DETERMINING THE POINT PREVALENCE OF MALNUTRITION IN CHILDREN AGED TWO YEARS AND BELOW IN TWO URBAN ZONAL HEALTH CENTRES IN LUSAKA

Dissertation

By

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTERS DEGREE OF PUBLIC HEALTH (MPH)

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Abstract

While the global status seems to be definite in statistics, published research apart from the Zambia Demographic Health Survey, providing reliable data in the City of Lusaka was limiting particularly involving anthropometric data on the height-for-age and weight-for-height of under-five children.

The study aimed at determining the point prevalence of malnutrition for children aged two years and below in two urban zonal child health centres in Lusaka. A cross sectional quantitative study design involving 366 children aged two years and below who attended child health clinics were randomly sampled, their weights, length and Mid Upper Arm Circumference were measured. Three anthropological indices using z scores were used to determine the level of malnutrition and the type of malnutrition.

The results show that the overall point prevalence for wasting in this study was 20%. However, the point prevalence for wasting in the two settings were as follows; Chipata was 22.6 % and Chilenje was 16.8 %. The overall point prevalence for Height for Age Index (stunting) was 32.2 %. However, the point prevalences for stunting in the two settings were as follows; Chipata was 27.6 % and Chilenje was 37.7%. The overall point prevalence for underweight was 56%. However, the point prevalences for underweight in the two settings were as follows; Chipata was 51.3 % and Chilenje was 61.7%.

A detailed examination of malnutrition showed that there was no difference across sex in the prevalence of malnutrition. All the three degrees of malnutrition were prevalent in children of all age intervals and that different determinants may be at play. The following variables were associated with malnutrition: Type of feeding, maternal infection, education, income, employment and being a twin. The results suggest that across the two settings, the point prevalence of malnutrition was higher than the national rates. The possible factors that are related to malnutrition in this study include: (a) mothers introducing mixed feeding in the first six months, (b) maternal HIV infection, (c) deprivations related to the living conditions to which a child is exposed and to the social and economic opportunities of care-takers, (d) higher levels of gestational malnutrition and, (e) lack of adequate parental care due to engagement in income generating activities.

Overall, the findings have important implications for research policy and programme efforts towards improved growth monitoring and designing of interventions to mitigate malnutrition and its determinants.
DECLARATION

I declare that the work presented in this thesis entitled “DETERMINING THE POINT PREVALENCE OF MALNUTRITION IN CHILDREN AGED TWO YEARS AND BELOW IN TWO URBAN ZONAL HEALTH CENTRES IN LUSAKA” is to the best of my knowledge and belief my own work and that it is original. The dissertation has never been presented anywhere in whole or in part for the award of a degree in any university and all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Audrey Cornhill Goma

Dated this 14th September 2013
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DEDICATION

To God who is my strength.
To the living memories of my parents Mr. George Stephen Howard Cornhill and Ms. Albertina Meamui Muliwana and forever more to my beloved husband Mtumbi Goma, our daughter Albertina and our son baby Mtumbi.
APPROVAL

The University of Zambia has approved this dissertation of Audrey Cornhill Goma as fulfilling the partial requirements for the award of the degree of Masters of Public Health.

Supervisors
I, the undersigned have read this dissertation and approved it for examination

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(Supervisor)

Name……………………………Signature……………………date……………………
(Co-Supervisor)

Head of Department

Name……………………………Signature……………………date……………………
(Head of Department)

EXAMINERS

Name……………………………Signature……………………date……………………

Name……………………………Signature……………………date……………………

Name……………………………Signature……………………date……………………

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I wish to thank supervisors Dr. S. Nzala and Dr. B. Amaadi for their time and tireless efforts in giving direction to this research.

I render special thanks to Mr. Mtumbi Goma and Mr. Jason Mwanza for the encouragement in completing this dissertation.

I wish to thank Mr. Mofu from National Nutrition Commission for the anthropometric devises used in this study, Natalie Cornhill and the staff in the two health centres who helped in collecting the data.

Lastly but not the least, I pay my gratitude to the respondents for whom this study was about, without their cooperation, this study would not have become a reality. It is my prayer that their efforts have contributed towards the fight against malnutrition and ultimately its eradication.

May The Almighty God bless you all.
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CHAPTER ONE - INTRODUCTION

1.0 Introduction

Malnutrition is the condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (too high an intake), or in the wrong proportions (Dorland’s Medical Dictionary). The term malnutrition therefore, refers to both under nutrition and over nutrition.

Under nutrition is the outcome of inadequate intake of nutrients. Under nutrition includes being underweight for one’s age, too short for one’s age (stunted), dangerously thin (wasted), and deficient in vitamins and minerals (UNICEF, Progress for children, 2006). Over nutrition (obesity) is the outcome of excess intake of nutrients. “For the purposes of this document, Malnutrition refers to under nutrition”.

The effects of malnutrition on human performance, health, and survival have been the subject of extensive research for several decades and studies show that malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, and physical work capacity (Pelletier and Frongillo, 2002). Malnutrition is an underlying factor in many diseases in both children and adults, and it contributes greatly to the disability-adjusted life years worldwide (Murray and Lopez, 1996). Malnutrition is responsible for at least 35% of under-5 deaths (Roberfroid et al, 2007). Malnutrition is also a direct cause of mortality, and a major disabler preventing children who survive to reach their full developmental potential. An estimated 32% of children less than 5 years of age in developing countries are stunted and 10% are wasted. Lack of appropriate breastfeeding and complementary feeding practices are main causes of malnutrition.

Malnutrition is particularly prevalent in developing countries, where it affects one out of every three preschool-age children (UN, 2004). A well-nourished child is one with access to adequate food supply, care, and health. Such a child will have weight and height measurements that compare very well with the standard normal distribution of heights (Ht)
and weights (Wt) of healthy children of the same age and sex. Thus, the best way to evaluate the nutritional status and overall health of a child is to compare the child’s growth indices with the set cut-off points in the standard normal distribution of well-nourished children that are associated with adequate growth (de Onis et al., 2005). Consequently, the assessment of children’s growth is a suitable indicator for investigating the wellbeing of children, and as well as for examining households’ access to food, health and care (de Onis et al., 2005).

Anthropometric evaluation is an essential feature of child nutritional evaluation for determining malnutrition, being underweight, obese, muscular mass loss, and fat mass gain. Anthropometric indicators are used to evaluate the prognosis of chronic and acute diseases, and to guide medical intervention in children. It has been shown that child nutritional status is an essential component of a country’s overall human development (Maluccio et al., 2005; Behrman et al., 2006; Glewwe and Miguel. 2007). There is a growing consensus that poor nutritional status during childhood (and in utero) can have long-lasting scarring consequences into adulthood, both in terms of health and mortality, and in terms of other measures of human capital such as schooling and productivity (Behrman et al, 2006; Glewwe and Miguel, 2007).

Growth, a physiological feature of infancy, childhood, and adolescence is the interaction of genetics and environmental circumstances involving wide spectrum of metabolic processes. Growth assessment is the single best measurement for defining the health and nutritional status of children, and changes in these factors invariably affect growth potentials (de Onis et al., 1992).

The common indicators to measure growth attainment are height-for-age (Ht/Age), weight-for-age (Wt/Age) and weight-for-height (Wt/Ht). Poor nutritional status is generally referred to as ‘Stunting’ (Ht/Age) to indicate long-term malnutrition (chronic), ‘Underweight’ (Wt/Age) to indicate present malnutrition and Wasting (Wt/Ht) to indicate chronic and on-going malnutrition (de Onis et al., 1992).

Children’s weight and height increase, as they get older. Growth attainment studies undertaken in developing countries indicate 197 million children under-five years having low nutritional status which increases their risk of dying before the first birthday by four times, as
compared with children from other continents (UNICEF, 2008). Furthermore, children under-five years from developing countries have the lowest nutritional status.

In essence, the growth of a child is depicted as follows in all our child health clinics:

\[ a) \text{ Good Growth} \]

The child has gained enough weight if the reference curve is going up and the slope is parallel to one of the reference curves.

Even if the child is small, the growth reference curve should still go up and should be parallel to one of the reference curves to show the child is growing well.

\[ b) \text{ Bad Growth} \]

The child’s growth is static if the reference curve is flat. This is a dangerous sign that need to be further investigated.

The child has lost weight if the child’s growth reference curve shows a downward direction.

The child's growth is slowing and the weight gain is less than expected if the curve is less steep than the reference curve.

\textit{1.1 Benefits of Growth monitoring}

There are indeed benefits from growth monitoring and promotion programmes. There is evidence from small-scale studies in Nigeria, Jamaica, India (Narangwal and Jamkhed, 2007), and from large programmes in Tanzania (Iringa), India (Tamil Nadu Integrated Nutrition Project), Madagascar and Senegal showing that children whose growth is monitored (weight gained in grams over weeks or months) and whose mothers receive nutrition and health education and have access to basic child health services, have a better nutritional status and/or survival than children who do not. There is tentative evidence from a large-scale programme in Brazil (Ceara) that participation in growth monitoring confers a significant benefit on nutritional status independent of immunization and socioeconomic status. There is evidence from India (Integrated Child Development Services) and Bangladesh (Bangladesh Rural Advancement Committee and Bangladesh Integrated Nutrition Project) that growth
monitoring has little or no effect on nutritional status in large-scale programmes with weak nutrition counselling and under nutrition non-intervention. Although there is no unequivocal evidence that growth monitoring is beneficial per se, it was perceived to be beneficial by the investigators of several of the studies (Narangwal and Jamkhe, 2007).

Growth monitoring can provide an entry point to preventive and curative health care and was an integral part of programmes that are associated with significant reductions in malnutrition and mortality. Good nutrition intervention and counselling is paramount for growth promotion and is often done badly.

1.2 Statement of the Problem

Data on the prevalence of malnutrition in developing countries indicate that on average, stunting (a deficit in height for age) and wasting (a deficit in weight for height) affect over 40% and 10% of under-5-year children, respectively (World Bank, 2009).

Malnutrition is one of the top causes of child morbidity and mortality in Zambia over the past five years (Macwan’gi, 2008).

In Zambia, stunting is at 45%, underweight is at 15% and wasting is at 5% (ZDHS, 2007). The following are notable problems:

1. While the global status seems to be definite in statistics, published research apart from the Zambia Demographic Health Survey, providing reliable data in Zambia is limiting showing point prevalence particularly involving anthropometric data on the height-for-age and weight-for-height of under-five children.

2. In addition, the nation just has a national picture of old data as at 2007 (ZDHS, 2007) and this has no geographic specification in terms of cities and especially for the City of Lusaka which has malnutrition intervention units spread out in the city suburbs.
Given this state of affairs, it is not possible to quantify the point prevalence of malnutrition and to apply on spot interventions since current growth monitoring does not identify children who are malnourished.
1.3 Research Questions

This study is seeking answers to the following questions.

1. What is the point prevalence of acute malnutrition in children aged 2 years and below who attend child health clinics in the two urban zonal health centres in Lusaka?
2. What is the point prevalence of chronic malnutrition among children aged 2 years and below who attend child health clinics in the two urban zonal health centres in Lusaka?

1.4 Research Objectives

General objective

To determine the point prevalence of malnutrition in children aged two years and below in two urban zonal health centres.

Specific objectives

1. To determine the point prevalence of acute malnutrition among children aged two years and below who attend child health clinics in the two urban Zonal health centres in Lusaka.
2. To determine the point prevalence chronic malnutrition among children aged two years and below who attend child health clinics in two urban Zonal health centres in Lusaka.
3. To identify associated factors of malnutrition.
CHAPTER TWO- REVIEW OF LITERATURE

2.0 Definitions of Malnutrition

Malnutrition is the condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (too high an intake) or in wrong proportions (Dorland’s Medical Dictionary). Malnutrition is technically a category of diseases that includes under nutrition, obesity and overweight, and micronutrient deficiency among other (WHO, 2012). However, it is frequently used to mean just under nutrition from either inadequate calories or inadequate specific dietary components for whatever reason (Katsilambros, 2011).

Classification of malnutrition (WHO)

1. Acute Malnutrition

a) Severe Acute Malnutrition

- MUAC < 11.5cm for children aged 6 – 59 months.
- Wt/Ht SD < -3
- and / or presence of oedema in both feet

b) Moderate Acute Malnutrition

- MUAC > 11.5cm <12.5cm
- Wt/Ht SD < -2
2. Chronic Malnutrition (stunting)

a) Severe Chronic malnutrition
   - Ht/age SD < -3

b) Moderate Chronic Malnutrition
   - Ht/age SD < -2

2.1 Risk of death and severe acute malnutrition

Following the release of the WHO child growth standards, the relationship between weight-for-height and the risk of dying was reassessed in existing epidemiological studies. This analysis showed that children with a weight-for-height below -3 SD based on the WHO standards had a high risk of death exceeding 9-fold that of children with a weight-for-height above -1 SD (Black et al., 2008). Similar studies using MUAC as diagnostic criteria showed that the risk of dying was increased below 115 mm (Myatt et al., 2006). The elevated risk of death below these cut-offs requires the implementation of intensive nutritional and medical support.

2.2 Specifying the Type of Malnutrition

When malnutrition or risk of malnutrition is being established, it is necessary to specify both the type of nutrient or nutrients under consideration and the cut-off values that will be used to distinguish between normal and abnormal ranges, or between low and high risk of malnutrition (Stratton et al., 2003). Nutrients can be divided into micronutrients (vitamins, minerals, trace elements) and macronutrients (carbohydrates, proteins, fats). Marasmus and

---

1 The assessment of the risk of death associated with different degrees of wasting can be carried out only by community based longitudinal studies with a follow up of untreated malnourished children. This can be analysed only from a limited number of existing studies. For ethical reasons, these observational studies cannot be repeated, as an effective community-based treatment of severe acute malnutrition is now possible.
kwashiorkor represent the two major classifications of macronutrient malnutrition. Marasmus is the type of malnutrition seen in patients with prolonged starvation.

It is easily recognized by a wasted, cachectic appearance. Although the diet may contain an acceptable protein to energy ratio, total dietary intake is inadequate. This results in utilization of endogenous fat and muscle tissue reserves for energy. In contrast, kwashiorkor results from a deficit of protein despite a relative adequacy of energy, and as such, may develop over a shorter period. The most common physical effects of kwashiorkor are loss of skin colour of both hair and skin, and oedema (Grisby, 2000). As a result, these patients may maintain relatively normal weight and anthropometric measurements. Without careful physical examination and review of biochemical data to reveal the large serum albumin loss, this form of malnutrition may be overlooked. Protein energy malnutrition (PEM) is used in more recent literature to describe any individuals with protein or energy malnutrition. Malnutrition due to vitamin, mineral, and trace element deficiencies may also occur in conjunction with PEM. Isolated vitamin or mineral deficiencies can also be detected in otherwise well-nourished patients (Grisby, 2000) Table 2.2.1.

Table 2.2.1 Percentage of Total Estimated Annual Burden of Disease in Africa Attributed to Major Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Childhood and maternal undernutrition</td>
<td>29.5</td>
</tr>
<tr>
<td>Under weight</td>
<td>18.0</td>
</tr>
<tr>
<td>Iron deficiency</td>
<td>2.9</td>
</tr>
<tr>
<td>Vitamin A deficiency</td>
<td>4.7</td>
</tr>
<tr>
<td>Zinc deficiency</td>
<td>3.9</td>
</tr>
<tr>
<td>Other nutrition related risks</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Source: Ezzai et al., 2003; Note: Percentage of total estimated annual burden of disease is the share of disability-adjusted life years (DALYs) lost attributed to major risk factors. Total estimated DALYs lost annually in Africa is 349,513,000.

Child Malnutrition remains one of Africa's most fundamental challenges for improved human development. Because the time and capacities of caregivers are limited, far too many children on the continent are unable to access and effectively use at all times the food and health services they need for a healthy life (Ezzati et al., 2003).
An estimated 200 million people on the continent, both children and adults, are undernourished, their numbers having increased by almost 20 percent since the early 1990s (FAO 2003). This malnutrition starts early in life more than a third of African children under the age of five are stunted in their growth and must face a range of physical and cognitive challenges not faced by their better-nourished peers. Malnutrition underlies 55 percent of all deaths of children under-five years of age globally (Pelletier et al., 1994), and malnutrition is the major risk factor for over 28 percent of all deaths in Africa, some 2.9 million deaths annually (Ezzati et al., 2003). Further, Pelletier and Frongillo (2003) have shown that countries in Sub-Saharan Africa reduced malnutrition rates over the period 1975–95 at the same modest rates as other regions of the world, the region would have experienced declines in under-five mortality rates 28 percent lower than those currently achieved. Childhood and maternal malnutrition is the primary risk factor contributing to almost 30 percent of the estimated annual burden of disease on the continent. The continuing human costs of malnutrition for individual Africans as measured by its contribution to high mortality and morbidity and unrealized human potential are enormous, and the aggregate costs at the national level impose a heavy burden on efforts to foster sustained economic growth and improved human development.

Malnutrition in any stage of childhood affects schooling and, thus, the lifetime earnings potential of the child. Malnutrition affects educational outcomes, including a reduced capacity to learn (because of early cognitive deficits or lowered current attention spans) and fewer total years of schooling. In Zimbabwe, stunting, via its association with a 7-month delay in school completion and a 0.7-year loss in grade attainment, has been shown to reduce lifetime income by 7 to 12 percent (Alderman et al., 2003). In general, in low-income agricultural countries, the physical impairment associated with malnutrition is estimated to cost 2 to 3 percent of gross domestic product (GDP) per year, even without considering the long-term productivity losses associated with developmental and cognitive impairment (Horton, 1999). Iron deficiency in adults has been estimated to decrease productivity between 5 and 17 percent, depending on the nature of the work performed (Horton 1999). Data from 10 developing countries have shown that the median loss in reduced work capacity associated with anaemia in adults is equivalent to 0.6 percent of GDP, whereas an additional 3.4 percent of GDP is lost because of the effects on cognitive development attributable to anaemia in children (Horton and Ross 2003). The impact of iodine deficiency diseases on cognitive
development alone has been associated with productivity losses totalling approximately 10 percent of GDP (Horton, 1999).

2.3 Causes of Malnutrition

Factors that contribute to malnutrition are many and varied. The primary determinants of malnutrition, as conceptualized by several authors relate to unsatisfactory food intake, severe and repeated infections, or a combination of the two (Rowland et al., 1988; Schroeder and Brown, 1994; UNICEF, 1998). The interactions of these conditions with the nutritional status and overall health of the child and by extension of the populations in which the child is raised have been shown in the UNICEF Conceptual framework of child survival (UNICEF, 1998). Briefly, the model characterizes the correlates of malnutrition as factors that impair access to food, maternal and childcare, and health care. These very factors affect the growth of children.

The United Nations Children's Fund (UNICEF) conceptual framework of the determinants of the nutritional status of children shown in figure 2.3.1 presents a generalized understanding of how malnutrition is the outcome of specific development problems related directly to the dietary intake and the health status of the individual.
The quality of these immediate determinants, in turn, is determined by the underlying food security status of the household in which a child resides. However, of equal importance is the availability of health services and a healthy environment and the quality of care the child receives that is, whether the available dietary resources for good nutrition are used effectively through appropriate caring practices, hence the need of growth monitoring. Sustained healthy and active life is only possible when these underlying determinants food, health, and care are each maximized. None of these is sufficient in itself, but all are necessary for good child growth (Jonsson 1993; Smith and Haddad; 2000).

The degree to which these three underlying determinants are expressed positively or negatively is a question of resources. These resources include the availability of food but
extend much further to include the physical and economic access that a child or his or her caregiver has to that food, the caregiver's knowledge of how to use available food and to properly care for the child, the caregiver's own health status, and the control the caregiver has over resources within the household that might be used to nourish the child. The level of access to information on and services for maintaining health, whether preventive and curative health services are available, and the presence or absence of a healthy environment with clean water, adequate sanitation, and proper shelter all contribute equally to determining the nutritional status of a child (Smith and Haddad; 2000; UNICEF, 1990).

When the distribution of resources within society is central to accounting for why some are undernourished and others are not, the framework moves from the realm of the individual and household to the political. The framework links the availability of nutrition resources to a set of basic determinants, which are themselves a function of how society is organized about economic structure, political and ideological expectations, and the institutions through which activities within society are regulated, social values, are met, and potential resources are converted into actual resources. Consequently, this conceptual framework identifies undernutrition as a subject for political debate and an issue of immediate concern to any national development strategies (Smith and Haddad; 2000).

Finally, it is important to recognize from this framework that a household or nation being food secure is not in itself sufficient to ensure the good nutritional status of children and others within that household or nation. It is possible to have poor nutritional outcomes without being food insecure. Food security is concerned with physical and economic access to food of sufficient quality and quantity. However, one may have reliable access to the components of a healthy diet, but because of poor health or care (such as poor infant-feeding practices), ignorance, or personal preferences, one may not be able or may choose not to use the nutrients to which one has access. In parallel to food security, one can speak of nutrition security. Nutrition security is achieved for a household when secure access to food is coupled with a sanitary environment, adequate health services, and knowledgeable care (Horton and Ross 2003).
2.4 Indicators of Child malnutrition: Outcomes and Inputs

In this section, measures of child malnutrition and of its determinants, the outcomes and inputs, respectively, to the process determining nutritional status are presented as a foundation for the discussion on the status and trends in these measures in Sub-Saharan Africa.

2.5 Outcome Indicators

There are a number of notable measurements of normal growth and under nutritional status. Table 2.5.2 provides a summary of the principal measures of both individual and aggregate nutritional status. Of these, the most commonly employed are the anthropometric measures of child nutritional status stunting, underweight, and wasting. Children with abnormally low growth are identified by comparison with the growth characteristics of children of a similar age, disaggregated by sex, in a standard, nutritionally secure population. Children whose growth is more than two standard deviations (Z-scores) below the mean physical characteristics for the nutritionally secure reference population are considered undernourished.

Of the other indicators of aggregate nutritional status, infant and under-five mortality and low birth weight prevalence are important proxy measures of nutrition security. Low birth weight reflects foetal growth retardation due to the poor health and nutrition of the mother and serves as an indicator of risk of infant mortality and future poor health. From a life cycle perspective on nutrition and the intergenerational transmission of poverty within society, as presented in low birth weight is a critical measure.
Table 2.5.1 Indicators of Nutritional Status (Source UNICEF, 2003:23)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>How collected</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low height-for-age, &quot;stunting&quot;</td>
<td>Height (or length) measurements of children 6 to 60 months or 6 to 36 months in age. Children with abnormally low growth are identified by comparison to physical characteristics of children of similar age, disaggregated by sex, in a standard, nutritionally secure population.</td>
<td>Indicative of long-term nutritional status of children. Best measure of cumulative growth retardation.</td>
</tr>
<tr>
<td>Low weight-for-age, &quot;underweight&quot;</td>
<td>Weight measurements of children 6 to 60 months or 6 to 36 months in age. Analysis similar to that above.</td>
<td>Non-specific indicator of overall undernutrition measures a combination of chronic and acute undernutrition.</td>
</tr>
<tr>
<td>Low weight-for-height, &quot;wasting&quot;</td>
<td>Weight and height measurements of children 6 to 60 months or 6 to 36 months in age. Analysis similar to that above.</td>
<td>Measures acute child undernutrition. Indicative of sharp short-term fluctuations in nutritional status. Most useful in emergencies where severity of the nutritional crisis is being assessed or short-term progress in nutritional status is being monitored.</td>
</tr>
<tr>
<td>Mid-upper arm circumference</td>
<td>Distance around the mid-upper arm. Standard threshold values used to determine whether a child is at risk.</td>
<td>Used in emergencies in contexts similar to where the wasting measure would be used.</td>
</tr>
<tr>
<td>Body mass index</td>
<td>Computed as weight (in kg) divided by height (in meters) squared. Standard threshold values used to determine whether an individual is underweight or overweight.</td>
<td>Indicator of nutritional status in adults and older children. Only indicator commonly used to assess both short- and long-term nutritional status of adults, usually women of childbearing age. Used for assessing the prevalence of both underweight and overweight individuals in a population.</td>
</tr>
</tbody>
</table>
Finally, measures of micronutrient deficiency are critical for assessing malnutrition in Africa. The burden of disease attributed to micronutrient deficiencies is often referred to as "hidden hunger": The clear link between a lack of sufficient food to eat and a poor physical state that one sees with a lack of carbohydrate, protein, and fat in the diet is not as readily seen when considering micronutrient deficiency. Subclinical levels of deficiency can have serious and irreparable consequences on health, mortality, and economic productivity. There are four principal micronutrient deficiencies of public health concern in Africa: vitamin A, iron, zinc, and iodine (Wagstaff and Watanabe, 2000; Zere and McIntyre, 2003; Smith et al., 2005).

Table 2.5.2 shows their principal sources and the health effects of deficiency.

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Principal dietary sources</th>
<th>Health effects of deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>Breast milk, liver, egg yolk, milk and dairy products, green leafy vegetables (esp. kale, amaranth, sweet potato, cowpea, and cassava leaves), yellow- and orange-colored fruits and vegetables (carrots, pumpkin, mango, papaya, oranges), orange-fleshed sweet potato, red palm oil.</td>
<td>In deficient populations, improvements in vitamin A status are associated with a 23 percent overall reduction in mortality among under-five children. Night blindness, the first stage in a set of increasingly severe eye problems (xerophthalmia) that leads to corneal ulcers and to blindness. Impaired resistance to infection.</td>
</tr>
<tr>
<td>Iron</td>
<td>Liver, meat, poultry, fish, cereals (esp. whole grain), nuts, beans, and green leafy vegetables. Also commercially produced iron-fortified foods.</td>
<td>Anemia, especially in women and children. Fatigue, with adverse effects on learning, productivity, and earnings. Pregnancy complications, maternal mortality, premature birth, and low birth weight. In children, significant loss of cognitive abilities as well as decreased physical activity and reduced resistance to disease. Significant impact on school enrollment and adult productivity.</td>
</tr>
<tr>
<td>Zinc</td>
<td>Animal and fish products, beans, and other legumes.</td>
<td>Low birth weight and poor growth, reduced resistance to infectious diseases, increased incidence of stillbirths, and possibly impaired cognitive development.</td>
</tr>
<tr>
<td>Iodine</td>
<td>Underlying cause of iodine deficiency is a deficiency of iodine in the local soil on which vegetation grows, animals graze, and crops are cultivated. This results in a shortage of iodine in local foodstuffs. Iodine fortification is the principal source of iodine, usually through iodized salt.</td>
<td>Mental retardation and stunted growth among children—&quot;cretinism.&quot; Goiter is a symptom of iodine deficiency, which in itself may pose social, economic, and physiological burdens on the individual. Improvements in iodine status are linked to a 13-point improvement in IQ among children. Iodine deficiency is linked to reduced economic productivity.</td>
</tr>
</tbody>
</table>

Table 2.5.2 Effects of Deficiency of Micronutrients and Principal Dietary Sources

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a. Humans generally are less able to absorb and utilize the vitamin A, iron, and zinc that come from plant foods than those that come from animal and fish sources.

Of the other indicators of aggregate nutritional status, infant, under-five mortality, and low birth weight prevalence are important proxy measures of nutrition security. Low birth weight
reflects foetal growth retardation due to the poor health and nutrition of the mother and serves as an indicator of risk of infant mortality and future poor health. From a life cycle, perspective on nutrition and the intergenerational transmission of poverty within society is of critical measure.

2.6 Input Indicators

The three underlying determinants of child under nutrition are household food security; quality of care; resources for health, including access to health services; and a healthy environment. These three inputs, to the process determine nutritional outcomes both for individuals and for populations as a whole. It is important to recognize that balance is required across these factors if under nutrition is to be sustainably reduced.

Food availability, access to food, and diet quality are various dimensions of food security that can be measured. Among the most common measures of access to food at the national level is the Food and Agriculture Organization of the United Nations (FAO) undernourishment measure, which takes into account food availability from production and trade and, using the distribution of consumption levels across the population, estimates what proportion of the population is unable to meet its daily energy requirements. Similar assessments can be made using detailed household consumption surveys. Dietary quality assessments can be made using information from both commodity-disaggregated national food balance sheets and household surveys. Although these estimates are by nature imprecise, and there are many valid critiques of them, in the absence of better indicators they are used extensively to monitor food security (Smith et al. 2003).

Direct measurement of quality of care is more problematic, requiring the use of proxy measures. Female education and literacy levels are important elements in this regard. There is considerable evidence that the nutritional status of children varies directly with the level of education of their parents, and in particular, their mothers. Women who have more education are better able to understand important nutritional care practices and to follow them with the children in their care. An additional contribution to nutritional care is the availability of public health services, particularly for a broad range of measures can be used to assess the degree to which good nutrition is assured by available health services and a healthy
environment. These include access to health facilities and health professionals, the burden of disease that health systems must bear, immunization coverage, the percentage of mothers receiving prenatal care, the use of safe drinking water and sanitation facilities, and so on (Wagstaff and Watanabe, 2000; Pradhan et al., 2003). Finally, general and household welfare measures income, assets, and poverty are also important in accounting for the nutritional status of children. Within the conceptual framework, these cut across the underlying determinants considered in the previous paragraphs for example, increased income will increase access to food, to health care, and to child care resources and emerge, in part, from the basic determinants beneath the underlying determinants of the framework. Moreover, as was noted earlier, improved nutrition is itself an important determinant of economic growth and improved welfare the relationship between these welfare measures and child nutritional status is neither linear nor one way (Pradhan et al., 2003; Smith et al., 2005). Nevertheless, they are important, relatively nonspecific inputs into the nutritional process.

2.7 Status and Trends in Child Malnutrition

Although poor nutrition and hunger affects all ages, the long-term development and welfare implications are especially important for young children because most malnutrition happens in the womb or in the first two years of life. Much of the early damage both physical growth and brain development is irreversible (SCN 2004: 40). Moreover, as the nutritional status of these children when in the womb is an important determinant of their developmental potential, maternal malnutrition is of equal concern. Figure 8.2 shows how malnutrition can be perpetuated across generations from mother to child in a spiral of poverty and despair.

In most of Sub-Saharan Africa increased levels of malnutrition are strongly associated with the age of the child. The decline in nutritional status from birth is astonishingly swift as new-borns in many African households face a challenging health environment and, in many cases, receive suboptimal feeding, that is, lack of exclusive breastfeeding and inappropriate or untimely complementary feeding. Although the average nutritional status of new-borns in these countries is similar to that of the well-nourished reference population, by about the age of 12 to 15 months about half of the children are underweight (weight-for-age Z-score less than −2.0) with very little improvement thereafter. This growth retardation experienced in the first year of life is very difficult to overcome in the later years of childhood (Wagstaff and Watanabe, 2000; Pradhan et al., 2003).
Globally, progress is being made in reducing malnutrition. The prevalence of child malnutrition has declined significantly over the past 25 years. Rates of stunting (low height-for-age) among children age six months to five years in all developing countries dropped almost 20 percentage points from 49 to 30 percent between 1980 and 2000, whereas underweight (low weight for age) rates dropped from 38 to 25 percent (de Onis et al. 2004). Taken as a whole, however, Africa is an unfortunate exception to these trends. Over the period 1980 to 2000, stunting rates declined by less than 4 percentage points in Africa, so that, with population growth, the actual number of stunted children actually increased by more than 12 million to 48.5 million. Both relative and absolute numbers of underweight children in Africa increased over the same period.

![Figure 2.7.1 Prevalence of Stunting in Children Age 6 to 60 Months, by Country (percent)](image)

Source: Data from UNICEF 2003.

National and broader regional patterns can be seen in the map portraying the national prevalence of stunted children in figure 2.3 a and b. In contrast to North Africa, where child undernutrition appears to be addressed relatively effectively, in Sub-Saharan Africa the pattern is less encouraging and somewhat more complex. Coastal West Africa, central Africa, and southern Africa have lower rates of stunting. Landlocked countries and others with a large proportion of their population in the interior tend to have higher rates. General perceptions that developed in the 1980s of poorly nourished populations in the Sahel and Ethiopia remain relatively accurate today. The grouping of countries with the highest
The prevalence of stunting, however, is found in southern and eastern Africa, reflecting a complex set of challenges that include civil conflict, economic downturns due to macroeconomic mismanagement or commodity price shocks, and droughts and floods, or the legacies of such events.

The prevalence of malnutrition can also be assessed at a sub national level. Using data from a range of DHS surveys, the Centre for International Earth Science Information Network (CIESIN) developed a series of maps describing the prevalence of under nutrition at this scale across the continent. Two of these are shown in figure 2.7.2 a and b. The map on the left of the figure is comparable in form to the map shown on the right but shows underweight prevalence, instead of stunting, and sub national spatial units (CIESIN 2004).

![Figure 2.7.2a. Sub national Estimates of underweight children](image)

![Figure 2.7.2b. Sub national Estimates of underweight children per square kilometer](image)

Source: Data from CIESIN 2004.

The map on the right provides a different perspective on malnutrition. By taking into account the area density of the population from which the estimates of underweight are being made, the map provides an indication of the spatial intensity of the problem of underweight children "hotspots" of malnutrition. In this light, although problematic across much of subtropical Africa, the map shows malnutrition hotspots in a handful of areas, including coastal and northern Nigeria, upland Ethiopia, the Lake Victoria basin, southern Malawi, and central
Mozambique. It is important to note that in many of these hunger hotspots, food production is not the limiting factor. One such example is the Iringa region in Tanzania, where over 70 percent of the children are stunted in their growth, even though it is a food basket for Tanzania (CIESIN 2004).

Place of residence, rural or urban can yield another important evaluation of the spatial pattern of child under-nutrition in Africa. Figure 2.7.3 shows stunting prevalence for children under-five, disaggregated by urban or rural residence. In all 17 countries, undernourished children are more prevalent in rural areas than in urban centres. Although food is produced on farms in rural areas, this does not mean that rural children are better nourished. Equally, important, safe water and adequate sanitation, health services, and the information needed by mothers or other caregivers to provide children with effective care are relatively less accessible in rural areas. It is not correct, however, to argue that malnourished children are primarily a rural phenomenon (ORC/Macro 2004).

Child malnutrition in Africa can also be examined from the dimensions of the gender and the age of the child. In contrast to South Asia, for example, differences in the prevalence of child malnutrition according to gender are not strong. In Sub-Saharan Africa, the tendency is for boys to have a somewhat higher probability of being malnourished than girls (Svedberg 1990). For example, in an assessment of stunting rates for children age 6 to 36 months in 28
African countries during the period 1987 to 2002, the average difference in stunting rates between boys and girls was 2.6 percentage points, with stunting rates being higher among boys in all but four of these countries.

Yet another interesting dimension of under nutrition in Sub-Saharan Africa, which shows that although malnutrition rates in these countries are higher among the poorer households, rates remains relatively high among the non-poor. In many countries in the region, more than 15 percent of the children in the highest wealth quintile are underweight.

Given the significant proportion of non-poor children that are malnourished, we should recognize that improved household welfare in itself is not sufficient to eliminate malnutrition. The higher level of nutritional resources available to wealthier households must be used effectively through proper care if malnutrition is to be eliminated in such households.

UNICEF and MI (2004) observed that progress had been made in Africa over the past 15 years in addressing micronutrient deficiency diseases. Although these problems are serious, clinical solutions are relatively inexpensive to implement salt iodization, fortification of commonly consumed commercial foods and supplemental doses of vitamin A and iron for women and children. The simplest and most sustainable way to eliminate micronutrient deficiencies is to make sure that individuals and households know the importance of a balanced diet and have access to what is required to consume such diets. However, in spite of the progress made in combating this "hidden hunger," many Africans still consume insufficient amounts of the relatively small quantities of these nutrients that they require or, due to poor health, are unable to use effectively that which they do consume and continue to suffer from micronutrient deficiencies. High levels of anaemia result in serious cognitive and productivity losses, reducing the ability of women to work and provide adequate care for their children and making pregnancy and childbirth much more risky for them than would otherwise be the case. Between 15,000 and 20,000 African women die each year owing to severe iron deficiency anaemia. The high prevalence of goitre in school-age children points to hundreds of thousands of children in Africa who have lowered intellectual capacity because of iodine deficiency. Vitamin A deficiencies in children are common across the continent, reducing their ability to resist infection and contributing to the deaths of more than half a million African children annually (UNICEF and MI, 2004).

Child malnutrition is closely correlated with under-five mortality. For the countries south of the Sahara, most recent estimates of under-five mortality are about 170 deaths in the first five years of life for every 1,000 live births (UNICEF, 2003). Figure 2.7.4 shows that, although many countries are making progress in reducing child deaths, some countries are failing to maintain effective past efforts and are experiencing a decline in the rate of progress against under-five mortality.

![Figure 2.7.4. Scatter Plot of National Under-Five Mortality and Underweight Prevalence Rates](image)


In spite of the high levels of under-five mortality in Africa, only a handful of African countries show accelerating declines in levels of under-five mortality. The scatter plot in figure 2.5 demonstrates the intertwining of nutritional and health concerns and highlights the scope of the linked problems of malnutrition and consequent under-five mortality in Sub-Saharan Africa. If one uses an underweight prevalence of 20 percent and an under-five mortality rate of 50 per 1,000 live births (bold gridlines in figure 2.5) as thresholds above
which these issues should be seen as critical public health problems requiring urgent action, under-five mortality remains a pressing issue in all countries, and in more than two-thirds, malnutrition is a critical concern (Black et al., 2003; Pelletier and Frongillo, 2003).

As noted, approximately 55 percent of all child deaths in developing countries can be attributed in part to malnutrition through its exacerbation of the effects of disease on a child's health (Pelletier et al. 1994). For example, 61 percent of diarrhoea deaths and 57 percent of malaria deaths would not occur if it were not for the underlying under nutrition. Even mildly underweight children have nearly double the risk of death of their well-nourished counterparts. This risk increases five to eightfold in moderately to severely underweight children (Black et al., 2003). Further, as noted earlier, Pelletier and Frongillo (2003) have shown that had the countries of Sub-Saharan Africa reduced malnutrition rates during 1975 to 1995 at the same modest rates as other regions of the world, the region would have experienced under-five mortality rates 28 percent lower than those achieved would.

2.8 Objectives of growth monitoring

The main aims of growth monitoring, as originally conceived, are to:

1. Provide a diagnostic tool for health and nutrition surveillance of individual children and to instigate effective action in response to growth faltering.

2. Teach mothers, families, and health workers how diet and illness can affect child growth and thereby stimulate individual initiative and improved practices.

3. Provide regular contact with primary health-care services, and so facilitate their utilization. The underlying logic is that if growth faltering is detected early and is made visible to health workers and families, then families can respond by changing their child-care practices, provided they are offered proper motivation, given clear, feasible alternatives, and given a role in deciding what practices they will try to change (Griffiths, 1981).

Subsequent objectives of growth monitoring that have developed include:
1. Community mobilization: Growth monitoring can serve as an entry point for community mobilization and social action, especially when growth monitoring data are aggregated and used for community-level assessment and analysis of child under nutrition. The premise is that caregivers’ participation in growth monitoring will lead to increased awareness of factors that detrimentally affect children’s health and that they will influence community leaders and citizens to take collective and effective action to address underlying socio-economic causes of poor health and promote social and economic equity. This is in keeping with the Alma Ata Declaration of 1978, which emphasizes the need for community and individual participation in primary health care.

2. Targeting supplementary feeding: The weight chart is widely used to determine eligibility for entry to supplementary feeding programmes. The criterion is usually a weight-for-age below one of the reference curves on the weight chart, equivalent to ‘moderate’ underweight. This invariably shifts the focus of growth monitoring towards identifying children who meet this criterion, rather than intervening at the first sign of growth faltering. Consequently, no action is taken until the child is significantly underweight. As health workers choose who should receive assistance, the collaborative involvement of families in decision-making is lost, as well as any educational benefit of regular growth monitoring. Using weight charts in this way is thus contrary to the precept of growth monitoring. Anecdotal reports suggest that once enrolled in supplementary feeding programmes and approaching the exit criterion, some children may be purposely underfed to remain beneficiaries. Although supplementary feeding programmes may have their place in offsetting food shortage, growth faltering is often the result of poor feeding practices, which can still prevail even among beneficiaries of food distribution programmes.

3. Reporting prevalence of underweight: Governments and agencies may require health workers to provide information on the extent of underweight in their locality, or the number of children failing to grow in a given month. Over 50% of countries transfer information obtained from growth monitoring to higher levels (de Onis et al. 2004). In some countries, time-consuming procedures are devised, with information systems spanning village, district, provincial, and national levels. In Vietnam, for example, it takes several days each month at district level to collect and aggregate village data in order to report to higher authorities the prevalence of underweight and coverage of...
child weighing (Shrimpton, 2003). Weights may be recorded in logbooks and never plotted, and the growth chart may be used simply to determine if a child is underweight, sometimes at a later date instead of in the mother’s presence. Thus, the promotive aims of growth monitoring are surrendered. Furthermore, the information submitted may not permit meaningful analysis and interpretation so that even the nutrition status surveillance objective may not be achieved.

2.9 Indicators of Malnutrition

World Health Organization (WHO) recommends that a child’s weight and height be expressed in terms of the number of standard deviations (SD) that a child’s measurement (weight or height) deviates from the median value of the international reference population for children of the same age and gender. At the population level or for the subgroup of children, these measures are referred to as Z scores (Dibley et al. 1987). The anthropometric indicators for a normal population is usually a bell-shaped symmetric distribution, while for the population in developing countries they are skewed to the left of normal distribution of the reference median, with a degree of overlapping (Mora ,1989). Percentage of children who’s Z-score falls below a defined cut-off point namely; minus 2SD from the median of the international reference, population identifies children who have poor nutritional status. Therefore, minus 2SDs is used as the cut-off point to identify children aged 0–59 months who are at risk of poor growth attainment in this paper, as it is considered to be the most widely referred to cut-off standard. A common pattern of growth in individual children in developing countries is low Ht/Age, normal or low Wt/Age and normal Wt/Ht. Of the three conditions, wasting is the most severe, and children seldom remain long in a wasted state, as they tend either to recover or to deteriorate further and die.

It is very evident from the literature above, that the basic causes of malnutrition relate to quality and quantity of actual resources, which together with poor public health, inadequate and childcare practices, as well as insufficient access to care leads to child malnutrition. See the summary in figure 2.9.1.
2.10 Research Designs Used in Growth monitoring

Though research involving growth and nutritional assessment has been studied extensively, research designs have not been consistent and not very elaborate. Most studies are Meta analytic in nature (de Onis.M, et al., 2007; Elana et al., 2007; Yang and de Onis, 2008). There is a tendency for most researchers to select cross sectional studies (Vonk et al., 1993) than longitudinal ones. In a number of occasions researchers have used already collated growth monitoring data (Jean-Christophe, 2007; Tarozzi, 2008) Some researchers have focussed on under-fives while others have opted to study under threes and sample sizes have ranged from 300 to about 1,800).
Most of the measures used included assessing growth and nutritional status through weight-for-age, weight-for-height, head circumference, and mid-upper-arm circumference (MUAC). Most of the data if not from demographic health surveys was gathered through questionnaires, verbal interviews, and child weighing. Table 2.4 summarises the most cited research designs.

A cross-sectional study was performed by during a 3-month period on 515 children 0-5 years old who attended the daily maternal and child health clinic of Consolata Hospital in Kyeni, Embu District, Kenya, to determine growth and nutritional status through weight-for-age, head circumference and mid-upper-arm circumference (MUAC). It was found that the average growth of these children developed according to international standards for the 3 parameters and remained above minus 2 standard deviations (SD). The study recommended that MUAC be included in routine clinical measurements.

A study by Hoffman DJ, Lee SK was carried out in The Democratic People's Republic of Korea (DPRK), which is one of the nutritionally vulnerable countries of the world. The objectives of this paper were to determine the current prevalence of under nutrition among children using data from the latest national survey and to compare the findings with those from the previous national survey in 1997. In 2002 with cooperation from UNICEF and the World Food Program (WFP), the government of the DPRK conducted a survey of 6000 households with children < 7 years old using multiple-stage sampling methods. Data were collected for socio-demographic variables, use of WFP food aid, and anthropometric measures of the youngest child in the household. The prevalence of stunting (height for age Z-score less than -2.0) in all children was 39.4% (40.2 and 38.5% for boys and girls, respectively).

The prevalence of wasting (weight for height Z-score less than -2.0) was 8.2% in all children (9.1 and 7.3% for boys and girls, respectively). The study concluded that acute malnutrition is decreasing in the DPRK, but chronic malnutrition that results in stunting is still highly prevalent. Continued surveillance of nutritional status of children in the DPRK is warranted given the continued state of malnutrition in that country.

A study by Majlesi et al in 2001 was carried out to determine the nutritional status in children of under-five years old in rural area of Khoramabad province. Data were gathered through
questionnaires, verbal interviews, and child weighing. Nutritional status was estimated via weight/age index and the data were analysed by chi-square test. The results show 7.7% malnutrition among the children in this area. Factors that influence the nutritional status were frequency of diarrhoea and acute respiratory infection, birth weight, duration of breast-feeding and milk formula.
<table>
<thead>
<tr>
<th>Author</th>
<th>Article</th>
<th>Research design</th>
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<tbody>
<tr>
<td>Vonk R, de Kleuver M, Ie EH, Voorhoeve HW</td>
<td>Growth of under-five-year-old children in Kyeni, Kenya.</td>
<td>A cross-sectional study was performed during a 3-month period on 515 children 0-5 years old who attended the daily maternal and child health clinic of Consolata Hospital in Kyeni, Embu District, Kenya, to determine growth and nutritional status through weight-for-age, head circumference and mid-upper-arm circumference (MUAC).</td>
</tr>
<tr>
<td>Yang and de Onis (2008)</td>
<td>Algorithms for converting estimates of child malnutrition based on the NCHS reference into estimates based on the WHO Child Growth Standards</td>
<td>Sixty-eight surveys from the WHO Global Database on Child Growth and Malnutrition were analyzed using the WHO standards to derive estimates of underweight, stunting, wasting and overweight. The prevalence based on the NCHS reference were taken directly from the database. National/regional estimates with a minimum sample size of 400 children were used to develop the algorithms. For each indicator, a simple linear regression model was fitted, using the logic of WHO and NCHS estimates as, respectively, dependent and independent variables. The resulting algorithms were validated using a different set of surveys, on the basis of which the point estimate and 95% confidence interval (CI) of the predicted WHO prevalence were compared to the observed prevalence.</td>
</tr>
<tr>
<td>Elana P. B, Dowshen S.A, Izenberg N (2007)</td>
<td>Public understanding of growth charts: A review of the literature</td>
<td>A literature search was carried out to identify and analyze the findings of studies that have examined the extent to which non healthcare professionals comprehend the information presented by growth charts.</td>
</tr>
<tr>
<td>Jean-Christophe F. (2007)</td>
<td>Urban–rural differentials in child malnutrition: Trends and socioeconomic correlates in sub-Saharan Africa</td>
<td>Levels and trends of urban–rural differentials in child malnutrition were investigated whether residual differences exist between urban and rural areas, given comparable measures of socioeconomic status (SES) of households and communities. Data was obtained from Demographic and Health Surveys of 15 sub-Saharan African countries.</td>
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<tr>
<td>Campanozzi et al., 2009</td>
<td>Hospital-acquired malnutrition in children with mild clinical conditions</td>
<td>Four hundred ninety-six children (age 1–192 months) with mild clinical conditions were studied. Weight and height were measured. Weight was assessed daily and body mass index (BMI) Z-score was calculated for all patients.</td>
</tr>
<tr>
<td>Jean-Christophe and Kuate-Defo (2005)</td>
<td>Socioeconomic inequalities in early childhood malnutrition and morbidity: modification of the household-level effects by the community SES.</td>
<td>Data from the Demographic and Health Surveys (DHS) of five African countries which have carried out more than one DHS in the 90s: Burkina Faso (1992/93, 1998/99); Cameroon (1991, 1998); Egypt (1992, 2000); Kenya (1993, 1998) and Zimbabwe (1994, 1999) was analysed following retrieval of nutrition and health-related information on women aged 15–49 years and their children born in the 3 or 5 years preceding the survey date, and on relevant child, mother, household and community characteristics.</td>
</tr>
<tr>
<td>Nojomi et al., (2004)</td>
<td>Risk analysis of growth failure in under-5-year Children</td>
<td>600 under-5-year children were selected by multistage random sampling. Household’s demographic and socioeconomic measures as well as child health and anthropometric characteristics were analyzed using Chi-square, t-test, ANOVA, and multiple logistic regressions. To make a comparison with the results of National Center for Health Statistics (NCHS), Epi Info 6 software was used. The data collection methods were weighing by scales, observation, and checklist.</td>
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<tr>
<td>Majlesi et al., (2001)</td>
<td>Growth Chart Study in Children Under 5 Years Old in Rural Area of Khoramabad Province</td>
<td>Data were gathered through questionnaires, verbal interviews and child weighing. Nutritional status was estimated via weight/age index and the data were analysed by chi-square test. The results show 7.7% malnutrition among the children in this area. Factors that influence the nutritional status were: Frequency of diarrhoea and acute respiratory infection, birth weight, duration of breast feeding and milk formula</td>
</tr>
<tr>
<td>Nursal et al., (2007)</td>
<td>Simple two-part tool for screening of malnutrition</td>
<td>This prospective study included 2211 patients. Each subject was assessed for malnutrition by the Subjective Global Assessment (SGA), and combination criteria (CC), which included anthropometric measurements and laboratory testing. Findings based on these methods were compared with findings in a series of malnutrition screening tests (malnutrition screening tool, self assessment portion of a mini-nutritional assessment, a question about unintentional weight loss, evaluation of loss of subcutaneous fat, and various combinations of these).</td>
</tr>
<tr>
<td>Roseli et al., (2009)</td>
<td>Anthropometric evaluation, risk factors for malnutrition, and nutritional therapy for children in teaching hospitals in Brazil</td>
<td>This longitudinal study followed, for 3 consecutive months, all children under 5 years of age (n = 907) hospitalized in pediatric medical wards of 10 Brazilian hospitals. A standard questionnaire was used and nutritional condition was evaluated at hospital admission and discharge: weight-for-height, weight-for-age and height-for-age z score.</td>
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<tr>
<td>Marzieh Nojomi, Arash Tehrani, Shahandokht Najm-Abadi (2004)</td>
<td>Risk Analysis Of Growth Failure In Under-5-Year Children</td>
<td>From February to April 2002, 600 under-5-year children were selected by multistage random sampling. Household’s demographic and socioeconomic measures as well as child health and anthropometric characteristics were analyzed using Chi-square, t-test, ANOVA, and multiple logistic regressions. To make a comparison with the results of National Center for Health Statistics (NCHS), we used Epi Info 6 software. Our data collection methods were weighing by scales, observation, and checklist.</td>
</tr>
<tr>
<td>Joseph J Valadez, T Lori Diprete Brown, William Vargas Vargas And David Morley (1996)</td>
<td>Using Lot Quality Assurance Sampling to Assess Measurements for Growth Monitoring in a Developing Country's Primary Health Care System</td>
<td>Supervisors sampled 10 households in each of 12 Health Areas (4-8 hours per area). No more than two performance errors were allowed for each CHW. This LQAS decision rule resulted in judgements with a sensitivity and specificity of about 95%.</td>
</tr>
<tr>
<td>F Majlesi, B Nikpoor, B Golestan , F Sadre</td>
<td>Growth Chart Study in Children Under 5 Years Old in Rural Area of Khoramabad Province</td>
<td>This cross sectional descriptive analytical study is done in rural areas of Khoramabad province, in winter 1998. Children under 5 years old were studied in 70 health houses. These health houses cover 8661 children in this area. The cases were chosen randomly via cluster sampling. 56 clusters, each containing 20 children, were chosen. The data were collected via standard questionnaires, mother interview and child weighing. Information resources were: mothers, prenatal care forms, child surveillance forms, child spacing forms, and growth charts. The data were analysed by SPSS software, and X^2 test.</td>
</tr>
<tr>
<td>Ibrahim (1999)</td>
<td>Anthropometric patterns and correlates of growth attainment in under-five Pakistani children</td>
<td>The data used in this paper is from 1990-91 Pakistan Demographic and Health Survey (PDHS II). Sample weights were used for the households to allow for the differentials in probability of selection in the four provinces, and to make the sample representative for the whole of Pakistan. The sample consisted of 7,193 households, with interviews of 6,611 women aged 15-49 years and 1,354 men (who were their husbands). The children aged 0-24 months were measured in a supine position on an adjustable wooden measuring board; the same board was used to measure the heights of older children while they were standing. Hanging spring scales were used to measure the weights of the children 0-24 months, and standard-measuring scales were used for those children who could stand.</td>
</tr>
</tbody>
</table>
CHAPTER THREE - RESEARCH METHODOLOGY

3.0 Research Design and Dimension

This was cross sectional quantitative study and it called for the researcher to collect quantitative data once and on the spot. Table 2.5 below shows a blueprint of this research design.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Research objectives</th>
<th>Population and Sampling</th>
<th>Data Collection tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the level of acute under nutrition among children aged two years and below who attend child health clinics in the two urban zonal health centres in Lusaka?</td>
<td>To determine the magnitude of acute under nutrition among children in the two urban Zonal health centres in Lusaka.</td>
<td>Children aged two years and below and under-five cards</td>
<td>Observations and use of a survey checklist</td>
</tr>
<tr>
<td>What is the level chronic under nutrition among children aged two years and below who attend child health clinics in the two urban zonal health centres in Lusaka?</td>
<td>To determine the magnitude chronic under nutrition among children in the two urban Zonal health centres in Lusaka.</td>
<td>Children aged two years and below and under-five cards</td>
<td>Observations and use of a survey checklist</td>
</tr>
</tbody>
</table>

3.1 Study Site

The study site was Lusaka Urban. The site has twenty-three clinics offering Child Health Services across four sub districts.

3.2 Data Sources

In this study, data was collected using a checklist and documentary reviews (UFC) (see Appendix III).

3.3 Population, Sampling, Inclusion and Exclusion Criteria

The study drew study units from two clinics. A simple random sampling method was used to select the two clinics in only two of the four clusters. In order to draw our study units, a sample survey based on the population size children that were attending and appearing on the
register was used. Glen Israel’s formula to determine the sample size when the population is known as shown below was used:

\[ n = \frac{N}{1 + \frac{N(e)^2}{40\%}} \]

Where \( n \) is the desired sample size, \( N \) is the population size, and \( e \) is the level of precision set in this case at 0.05. This formula does not have assumptions a priori. The sample size for children aged two and below was estimated at 40% of the estimated sample size for under-fives according to the clinic records obtained from the two child health centers. The ideal sample size therefore of under twos was estimated to be 258.

<table>
<thead>
<tr>
<th>Under-five population per month</th>
<th>Estimated sample size for under-fives</th>
<th>Estimated sample size for under twos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chipata – 1800</td>
<td>330</td>
<td>132</td>
</tr>
<tr>
<td>Chilenje – 1500</td>
<td>315</td>
<td>126</td>
</tr>
<tr>
<td>Total study sample</td>
<td>-</td>
<td>258</td>
</tr>
</tbody>
</table>

Only children enlisted in the under-five-clinic register and who would have attended two or more growth monitoring sessions consecutively and are not too sick to warrant admission were enlisted.

3.4 Materials and Methods

The human resource to be used for the study shall consist of the researcher and the health workers in the two centres. The staff in the two health centres were trained as assistants in taking anthropometric measurements. Before the study, the teams met on two separate sessions to discuss the aims, objectives, and methodology of the survey and to develop perfect strategies for the survey. The researcher conducted a pilot study on a small population at Chainama Clinic that was allocated by the District Health Office. This clinic’s data has not been included in the main study.

Recruitment of children of two years and below was done between 9 am and 12 pm the time when the Clinic was in session. Every mother/guardian was approached and the information sheet was given to the parents or guardians. Where a parent or guardian was not in position to read or write, they were helped by the research assistants (staff) to make sure they understood
the study and that it was voluntary. Concert forms were then administered to those parents or guardians who wished to participate in the study.

The arm circumference was measured using a MUAC tape, weight of the children was measured using the mother to child scale, height was measured using height boards, and head circumference of the children was measured using a tape.

The researcher also collected information about risk factors of stunting and wasting. This was recorded in a standardized way using a well-designed checklist. Elements shall include the following sections:

1. Socioeconomic status, family composition, age, weight, height, birth weight, length of time from previous birth, and the history of vaccinations and underlying diseases.
2. Body weight was measured using a mother to child scale.
3. Height or length was measured using a stadiometer.
4. Children’s age was calculated in months from birthday to the time of the study.
5. Arm circumference was measured using a MUAC tape for children between 6 to 59 months.
6. For children less than 1 year, the head circumference was measured using a tape.
7. All children under the study were screened for oedema.

3.5 Identification of Variables

The dependent variable in this study was nutritional status of child and in this study; it was measured using five anthropometric factors, which are:

1. Height-for-age (Ht/Age), which indicates the level of stunting\(^2\),
2. Weight-for-age (Wt/Age), which indicates the level of underweight, and
3. Weight-for-height (Wt/Ht) which indicates the level of wasting.
4. Mid-upper-arm circumference (MUAC).

\(^2\) Height for age more than two standard deviations below the WHO reference height reflects growth failure and serves as the best general proxy for constraints to human welfare of the poorest, including dietary inadequacy, infectious diseases, and other environmental health risks (Beaton 1990, Baghiigwa and Younger 2005).
The independent variables or associated variables were:

1. Whether mother is alive or dead
2. Education of the mother and father
3. Marital status of the mother
4. Family income
5. Type of feeding
6. Number of children under-five in the family
7. Birth interval in months between this child being monitored and the previous one.
8. Childhood factors
9. Maternal factors
10. Source of water
11. Status of vaccination
12. Type of toilet

3.6 Operationalisation of Variables

In this study, the dependent variables were operationalised as follows:

Severe Acute Malnutrition

A child was considered to have severe acute malnutrition if:

- MUAC < 11.5cm for children aged 6 – 59 months
- Wt/Ht SD < -3 and / or
- Presence of oedema in both feet

Acute Malnutrition

A child was considered to have acute malnutrition if:

- MUAC > 11.5cm < 12.5cm
- Wt/Ht SD < -2
- No oedema in both feet
Chronic Malnutrition (Stunting)

Severe Chronic malnutrition

A child was considered to have chronic malnutrition or stunted if:

- Ht/age SD < -3

In this study, the independent variables or associated were operationalised as follows:

1. Education of the mother was considered to be the highest number of years one went to school. Education was measured on a nominal scale as follows: Primary education, secondary education, higher education (college or university education).

2. Family income as earnings in Zambian Kwacha from all undertakings and an income below the food basket for the month under study shall be considered as presence of poverty and above this as absence of poverty.

3. Type of feeding means a child being subjected to any one of the infant feeding practices at the time of the study.
   - (a) Exclusive breast-feeding up to 6 months
   - (b) The baby is on exclusive alternative infant formula
   - (c) The baby is on animal milk
   - (d) The baby is on mixed feeding (breast milk and other foods)

4. At what age was the baby weaned

5. Immunisation status was operationalised as follows:
   - (a) BCG at Birth
   - (b) OPV 0 at birth to 13 days.
   - (c) OPV 1 at 6 weeks
   - (d) OPV 2 at least 4 weeks after OPV 1
   - (e) OPV 3 at least 4 weeks after OPV 2
   - (f) OPV 4 at 9 months only if OPV 0 was not given
   - (g) DPT – Hep B- Hib1 at 6 weeks
   - (h) DPT – Hep B- Hib2 at least 4 weeks after Hib 1
(i) DPT – Hep B- Hib3 at least 4 weeks after Hib 2
(j) Measles at 9 months or soon after
(k) Rotavirus

6. Number of children under-five in the family
7. Birth interval in years between this child and the previous one
8. Marital status as a state of having a spouse in form of being: married, widowed, divorced, single or cohabiting.
9. Child factors will include presence of a twin child, infection; child fed predominantly a cereal-based porridge every day with very little dietary diversity. Child fed predominantly a cereal-based porridge every day with very little dietary diversity.
10. Maternal factors included presence of infection, breast problem, and maternal mental illness.
11. Source of water being a tap at home, a communal tap, a shallow well and other source.
12. Type of toilet being: water cistern in house, communal water cistern, pit latrine, and other.

3.7 Ethical Considerations

A written consent was obtained from mothers or guardians after explaining the purpose of the research and ensuring that they understood clearly the issue at hand. This took place after clearance by the UNZA research ethics committee and permission obtained from the Lusaka District Health Management. Not all mothers who declined to sign the consent form were included in the study. This study had no perceived risks on the participants.

Information obtained from mothers or guardians during the study was kept strictly confidential as it borders on personal information, which most people would rather keep to themselves. The checklists were kept by the researcher in the strictest of confidence for only six months after which time all the responses were examined. There were no names written on them. Each mother or guardian was given transport reimbursement of K30,000.
3.8 Data Analysis

Data was analysed using SPSS version 17 (SPSS, Inc., Chicago, IL). Descriptive statistics in form of univariate, bivariate and multivariate analyses using ANOVA\(^3\) to test and compare factors among the respondents in the two clinic settings. Probability values below 0.05, two-tailed, were considered significant. Pearson’s chi-square or Fisher’s exact test was used for category data.

An assessment of the data sets to determine (a) first the point prevalence of malnutrition and (b) the levels of under-nutrition based on the operationalisation and interpretation as previously described using the z score was done during data analysis. The Z-score is defined as follows: \(z_i = (A_i - \bar{A}_r) / (SD \text{ Reference population})\) where: \(A_i\) is the value of the index of child \(i\); \(\bar{A}_r\) is the value of the index for the median child in the reference population; and \(SD\) is the standard deviation of the index for the reference population. A z-score describes how far and in what direction an individual’s anthropometric measurement deviates from the median in the 2006 WHO Child Growth Standards for his or her sex.

In order to determine the values, each child’s anthropometric z score index was compared to a reference distribution for the indices of interest. The distance to the median individual from the reference population was chosen to indicate whether a child was wasting, stunting or underweight (exhibiting chronic or acute under nutrition).

In this study, the point prevalence was calculated from the under-five population per month as a base rate. Noting that the study did not have one indicator for malnutrition but three indices, point prevalences of these indicators were used instead. The following formula was used to calculate the point prevalence.

\[
\text{Point prevalence} = \frac{N \text{ cases of malnutrition in a defined population at a particular point in time}}{\text{Number of persons in a defined population at the same time}}
\]

\(^3\) One-way Analysis of Variance (ANOVA) was performed to check whether the differences in child malnutrition by wealth of residence were significant in the bivariate analysis.
CHAPTER FOUR – RESULTS

4.0 Demographic profile of the respondents

Three hundred and sixty six under twos were enrolled in the study after receiving approval from the University of Zambia Biomedical Research Ethics Committee of whom n = 199 (54.4%) were from Chipata compound and n = 167 (45.61%) were from Chilenje. Within the sample, just over half n = 191 (52.2%) were male infants and n = 175 (47.8%) were female infants. The age range was 2 to 24 months years, with the modal age being 3 months years, the mean age was 10.4 (SD ± 6.8). Most of the infants n = 306 (83.6%) hailed from homes of married couples as compared to n = 60 (17.4%) were not. Nearly every mother n = (91.1%) had been to school (primary, secondary or higher education) except for n = 33 (8.9%) who stated that they had never been to school. Nearly every mother was not in employment. Only 69 (18.9%) of the mothers were in gainful employment and n = 297 (81.2%) were not. Just less than half n = 162 (44.3%) were earning low incomes when cumulative incomes with their husbands were summed. These mothers were unable to meet their basic needs. As for the more than half n = 194 (55.7%) mothers, they claimed to be in a position to meet their basic needs because their incomes were either high or just moderate to meet their basic needs (Table 4.0.1).
<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilenje</td>
<td>167</td>
<td>45.6</td>
</tr>
<tr>
<td>Chipata</td>
<td>199</td>
<td>54.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>191</td>
<td>52.2</td>
</tr>
<tr>
<td>Female</td>
<td>175</td>
<td>47.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Summed income status of couple</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The income we have is high and we are able to meet our needs</td>
<td>19</td>
<td>5.2</td>
</tr>
<tr>
<td>The income we have is just moderate and we are able to meet our needs</td>
<td>185</td>
<td>50.5</td>
</tr>
<tr>
<td>The income we have is low and we are not able to meet our needs</td>
<td>162</td>
<td>44.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>306</td>
<td>83.6</td>
</tr>
<tr>
<td>Divorced</td>
<td>8</td>
<td>2.2</td>
</tr>
<tr>
<td>Separated</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Single</td>
<td>48</td>
<td>13.1</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>.3</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>1</td>
<td>.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Mother’s education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never been to school</td>
<td>33</td>
<td>8.9</td>
</tr>
<tr>
<td>Primary</td>
<td>103</td>
<td>27.9</td>
</tr>
<tr>
<td>Secondary</td>
<td>179</td>
<td>48.5</td>
</tr>
<tr>
<td>Higher education (College or University)</td>
<td>54</td>
<td>14.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Mother’s employment status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>69</td>
<td>18.9</td>
</tr>
<tr>
<td>No</td>
<td>297</td>
<td>81.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>366</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The mean and median family size was 5 (SD ±2.1). The household family size ranged from 2 to 14 and the mean, median and mode of under-five’s in the households was 1 (SD ± 0.8). In the households the number of under-fives ranged from 1 to 7.

In this study, n = 22 deliveries took place at home and as such, there birth weights were not known. Seven of these deliveries registered for under five clinic in Chilenje and 15 in Chipata compound representing a within population ratio home of 4% for Chipata and 7% for Chilenje. The sample mean birth weight was 2.8 (SD ± 0.8) and this was significantly lower than the national average of 3.1kg.

The mean birth weight for boys was 2.9 (SD ± 0.8) and that for girls was 2.7 (SD ± 0.8). However a critical analysis shows that the mean birth weight was not significantly different t = 56.5; df 365 p = 0.005.

In the sample, there were 5 records of macrosomias (figure 4.0.1) and 1 microsomia. 7 deliveries took place at home (with no record of birth weight) in the study (see the elements of outliers below the lower whisker and above the upper whisker. The mean birth weights for Chilenje were 2.9 kg and Chipata was 2.7 kg. There was a significant difference in the mean birth weights between the two geographic units p = 0.001 at the 0.05 alpha level.
One macrosomia in the study was female and four were males (figure 4.1.1) and there was only one microsomia who was actually a male. There was a significant difference in the mean birth weights between the two geographic units \( p = 0.000 \) at the 0.05 alpha level.

### 4.1 Immunisation Status

Nearly every child who was attended to was on schedule regarding BCG and OPV immunization. In the sample \( n = 336 \) (91.8%) children received BCG at birth, \( n = 22 \) who were born at home, 8.2% did not receive BCG at birth. Among attendees, Immunisation status for OPV at birth to 13 days was 87%. 73.2% of the children received at least three doses of OPV and 93.4% of the children had at least three doses of Hep B-Hib 3.

Nearly every child who was attended to was on schedule. The Immunisation trend shows that the older a child grows the greater the chance of missing a scheduled vaccine.

Regarding measles, among attendees, Immunisation status at 9 months was 43.4% (Table 4.1.1) as most of the children were not eligible.
4.2. Child and Infant Feeding

In this cohort, mothers did not ensure that their children were exclusively breastfed the first six months this is because out of the population N= 366, only n = 88 (24%) were exclusively breastfed the first six months. Eighty nine children (24.3%) were on other foods and majority or just less than half n = 180 (49.2%) of the cohort were on mixed feeding (breast-milk and other foods). (Table 4.2.1)

Table 4.2.1 Type of feeding by age group

<table>
<thead>
<tr>
<th>Type of feeding</th>
<th>Yes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding up to 6 months</td>
<td>88</td>
<td>24.0</td>
</tr>
<tr>
<td>The baby is on exclusive replacement infant formula</td>
<td>8</td>
<td>2.2</td>
</tr>
<tr>
<td>The baby is on animal milk</td>
<td>1</td>
<td>.3</td>
</tr>
<tr>
<td>The baby is on mixed feeding (breast-milk and other foods)</td>
<td>180</td>
<td>49.2</td>
</tr>
<tr>
<td>Other Foods</td>
<td>89</td>
<td>24.3</td>
</tr>
<tr>
<td>Total</td>
<td>366</td>
<td>100.0</td>
</tr>
</tbody>
</table>
A critical examination of the distribution of z scores relative with type of feeding shows that cases of malnutrition increased with age and that these were dependent on type of feeding (see Table 4.2.2). This showed that malnutrition occurred in relatively elder children. There were few cases of malnutrition in the exclusive breastfeeding category than any other category. The chances of having a child getting malnourished were higher in the mixed feeding (breast milk and other foods) category than any other.
### Table 4.2.2 Distribution of type of feeding by Z score indices

<table>
<thead>
<tr>
<th>Type of infant and child feeding</th>
<th>Wt/age SD</th>
<th>Wt/length SD</th>
<th>Length/age SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding up to 6 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The baby is on exclusive replacement infant formula</td>
<td>2</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>The baby is on animal milk</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>The baby is on mixed feeding (breast-milk and other foods)</td>
<td>10</td>
<td>19</td>
<td>58</td>
</tr>
<tr>
<td>Other foods</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>37</td>
<td>96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of infant and child feeding</th>
<th>Wt/age SD</th>
<th>Wt/length SD</th>
<th>Length/age SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding up to 6 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The baby is on exclusive replacement infant formula</td>
<td>60</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>The baby is on animal milk</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>The baby is on mixed feeding (breast-milk and other foods)</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other foods</td>
<td>30</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>175</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of infant and child feeding</th>
<th>Wt/age SD</th>
<th>Wt/length SD</th>
<th>Length/age SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding up to 6 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The baby is on exclusive replacement infant formula</td>
<td>4</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>The baby is on animal milk</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>The baby is on mixed feeding (breast-milk and other foods)</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other foods</td>
<td>26</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>61</td>
<td>104</td>
</tr>
</tbody>
</table>

### 4.3 Profile of Malnutrition

In this section, three forms of malnutrition are presented based on the variables that were determined a priori and these are: Height for Age Index (stunting), Weight for Age Index (underweight) and Weight for Height (Acute malnutrition or wasting).

**Height for Age Index (stunting)**

One hundred and eighteen (32.2%) out of 366 of the children who attended the well-baby sessions were found to be stunted. Within this population N = 366, n = 8 fell within <-2 z-
score (stunted) whereas \( n = 110 \) fell within \(< -3 \) z-score (severely stunted). Therefore, the point prevalence for stunting in this study was 32.2%. However, the point prevalences in the two settings were as follows; Chipata was 27.6 % and Chilenje 37.7% (see Table 4.3.1).

**Weight for Age Index (underweight)**

Weight for age was used as an indicator for underweight signaling both severe underweight and underweight. Two hundred and five children who attended the well-baby sessions were found to be underweight. Within the population \( N = 366 \), \( n = 24 \) (6.5%) fell within \(< -2 \) z-score (underweight) whereas \( n = 181 \) (49.4%) fell within \(< -3 \) z-score (severely underweight). The point prevalence for underweight in this study was 56 %. However, the point prevalences in the two settings were as follows; Chipata was 51.3 % and Chilenje \( n = 61.7 \) % (see Table 4.3.1). Being underweight is not an indicator of acute or chronic malnutrition but shows that children are undernourished.

**Weight for Height (Acute malnutrition or wasting)**

Weight-for-height was used to define wasting or thinness in the population. Seventy three of the children who attended the well-baby sessions were found to be wasted. Within the population \( N = 366 \), \( n = 1 \) fell within \(< -2 \) z-score (wasted) whereas \( n = 72 \) (19.6%) fell within \(< -3 \) z-score (severely wasted). The point prevalence for wasting in this study was therefore 20%. So we can say that one fifth of children in the two settings where suffering from acute malnutrition (table 4.3.1). However, the point prevalences in the two settings were as follows; Chipata was 22.6 % and Chilenje 16.8 % (see Table 4.3.1).
Table 4.3.1 Distribution of type of Malnutrition by locality

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chilenje N = 167</th>
<th>Chipata N = 199</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight/age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;-2 (Under weight)</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>&lt;-3 (Severe underweight)</td>
<td>85</td>
<td>96</td>
</tr>
<tr>
<td>Weight/length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;-2 (Wasting)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>&lt;-3 (Severe wasting)</td>
<td>27</td>
<td>45</td>
</tr>
<tr>
<td>Edema</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>No</td>
<td>166</td>
<td>189</td>
</tr>
<tr>
<td>Height/age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;-2 (Stunting)</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>&lt;-3 (Severe stunting)</td>
<td>57</td>
<td>53</td>
</tr>
</tbody>
</table>

A further examination of the distribution of stunting, wasting and underweight showed that there were variations across the two geographic sites. However, in bivariate analyses, three out of the six predictor variables were significantly associated with malnutrition and all the \( p \) values were < 0.05 (see Table 4.3.2).

Table 4.3.2 Associations of nutritional status by Geographic Area

<table>
<thead>
<tr>
<th>Association</th>
<th>( \chi^2 ) obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic area * Wt/age SD</td>
<td>21.726</td>
<td>5</td>
<td>.001</td>
</tr>
<tr>
<td>Geographic area * Wt/Length SD</td>
<td>9.429</td>
<td>5</td>
<td>.003</td>
</tr>
<tr>
<td>Geographic area * Length for age SD</td>
<td>23.817</td>
<td>5</td>
<td>.001</td>
</tr>
</tbody>
</table>

A detailed examination of malnutrition showed that there was no difference across sex in the prevalence of malnutrition (Table 4.3.3).
The three degrees of malnutrition were prevalent in children of all age intervals (Table 4.3.4) and that different determinants may be at play.

Table 4.3.3 Distribution of Malnutrition by Z score indices across sex

<table>
<thead>
<tr>
<th>Wt/age SD</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1 sd</th>
<th>med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>16</td>
<td>54</td>
<td>0</td>
<td>82</td>
<td>9</td>
<td>2</td>
<td>175</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>21</td>
<td>42</td>
<td>0</td>
<td>99</td>
<td>15</td>
<td>4</td>
<td>191</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>37</td>
<td>96</td>
<td>0</td>
<td>181</td>
<td>24</td>
<td>6</td>
<td>366</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wt/Length</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1 med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>4</td>
<td>11</td>
<td>48</td>
<td>72</td>
<td>39</td>
<td>1</td>
<td>175</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>19</td>
<td>32</td>
<td>103</td>
<td>33</td>
<td>0</td>
<td>191</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>30</td>
<td>80</td>
<td>175</td>
<td>72</td>
<td>1</td>
<td>366</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length / age</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1 med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>27</td>
<td>30</td>
<td>46</td>
<td>8</td>
<td>55</td>
<td>5</td>
<td>175</td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>31</td>
<td>58</td>
<td>8</td>
<td>55</td>
<td>3</td>
<td>191</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>61</td>
<td>104</td>
<td>16</td>
<td>110</td>
<td>8</td>
<td>366</td>
</tr>
</tbody>
</table>

Table 4.3.4 Distribution of Malnutrition by Z score indices across age

<table>
<thead>
<tr>
<th>Wt/age SD</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1</th>
<th>med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 to 24 months</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>0</td>
<td>23</td>
<td>5</td>
<td>3</td>
<td>66</td>
</tr>
<tr>
<td>13 to 18 months</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>0</td>
<td>17</td>
<td>2</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>7 to 12 months</td>
<td>6</td>
<td>11</td>
<td>32</td>
<td>0</td>
<td>55</td>
<td>4</td>
<td>1</td>
<td>109</td>
</tr>
<tr>
<td>1 to 6 months</td>
<td>3</td>
<td>10</td>
<td>30</td>
<td>0</td>
<td>86</td>
<td>13</td>
<td>2</td>
<td>144</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>37</td>
<td>96</td>
<td>0</td>
<td>181</td>
<td>24</td>
<td>6</td>
<td>366</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wt/Length</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1</th>
<th>med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 to 24 months</td>
<td>20</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>20</td>
<td>66</td>
</tr>
<tr>
<td>13 to 18 months</td>
<td>16</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>12</td>
<td>47</td>
</tr>
<tr>
<td>7 to 12 months</td>
<td>52</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>22</td>
<td>0</td>
<td>24</td>
<td>109</td>
</tr>
<tr>
<td>1 to 6 months</td>
<td>87</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>26</td>
<td>0</td>
<td>24</td>
<td>144</td>
</tr>
<tr>
<td>Total</td>
<td>175</td>
<td>8</td>
<td>30</td>
<td>0</td>
<td>72</td>
<td>1</td>
<td>80</td>
<td>366</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length / age</th>
<th>&lt; -3</th>
<th>&lt; -2</th>
<th>- 1</th>
<th>med</th>
<th>1sd</th>
<th>2sd</th>
<th>3sd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 to 24 months</td>
<td>17</td>
<td>9</td>
<td>7</td>
<td>20</td>
<td>17</td>
<td>2</td>
<td>10</td>
<td>66</td>
</tr>
<tr>
<td>13 to 18 months</td>
<td>15</td>
<td>11</td>
<td>8</td>
<td>16</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>7 to 12 months</td>
<td>15</td>
<td>18</td>
<td>39</td>
<td>52</td>
<td>30</td>
<td>3</td>
<td>1</td>
<td>109</td>
</tr>
<tr>
<td>1 to 6 months</td>
<td>8</td>
<td>23</td>
<td>50</td>
<td>87</td>
<td>51</td>
<td>2</td>
<td>1</td>
<td>144</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>61</td>
<td>104</td>
<td>175</td>
<td>110</td>
<td>8</td>
<td>12</td>
<td>366</td>
</tr>
</tbody>
</table>
Nutritional Status and Known Risk Factors

In order to assess the presence of the known risk factors of malnutrition in the sample, association tests were conducted using chi square test of significance. The seven risk factors were assessed using z scores as measures of malnutrition.

Type of feeding was significantly associated with weight for age, weight for length and length for age (Table 4.3.5) p < 0.05.

<table>
<thead>
<tr>
<th>Association</th>
<th>( \chi^2 ) obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of feeding * Wt/age SD</td>
<td>36.795a</td>
<td>20</td>
<td>.012</td>
</tr>
<tr>
<td>Type of feeding * Wt/Length SD</td>
<td>31.365a</td>
<td>20</td>
<td>.051</td>
</tr>
<tr>
<td>Type of feeding * Length for age SD</td>
<td>70.361a</td>
<td>24</td>
<td>.001</td>
</tr>
</tbody>
</table>

Mothers’ education was significantly associated with malnutrition p < 0.05 except for weight for length (Table 4.3.6) which showed no significant association.

<table>
<thead>
<tr>
<th>Association</th>
<th>( \chi^2 ) obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s education * Wt/age SD</td>
<td>43.926a</td>
<td>15</td>
<td>.001</td>
</tr>
<tr>
<td>Mother’s education * Wt/Length SD</td>
<td>20.949a</td>
<td>15</td>
<td>.038</td>
</tr>
<tr>
<td>Mother’s education * Length for age SD</td>
<td>51.376a</td>
<td>18</td>
<td>.001</td>
</tr>
</tbody>
</table>

Mother’s employment status was significantly associated with weight for age, weight for length and length for age p < 0.05 (Table 4.3.7).

<table>
<thead>
<tr>
<th>Association</th>
<th>( \chi^2 ) obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the mother working? * Wt/age SD</td>
<td>37.811a</td>
<td>15</td>
<td>.001</td>
</tr>
<tr>
<td>Is the mother working? * Wt/Length SD</td>
<td>55.452a</td>
<td>15</td>
<td>.001</td>
</tr>
<tr>
<td>Is the mother working? * Length /age SD</td>
<td>28.487a</td>
<td>18</td>
<td>.005</td>
</tr>
</tbody>
</table>
Mastitis or any other breast problem was not significantly associated with malnutrition (Table 4.3.8).

<table>
<thead>
<tr>
<th>Association</th>
<th>χ² obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the mother got any breast problem? * Wt/age SD</td>
<td>9.438a</td>
<td>5</td>
<td>.093</td>
</tr>
<tr>
<td>Has the mother got any breast problem? * Wt/Length SD</td>
<td>4.045a</td>
<td>5</td>
<td>.543</td>
</tr>
<tr>
<td>Has the mother got any breast problem? * Length for age SD</td>
<td>7.049a</td>
<td>6</td>
<td>.316</td>
</tr>
</tbody>
</table>

The presence of twins in a household was significantly associated with malnutrition. (Table 4.3.9) p < 0.05.

<table>
<thead>
<tr>
<th>Association</th>
<th>χ² obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the child a twin? * Wt/age SD</td>
<td>13.250a</td>
<td>5</td>
<td>0.021 Cramer V = 0.27) low association</td>
</tr>
<tr>
<td>Is the child a twin? * Wt/Length SD</td>
<td>4.045a</td>
<td>5</td>
<td>0.043</td>
</tr>
<tr>
<td>Is the child a twin? * Length for age SD</td>
<td>28.267a</td>
<td>6</td>
<td>0.001 Cramer V = 0.19) low association</td>
</tr>
</tbody>
</table>

Maternal infection was significantly associated with weight/age and length for age (Table 4.3.10).

<table>
<thead>
<tr>
<th>Association</th>
<th>χ² obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt/age SD * Has the mother got any infection?</td>
<td>28.137a</td>
<td>15</td>
<td>.021(Cramer V = 0.24) low association</td>
</tr>
<tr>
<td>Wt/Length SD * Has the mother got any infection?</td>
<td>12.751a</td>
<td>15</td>
<td>0.021</td>
</tr>
<tr>
<td>Length for age SD * Has the mother got any infection?</td>
<td>65.741a</td>
<td>18</td>
<td>0.001(Cramer V = 0.16) low association</td>
</tr>
</tbody>
</table>
Further, associations with other determinants were not significant (Tables 4.3.11 to 4.3.14). What were significant $p \leq 0.05$ were marital status and length for age SD, Family size and Length for age SD, Income and Wt/age SD, Income and Wt/Length SD and finally, Income and Length for age SD.

**Table 4.3.11 Associations of nutritional status and marital status**

<table>
<thead>
<tr>
<th>Association</th>
<th>$\chi^2$ obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status. * Wt/age SD</td>
<td>17.688*</td>
<td>25</td>
<td>0.855</td>
</tr>
<tr>
<td>Marital status. * Wt/Length SD</td>
<td>7.390*</td>
<td>25</td>
<td>1.000</td>
</tr>
<tr>
<td>Marital status. * Length for age SD</td>
<td>61.983*</td>
<td>30</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Table 4.3.12 Associations of nutritional status and family size**

<table>
<thead>
<tr>
<th>Association</th>
<th>$\chi^2$ obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family size. * Wt/age SD</td>
<td>39.829*</td>
<td>65</td>
<td>0.994</td>
</tr>
<tr>
<td>Family size. * Wt/Length SD</td>
<td>69.976*</td>
<td>65</td>
<td>0.314</td>
</tr>
<tr>
<td>Family size. * Length for age SD</td>
<td>77.104*</td>
<td>78</td>
<td>0.507</td>
</tr>
</tbody>
</table>

**Table 4.3.13 Associations of nutritional status and No. of Under 5s**

<table>
<thead>
<tr>
<th>Association</th>
<th>$\chi^2$ obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Under 5s. * Wt/age SD</td>
<td>25.397*</td>
<td>30</td>
<td>0.706</td>
</tr>
<tr>
<td>No. of Under 5s. * Wt/Length SD</td>
<td>37.749*</td>
<td>30</td>
<td>0.156</td>
</tr>
<tr>
<td>No. of Under 5s. * Length for age SD</td>
<td>25.998*</td>
<td>36</td>
<td>0.891</td>
</tr>
</tbody>
</table>

**Table 4.3.14 Associations of nutritional status and income**

<table>
<thead>
<tr>
<th>Association</th>
<th>$\chi^2$ obs Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income. * Wt/age SD</td>
<td>34.805*</td>
<td>10</td>
<td>0.001</td>
</tr>
<tr>
<td>Income. * Wt/Length SD</td>
<td>27.406*</td>
<td>10</td>
<td>0.002</td>
</tr>
<tr>
<td>Income. * Length for age SD</td>
<td>33.432*</td>
<td>12</td>
<td>0.001</td>
</tr>
</tbody>
</table>
CHAPTER FIVE - DISCUSSION AND CONCLUSIONS

5.0 What this study shows

The point prevalence for wasting in this study was therefore 20%. So we can say that one fifth of the children in the two settings where suffering from acute malnutrition. However, the point prevalence rates in the two settings were as follows; Chipata was 22.6% and Chilenje was 16.8%.

The point prevalence of chronic malnutrition (stunting) was 32.2%. However, the point prevalence rates in the two settings were as follows; Chipata was 27.6% and Chilenje was 37.7%.

The point prevalence for under-weight in this study was 56% and in the two settings Chipata was 51.3% and Chilenje 61.7%.

From the above results, we can say that there were more children in Chilenje who were chronically malnourished than Chipata and that there were more children in Chilenje who were under-weight than Chipata. This could have been due to the fact that there were more parents in Chilenje who were in gainful employment than Chipata. Mothers in employment have less time to monitor their children’s nutritional intake. The other reason could have been due to the fact that there were higher levels of maternal infection in Chilenje compared to Chipata as mothers tended to go for other infant feeding options.

A detailed examination of malnutrition showed that there were no differences across sex in this study (Table 4.3.3), these findings are consistent with the previous report in India, in a study of malnutrition among children younger than six years in three tribal communities Kshatryia and Gosh (2008) found that there was no sex difference in prevalence of malnutrition.

All the three degrees of malnutrition were prevalent in children of all age intervals (Table 4.3.4) and that different determinants may be at play.

The following variables were associated with malnutrition: Type of feeding, maternal infection, education, income, employment and being a twin.
5.1 Lessons Learnt from the Study

Overall, the results presented above provide evidence that relying on weight for age alone will not adequately capture children who have a high risk of death from the consequences of severe acute malnutrition or chronic malnourished children with long term effects. There is no evidence to associate increased risk of under nutrition with Immunisation, infection in the child, marital status, number of children below five and birth interval.

We can also say that geographical area and maternal infection plays an important role in the occurrence of malnutrition. This is supported by differences in point prevalence rates between Chilenje and Chipata of malnutrition. Regarding maternal infection, HIV infection was the single most leading factor of malnutrition as mothers tended to go for other feeding options. Since the risk of HIV infection tends to be higher among the more affluent sub-groups of the population especially in wealthier households living in Chilenje than Chipata a fact Magadi and Desta (2009) and Mishra et al.( 2007) have observed in Sub Saharan studies

In this study, vulnerability to malnutrition regarding type of feeding was observed. The fact that the vulnerability for malnutrition of children whose mothers introduced mixed feeding in the first six months is particularly apparent in this study and it suggests the need to emphasise exclusive breastfeeding within this critical age group of 0 to 6 months.

While this study has shown that HIV is a predictor of under nutrition, previous studies have suggested no significant difference in the prevalence of under nutrition in children by maternal HIV and survival status (Bridge et al., 2006; Nalwoga et al., 2010; Nakiyingi et al., 2003). Our findings relating to maternal HIV status are consistent with the latter (Nakiyingi et al., 2003) which was based on a multivariate analysis controlling for the effect of other significant factors, unlike the former studies that were based on bivariate distributions.

The observed nutritional statuses in the two geographic areas reflect a larger set of deprivations related to the living conditions to which a child is exposed and to the social and economic opportunities of care-takers. Though this study assessed a set of underlying determinants (factors) of nutritional status some of them as shown in the results section have
been identified as not potential obstacles to the growth and development of children and this is contrary in part to research findings in this area (Braveman and Egerter, 2008; WHO, 2010; Bunn, 2009; Nalwoga et al., 2010).

The observed under nutrition among children within the first six months may be partly attributable to higher levels of gestational malnutrition and maternal HIV infection where mothers have opted for other infant feeding options.

It was not expected that reduced breastfeeding in the study sample and possible causes could be mother’s HIV infection or lack of adequate parental care due to engagement in income generating activities. The fact that children who were never breastfed have two times the odds of being malnourished compared to those who were breastfed for up to six months and that HIV positive mothers are significantly less likely to have breastfed their children after six months, suggests a possible indirect effect of mothers HIV status on child malnutrition through lack of breastfeeding. The evidence of increased vulnerability for children whose mothers are of low education, low income households and are infected with HIV calls for greater integration of child nutrition and social welfare for improved nutrition and survival chances of children in the two settings.

The relation between income growth and child malnutrition is one factor worth discussing in this study. Though the researcher did not use regression methods in attempting to isolate strong predictors as do most studies, this was not the case since the focus of the study was point prevalence. However, studies elsewhere support the findings. In a seminal paper, Smith and Haddad (2002) ran country fixed-effects multivariate regressions on a sample of more than 60 countries over a period 1970-1995, found that the impact of economic growth is positive but declines as income levels increase. They stress that other non-income factors have larger statistically significant effects on nutrition indicators. Gabriele and Schettino (2007) also point at a nonlinear negative linkage between income and underweight: the correlation is very strong in very poor countries but weakens progressively as income per capita goes up. Harttgen et al., (2012) show that the effect of GDP growth on underweight rates in Africa between 1991 and 2009 has been positive but small, and that other determinants, such as socioeconomic position within society or mothers’ level of education, have revealed higher and statistically significant impacts.
5.2 Limitations and Significance of the Study

This study like all other studies is not immune from methodological or design limitations. It is interesting to note that the analysis presented in this study provides no evidence that paternal factors or children in households where other adult household members (other than mother) are HIV positive, or living in a household that is poor and members are less educated are more undernourished than those in less affected households. This could have been done in order to show the impacts. There are research implications arising from this with support from previous research elsewhere in sub-Saharan Africa (Bridge et al., 2006; Owen et al., 2009; Zidron et al., 2009), the researcher is calling for further research to better understand other possible mechanisms.

Another limitation is that the researcher only had information about the status of one caregiver, which limits the interpretation of our findings. It is likely that the status of all other primary caregivers contribute to the children’s health.

Despite these limitations, this study has several significant points and these include the following:

The study provides new information on children of two years and below and maternal reports of general health, which is important considering the limited number of studies on children below two years. This study highlights the need for more research on the health of families taking care of a child who is below two because they represent a heterogenous group with respect to various complex family factors. Such complexities are likely to account for some of the discrepant findings related to children below two years. The results suggest that within the under two population, some children may be at heightened risk for experiencing poor health outcomes.

The epidemiological evidence this study has provided suggests that the children under two face serious nutritional deficits which have been overlooked noting that emphasis has been on weight for age. The fact that point prevalence rates for stunting, wasting and underweight have been defined and known shows that malnutrition is of great concern and requires interventions in the two communities.
The fact that there were children between two and six months exhibiting malnutrition, is a significant finding in this study and adds to evidence that there is a critical window for a child's optimal physical and mental growth and development, from when the child is still in the mother's womb and during the first two years of life. There are therefore implications and this calls for efforts to intervene during this period to counter the effects of malnutrition and interventions at this stage could reverse the harm it causes. This is critical because in the two settings, the opportunity was missed and most of the children would never make up the difference in growth and development, and they will be adversely affected for the rest of their lives.

The results will be useful especially to the SUN movement as they will augment its work. The SUN movement is a collective effort to support governments as they invest in policies and actions to improve maternal and child nutrition from conception until a child reaches the age of two years. The movement is built on the engagement of countries affected by a high burden of malnutrition, and Zambia is one of the countries involved.

The study is also significant in that it has shown that monitoring weight only (Wt/age) is not adequate to identify all children who are at risk of death from consequences of severe acute malnutrition or chronic malnourished children with long term effects.

This exploratory study on childhood malnutrition is likely to trigger the formulation of appropriate child health interventions aimed at addressing factors affecting growth monitoring and mitigating malnutrition among children below two years in the two settings in Lusaka. Special attention should be on children who are particularly at an increased risk such as those whose mothers have no education or living in poverty and have HIV infection. Available evidence suggests that without intervention, 20–45 percent of children born to HIV positive mothers would acquire the infection from their mothers through vertical transmission (WHO, 2010), and that the risk of under nutrition is significantly higher among children infected with HIV than among non-infected children (Bunn, 2009; Nalwoga et al., 2010).

5.3 Conclusions

The study examined the point prevalence rates of acute and chronic malnutrition in two research settings of Lusaka. The results suggest that across the two settings the point prevalence of acute malnutrition was higher than the national rates and for chronic it was lower than the national rates. However, these comparisons ought to be considered cautiously.
because one may commit an ecological inferential fallacy about individual observations of only two health centres whose epidemiological pattern was drawn from data about aggregated findings of the nation. The study has also shown that there were no differences across sex in the prevalence of malnutrition. All the three degrees of malnutrition were prevalent in children of all age intervals and that different determinants may be at play. The following variables were associated with malnutrition: Type of feeding, maternal infection, education, income, employment and being a twin.

Overall, the findings have important implications for research policy and programme efforts towards improved growth monitoring and designing of interventions to mitigate malnutrition and its determinants.
Bibliography


APPENDICES
Appendix 1- Information sheet (parents/guardians)

Dear participant,

I am Audrey Cornhill Goma a masters and public health student at the University of Zambia, school of medicine in the department of community health.

I am doing a study on the growth of children below two years in two health centres including this one.

I will, together with the health workers determine growth of your children under two years, by measuring the size of the arm, head, weight and height of your child and review your under-five clinic cards.

**Confidentiality**

There will be no names or identifying marks written on the small paper. Only serial numbers will be used in order to hide the identity of the participants. The information obtained shall be kept strictly confidential for only six months, the time when I will be working on the papers to write my findings. After this period, they will be destroyed.

**Risks**

There are no risks involved in the participation of this study except that you will be inconvenienced for about twenty to thirty minutes at the clinic to answer the few questions and to take extra measurements of the child.

**Benefits**

There are some benefits to you or the child by participating in this study. In case your child is seen to have slow growth or has malnutrition, the child will be given extra care in form of drug supplementation or food supplementation or be referred to the University Teaching Hospital for further attention. In addition, there are additional benefits arising from this study because the results will be used by public health workers, policy makers and other stakeholders to improve service delivery in the clinics with appropriate interventions for mitigating under nutrition.

**Participation**

Participation in this study is entirely free. You are free to decline to be in the study. In case you agree and feel to withdrawal at any time, you may do so. Your refusal or withdrawal will have no effect on you or your child because the researcher is not part of the health care team and will not influence the care at all.

In case you have complaint against this research or the researcher, you may contact the Chairperson of the University Of Zambia Biomedical Research Ethics Committee in the School of Medicine at P.O. Box 50110 Lusaka or phone on 0211256067.

In case also you have some questions to ask the researcher, you may contact her as follows:
Audrey Cornhill Goma
University Of Zambia
School of Medicine
P.O. Box 50110
Lusaka
Cell: 0976254142/0955600026
Appendix 11- Consent form (parents/guardians)

I have read the information provided concerning this study and I fully understand. I agree to participate in this study voluntary.

Participant’s signature………………….. Thumb print…………………..
Date…………………………………………..

Witness’s name…………………………… Signature…………………………
Date…………………………………………..

Researcher’s name……………………….. Signature…………………………
Date…………………………………………..
### Appendix III- Survey Checklist For Under Twos (SCFUT)

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<td>1.</td>
<td>Health Centre number</td>
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<td>2.</td>
<td>Marital status</td>
<td>Married</td>
<td>Divorced</td>
<td>Separated</td>
<td>Single</td>
<td>Widowed</td>
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<td>3.</td>
<td>Sex of child</td>
<td>M</td>
<td>F</td>
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<td>4.</td>
<td>D.O.B</td>
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<td>5.</td>
<td>Age (months)</td>
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<td>6.</td>
<td>Birth weight (months)</td>
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<td>7.</td>
<td>MUAC</td>
<td>cm</td>
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<td>8.</td>
<td>Weight</td>
<td>gm</td>
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<td>9.</td>
<td>Length</td>
<td>cm</td>
<td></td>
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<td>10.</td>
<td>Head circumference (under ones)</td>
<td>cm</td>
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<td>11.</td>
<td>Presence of oedema</td>
<td>Yes</td>
<td>No</td>
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<td>12.</td>
<td>Family size (number of people you are living with in your home)</td>
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<td>13.</td>
<td>No of children under-five in the family</td>
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<td>14.</td>
<td>Birth interval in years between this child and the previous one</td>
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<td>15.</td>
<td>Immunisation status</td>
<td></td>
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<td></td>
<td>(a) Received OPV 0 at birth to 13 days</td>
<td>Yes</td>
<td>No</td>
<td>Not applicable</td>
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<td></td>
<td>(b) Received OPV 1 at 6 weeks</td>
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<td></td>
<td>(c) Received OPV 2 at least 4 weeks after OPV 1</td>
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<td></td>
<td>(d) Received OPV 3 at least 4 weeks after OPV 2</td>
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<td></td>
<td>(e) OPV 4 at 9 months if OPV 0 was not given</td>
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<td></td>
<td>(f) Received DPT – Hep B- Hib1 at 6 weeks</td>
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<td></td>
<td>(g) Received DPT – Hep B- Hib2 at least 4 weeks after Hib 1</td>
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<td></td>
<td>(h) Received DPT – Hep B- Hib3 at least 4 weeks after Hib 2</td>
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<td>(i) Measles at 9 months</td>
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<td></td>
<td>(j) Rotavirus</td>
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<td>16.</td>
<td>Type of feeding</td>
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<td></td>
<td>(a) Exclusive breast-feeding up to 6 months</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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<td></td>
<td>(b) The baby is on exclusive alternative infant formula</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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<td></td>
<td>(c) The baby is on animal milk</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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<td></td>
<td>(d) The baby is on mixed feeding (breast milk and other foods)</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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<td>17.</td>
<td>At what age was the baby weaned</td>
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*The income we have is high and we are able to meet our needs*

*The income we have is just moderate and we are able to meet our needs*

*The income we have is low and we are not able to meet our needs*
19. Mother’s education
   (a) Primary education,
   (b) secondary education,
   (c) Higher education (college or university education).

20. Is the mother alive?  Yes  No
21. Is the mother working?  Yes  No
22. Are any of the following maternal factors present?
   (a) Infection  Yes  No
   (b) Breast problem  Yes  No
   (c) Maternal mental illness  Yes  No

23. Are there any of the following child factors?
   (a) Twin child  Yes  No
   (b) Child infection  Yes  No
   (c) Child fed predominantly on a cereal-based porridge every day with very little dietary diversity.  Yes  No
   (d) Inadequate introduction of complementary foods (too early, too late, insufficient quantity and quality)  Yes  No

24. Source of water
   (a) Tap at home
   (b) Communal tap
   (c) Shallow well
   (d) Other
   (e) Home chlorination

25. Type of toilet
   (a) Water cistern in house
   (b) Communal water cistern
   (c) Pit latrine
   (d) Other
Appendix IV - Letter of Authorisation to Conduct the Study from Graduate Studies

THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

Telephone: 252641
Telegram: UNZA, Lusaka
Tel.: UNZALU ZA 64370
Email: sronzala@yahoo.com

01\textsuperscript{st} March, 2012

Mrs Audrey Cornhill Goma
School of Medicine
UNZA
Lusaka

Dear Mrs Cornhill Goma,

RE: GRADUATES PROPOSAL PRESENTATION FORUM (GPPF)

Having assessed your dissertation entitled "Assessing Growth Monitoring for under Twos in Four Urban Zonal Health Centres in Lusaka". We are satisfied that all the corrections to your research proposal have been done. The proposal meets the standard as laid down by the Board of Graduate Studies.

You can proceed and present to the Research Ethics.

Yours faithfully,

[Signature]

Dr. S. H. Nyalag
ASSISTANT DEAN, POSTGRADUATE

CC: HOD – Community Medicine
Appendix V- Letter of Authorisation to conduct the Study

1 March 2012

Ms. Audrey Cornhill Goma
65 Mwambula Road
Jesmondine
P.O. Box 320153
Woodlands
LUSAKA

Dear Ms. Goma,

RE: PERMISSION TO COLLECT DATA

We are in receipt of the letter dated 29th February, 2012 on the above subject.

Lusaka District Health Management Office has no objection for you to collect data for your Research on "Malnutrition and Child Monitoring". However, provided you acquire the necessary ethics approval from the Research Ethics Committee for your research before commencing your research in our health centres.

Yours sincerely

[Signature]

DR MASUMBA MASANINGA
AG/DISTRICT MEDICAL OFFICER