica A. 2011. “Household and Community HIV/AIDS Status and Child Malnutrition in Sub-Saharan Africa: Evidence from the Demographic and Health Surveys.” *Social Science and Medicine* 73(3): 436–46.

Midi, Habshah, S.K. Sarkar and Sohel Rana. 2010. “Collinearity Diagnostics of Binary Logistic Regression Model Habshah Midi ∗ S.K. Sarkar † Sohel Rana ‡.” *Journal of Interdisciplinary Mathematics* 13(3): 253–67.

Mohammed, Shimels Hussien, Fatima Muhammad, Reza Pakzad, and Shahab Alizadeh. 2019. “Socioeconomic Inequality in Stunting among under - 5 Children in Ethiopia : A Decomposition Analysis.” *BMC Research Notes*: 1–5. https://doi.org/10.1186/s13104-019-4229-9.

Onis, Mercedes De, and Francesco Branca. 2016. “Review Article Childhood Stunting : A Global Perspective.” 12: 12–26.

Poel, Ellen Van De et al. 2007. “International Journal for Equity in Malnutrition and the Disproportional Burden on the Poor : The Case of Ghana.” 12: 1–12.

———. 2008. “Socioeconomic Inequality in Malnutrition in Developing Countries.” 044800(April).

Van de Poel, Ellen, Owen O’Donnell, and Eddy Van Doorslaer. 2007. “Are Urban Children Really Healthier? Evidence from 47 Developing Countries.” *Social Science and Medicine* 65(10): 1986–2003.

Pradhan, Jalandhar, and Perianayagam Arokiasamy. 2010. “Socio-Economic Inequalities in Child Survival in India : A Decomposition Analysis.” *Health policy* 98(2–3): 114–20. http://dx.doi.org/10.1016/j.healthpol.2010.05.010.

Sarma, Haribondhu, Jahidur Rahman Khan, and Sayeeda Tarannum. 2019. “Factors Influencing the Prevalence of Stunting Among Children Factors Influencing the Prevalence of Stunting Among Children Aged Below Five Years in Bangladesh.” (July 2017).

Sharaf, Mesbah Fathy, and Ahmed Shoukry Rashad. 2015. “Regional Inequalities in Child Malnutrition in Egypt, Jordan, and Yemen: A Blinder-Oaxaca Decomposition Analysis.” *Health Economics Review* 6(1). http://dx.doi.org/10.1186/s13561-016-0097-3.

———. 2016. “Regional Inequalities in Child Malnutrition in Egypt, Jordan, and Yemen: A Blinder-Oaxaca Decomposition Analysis.” *Health Economics Review*: 0–11. http://dx.doi.org/10.1186/s13561-016-0097-3.

Singh, Shrikant, Swati Srivastava, and Ashish Kumar Upadhyay. 2019. “Socio-Economic Inequality in Malnutrition among Children in India : An Analysis of 640 Districts from National Family Health Survey.” 0: 1–9.

Sinning, Mathias, Markus Hahn, and Thomas K. Bauer. 2008. “The Blinder-Oaxaca Decomposition for Nonlinear Regression Models.” *Stata Journal* 8(4): 480–92.

Smith, Lisa C, Marie T Ruel, and Aida Ndiaye. 2004. “WHY IS CHILD MALNUTRITION LOWER IN URBAN THAN RURAL AREAS ? EVIDENCE FROM 36 DEVELOPING COUNTRIES.” (176).

Srinivasan, Chittur S, Giacomo Zanello, and Bhavani Shankar. 2013. “Rural-Urban Disparities in Child Nutrition in Bangladesh and Nepal.” : 1–15.

Srinivasan, Chittur, and Bhavani Shankar. 2014. “Rural-Urban Disparities in Child Nutrition in Bangladesh and Nepal.” (June 2013).

Tadesse, Sebsibe, and Yinges Alemu. 2015. “Urban-Rural Differentials in Child Undernutrition In.” 7(January): 15–23.

Tadesse, Sebsibe and Yinges Alemu2. 2015. “Urban-Rural Differentials in Child Undernutrition in Ethiopia.” (February).

UNDP. 2015. “Country Economic Brief.” (1).

Unicef/ WHO/The World Bank. 2018. “LEVELS AND TRENDS IN CHILD MALNUTRITION.” : 1–16.

———. 2019. “Levels and Trends in Child Malnutrition - Unicef WHO The World Bank Joint Child Malnutrition Estimates, Key Findings Pf the 2019 Edition.” *Unicef*: 4. http://www.unicef.org/media/files/JME_2015_edition_Sept_2015.pdf.

UNICEF. 1992. “A UNICEF POLICY REVIEW STRATEGY FOR IMPROVED NUTRITION OF CHILDREN AND WOMEN IN DEVELOPING COUNTRIES UNICEF.” : 1–38.

Uthman, Olalekan A. 2009. “Decomposing Socio-Economic Inequality in Childhood Malnutrition in Nigeria.” : 358–67.

Uthman, Olalekan A, and Eugene J Kongnyuy. 2008. “BMC International Health and A Multilevel Analysis of Effect of Neighbourhood and Individual Wealth Status on Sexual Behaviour among Women : Evidence from Nigeria 2003 Demographic and Health Survey.” 7: 1–7.

Wemakor, Anthony et al. 2018. “Young Maternal Age Is a Risk Factor for Child Undernutrition in Tamale Metropolis , Ghana.” *BMC Research Notes*: 1–5. https://doi.org/10.1186/s13104-018-3980-7.

WHO. 2017. “Stunted Growth and Development.” *Maternal and Child Nutrition* 9(2): 27–45.

Wirth, James P et al. 2017. “Original Article Assessment of the WHO Stunting Framework Using Ethiopia as a Case Study.” : 1–16.