KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI, GHANA

ASSESSING THE EFFICACY OF ACUTE MALNUTRITION MANAGEMENT OF GHANAIAN CHILDREN FROM 0 TO 59 MONTHS AT THREE NUTRITION REHABILITATION SITES IN THE ASHANTI REGION

by

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(Human Nutrition and Dietetics)

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DECLARATION

I hereby declare that this thesis is my own work towards the MPhil and that, to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

To any determined and hardworking woman in pursuit of academic excellence

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ABSTRACT

Great potentials needed to build up societies are lost when children are affected with malnutrition at early stages of life. Prevention and management of this condition are therefore highly important. An important reason behind failure of malnutrition management is limited knowledge and competency of health professionals. In Ghana, there is paucity of data on performance (mortality, default and recovery rates) of malnutrition management programmes for acute malnutrition at different centers across the country and how that is associated with compliance to management protocols. The study was therefore undertaken to determine whether the management plans in existence are yielding results based on the Global Sphere Standards. A retrospective study was conducted at three nutrition rehabilitation sites in the Ashanti Region namely the Komfo Anokye Teaching Hospital (KATH), Agogo Presbyterian Hospital (APH) and Agogo CMAM center (OPC C). Records of 100 children from 0 to 59 months, who were managed for acute malnutrition at the sites from 1st January to 31st December 2013 were retrieved. Data on socio-demographic characteristics, anthropometric measurements, feeds offered, complications, recovery, length of stay, mortality and defaulters were collected. Questionnaires were also served to staff such as nutritionists, doctors and nurses who collaborate in treating malnutrition to assess their level of knowledge and competencies in the management of acute malnutrition. Key informant interviews were further organised with a key staff at each treatment site to find out what goes into the management of malnourished children at the various centers. Based on the anthropometric assessment and complications a child presents with, the fellow received either In-Patient Care (IPC) or Out Patient Care (OPC). 100 children and seven health care personnel were involved in the study. Majority of the children (92.9%) were from 6 to 59 months while minority (7.1%) were 0 to 5 months old. Majority of the children (92%) had Severe Acute Malnutrition (SAM) while 8% had Moderate Acute Malnutrition (MAM). On discharge at IPC, there was a significant difference ($p<0.01$) between the weights gained at discharge and weights noted on admission. At OPC, there was also a significant difference ($p<0.05$) between weights gained at discharge and the weights recorded on admission. Furthermore at IPC, recovery rate stood at 82.6%, mortality rate was 11.6% while defaulter rate was 5.8%. At OPC, recovery rate was 21.4%, defaulter rate was 71.4%, non-response rate was 7.2% and no death was recorded. The highest mean score on the competency assessment was 69.5% by the KATH staff followed by APH staff with 63.0%. In conclusion, in comparison with the Global Sphere Standards, it was identified that management of acute malnutrition met recommended standards in terms of recovery and defaulter rates at IPC. On the other hand, the high defaulter rate and low recovery rate observed at OPC calls for serious attention. The results of the competency and knowledge level assessment indicated that most of the staff of the treatment centers (both IPC and OPC) who were assessed had very good knowledge levels about management of acute malnutrition. This knowledge level had a good effect on the services given at IPC's. However this same appreciable level of knowledge particularly of OPC staff should be properly translated into practice to achieve greater positive results at the OPC's.

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LIST OF ABBREVIATIONS/ACRONYMS

AIDS –	Acquired Immune Deficiency Syndrome
APH-	Agogo Presbyterian Hospital
CBT –	Community based therapeutic care programme
CHRPE –	Committee on Human Research and Publication Ethics
CMAM –	Community-based Management of acute Malnutrition
CMV –	Combined Mineral and Vitamin mix
CWC –	Child Welfare Clinic
F-100 -	Formular 100
F-75-	Formular 75
F-K –	Fortified “Kooko”
GDHS –	Ghana Demographic and Health Survey
GHS –	Ghana Health Service
GSS –	Ghana Statistical Service
GSS(I) –	Global Sphere Standards
H/A –	Height for Age
HIV –	Human Immunodeficiency Virus
IM-SAM –	Integrated Management of Severe Acute Malnutrition
IPC –	In-Patient Care
IPC A –	Komfo Anokye Teaching Hospital In- Patient Care Site
IPC B-	Agogo Presbyterian Hospital In-Patient Care Site
ITT –	Intention To Treat analysis
K diet –	Kwashiorkor diet
KATH –	Komfo Anokye Teaching Hospital
KCl –	Potassium Chloride

KNUST – Kwame Nkrumah University of Science and Technology

MAM – Moderate Acute Malnutrition

MDG's – Millennium Development Goals

MICS – Multiple Indicator Cluster Survey

MOH – Ministry of Health

MUAC – Mid Upper Arm Circumference

NRC – Nutrition Rehabilitation Center

NRU- Nutrition Rehabilitation Unit

OPC – Out Patient Care

OPC A- Komfo Anokye Teaching Hospital Out- Patient Care Site

OPC B - Agogo Presbyterian Hospital Out-Patient Care Site

OPC C- Agogo community based management of acute malnutrition Out Patient Care Site

ORS – Oral Rehydration Solution

OTP - Out Patient Therapeutic Feeding Programme

(P) RUTF – Peanut based Ready to use therapeutic food

Resomal- Rehydration Solution for Malnutrition

RUTF- Ready to use Therapeutic Food

SAM – Severe Acute Malnutrition

SMS – Soy-maize-sorghum

SPSS – Statistical Package for the Social Sciences

UNICEF – United Nations International Children's Emergency Fund

W/A – Weight for Age

W/H – Weight for Height

WHO – World Health Organization

CHAPTER ONE

INTRODUCTION TO STUDY

This chapter presents an introduction to the study undertaken. It gives a background to the research, states the problem for research, gives the research hypothesis and presents the main aim of the study. The chapter ends by presenting the specific objectives and the justification for this study.

1.1 Background to study

Prevention and management of malnutrition in order to promote child survival are great keys to global, regional and national development (Stoltenberg, 2006 and World Bank, 2006). This is because great potentials needed to build up societies are lost when children are plagued with malnutrition at early stages of life (Allen *et al*, 2003). Studies have clearly pointed out that, malnutrition results in short stature, impaired neurological and cognitive development which increases the risk of morbidity and mortality resulting in impaired performance at school and ultimately the inability to contribute to societal development in adult life (Allen *et al*, 2003).

Technically malnutrition represents both deficiency in nutrients and the excess intake of nutrients which predisposes the human being to an increased risk of diseases and infections, even though it is mostly used to represent undernutrition (Chiwaula, 2011). For this particular research as was similarly done by Chiwaula (2011) and Anon (2006) emphasis was placed on acute malnutrition due to its high effect on childhood mortality rates.

In fact, studies have shown that acute malnutrition in all its facets be it severe or moderate need to be effectively tackled because three-quarters of mortality cases

associated with malnutrition actually result from moderate malnutrition with patients showing no outward sign of vulnerability (Pelletier *et al*, 1995; Gross *et al*, 2006 and Muller *et al*, 2006). Moreover, the risk of death rises sharply with severity in malnutrition or deteriorated nutritional status (Pelletier *et al*, 2005). WHO estimates that as of 2013 about twenty million children suffered worldwide with severe acute malnutrition (WHO, 2013). In developing countries especially in sub-Saharan Africa, malnutrition is in the lead as one of the main determinants of child mortality (Berkley *et al*, 2005 and Allen *et al*, 2004).

Statistics available points to the fact that 6 percent of Ghanaian children are suffering from acute malnutrition where as 1 percent are experiencing the acute malnutrition in its severe form (Ghana Statistical Service, 2011).

It is an undeniable fact that, the quality and type of management offered in the event of malnutrition affects nutritional rehabilitation outcomes especially mortality and recovery (Sandige *et al*, 2004; Pouane *et al*, 2004 and Allen *et al*, 2007). Whereas supplementary feeding programmes, be it targeted or blanket, are employed in the management of Moderate Acute Malnutrition (MAM), treatment of Severe Acute Malnutrition (SAM) usually involves therapeutic feeding (The Sphere Project, 2011). In present times, WHO advocates for the use of Community-based Management of Acute Malnutrition (CMAM), an integrated approach of the In-Patient Care (IPC) and Out-Patient Care (OPC) systems in the treatment of severe acute malnutrition (WHO, 2013).

To add to what has been stated earlier, though various treatment plans for malnutrition exist, the process of it being properly interpreted and put into practice by staff, case load at a facility, training of the practitioners as well as the quality and availability of

required supplies are critical pointers to the outcome of a nutritional rehabilitation (Pouane *et al*, 2004). Other studies have ascribed failure to improved outcomes of malnourished children to HIV infection, lack of maternal participation in the feeding programme, inadequate care and prescription errors and over prescription of intravenous therapies and blood transfusion (Maitland *et al*, 2006). Scrimshaw *et al*, (1997) in a study, similarly point to the fact that infections and diseases that co-exist with malnutrition need to be effectively handled because they are likely to interfere with recovery rates of children.

Navarro-Colorado (2007) in an audit of a number of Supplementary Feeding Programs (SFP) based in Africa and Asia found very high defaulter rates thereby affecting the outcome of management offered to the malnourished children. Some researchers are also of the opinion that successful management of malnourished children requires that each child is treated with special care and affection (Chiwaula, 2011).

However success cannot be measured without the use of key indicators based on the Global Sphere Standards namely; mortality rate, default rate and recovery rate (The Sphere Project, 2011). A supplementary feeding programme designed to target moderately acute malnourished children achieves its target when death rate is below three percent (3%), recovery rate is above seventy-five percent (75%) and default rate is below fifteen percent (15%) (The Sphere Project, 2011).

On the other hand, the Global Sphere Standards indicate that therapeutic treatment approaches for SAM are considered effective when the proportion of discharges from therapeutic care who died (mortality rate) is lower than ten percent (10%), recovery

rate is above seventy-five percent (75%) and defaulter rate is less than 15percent (The Sphere Project, 2011).

It is worth noting that MAM and SAM are being managed in Ghana using different approaches for several decades now, although little is known about the performance of these management approaches (GHS/UNICEF, 2011). MAM management in Ghana is usually through supplementary feeding programmes and may be targeted or blanket depending on the design chosen (GHS/UNICEF, 2011).

In the recent past, in-patient care mode of managing patients with SAM was one of the major approaches to the treatment of severe malnutrition in Ghana especially in situations of added medical complications or co-morbidities (GHS, 2010). Nutritional Rehabilitation Centres and Day Care Centres were also established in certain areas where daily out-patient services were offered to patients who were moderately malnourished (GHS/UNICEF, 2011).

In June 2007, CMAM which is a form of the integrated management of SAM was introduced in Ghana and piloted in 2008 at two sites: Ashiedu Keteke Sub-Municipal in Greater Accra Region and Agona West Municipal in the Central region (GHS/UNICEF, 2011).

Based on the successful implementation at these two pilot areas the CMAM model was further introduced into the following regions:- Upper East, Upper West, Northern, Central and Greater Accra Regions (GHS/UNICEF, 2011). Presently Ghana is turning most of its nutritional rehabilitation centers into OPC sites to help in the effective implementation of the CMAM.

Staff in many hospitals where malnutrition was managed have started receiving training and supplies in order to use such facilities as both in-patient and out-patient care sites.

Though the various forms of malnutrition management have been in existence for some time, there is paucity of data on the efficacy of the varied treatment plans that are used at different areas based on the setting and resources available all over the world with Ghana being inclusive (WHO, 2013).

1.2 Problem Statement

The contribution of acute malnutrition to childhood deaths cannot be underestimated (Pelletier *et al*, 1995; Allen *et al*, 2007 and WHO, 2013). Regrettably children die even when they are being put through various forms of management to aid in their recovery (Schofield *et al*, 1996 and Damme *et al*, 2002). Though Ghana has prevalence rates of 6% and 1% for wasting and severe wasting respectively, with reports of acute malnutrition in all ten regions and Ashanti Region experiencing a total prevalence rate of 6% for wasting and severe wasting, CMAM coverage and implementation which is considered as one of the effective models of malnutrition treatment has still not occurred nationwide (GSS, 2011; GHS/UNICEF, 2011 and WHO, 2013). Though there has been some level of scaling up of CMAM to cover many districts of Ghana, its overall effectiveness on the acutely malnourished children has not been ascertained (GHS/UNICEF, 2011).

The situation is further worsened when timely detection of cases and accessibility to nutritional rehabilitation centers in some rural areas of the country still remain a challenge (English *et al*, 2004 and Nolan *et al*, 2001). Even more challenging is when

standardized malnutrition treatment guidelines are not followed even when just IPC or OPC is solely being implemented as supported by the work of Schofield *et al*, (1996).

Studies by Schofield *et al*, (1996) and Damme *et al*, (2002) further showed that although severely malnourished patients were being managed through in-patient care, mortality rates of children receiving care still remained high and few children were able to actually access care.

Briend (2010) in a study found out that even with the interventions of Ready-to-Use-Therapeutic Feed (RUTF), which helped to reduce mortality rates globally, coverage rates still remained low and the programmes were costly to implement. Though the IPC and OPC as well as the CMAM are being implemented in Ghana, there are no published data clearly depicting mortality rates, recovery rates, defaulter rates and length of stay of patients undergoing the various forms of management. The fact that, there is currently no published data on these management outcomes does not help in appraising the quality of service being rendered (Chiwaula, 2011). It was therefore against this backdrop that this study was undertaken to ascertain the efficacy of the acute malnutrition management among children from the ages of 0 to 59 months in Ghana.

1.3 Hypothesis:

Null Hypothesis (H_O): Rates of mortality, recovery, default and length of stay for children undergoing treatment for acute malnutrition using different approaches such as IPC, OPC and CMAM would not be different from the acceptable ranges of the Global Sphere Standards.

Alternative Hypothesis (H_1): Rates of morality, recovery, default and length of stay for children undergoing treatment for acute malnutrition using different approaches such as IPC, OPC and CMAM would differ based on the Global Sphere Standards.

1.4 Aim of research

To determine the efficacy of acute malnutrition management among children (0-59 months) in Ghana.

1.5 Specific Objectives

- To determine the change in weight, height and MUAC after malnutrition management.
- To determine weight-for-height/length, weight-for-age and height/length-for-age z-scores before and after malnutrition management.
- To determine the rates of mortality, recovery, default and length of stay of children undergoing malnutrition management.
- To ascertain the knowledge and competence levels of staff and further compare the effectiveness of the various approaches for treating acute malnutrition.

1.6 Justification

As studies by Schofield *et al*, (1996), Damme *et al*, *(*2002) and Briend (2010) indicate, the kind of services offered during the management of the malnourished is of high essence as it could lead to high recovery outcomes or high case fatality rates. This study therefore helped ascertain whether the various malnutrition treatment approaches were being well undertaken in the country and achieving desired results based on the Global Sphere Standards.

Biggs (2013) also indicated in a South African study that the knowledge level of health care providers was one of the key determinants of the outcomes of malnutrition management. Premised on this assertion, this particular study found out the knowledge levels of staff involved in the management of malnutrition and how that impacts on the services provided at the various treatment sites. The results from the study is highly important because it would help provide data on the various malnutrition outcome indicators such as: recovery, mortality and default rates.

These findings would then inform appropriate planning and implementation of nutrition interventions and malnutrition treatment approaches specific to our clinical conditions to curb or reduce SAM thereby enhancing the nutritional status of children in the Ashanti Region and most likely children in Ghana.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents information on literature extensively reviewed on the topic under various sub-headings. It also presents data on a systematic review organised on this research area.

2.1 Malnutrition

Malnutrition presents huge consequences which are extremely costly due to its negative impact in terms of poor development biologically or socially on affected individuals and society at large (Allen *et al*, 2007). An illustration of this fact is the loss of future leaders when sick malnourished children die at a faster rate in comparison to well-nourished ones (Black *et al*, 2008). As such it is not shocking that countries that have high prevalence of acute malnutrition usually have very high early childhood and infant mortality rates (Berkley *et al*, 2005 and Allen *et al*, 2004). Unfortunately these trends show that the living conditions in these countries are of low quality because issues of early childhood and infant mortality are critical pointers of a country's socio-economic situation and a predictor of the quality of life of the population (Hamilton *et al*, 2013 and Miller *et al*, 2011).

2.2 Definition of malnutrition

Malnutrition is described as either chronic or acute (International Malnutrition Taskforce, 2012). Chronic malnutrition is developed as a result of prolonged episodes of inadequate nutrition. These prolonged episodes may lead to stunting, a situation where an individual is too short for the age (Thakwalakwa, 2009).

Acute malnutrition on the other hand is the result of a relatively short period of inadequate nutrition (Thakwalakwa, 2009). This rather short period of nutritional inadequacy may result in wasting or fluid retention in the body known as oedema (WHO, 2013). Of serious importance in the management of acute malnutrition are the severe or moderate categories (The Sphere Project, 2011).

2.2.1 Moderate acute malnutrition (MAM):

MAM is defined by WHO with MUAC ranges of 11.5 to 12.5cm or a weight-for-height standard deviation of less than -2 to -3 standard deviations (The Sphere Project, 2011).

2.2.2 Severe acute malnutrition (SAM):

Due to the physiological make up of infants at various stages while they are under five years, the indicators of severe acute malnutrition have been categorized into two groups. These are: 1) infants from 0-5 months 2) children from 6 to 59 months (WHO, 2013).

For infants 0-5 months, SAM is defined as weight-for-length less than –3 z-score, or presence of bilateral pitting oedema whereas for children 6 to 59 severe acute malnutrition is defined as weight-for-height ≤–3 z-score, or mid-upper-arm circumference <115 mm, or presence of bilateral pitting oedema (WHO, 1999; WHO, 2007; WHO, 2011; WHO, 2013).

SAM can be further divided into complicated or uncomplicated states depending on the clinical manifestations and other disease conditions associated with it (WHO, 2009 and WHO, 2013). In actual sense, SAM with complications refers to a condition where a severely acutely malnourished child presents with additional morbidities or

conditions that need further management such as hypoglycaemia, hypothermia, loss of appetite, dehydration, malaria and HIV/AIDS. On the other hand, when co-morbidities or unfavorable conditions that need extra management are absent when a child is severely acutely malnourished, that state is referred to as SAM without complications (International Malnutrition Taskforce, 2012).

2.3 Management options for acute malnutrition

It has been realized from various studies that the form of treatment that is offered to a malnourished child has a huge impact on the possibility of the child recovering or deteriorating.

This assertion has led to various kinds of treatment approaches being administered to malnourished children (Briend, 2010). It is however important to note that all countries are encouraged to find out the best treatment option for treating malnutrition cases as the one size fits all technique does not usually work (UNICEF, 2007).

2.3.1 Management of moderate acute malnutrition (MAM)

MAM is a form of malnutrition that need to be tackled seriously because more than 80% of the malnutrition associated deaths occur in children with mild to moderate malnutrition (Pelletier *et al*, 1995). It is worth noting that cases of moderate acute malnutrition actually outnumber the cases of severe acute malnutrition (Allen *et al*, 2007). Thus, it is critical to intervene in children with moderate acute malnutrition at the community level to increase chances of child survival (Pelletier *et al*, 2003).

The Supplementary Feeding Programme (SFP) design is usually employed in the management of MAM (The Sphere Project, 2011). It may either be targeted or blanket depending on the design (The Sphere Project, 2011). As the name supplementary

feeding implies, children are usually provided with daily rations of food based on WHO specifications to prevent deterioration of their conditions (IMTF, 2012). Usually caregivers of moderately malnourished children are offered nutritional counseling to properly care for their children because faulty child care practices and ignorance of basic nutrition are also known to result in a child's malnourished state (Allen *et al*, 2007).

In the past, Ghana had a number of operational nutritional rehabilitation and day care centers which were established to provide daily out-patient services to patients who were moderately malnourished (GHS/UNICEF, 2011).

In recent times however due to the introduction of CMAM, moderately malnourished children are directly identified at the community level and then appropriate feeding regimens especially RUTF are offered to them at Out-Patient Care Site (GHS/UNICEF, 2011 and WHO, 2013).

2.3.2 Management of severe acute malnutrition (SAM)

Management of SAM is very complex as it requires critical knowledge and appreciation of the condition as well as collaborative efforts between health care personnel and caregivers (Allen *et al*, 2007 and Ashworth, 2004). Due to the complexity of the management of SAM, WHO (2013) recently reviewed existing standards of treatment and have published new guidelines on the management of the condition. In the effective management of SAM, WHO strongly advocates for the use of the CMAM model where both moderate and severe acute malnutrition be it complicated or not are identified early and children treated accordingly (WHO, 2013).

CMAM combines both in-patient and out-patient care to treat SAM cases (WHO, 2013). The CMAM has advantages of easier access for rural populations thereby

allowing intervention to occur earlier in the course of the disease (Tectonidis, 2006 and Collins *et al*, 2006). Furthermore, in the CMAM, children managed at the outpatient care site are protected from nosocomial infections and hospital staff are able to focus on children with complications who require inpatient care (Allen *et al*, 2007).

2.3.3 Assessment and management of severe acute malnutrition in children less than 6 months

Due to important physiological differences such as relatively immature thermoregulation, renal and gastrointestinal functions, that occur in children less than 6 months as compared to children from 6 to 59 months, the definition and management of SAM in the lesser age cohort is different (WHO, 2013). In less than 6 month old children, SAM is defined as weight-for-length less than –3 z-score, or presence of bilateral pitting oedema (WHO, 2013). In this class of infants, SAM may also be presented as complicated or uncomplicated and infants falling into any of these categories should be managed either at the inpatient care or outpatient care sites respectively (WHO, 2013).

Due to the role of antibiotic in helping to reduce mortality in SAM children, WHO recommends that this class of infants should be given parenteral antibiotics to treat possible sepsis and offered appropriate treatment for other medical complications such as tuberculosis (TB), HIV, surgical conditions or disability. Those in OPC also receive a course of broad-spectrum oral antibiotic, such as amoxicillin, in an appropriately weight-adjusted dose (WHO, 2013). In order for children to be fed well, establishing or re-establishing effective exclusive breastfeeding by the mother or other caregiver is critically prioritized for this category of infants (WHO, 2013). To prevent

exacerbation of fluid and electrolyte imbalance in non-oedematous SAM children who are less than six months, expressed breast milk is offered (WHO, 2013).

In situations where expressed breast milk is not available, commercial infant formula or F-75 or diluted F-100 may be given, either alone or as the supplementary feed together with breast milk (WHO, 2013).

Diluted F-100 is made by diluting the standard F-100 with thirty percent of water (WHO, 2005 and WHO, 2013). This diluted F-100 is given to these SAM infants due to the high renal solute load and risk of hypernatraemic dehydration when fed on normal F-100 (WHO, 2013 and WHO, 2005). For infants with SAM and oedema, infant formula or F-75 is given as a supplement to breast milk (WHO, 2013). In situations where there is very low prospect of breastfeeding for this class of infants, appropriate and adequate replacement feeds such as commercial (generic) infant formula, are offered with relevant support from health care providers to caregivers to enable safe preparation and use, even at home upon discharge (WHO, 2O13).

Infants who are less than 6 months of age and have been admitted to IPC are transferred to OPC when all clinical conditions or medical complications, including oedema, are resolved, the infant has good appetite, is clinically well and alert, and weight gain is either above the median of the WHO growth velocity standards or more than 5 g/kg/day for at least 3 successive days, together with other successful immunizations and routine intervention checks (WHO, 2013). They are then placed in community based follow-up to ensure continued care and prevention of relapse (WHO, 2013). In the event of effective breastfeeding or replacement feed intake, adequate weight gain, and weight-for-length of ≥–2 z-score, infants less than 6

months are recognized to have fully recovered from care and are totally discharged (WHO, 2013).

2.3.4. Severe acute malnutrition management for children from six to 59 months

From IPC through to OPC, a ten step summary of detailed WHO guidelines for managing severe malnutrition are followed (WHO, 1999).

These guidelines are employed because they are based on sound nutritional and pathophysiological principles and further informed by extensive clinical experience and findings from research (Allen *et al*, 2007). These effective management approaches are important to implement in order to ensure child survival (Stoltenberg, 2006).

WHO currently recommends that MUAC indicators should be used to assess SAM because it is better able to identify malnourished children who are at high risk of death (WHO, 2013 and Briend *et al*, 2012). Formerly, visible severe wasting, one of the Integrated Management of Childhood Illness used to be recognized as a sole indicator of severe acute malnutrition (WHO, 2011; WHO, 2008; WHO, 2007 and WHO, 2005). Presently WHO recommends that it should not be used as a standalone indicator of SAM but in combination with other malnutrition indicators (WHO, 2013). This however does not stop a trained clinician from undressing a SAM child to identify other medical complications (WHO, 2013).

WHO recommends that on assessment, if a child presents with any of these indicators be it a weight-for-height ≤–3 z-score, or mid-upper-arm circumference <115 mm, or presence of bilateral oedema with medical complication such as dehydration, hypothermia, hypoglycaemia, poor appetite, or oedema, a referral to IPC should take place (Briend, 1993 and WHO 2000). This is because the medical complications

should be brought under control and the child stabilized before being referred to OPC (WHO, 2009 and WHO, 2013).

Golden *et al,* (2010) and Myatt *et al*, (2006) in various studies pointed out the disparities in the use of percentage weight gain as a discharge criterion. WHO (2013) in a review therefore recommended that percentage weight gain should not be used as a discharge or transfer criterion but rather SAM children admitted to IPC could be transferred to OPC when medical complications, including oedema, were resolving, when there is the presence of good appetite, and the children were clinically well and alert. Thus, transfer of children from IPC to OPC is based on a child's clinical condition and not on specific anthropometric outcomes such as a specific MUAC or weight-for-height/length (WHO, 2013).

It is important to note that currently children admitted with only bilateral pitting oedema are discharged from treatment based on whichever anthropometric indicator, be it MUAC or weight-for-height that is routinely used in programmes (WHO, 2013). Due to the alarming rates of death that occur after discharge, WHO recommends that SAM children discharged from treatment programmes should be periodically monitored to reduce the incidence of relapses (WHO, 2013; Winful, 1999 and Reneman *et al,*1997).

Currently in Ghana, the admission criteria for CMAM for children 6-60 months are W/H of <- 3 z-score or MUAC < 115 mm and occurrence or absence of bilateral pitting oedema, poor or good appetite or any other medical complication (GHS, 2010). Transition from IPC to OPC is based on reduced oedema, resolving medical complication and good appetite. The discharge criteria of fifteen percent (15%)

weight gain over oedema-free weight on enrolment, for children admitted based on weight-for-height is still in force though (GHS/UNICEF, 2011 and GHS, 2010).

It is worth noting that, the present in –patient care guideline being used in Ghana was based on the former WHO (2009) recommendations and with Ghana forming part of the WHO member countries, there is a high possibility for the adoption of the 2013 WHO updates very soon.

2.3.5 Phases in malnutrition management

Due to the presentation of SAM among children, its management is broken up into two main phases namely stabilization and rehabilitation based on the WHO ten steps of treating SAM (WHO, 1999 and Bhan *et al*, 2003). However there is a short transition phase that is used in certain countries at the end of stabilization and the start of rehabilitation (WHO, 2013). The aim of the transition phase is to prevent a possible fluid and nutrient overload after child ends F-75 and is being started on F-100 (WHO, 2009). After rehabilitation, follow-up is undertaken in order to prevent a possible incidence of relapse which is very common in areas with poverty and faulty child care practices (Allen *et al*, 2007 and WHO, 2013).

2.3.5.1 Stabilization phase:

During the days of stabilization, medical complications such as hypoglycaemia, hypothermia and dehydration are treated and prevented (WHO, 1999). Furthermore, electrolyte imbalances and micronutrient are corrected, infections are treated, cautious feeding is started while emotional or sensory stimulation is being undertaken (WHO, 1999 and Bhan, 2003).

2.3.5.2 Rehabilitation phase:

During rehabilitation which may span over a total of two to six weeks, feeding is continued in order to catch-up on the growth the child may have lost. Electrolyte imbalance and micronutrient deficiencies are continually corrected. At this phase, iron which was prohibited at stabilization is permitted to be given. One essential step undertaken during this stage is that the child is prepared for discharge (WHO, 2009).

The goal of treatment at this phase is to achieve a weight gain greater than 10 g/kg/day until the patient has fully recovered. Frequent feed intake help to achieve daily energy and protein intakes of 630-920 kJ/kg/day and 4-5g/kg/day, respectively. Importantly, increases in energy and protein intake are done gradually to avoid cardiac failure (Bhan *et al*, 2003).

2.3.6 Hypoglycaemia and hypothermia

Hypoglycaemia and hypothermia are two common SAM complications which usually occur together (Bennish *et al*, 1990). A fasting blood sugar level of less than 3.0 mmol/L is indicative of hypoglycaemia whereas rectal temperature less than 35.5°C or axillary temperature less than 35°C indicates hypothermia (WHO, 2000).

Body temperature has been shown to decrease during hypoglycaemia (Fruchwald-Schultes *et al*, 2000). Usually they are indicative of possible serious infection and are associated with a high case fatality (Bennish *et al*, 1990). Treatment includes prompt initiation of two hourly feeding (day and night); keeping the child well clothed, with the head covered, in a warm environment; and antibiotics for infection, which is likely to be present (Bhan *et al*, 2003 and WHO, 2009).

2.3.7 Infection in SAM children

A SAM child may easily have severe infection but its presentation may be masked (WHO, 2009). This is because the usual signs of fever associated with severe infections may be absent due to a damaged immune system (Bhan *et al*, 2003 and WHO, 2009). In SAM children, serious infection is usually represented by hypoglycaemia, hypothermia, lethargy, inability to breastfeed or a sickly look (WHO, 2009 and Bhan *et al*, 2003). There is a great need to carry out routine microscopic examination and culture of urine because urinary tract infections are commonly noticed in such children (International Working Group on Persistent Diarrhoea, 1996).

Other microscopic and stool examination are also undertaken to depict other forms of infection based on the standards of that country (WHO, 2009). Usually antibiotics are prescribed to treat these infections (WHO, 2009). In Ghana, amoxicillin is offered when there are no complications (GHS, 2010).

In the existence of complications, gentamycin plus ampicillin later followed by amoxicillin are administered. After the initial bout of antibiotics if the child fails to improve within 48 hours, chloramphenicol is added. Furthermore in the presence of HIV, the child is offered cotrimoxazole oral. In addition to these, specific antibiotics are administered for specific infections based on the national standard treatment guidelines (GHS, 2010). All antibiotics stated are prescribed based on the right dosage with reference to the national standard treatment guideline (GHS, 2010).

Studies have shown that the presence of HIV/ AIDS in malnutrition mostly increases length of stay at treatment sites if recovery occurs (Chiwaula, 2011). Mostly cases associated with HIV/AIDS are associated with higher mortality rates or treatment failures (WHO, 2000; Kessler *et al*, 2000 and Brewster *et al*, 1997). A Malawian

study also revealed that severely malnourished children with HIV infection have an increased risk of mortality compared with their uninfected counterparts (Fergusson *et al*, 2009).

2.3.8 Electrolyte imbalance in malnutrition

The normal physiology of children is extremely altered in the event of SAM (WHO, 2013). Usually there are altered balances in electrolytes namely Sodium, Potassium and Magnesium (WHO, 2009). SAM children equally present with altered fluid distribution (WHO, 2013). SAM children, who present with bilateral pitting oedema usually have high intracellular sodium and are inclined to fluid retention whereas intracellular potassium is lost to the extracellular space and total body potassium is often very low (WHO, 2013). These changes occur due to the adaptive responses to infections and damage to cell membranes by free radicals.

Non oedematous children who are severely wasted equally experience adaptive physiological changes such as fluid retention, reduced renal and cardiac output due to depletion of intracellular and total body potassium (WHO, 2013). Thus, fluid management is complex in all children with SAM (Bhan *et al*, 2003). WHO recommends that children with severe acute malnutrition who present with dehydration but who are not in shock are rehydrated slowly, either orally or by nasogastric tube, using oral rehydration solution for malnourished children (5–10 mL/kg/hour up to a maximum of 12 hours) (WHO, 2013). Research has further proven that Full-strength, standard WHO low-osmolarity oral rehydration solution (75 mmol/L sodium) should not be used for rehydration in dehydrated SAM children because of the worsening effect on electrolytes it may create. The half-strength standard WHO low-osmolarity oral rehydration solution is given, with added

potassium and glucose, unless the child has cholera or profuse watery diarrhoea (WHO, 2013).

2.3.9 Micronutrient imbalance and SAM

Severely malnourished children are often deficient in Vitamin A, Zinc, Iron, Folic acid, Copper, and Selenium (Bhan *et al*, 2003). Zinc and Vitamin A deficiencies result in impaired function of the immune system and have direct effects on the structure and function of mucosa (Bhan *et al*, 1998). Copper deficiency on the other hand is usually characterised by neutropenia, bone abnormalities and microcytic anaemia that fails to respond to iron (Bhan *et al*, 2003). Selenium deficiency results in impaired cardiac function (Bhan *et al*, 2003). Zinc supplementation has been positively associated with reduced incidence of diarrhoea and pneumonia and improves growth (Zinc Investigators' Collaborative Group, 1999). Vitamin A supplementation has further been shown to reduce mortality and morbidity due to diarrhoea and measles (Beaton *et al*, 1993).

Iron supplementation on the other hand has been identified to improve cognition and growth but is not recommended in the stabilization phase because it may worsen existing infection (Stoltzfus, 1998). Many malnourished children are also deficient in riboflavin, ascorbic acid, pyridoxine, thiamine and the fat-soluble vitamins D, E and K (WHO, 2009). These micronutrient deficiencies explain why their feeds are fortified by the addition of the Combined Mineral and Vitamin mix (CMV) (WHO, 2013). Of high importance in the administration of Vitamin A is the fact that children with SAM are not supposed to be given a high dose of Vitamin A (50 000 IU, 100 000 IU or 200 000 IU) based on their age at admission if they are being given therapeutic foods that are already fortified based on WHO specifications or have

Vitamin A as part of daily supplements, due to the possible toxicity associated with overdose of the Vitamin (WHO, 2013).

In actual sense, both the oral rehydration fluid used for malnourished children (Resomal) and the therapeutic foods recommended by WHO, namely F-75, F-100 and ready-to-use- therapeutic-food(RUTF) contain vitamin A and zinc, together with other vitamins, trace elements and electrolytes, to correct deficiencies associated with SAM (WHO, 2013).

2.4 The essence of knowledge in the management of acute malnutrition:

From the afore mentioned, a critical understanding and implementation of the various treatment modules based on the resources and conditions of an area by qualified trained health care personnel is of high essence to ensure good nutritional outcomes (Allen *et al*, 2007). It is quite worrisome that the quality of care provided to SAM children throughout Sub-Saharan Africa and other economically poor countries are compromised due to shortages of staff and resources (English *et al*, 2004 and Nolan *et al*, 2001). Unfortunately Ghana is not spared from this low quality of malnutrition management due to inadequate staff strength in almost all hospitals in the country. Currently many health facilities in the country are without Nutritionists or Dieticians who play key roles in the management of malnutrition (Peprah, 2013).

Ignorance on the part of care givers about basic nutritional care practices further places children at the risk of being malnourished (Allen *et al*, 2007). This in effect leads to negative outcomes for instance in terms of death and default especially during follow-ups (Winful, 1999).

2.5 Systematic review on the assessment of the efficacy of malnutrition management

A number of studies have been done to examine the efficacies of the different management plans that exist in relation to malnutrition (WHO, 2013). Though several reviews and commentaries as well as journal publications exist on studies done in Africa, few published works were found for Ghana in assessing the effectiveness of the various treatment modules. Aside this, there is paucity of data associated with the management of malnutrition among children from 0 to 5 months (WHO, 2013). WHO currently recommends several studies into the management of malnutrition and further ethically right studies for malnourished children within the 0 to 5 months cohort to inform relevant recommendations and guidelines (WHO, 2013).

2.5.1 Search strategy

A search was conducted in PubMed, PlosOne, Medline, Cochrane Library and Science Direct databases for studies published on the management of SAM among children from 0 to 59 months from the years 1990 to 2014.

Keywords for the search included malnutrition, nutrition rehabilitation, community based management of acute malnutrition, in-patient care, out-patient therapeutic care, facility based management, home based therapy, integrated management of acute malnutrition, severe acute malnutrition, ready-to-use therapeutic feeds, mortality rate, rate of default, survival rate, nutritional outcomes, recovery rate, length of stay, and hospital based management.

Exposures on which emphasis was placed for the search were in-patient care of SAM cases, out-patient therapeutic care, nutritional rehabilitation, community based

management of acute malnutrition, and integrated management of severe acute malnutrition.

Outcomes of interest were length of stay, mortality rate, cure rate, default rate and recovery rate.

2.5.2 Inclusion and exclusion criteria

The review was conducted on children from the ages of 0 to 59 months who were severely malnourished under non-emergency settings. Studies involving animal subjects and malnutrition management under emergency settings were excluded.

2.5.3 Search Results

Initial search from the databases stated above made available over 2076 references that could be included in the review. The title of each reference was checked in order to eliminate any reference that was a single case study, review, abstract publication, commentary or title that did not include any nutritional indicator at all.

After this check, about 2010 references were eliminated leaving 66 references. Abstracts of the 66 study references were then assessed in terms of aim of the study, study design, exposures and outcome measures, findings and conclusions. The aims or objectives of each study must be to show how the management of severe acute malnutrition impacts on mortality rate, cure rates, length of stay, rate of recovery and rate of default of subjects being treated. All study designs with the exception of reviews and single case studies were accepted.

This implied that the study could either be observational or interventional as long as the exposures and outcomes were measured. After each of the abstracts had been

scrutinized, 15 abstracts were accepted which were categorized into three based on the type of management intervention used. These three categories were;

i) In-patient therapeutic care of severe acute malnutrition

ii) Out-patient management of severe acute malnutrition

iii) Integrated management of severe acute malnutrition

2.5.4 Data extraction

Data extraction was undertaken based on the following criteria:

- Publication details
- Study design
- Number of subjects and their characteristics
- Aim or objectives of studies
- Outcome measures
- Findings and conclusions

2.5.5. Study characteristics

Almost all subjects involved in this study were children who were from the ages of 0 to 59 months and were suffering from SAM. Few of the studies had adult subjects who were facility staff or care givers who were interviewed on the management procedures being offered to patients.

More than half (60%), nine (9) out of the 15 studies had used in-patient management practices, five (5) out of 15 representing 33% involved subjects who received out-patient therapeutic care and one (1) out of 15 representing 7% involved subjects who went through the integrated management of severe acute malnutrition programme. The studies were conducted in two continents, Africa and Asia. These continents are

known to have the highest prevalence of malnutrition all over the world (Collins *et al*, 2006 and Schofield *et al*, 1996). Eleven (11) studies representing 73.3% were conducted in Africa while four (4) studies representing 26.7% were conducted in Asia.

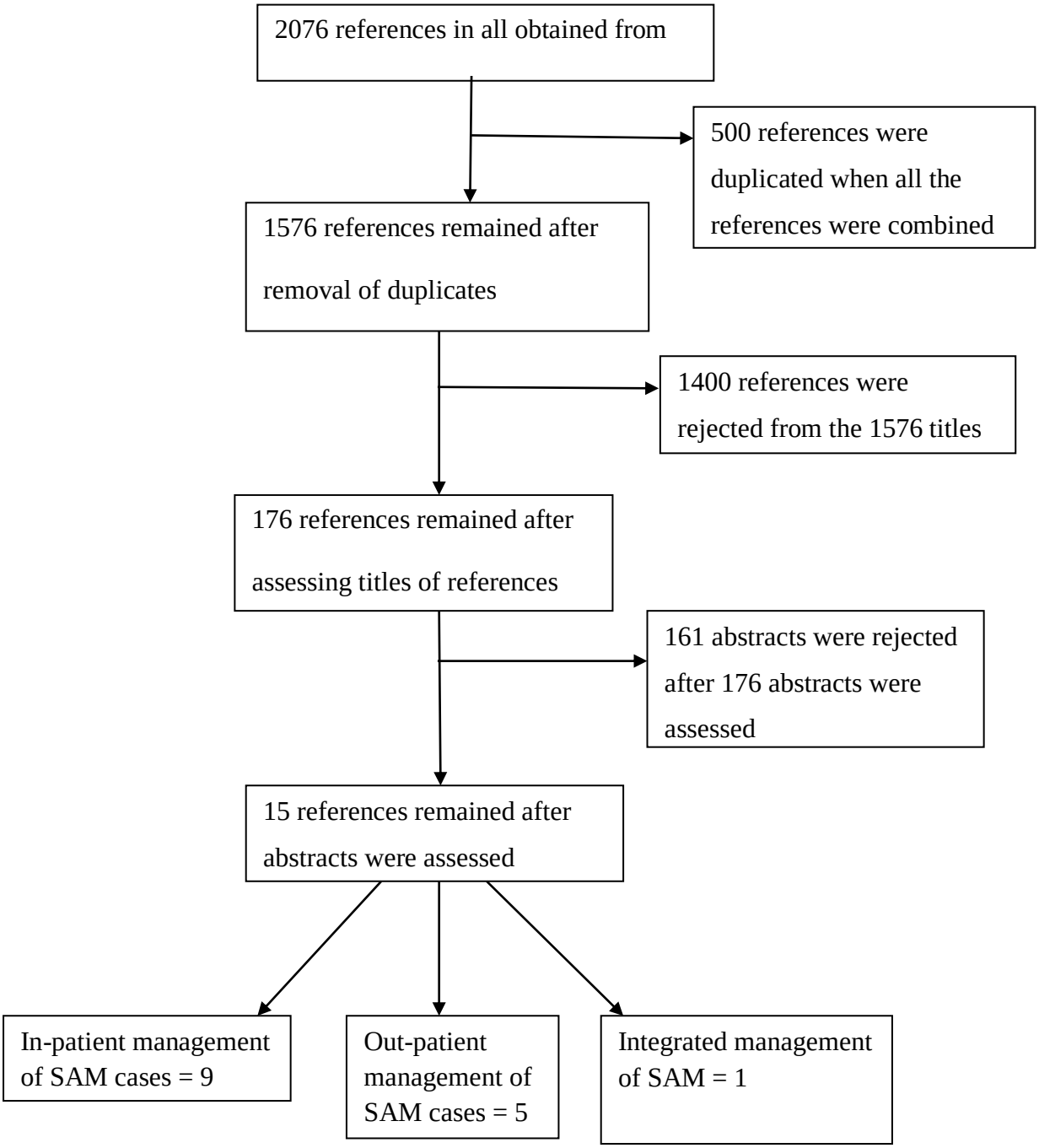


Figure. 2.1: Selection process

Source: Author's construct, 2015

2.5.6 Findings for studies for in-patient management of severe acute malnutrition

Nine studies (60%) were found under the category of in patient management of SAM. Four out of these nine studies were Randomized Controlled trials. Out of these four, three were conducted on the African continent specifically South Africa, Zambia and Malawi. The other study was conducted in Asia precisely in India.

Five out of the nine studies were observational researches. Four out of these five were conducted in Africa specifically Guinea Bissau, Mozambique, Burkina Faso and South Africa. One was however conducted in India on the Asian continent.

2.5.7 Findings from interventional studies under in patient management

Perra *et al*, (1995) carried out a study on 1038 severely malnourished children from 6 to 47 months. Out of this number, 354 received rehabilitation while 684 had no rehabilitation. After 36 months of follow up, 25% reduction in mortality was realized. The difference in mortality was much higher in the first three months. Also there was higher mean weight gain among rehabilitated children which lasted up to 18 months. In short, it was identified that low-cost outreach nutritional rehabilitation centers were effective both in the short term and in the mid – term to improve the nutritional situation and the mortality of SAM children.

Pouane *et al*, (2004) realised that in the 12 month period immediately after the implementation of proper dietetic procedures in the management of SAM, case fatality rates which were usually around 50% and 28% in the Mary Theresa and Sipetu hospitals had both dropped to approximately 25%. Furthermore, the research led to a formation of a hospital nutrition team which identified shortcomings in the clinical management of SAM children and took action to improve quality of care.

Trehan *et al,* (2013) realized from the study undertaken that 88.7%, 90.9% and 85.1% of children in the amoxicillin, cefdinir and placebo groups respectively recovered. The mortality rates for the three groups were 4.8% for amoxicillin, 4.1% for cefdinir and 7.4% for placebo groups. Furthermore among children who recovered, the rate of weight gain was increased among those who received antibiotics. No interaction between the type of severe acute malnutrition and intervention group was observed for either the rate of nutritional recovery or the mortality rate.

Irena *et al,* (2013), in trying to assess the effectiveness of milk-free RUTF in SAM management found out that there was no equivalence between soy-maize-sorghum (SMS) RUTF and standard peanut based (P) RUTF as was depicted by the recovery rates for SMS and P RUTF's which were 53.3% and 60.8% respectively for the intention to treat analysis (ITT) and 77.9% and 81.8% respectively per protocol (PP) analyses.

2.5.8 Findings from observational studies under in-patient management of SAM

Nhampossa *et al,* (2013) found out from the study that case fatality rate of SAM was 7%. Also bacteraemia, hypoglycaemia, oral candidiasis, prostration, oedema, pallor and acute diarrhoea were independently associated with an increased risk of in-hospital mortality. Malaria parasitaemia and breastfeeding were however independently associated with a lower risk of a poor outcome. Overall community based incidence rate was 15 cases per 1000 child years at risk and children aged 12 to 23 months had the highest incidence.

Singh *et al,* (2014) reported in its study that of the program exits, 1.2% children died, 47.2% defaulted while 51.7% were discharged. The average weight gain was 12.1 g/kg body weight per day while the average length of stay was 13.2 days.

It was realized that 46.8% of the subjects were discharged after recovering with a weight gain of 15% whereas 53.2% of the children were discharged with a weight gain less than 15%.

Savadogo *et al,* (2007) realized from the study that out of the 1322 hospitalized children, 8.5% dropped out while 16% of them died. The daily weight gain recorded was 10.18 g/kg/day. It was identified that patients were at high risk of early death as 80% of the deaths occurred during the first week. The risk of dying was highest among those with weight for height less than -4 s.d. and low MUAC for age as shown by the Kaplan-Meier survival curves and Cox model. Furthermore, among children discharged from the nutritional rehabilitation centre, 10.9% had weight for height of less than - 3 s.d.

Biggs (2013) revealed in the study that the dietetic practices for infants with SAM in South Africa did not go according to the WHO protocol but mostly followed current expert opinion closely. Furthermore it was realized that most dietitians omitted the cautious refeeding which was neither in conformity with current expert opinion or the WHO protocol and could predispose the children to the refeeding syndrome.

2.5.9 Findings from outpatient management of malnutrition studies

Five (5) studies were found under this category. Out of these five, four were observational studies whereas one was an interventional study. The Randomised Controlled Trial carried out by Shewade *et al,* (2013) was undertaken in India. Two (2) of the observational studies were undertaken in Ethiopia while the other two were undertaken in Guinea Bissau and Cambodia.

2.5.10 Findings from the interventional study

Shewade *et al,* (2013) in determining the effectiveness of indigenous ready-to-use-therapeutic-foods (RUTF) in community based management of uncomplicated SAM found out that, as compared to control group, addition of RUTF in a study group resulted in average additional increase in weight by 13g/kg of baseline weight per week per child. Thus, indigenous RUTF was effective in community-based management of uncomplicated SAM.

2.5.11 Findings from the observational studies

Belachew *et al,* (2007) in assessing OTP for SAM found out that OTP had enhanced community's understanding of malnutrition and helped with the behaviour change communication on optimal infant and young child feeding. Rapid recovery of SAM patients taking plumpy nuts was also observed. Furthermore, there were reductions in the timing that malnutrition could be treated without admitting the child, the burden of malnutrition and associated mortality. There was however irregularity and incompleteness of supply availability, high attrition of trained human power and inadequate support from governments and agencies.

Harris *et al,* (2011) found out from a study that, the home based treatment of acute malnutrition in urban poor communities was an example of effective community based rehabilitation of children with moderate or severe acute malnutrition.

The mean outcome weight-for-height z-score was -1.5 Also 55% of the children seen reached a weight for height z-score greater than or equal to negative 1 over a mean period of 14 weeks of rehabilitation. The average rate of weight gain was 4g/kg/day while the case fatality rate was 5.6%

Colombatti *et al,* (2008) found out from the study conducted that all the children who were admitted recovered with a weight gain of 4.45g/kg per day while none died or relapsed after 1 year. It was further realized that severely malnourished children there were mainly infants, part of large families and had illiterate mothers.

Yebyo *et al,* (2013) found out from the study that the recovery, defaulter, mortality and weight gain rates of children being managed for SAM were 61.78%, 13.85%, 3.02% and 5.23 g/kg/day respectively. It was further realized that routine medications were administered partially and children with medical problems were managed inappropriately. It was also indicated that as a child consumed one more sachet of plumpy nut, the recovery rate from SAM increased by 4%. Children who took amoxicillin and deworming tablets had 95% more probability to recover from SAM as compared to those who did not take them.

2.5.12 Findings from the integrated management of SAM

Aguayo *et al,* (2013) assessed the effectiveness of an integrated model for the management of SAM in India and found out that of the 2684 programme exits, 0.4% died, 32.0% defaulted (did not complete treatment) and 67.6% were discharged after a mean stay of 75.8 +or- 9.4 days. The mean weight gain among discharged children was 2.7 +or- 1.9g per kg body weight. Also on discharge, about 65% of the children had recovered by gaining greater than or equal to 15% of initial weight. Thus the survival rates in the IM-SAM programme were very high.

2.5.13 Discussions from findings from interventional studies under in-patient management

The findings from Perra *et al,* (1995) to a great extent lend support to the assertion that the appropriate management and treatment offered in cases of SAM cases can either lead to a decreased or increased rate of mortality (Briend, 2010). It could be realized that the rehabilitation provided to the over three hundred SAM cases greatly prevented a high number of death tolls especially during the critical stage of the first three months period. Similar results were realized by Ashworth (2004) when it was stated that good malnutrition care led to comparatively better nutritional outcomes.

It is certainly an undeniable fact that appropriate management of SAM cases can lead to a critical reduction in the number of deaths experienced at various facilities (Allen *et al,* 2007).

This situation was greatly supported by Pouane *et al,* (2004) when it was realized that after proper dietetic procedures were followed in the management of malnutrition cases, case fatality rates which were usually around 50% and 28% in the hospitals in which the study was conducted dropped to approximately 25% each.

Trehan *et al,* (2013) further buttressed the assertions made by Pouane *et al,* (2004) when it was again stated that following appropriate therapeutic plans led to a drop in mortality rates and an increase in the rates of recovery. The study revealed that administration of the right medications in their right amounts and timings contributed immensely to a reduction in mortality rates as agreed by WHO (2009). It was further noted that if the right medication was not offered and a substitute was given it did not prevent the rates of death as supported by Allen *et al,* (2007). This assertion was validated when mortality rates in the intervention groups namely amoxicillin and

cefdinir dropped to 4.8% and 4.1% respectively where as the placebo group had a higher mortality rate of 7.4%

Ready to use therapeutic foods are standard based specially made feeds that are offered to severely malnourished children during the period of rehabilitation in order to help patients to gain weight and to catch up with growth (WHO, 2009). Irena *et al,* (2013) in a study realized that offering the proven standard based RUTF was highly important in ensuring the recovery of SAM children as supported by the work of Sandige *et al,* (2004). This revelation was made when there were higher recovery rates recorded by patients who were given the standard peanut based RUTF as compared to patients who were served with the soy-maize-sorghum RUTF.

2.5.14 Discussions of findings from in-patient observational studies

One of the main criteria in admitting SAM children to inpatient care is the presence of medical complications and Nhampossa *et al,* (2013) observed that the kind of medical complications prevailing at a particular time had an effect on the recovery rates of patients. This was particular so because good nutrition has been identified to significantly boost the immune system of malnourished children.

Practically Nhampossa *et al,* (2013) identified that in the presence of hypoglycaemia, bacteraemia or oral candidiasis, death tolls shot up where as poor outcomes were significantly lowered in situations where SAM children were properly breastfed and did not have malaria. This study is supported by the findings of Pelletier *et al*, (1995), WHO (2009) and Chiwaula, (2011) which explain that the presence of comorbidites and complications such as hypoglycaemia, bacterial or viral infection may significantly affect recovery rates of malnourished children.

Just as Perra *et al*, (1995) asserted to in a randomized controlled trial, Singh *et al,* (2014) put evidence to the fact that rates of weight gain and recovery were quicker in situations where in-patient treatment or management were offered.

Savadogo *et al,* (2007) in realizing the enormous contribution of in-patient management in the reduction of mortality brought into the lime light certain key findings under the in-patient management. It was realized that more than half of the deaths that occurred were usually recorded in the first week of management and among SAM cases with the highest risks of death. It was also identified that patients who had the highest risk of death were those who had weight for height z-scores of less than -4 s.d. A similar revelation was made in the work of Pelletier *et al,* (2004) which states that the risk of death rises progressively with deteriorating nutritional status.

As supported in many of the studies cited above, Biggs (2013) further expressed the need for health care practitioners to know and follow the right dietetic practices to lower mortality rates and to increase recovery rates.

One key reason was the fact that if cautious feeding was not undertaken as was expected, patients were exposed to complications including refeeding syndrome which did not have desirable consequences. A similar study organized by Ashworth (2004) proved that in the event of upgrade of knowledge and training of health care staff, mortality cases dropped from 46% to 21%.

2.5.15 Discussion of findings on interventional study under outpatient management of SAM cases

Shewade *et al,* (2013) in a very critical study proved that locally available resources could be used in the production of recognized standard based ready to use therapeutic feeds. This really helped in ensuring high level of sustainability in the provision of ready to use therapeutic feeds. The above named study however gives a contrasting view to that of Irena *et al,* (2013) which indicated that only the proven standard peanut based RUTF was highly efficacious in ensuring high recovery rates.

2.5.16 Discussions on findings from outpatient management observational studies

Belachew *et al,* (2007) in assessing the contributions of out-patient therapeutic feeding centres realized that OTP's had significantly transformed people's perceptions about severe acute malnutrition. Facts from the study showed how people were educated on the need to breastfeed and to ensure optimal breastfeeding practices for infants and children.

It is an undisputable fact that, well equipped technical staff would be better positioned in offering the recommended practices in order to save lives as supported by a similar study conducted by Biggs (2013). English *et al,* (2004) and Nolan *et al,* (2001) made similar recommendations as they realized that the quality of staff and availability of resources in health institutions had a great impact on the quality of care provided to malnourished children. The study realized that there was a high attrition rate of human power especially in African settings and this situation needs to be dealt with all agencies concerned to ensure that in terms of children, the future human resource is not eroded even before reaching adolescence (Biggs, 2013 and English *et al,* 2004).

Another key area that had been studied was the efficacy of home based treatment of severe acute malnutrition. Harris *et al,* (2011) realized that in the areas where it was undertaken, the home based treatment was highly efficacious. Colombatti *et al,* (2008) further added a strong statement to the fact that out-patient therapeutic feeding centres were highly effective in the management of SAM. With an observation of Ghanaian out-patient care centers, it could be realized that most of the patients are regularly monitored and certain feeding supplements are provided to them (GHS/UNICEF, 2011). Due to the feeds they sometimes receive, some of the parents/care givers try not to miss their children's scheduled review appointments. While the feeds serve as an incentive, the children are attended to by qualified health personnel. This situation in effect helped the children to reach their nutritional targets without many barriers.

Once again this is firmly supported by the works of Allen *et al,* (2007), Nolan *et al,* (2001) and English *et al,* (2004) where it is indicated that the efficacy of the treatment plan largely hinges on the resources be it staff wise or in terms of feeds that are offered to workers and the sick children. In the same vein, the essence of appropriate medical and clinical practice was underscored when Yebyo *et al,* (2013) proved that when appropriate medical care was partially administered, it led to further lengthened rates of recovery and mostly higher mortality rates.

This assertion is clearly supported in a study by Briend (2010) which states that the kind of management offered to a malnourished child can either aid in his or her recovery or deterioration.

2.5.17 Discussions of findings from the integrated management of severe malnutrition

Aguayo *et al*, (2013) proved that where the management plan of severe malnutrition had the composition of both in-patient and out-patient management, there were substantially higher survival and recovery rates. In Ghana, a report on CMAM implementation in the Upper East Region showed positive nutritional indicators and higher cure rates (GHS/UNICEF, 2011). This in effect only proves that where timely detection and in patient as well as outpatient care are offered, patients have better nutritional outcomes (WHO, 2013).

2.5.18 Research gap identified

Aside the CMAM technical meeting organized in the Upper East Region there is no published study conducted all over the ten regions of Ghana to clearly depict the efficacy of the various forms of management plans for acute malnutrition. This necessitated the current study.

CHAPTER THREE

METHODOLOGY

This Chapter presents the methodology employed in order to undertake the study. Information presented in this chapter includes the study area, study subjects, eligibility criteria and exclusion criteria. Furthermore available in this chapter are information on sample size determination, data collection procedure, data analysis, ethical clearance and the limitations of the study

3.1 Study Area

A retrospective cohort study was conducted at three treatment sites namely, the Agogo Presbyterian Hospital (APH), the Komfo Anokye Teaching Hospital (KATH), and the Agogo Community-based Management of Acute Malnutrition Center (Agogo CMAM center)

The Agogo Presbyterian Hospital, one of the facilities under the Christian Health Association of Ghana (CHAG) is the oldest mission hospital in Ghana. It is the second largest hospital in the Ashanti Region. It receives many referral cases from Ashanti Region and beyond. It has a Paediatric department which is made up of sections such as the Child Welfare Clinic, a Neonatal Intensive Care Unit and a 50 bed capacity Children's Ward. Though the hospital had a number of Paediatric Specialists and Consultant, there was no substantive Nutritionist or Dietician but a Nutrition Intern who was undertaking his National Service and acted in the capacity of a Nutrition Officer. Two forms of management were practiced at APH namely: in-patient care and out-patient care. APH also collaborated with the Agogo CMAM center in managing some of their cases under the OPC module of CMAM.

The Komfo Anokye Teaching Hospital run by the Ghanaian Ministry of Health is the second largest hospital in Ghana and the main referral hospital for the Northern sector of Ghana. It has a bed capacity of over a thousand. There is a Nutritional Rehabilitation Centre (NRC) managed by Nutrition Officers under the Child Health Directorate located there. The facility can boast of about six Nutritionists and a number of Consultant and Specialist Paediatricians who team up with other paramedics to manage malnutrition cases.

The Agogo CMAM center on the other hand is located at Agogo in the Asante Akyem North District of Ghana. The center functions as an Out Patient Care Site for the implementation of the Community Based Management of Acute Malnutrition treatment module. The site is run by Community and Public Health Nurses who administer nutrition therapy to the children referred or brought there.

Retrospective data was collected from the treatment sites from March to June, 2014.

3.2 Subjects

The main subjects of the study were children from 0 to 59 months, who were managed on the grounds of severe acute malnutrition at the treatment sites from the period of 1st January to 31st December, 2013. Auxiliary subjects made up of seven health care staff took part in the study by filling out checklists which were used to assess their knowledge and competencies. Furthermore one key person at each care site was contacted for a key informant interview.

3.3 Eligibility criteria

-Acutely malnourished children who were within the age range of 0 to 59 months and were managed at the selected malnutrition treatment centers from the period 1st January to 31st December, 2013.

- Health care staff responsible for the treatment of malnourished cases at the selected facility.

3.4 Exclusion criteria

-Children who were below five years and were not acutely malnourished.

-Malnourished children who were equal to or above the age of five years

-All children equal to or above the age of five years

-Staff who were not involved in malnutrition management at the selected facilities

3.5 Sample size determination

The sample size for the study was calculated using the Cochrane's sample size determination formular (Cochrane, 1977) below:

$N= z^2 p(1-p)/d^2$

Where N= Sample size

z= z-score (1.96)

p=prevalence of wasting in Ashanti Region

d= marginal error

z=1.96; p= 6% or 0.06 (GSS, 2011);

Using Confidence Interval of 95%, d= 0.05

$N= 1.96^2 *0.06(1-0.06)/0.05^2$

= 3.8416*0.06(0.94)/0.0025

=3.8416*0.0564/0.0025

=0.21666624/0.0025

= 86.67

=90

Rounded up to the nearest hundred to account for loss to follow up = 100 subjects

Based on this, a total of 100 children were recruited from the various treatment sites. 46 obtained from APH, 40 from KATH N.R.C. and 14 from Agogo N.R.C.

3.6 Data Collection Procedure

Clinical records of all children who were managed at the treatment sites within the period 1st January to 31st December 2013 were retrieved by the surveyor and used to fill out questionnaires. The information collected included data on socio-demographic characteristics, anthropometrics, intake of feeds, medical problems, routine medication intakes, recovery, length of stay, mortality, defaulters and laboratory tests conducted.

Checklists were also served to health care staff such as nutritionists, doctors and nurses who collaborate in treating malnutrition to assess their level of knowledge, skill and competencies in malnutrition management.

A key informant interview was organized with a key staff at each of the care sites in order to find out what goes into the management of malnourished children at the various centers.

3.7 Data analysis

Data storage and analysis were done by Microsoft Excel 5.0, the Graph Pad Prism and the Statistical Package for Social Sciences (SPSS) Version 16.0. Non parametric and parametric tests were used to test for significance within variables of interest.

WHO Anthro software was also used to find out the appropriate z-scores of the nutritional indices such as weight-for-height/length, weight-for-age and height/length-for-age.

Descriptive statistics were also employed in the calculation of certain parameters as represented as follows:

For the purpose of the study, outcome indicators such as rates of mortality, defaulter and recovery which helps in the assessment of the quality of services provided at a particular treatment site in comparison to the Global Sphere Standards (GSS(I)) were calculated as follows:

Mortality rate at IPC (%) = Number of deaths at IPC divided by total number of exits at the IPC multiplied by 100%

Defaulter rate at IPC (%) = Number of defaulters at IPC divided by total number of exits at the IPC multiplied by 100%

Recovery rate at IPC (%) = Number of children who recovered at IPC divided by total number of exits at the IPC multiplied by 100%

Non response rate is also a criterion that represents children who reached their limit of stay at the IPC but did not attain the target set for discharge be it target weight-for-height or MUAC-for- age. It was also calculated as follows:

Non response rate at IPC (%) =Number of children who non recovered at IPC divided by total number of exits at the IPC multiplied by 100%

At OPC, these rates were calculated as follows:

Mortality rate at OPC (%) = Number of deaths at OPC divided by total number of exits at the OPC multiplied by 100%

Defaulter rate at OPC (%) = Number of defaulters at OPC divided by total number of exits at the OPC multiplied by 100%

Recovery rate at OPC (%) = Number of children who recovered at OPC divided by total number of exits at the OPC multiplied by 100%

Non response rate is also a criterion that represents children who reached their limit of stay at the OPC but did not attain the target set for discharge be it target weight-for-height or MUAC, plus those who deteriorated and had to be referred to IPC. It was calculated as follows:

Non response rate at OPC (%) =Number of children who non recovered or deteriorated at OPC divided by total number of exits at the OPC multiplied by 100%

MUAC gain was also calculated. MUAC gain helps to identify whether a child is achieving catch-up growth with a resultant increase in the fat stores around the mid upper arm.

At IPC, it was calculated as follows:

MUAC gain at IPC (mm/cm) = (MUAC(mm) at the end of treatment at IPC) subtracted by (MUAC (mm) at the beginning of treatment at IPC) divided by (MUAC at the beginning of treatment at IPC (cm))

At OPC, MUAC gain was also calculated as found below:

MUAC gain at OPC (mm/cm) = (MUAC (mm) at the end of treatment at OPC) subtracted by (MUAC (mm) at the beginning of treatment at OPC) divided by (MUAC at the beginning of treatment at OPC (cm))

Average weight gain was calculated among recovered children to assess the quality of recovery and identify potential problems with the feeding protocols and their implementation. For this study it was calculated as follows:

Average weight gain at IPC (g/kg) = (weight(g) at IPC discharge subtracted by weight(g) at IPC admission) divided by (weight(kg)at IPC admission)

For OPC, average weight gain was calculated as indicated below:

Average weight gain at OPC (g/kg) = (weight(g) at OPC discharge subtracted by weight(g) at OPC admission) divided by (weight(kg)at OPC admission)

The length or duration of stay gives information about how long a child stays at the IPC or OPC before exiting. It also helps in the assessment of the quality of recovery and in the identification of any setbacks with the feeding protocol used at the facility. It was calculated as the total number of days spent at the IPC or OPC by a particular child. For the purpose of this study the length of stay was categorized into ranges of 7 days each specifically for IPC. At OPC, the length of stay was also classified on weekly basis.

3.8 Ethical clearance

Ethical clearance for the study was obtained from the Committee on Human Research and Publication Ethics of Komfo Anokye Teaching Hospital/School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. For emphasis, at KATH, consent was sought from the Head of the Child Health Directorate, the Head of the Nutrition Unit and the Research and Development Office for the utilization of records of all malnourished children under five years managed at the Child Health Directorate.

At APH, consent was sought from the General Manager, the Medical Administrator, the Nursing Administrator and the Head of Paediatrics Department for the use of appropriate records.

At the Agogo Nutrition Rehabilitation Center, approval was obtained from the Nurse in charge of the Out Patient Care Site for utilization of records of children.

Permission was also sought from and granted by The Sphere Project office for the utilization of the Global Sphere Standards in the study.

3.9 Study limitations

There were some shortfalls that were encountered during the research work. Paramount among these were the inability to trace certain folders or records of all the children who had been attended to at the various treatment sites. Records on death cases were also very difficult to trace. In some facilities particulars of deceased children were reportedly burnt in order to create space for the living. This obviously affected the calculation of mortality rates as accurate data on death could not be collated at some of the institutions. Other information that could also not be traced in

the children's health records were anthropometric information such as weight, height or recumbent length and specific date of discharge especially in outpatient facilities.

There was also the challenge in precision of diagnosis. This was because; if anthropometric measurements were done inaccurately children would obviously be misdiagnosed.

CHAPTER FOUR

RESULTS

This chapter is in three parts. The first part reports on the data obtained from the key informant interviews organized at the various care sites. The second part presents information on the checklist that was used to assess the knowledge, competency and skill levels of sampled staff at the treatment facilities. The third part presents information on data retrieved from the folders and records of children who were managed from 1st January to 31st December 2013 on account of acute malnutrition at the various care sites.

4.1 First section of results

The first section of the results presents information on the key informant interview organized at the various treatment sites

4.1.1 Key Informant Interview organized at the Komfo Anokye Teaching Hospital (KATH) Nutrition Rehabilitation Center

At the KATH, a Nutrition Officer served as the main informant in an interview organized to ascertain how practices were undertaken at the center. There is a Nutrition Rehabilitation Center which falls under the Directorate of Child Health. The study revealed that the center runs two main treatment sites – the In-Patient Care Site and the Out-Patient Care Site. Due to its status as a teaching hospital, the directorate had a number of Paediatric Consultants, Specialists, Resident Doctors and House Officers. The Nutrition Rehabilitation Center specifically had about five Nutrition Officers. There were Nutrition interns and student nutritionists who were posted to the center either on national service or attachment. Usually a child who passed the criteria

for admission was referred for nutritional care from doctors. On being seen by the Nutrition Officers, anthropometric assessments were undertaken. These assessments usually included weight, height and mid upper arm circumference (MUAC) measurements.

The measurements that were taken were compared with the respective weight, height and MUAC measures for a normal population with the same ages and sexes. Biochemical assessments which had already been undertaken on request by the Medical Officer were then looked at. Key laboratory findings that were checked were electrolytes such as Sodium, Potassium, Magnesium and Chloride. Clinical presentations of malnutrition such as oedema, dermatosis, baggy pants, protruded abdomen and scaly hair were then noted if present. After the checking of complications present, the child's nutritional history was then taken. After that, information on socio-demographic characteristics of the child was then noted. The demographic information taken helped the medical team to know the educational and economic background of the family the child was from. This would inform health workers as to the most suitable form of treatment that could be offered the child. The study showed that the center clearly followed the criteria for management of malnourished children programmed by the World Health Organization and adopted by the Ghana Health Service. The cut-offs for malnutrition assessment using either weight-for-height or MUAC for age was used to admit a child into a particular treatment plan be it in-patient or out-patient care. It was identified that due to its status as a major referral center for middle and northern parts of Ghana, most of the malnourished cases that were seen at the center were of the severe state. These severe forms of acute malnutrition were treated at the In-Patient Care Site. Usually these SAM cases also presented with complications. Some of the usual disease conditions

ranged from retroviral infection, through generalized oedema, tuberculosis, malaria, to pneumonia. Due to the usual presence of complications, the treatment of the condition usually required concerted efforts by both the medical and paramedic team. Paramedics who were instrumental in the treatment of the children were nurses, radiologists, physiotherapists and psychologists.

The information collected for the study revealed that the process of managing a malnourished child was categorized into three main phases namely stabilization, transition and rehabilitation. During the stabilization phase metabolic abnormalities were corrected and complications were resolved. During stabilization, feeding was started whereas medications were also given to resolve all medical abnormalities. For a child less than 6 months, diluted F-100 was offered whereas for a child who was aged 6 months and above, F-75 was offered as a start-up feed. Specific quantities were offered within the allowable limits of the WHO protocol. During the transition phase F-100 was slowly introduced. At the initial point, the amount offered was similar in quantity to the amount of F-75 offered at the stabilization phase. When the child had been sufficiently identified to accept sufficient quantities of the feed, the rehabilitation phase was initiated. At this phase diluted F-100 was still offered to children below six months whereas for a child above 6 months, F-100 was offered. The main idea for rehabilitation was to ensure catch-up growth. When a child had been identified to have gained substantial weight in comparison to the height, usually 15% of the admission weight added on to the initial weight, then the child was noted to have gained enough weight ready for discharge. MUAC was also monitored to determine whether the child had accumulated enough fat or not. When a child had a MUAC reading of 12.5 cm for three consecutive visits, the child was considered to have recovered. It was noted that the Rehydration Solution for Malnutrition

(Resomal) was offered to children who presented with dehydration. About three different forms of plans known as Plan A, Plan B and Plan C were followed when children were being offered the Resomal. These plans were usually based on the route (whether oral or intravenously) and severity of the dehydration. The decision on the plan to be used was taken by the Medical Officers in consultation with the Nutrition Officers. It was revealed from the study that due to lack of space, the malnourished child was discharged from In-Patient Care once all metabolic abnormalities were corrected and complications were stabilized.

The child was then attended to at the OPC till full recovery was attained. At OPC, management continued. Usually, the children were given supplements based on their ages and weight. Based on their specific weights and ages, they were given packs of RUTF to take home. On the next visit, the caregivers were expected to bring empty packs of the feed to prove whether the feeds were consumed or not. With the help of benevolent organizations, the NRC had in stock a pile of powdered milk products which they gave out to malnourished children who were 12 months and above. As such based on a child's weight and age, specific quantities were offered. On each review a targeted level of weight increase was stated. On each OPC attendance, the weight was monitored to see whether the increment had been attained. When the expected amount of weight gain was achieved, the child was then fully discharged from rehabilitation.

4.1.2 Key Informant Interview organized at the Agogo Presbyterian Hospital (APH) In-Patient Care (IPC) and Out-Patient Care (OPC) Sites

The informant at APH was a Nutrition Intern who was acting in the capacity of a Nutritionist at the hospital. The hospital had two Paediatrician Specialists, a

Consultant Paediatrician, Resident Medical Officers, House officers (newly completed Medical Doctors working under supervision) and a number of trainee Physician Assistants. It was revealed from the study that, the Medical Officers in conjunction with the Nutrition Intern, Nurses, Radiologists, and Medical Laboratory Technologists collaborated in the treatment and management of acute malnutrition. It was further revealed that children were usually brought into the Child Welfare Clinic (CWC) by caregivers on presentation of certain signs of illness. On arrival At the CWC, a series of assessments was undertaken to ascertain whether a child was malnourished or not. The assessments carried out included, anthropometric measurements, biochemical, clinical, dietary and information on social factors. On the anthropometric assessments, a weighing scale was used to assess the weight of a child. A stadiometer was then used to measure the height of the child when the fellow was aged six months and above.

It was further revealed from the study that, when a child was below the age of six months or above six months and could not stand, an infantometer was used to measure their recumbent length. MUAC measurement was also carried out. The child's weight for height and MUAC for age were all compared with the standard WHO measurements for a normal reference population. Once the child was found to be wasted, be it moderate or severe, the individual was put through the appropriate management plan.

Usually, when a child was severely malnourished and presented with complications such as retroviral infection, pneumonia, cerebral palsy or malaria, the fellow was attended to under in-patient care. When a child was moderately malnourished and presented with no complications, out-patient care was carried out. Biochemical tests were also carried out to assess whether any infection or electrolyte imbalance existed.

Apart from the earlier assessments, clinical signs and symptoms of malnutrition such as generalized oedema, dermatosis, protruded abdomen, brown or scaly hair, baggy pants and showing of ribs and collar bones were observed and noted. All these assessments were undertaken to find out the appropriate management plan to put the child through, be it in or out-patient care. In terms of management, medications and feeds were given to help achieve recovery. Specific medications were also offered based on the disease condition of the child.

Some of the medications that were usually offered included cefuroxime, gentamycin, septrin and phenobarbitone. Feeds were prepared by the Nutrition Intern and served to the malnourished children. It was realized from the study that, the WHO protocol on feeding was not followed. Fortified Kooko (FK) was used in place of F-75. The FK was made from milled roasted maize and groundnuts. The flour obtained from the milling was then used in the preparation of porridge. With the exception of sugar, milk was not added to the FK. The main idea behind this was to help prevent or reduce the incidence of diarrhoea if a child was experiencing such condition. After the diarrhoea had resolved, smaller portions of F-100 was mixed with the FK and served to the child. The WHO standards for making F-100 where cereal base, milk, sugar, vegetable oil, and CMV were utilized was equally employed in the facility in the preparation of the F-100. A combination of F-100 and Fortified Kooko were usually given during the transition phase.

F-100 was then fully introduced during rehabilitation phase. It was noted that F-100 was also called Kwashiorkor Diet (K Diet) in this facility. In the preparation of the feeds, a combined mineral and vitamin mix (CMV) was added in order to provide the child with the appropriate minerals and vitamins essential in curing the child.

Mostly, this CMV was unavailable and as such improvisations were made. Usually Potassium Chloride (KCl) either in a form of an injectable or powder was used. KCl was employed because most malnourished children were usually deficient in Potassium and Chlorine. When a child had been identified to be ingesting sufficient quantities of the feed or finishing the quantity expected, an appetite test was organised. In the conduction of the test an amount of RUTF was offered to the child gently. If the child was able to consume the feed expectedly, then RUTF was introduced. The RUTF was served based on the calculation of 200 kcal per kg body weight per day. Counseling on the need to ensure hygiene, how to keep the feed and how to offer the RUTF appropriately to the child was given to the child's caregiver. After good consumption of the RUTF for a number of days, the mother was taught how to prepare nutritious home feeds under supervision at a kitchen designated for that purpose. These home feeds were then introduced in conjunction with the RUTF for a number of days till the child was deemed fit for discharge to OPC.

Just before discharge took place, the caregiver was counseled on the preparation of nutritious feeds at home. A review date was then given to these caregivers to bring their children for assessment. Usually the first review was within a period of one or two weeks.

The study revealed that for a child below 6 months, the main intention was to re-establish breastfeeding so the child was fed with Diluted (Dil) F-100. Dil F-100 was made from diluting the normal volume of F100 with 30% of water. Due to the age, breast milk was still given. It was given either through the normal route or in the form of expressed breast milk. In the event that the child could not get sufficient breast milk through the normal route, expressed breast milk was added. These feeds were given till the child was cured. When the rehabilitation had been effectively achieved

and all complications had resolved, the child was discharged home. Nutritional counseling was then offered to mothers and caregivers for them to know the appropriate breastfeeding practices that should be undertaken.

It was found out from the study that the standard rehydration solution for the malnourished child (Resomal) was not used in this facility. Rather, ORS which was supposed to be given to a normal child was also offered in case of malnutrition. However the ORS served was usually diluted with double the amount of water needed for the normal child.

The follow up phase for children above six months were undertaken at the out-patient care site. The children were usually brought in on weekly, forth nightly, monthly or bi-monthly basis as was deemed appropriate. At the out-patient care site, anthropometric measurements were undertaken. Then, RUTF's were offered based on the child's weight. On the next visit to OPC, caregivers brought along empty sachets to prove whether they had been compliant or not.

4.1.3 Key Informant Interview organized at the Agogo Outpatient Care Site (OPC C)

The key informant for the interview at OPC C was a Community Health Nurse who collaborated with other nurses and caregivers to attend to acutely malnourished children in need of care. The OPC C implements the out-patient care module of the community based management of acute malnutrition (CMAM) programme. At this treatment site, only children who were 6 months and above were attended to. The center was run by a number of Community and Public Health Nurses. Children taken care of at this center were identified either directly through community outreaches or were referred to the center for treatment from other health facilities or hospitals. At

the OPC, assessments were undertaken on the child. The study revealed that the main criterion for admission at the center was the MUAC for age. If the MUAC was found to be less than 11.5 cm, the child was admitted for treatment. Other physical assessments such as oedema presence, bodily temperature, presence of diarrhoea, and nature of skin were also checked.

When any of the complications were identified the child was referred to IPC. During treatment, records on vaccination were also taken. If the child had not been given all the vaccines appropriate for the particular age, then that appropriate vaccine would be administered. Deworming was also checked. If the response was in the negative, the child was offered anthelminthic such as Albendazole or Mebendazole according to the right prescription. After all the medical, diagnostic and anthropometric checks had been carried out, the child was offered appropriate therapeutic feeds. The amount of RUTF offered was based on the calculation of 200 kcal of energy per kilogram bodyweight. The caregiver or mother was taught how to efficiently feed the child with the RUTF and to ensure personal and environmental hygiene during feeding. At review sessions, caregivers were required to produce empty sachets of the RUTF which were offered to the child as proof of compliance to feeding instructions.

Furthermore at these reviews, the child's MUAC was assessed. When the MUAC reading stayed at 12.5cm for three consecutive visits, the child was discharged as cured. Though the MUAC was the criterion for admission and discharge, the weight of the child was monitored on each visit till the target weight that had been set was reached. On discharge the caregiver was sometimes counseled on how to feed the child appropriately.

4.2 Second Section of Results

4.2.1 Results from checklist filling

Checklists were offered to staff made up of Nutritionists, Nutrition Interns, Nurses, Medical Officers, and Physician Assistants at the various healthcare facilities. It was intended to assess their levels of knowledge, competency and skills in the management of acute malnutrition. After completion of the checklists, marks were awarded and the grading scale stated as follows was used:

100% - 70% - Excellent; 69.9% - 60% - Very good; 59.9% - 50% - Good;

49.9% downwards –Poor

On the average, KATH staff recorded the highest average score of 69.5% while APH staff had a mean score of 63%. Staff of Agogo OPC however were non-compliant as they did not fill the checklists. A picturesque view of the scores is being given on Fig 4.1 below.

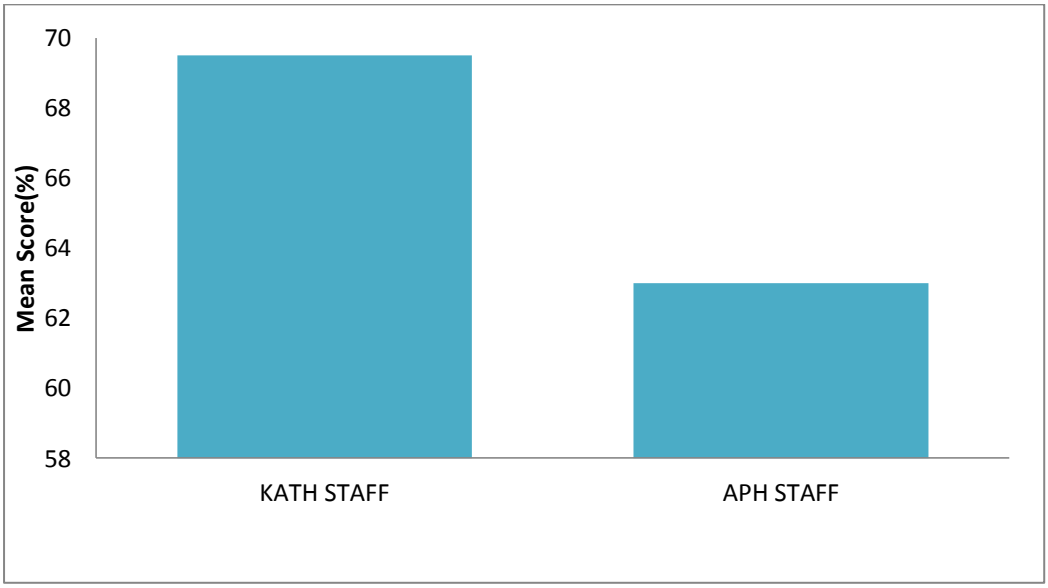


Figure 4.1 Comparison of Mean Competency Scores of Staff at KATH and APH

Source: Author's construct, 2015

4.3 Third Section of Results (Results from data collected from folders)

4.3.1 Part One: Admission Characteristics

4.3.1.1 Gender distribution

From the data gathered, majority of the children (61%) were males whereas minority (39%) were females. At KATH 62.5% were males while 37.5% were females. At APH, more than half of the children, 58.7% were males while 41.3% were females. At OPC C majority (64.3%) were also males while 35.7% were females. These facts are presented on Table 4.1 shown below

Table 4.1 - Gender distribution at treatment sites

TREATMENT SITE	MALES	FEMALES	TOTAL
ALL SITES	61 (61%)	39 (39%)	100 (100%)
KATH	25(62.5%)	15(37.5%)	40
APH	27(58.7%)	19(41.3%)	46
OPC C	9(64.3%)	5(35.7%)	14

Source: Author's construct, 2015

4.3.1.2 Age ranges of children:

The largest cohort of children 91 in number representing 92.9% were within the ages 6 to 59 months. The minority forming 7.1% of the study population who were 7 in number fell within the 0 to 5 months age cohort. It is worth noting that records on ages were not obtained for two children at OPC C. The distribution of children according to age ranges is shown on Table 4.2

Table 4.2 – Age ranges of children

TREATMENT SITE	0 – 5 MONTHS N (%)	6 – 59 MONTHS N (%)
KATH(IPC A,OPC A)	5 (12.5%)	35 (87.5%)
APH (IPC B, OPC B)	2 (4.3%)	44 (95.7%)
OPC C	0	12 (100%)

Source: Author's calculations, 2015

4.3.1.3 Types of malnutrition cases presented

From the data collected, majority of the children (92%) presented with Severe Acute Malnutrition (SAM) while minority (8%) presented with Moderate Acute Malnutrition (MAM).

4.3.1.4 Enrolment by months at the various health centers

It was realized from the study that the month that recorded the highest number of attendance in all facilities was November with 20 children attending. April however had the least recorded cases with only three children visiting the centres as depicted in figure 4.2.

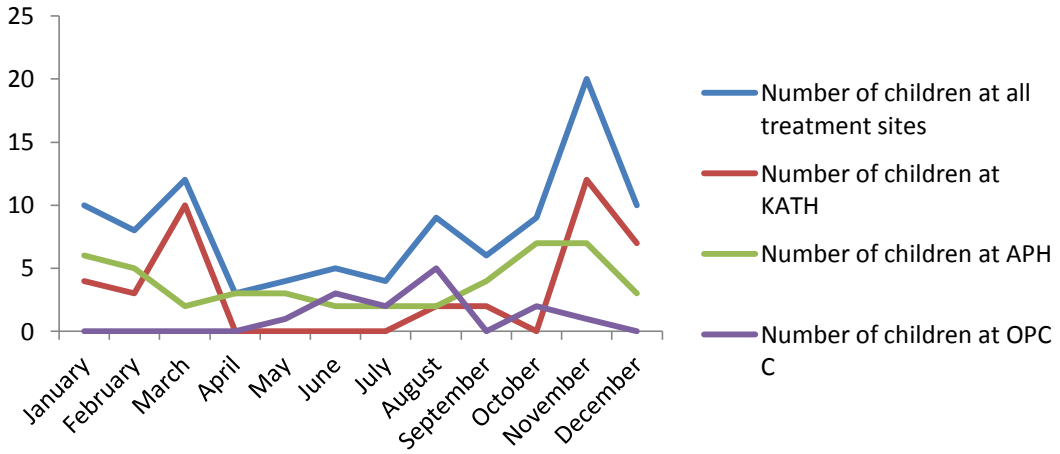


Figure 4.2: Enrolment by months at treatment sites

Source: Author's construct, 2015

4.3.1.5 Comparison of Mean Weight at IPC Admission to Standard mean weight

Figure 4.3 gives the comparison of WHO standard mean weight (in purple) with the mean weights of children of different age brackets at the IPC (in blue –*representing the total of IPC A and IPC B*), IPC A (in red) and IPC B (in green) . It is evident from the figure that the mean weights for the children at the various IPCs were below the standard mean weight, indicating that all the children were underweight when they were admitted at the IPCs. There was a significant difference ($p < 0.01$) between the admission weight of all the children attended to at the IPC and the expected weight they should have recorded in comparison to their respective ages and sexes using the Wilcoxon Signed Ranks test (see appendix E). This is clearly depicted on Figure 4.3 shown below.

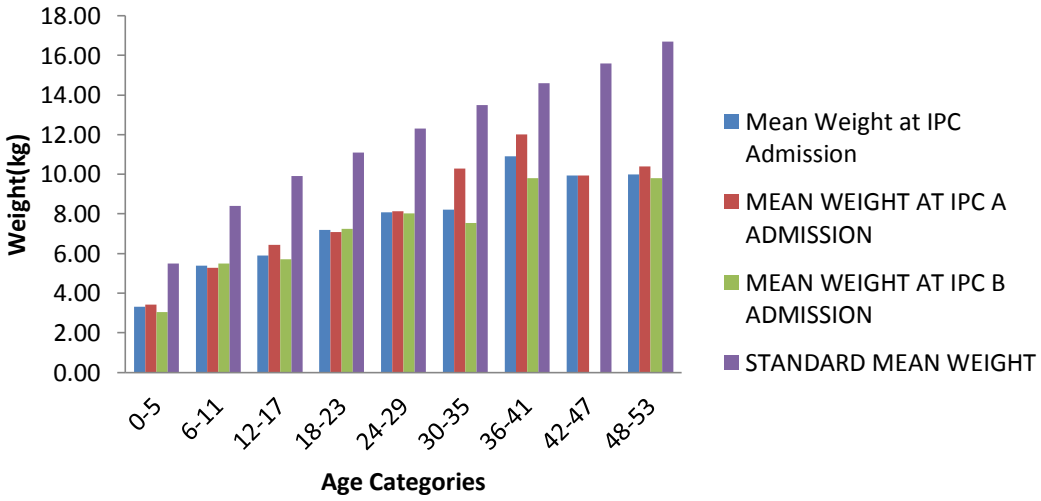


Figure 4.3: Comparison of mean weight at IPC on admission with standard mean weight

Source: Author's construct, 2015

4.3.1.6 Comparison of Mean Height at IPC Admission with Standard Mean Height

Figure 4.4 gives the comparison of WHO standard mean height (in blue) with the mean heights of children of different age brackets at the IPC (in red-*representing all IPC sites sampled*), IPC A (in green) and IPC B (in purple). It is evident from the figure that the mean heights for the children at the various IPCs were below the standard mean height for their ages, indicating that all the children were stunted when they were admitted at the IPCs. Furthermore, there was a significant difference ($p < 0.01$) between the admission height of all the children attended to at the IPC and the expected height they should have recorded in comparison to their respective ages and sexes using the Wilcoxon Signed Ranks test (see appendix E). This is clearly depicted on Figure 4.4 below.

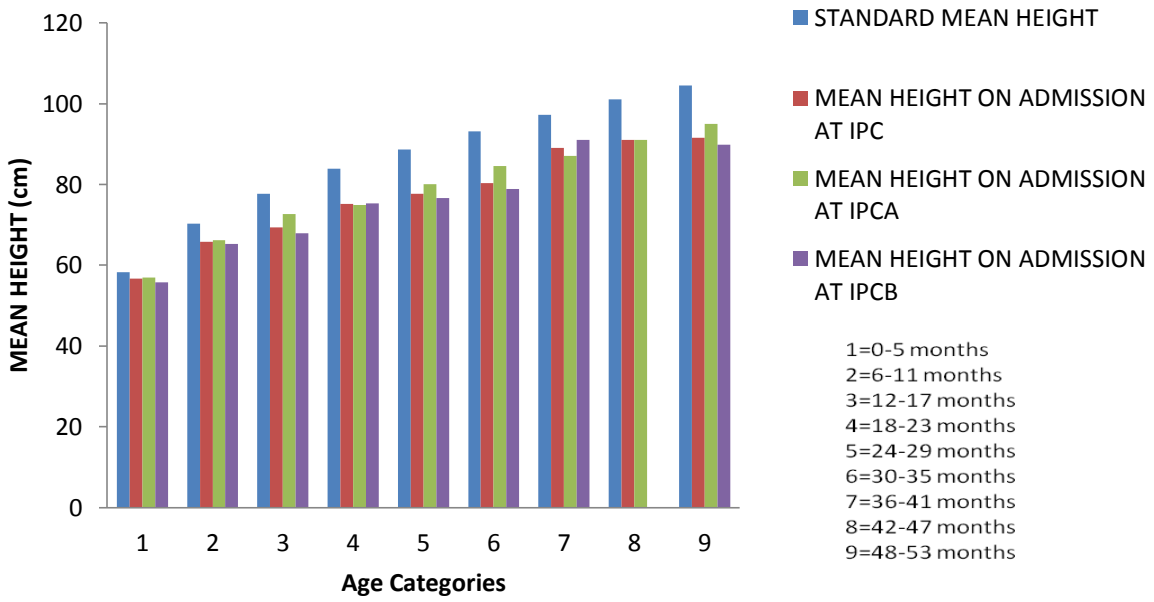


Figure 4.4 - Comparison of observed mean height on admission with expected mean height for age at IPC

Source: Author's construct, 2015

4.3.1.7 MUAC measurement at IPC admission

Less than half of the children approximately, 40% out of the 86 children attended to at IPC*(representing all IPC sites sampled)* had their MUAC's measured on admission. Out of this, only 11.8% representing 4 children had their MUAC's falling into the adequate standard range for their ages. However majority of the children (30 in number) representing 88.2% recorded MUAC's which deviated from the normal MUAC ranges expected for their ages.

4.3.1.8 Comparison of Mean Weight at OPC Admission to standard mean weight

Figure 4.5 gives the comparison of WHO standard mean weight (in deep blue) with the mean weights of children of different age brackets at the OPC (in red-*representing all OPC's sampled*), OPC A (in green), OPC B (in purple) and OPC C (in light blue). It is evident from the figure that the mean weights for the children at the various OPCs were below the standard mean weight for their respective ages indicating that all the children were underweight when they were admitted into treatment at the OPCs. It was further identified that there was a significant difference ($p<0.01$) between the observed weight at OPC and the expected weight they should have had when the Wilcoxon Signed Ranks Test was run (see appendix E).

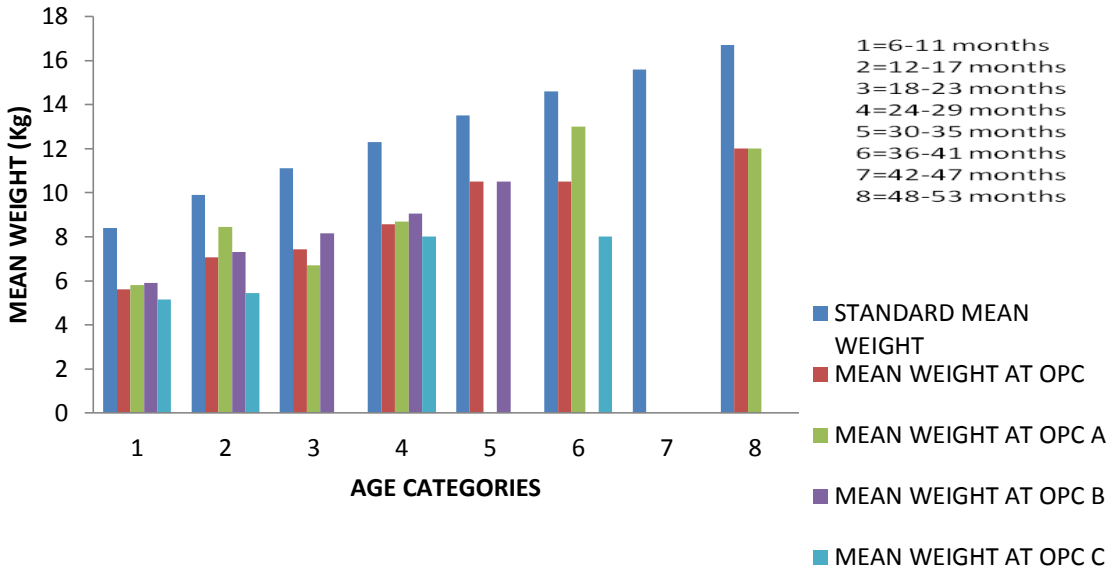


Figure 4.5- Comparison of the Mean Weight recorded at OPC's on admission with Standard Mean Weight

Source: Author's construct, 2015

4.3.1.9 Height measurement at OPC on admission

It was noted that all except one child had their height not measured at OPC (*representing all OPC's sampled*). The height noted was 84.0 cm and this was recorded specifically at APH OPC.

4.3.1.10 MUAC measurement at OPC on admission

Out of the 42 children who were attended to at OPC (*representing all OPC's sampled*), only 14 of them representing 33% had their MUAC's recorded on admission. All the 14 also had their MUAC falling below the adequate standard ranges for their ages.

4.3.2 Part Two: Outcome characteristics

4.3.2.1 Comparison of mean weight at IPC discharge with mean weight recorded on IPC admission

The comparison between mean weight on admission and at discharge at IPC (*representing all IPC's sampled*) is presented on Figure 4.6. It can be observed from the figure that the mean weight at discharge was higher than the mean weight on admission at the center. This implies that the children gained weight at the IPC. However, no weight gain was recorded for children aged between 30-35 and 36-41. There was a significant difference ($p<0.01$) between the weight recorded on admission and that on discharge when the Wilcoxon Signed Ranks test was run (see appendix E). This is clearly depicted on figure 4.6 below.

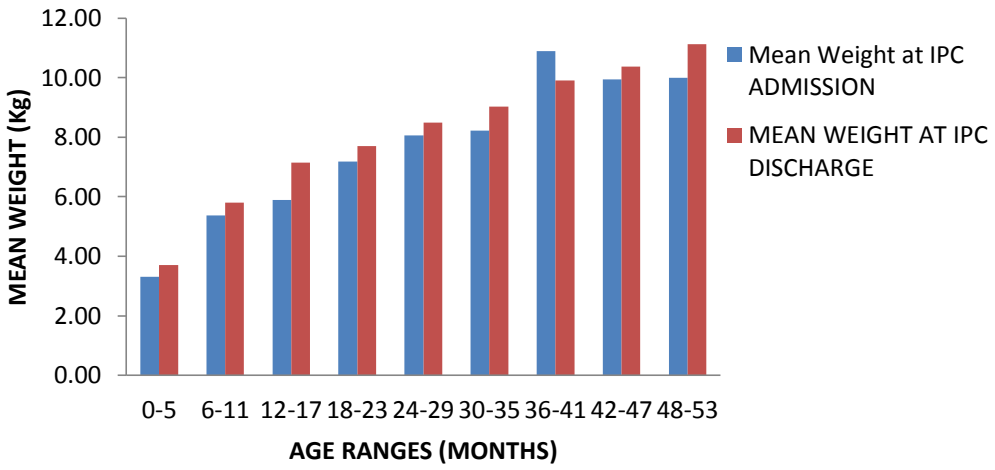


Figure 4.6- Comparison of IPC means weight on admission and discharge

Source: Author's construct, 2015

4.3.2.2 Comparison of Mean discharge weight at IPC A with mean weight recorded on IPC A admission

From Figure 4.7, it can be clearly deduced that most of the children attended to, recorded an increase in weight upon discharge with the lowest weight gain being achieved among children from 0-5 months at IPC A. No weight gain was however recorded among children between the ages of 30 -35 and 36-41. The highest weight of 13.00 kg was observed among children within the age range of 48-53. When the Wilcoxon Signed Ranks test was performed, it was identified that there was a significant difference ($p<0.01$) between weight at start of IPC A and weight recorded at discharge (see appendix E). This is shown in figure 4.7 below

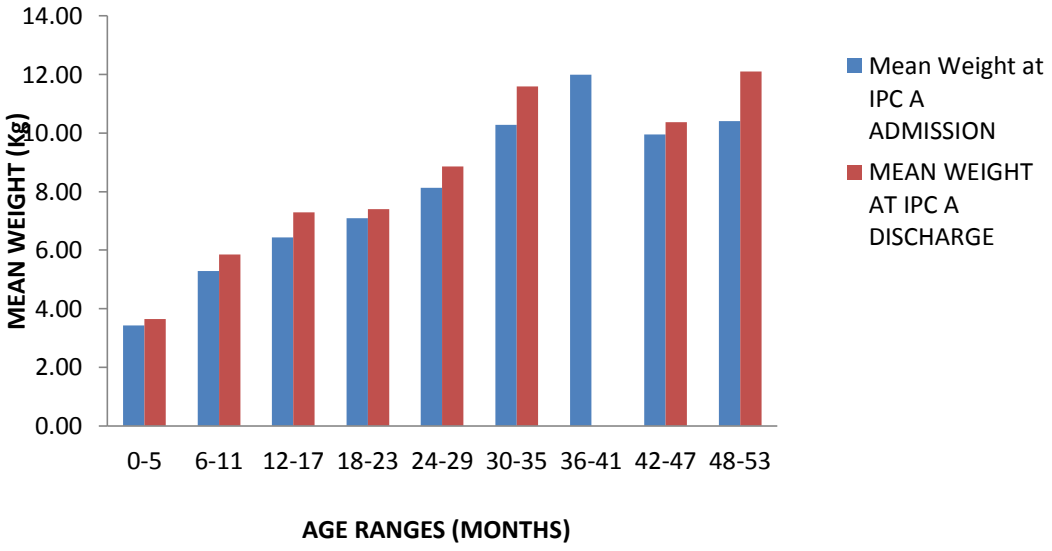


Figure 4.7- Comparison of IPC A mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.3 Comparison of mean weight at IPC B discharge with mean weight recorded at IPC B on admission

The figure 4.8 below gives a picturesque view of the weight recorded by the children on admission and discharge. From the graph it can be identified that all the weights

attained on discharge were higher than that recorded on admission. From the graph, the highest weight of 10.0 kg which was slightly similar to the weight observed during admission was achieved by the children within the 36-41 months age group. The lowest weight (3.8kg) achieved during discharge also occurred within the 0-5 months range. When a paired samples test was run, there was a significant difference ($p<0.01$) between weight at start of IPC B and weight recorded at discharge (see appendix E). This is shown in figure 4.8 below

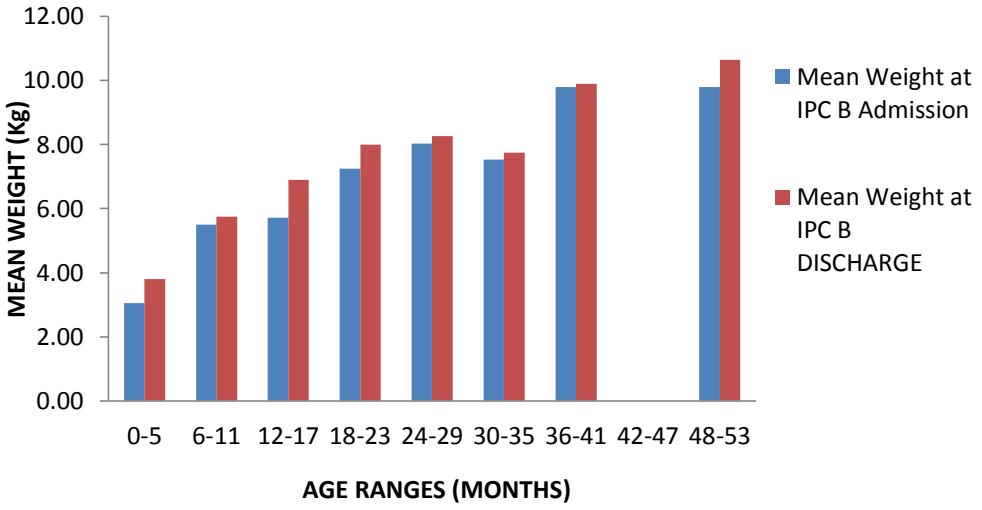


Figure 4.8 - Comparison of IPC B mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.4 Comparison of mean weight at OPC discharge with mean weight recorded at OPC on admission

From the graph (figure 4.9) shown below, it can be identified that all weights recorded on discharge at OPC (*representing all OPC's sampled*) were above those recorded during admission. The highest weight of 12 kg observed during discharge was within the 18-23 months while the lowest weight achieved of 7 kg was observed among the 6-11 months group. It can however be noted that there was a significant difference

($p<0.05$) between weight at admission and discharge weight at OPC when the Wilcoxon Signed Ranks test was performed (see appendix E).

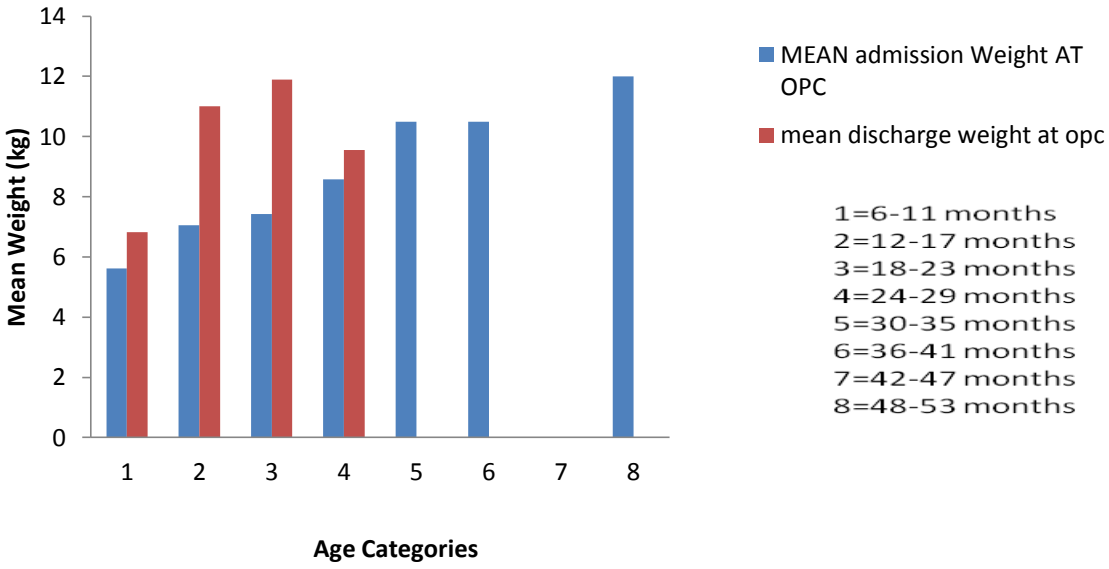


Figure 4.9-Comparison of OPC mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.5 Comparison of mean weight at OPC A discharge with mean weight recorded at OPC A on admission

Figure 4.10 gives a comparison of weight attained on discharge as against those on admission for OPC A. Though three age groups (18-23, 36-41, and 48-53 months) had no corresponding discharge weights, the rest of the weights recorded on discharge depicted an increase in their admission weights. The highest weight of 12 kg was recorded among the 24 to 29 months. The lowest increase in weight of 7kg was recorded within the 6-11 months. Wilcoxon Signed Ranks test revealed no significant difference between weight at admission and discharge weight at OPC A (see appendix E).

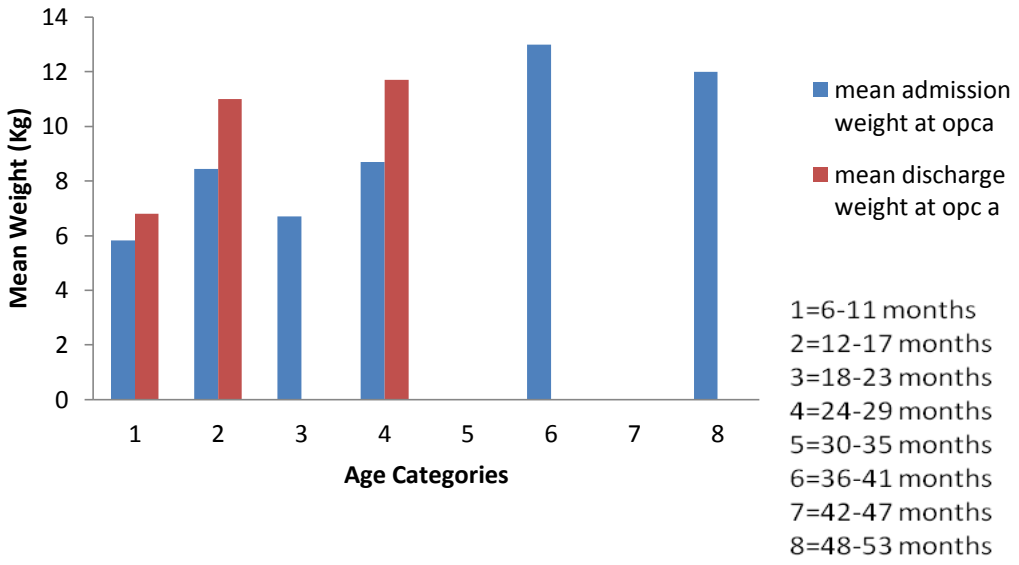


Figure 4.10 - Comparison of OPC A mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.6 Comparison of mean weight at OPC B discharge with mean weight recorded at OPC B on admission

The figure 4.11 gives a comparison of mean weights on admission and discharge for the children at OPC B. It can be clearly identified that only two groups of children notably the 18-23 and 24-29 months age ranges recorded weights during discharge.

The highest increase in weight of about 12kg was achieved among the children who were 18 – 23 months upon discharge. The lowest discharge weight of 6 kg which was lesser than the admission weight was achieved by the age range from 24 to 29 months. Test for significance at OPC B however could not be run on the weights at admission and discharge. This can be attributed to the few data points achieved as was obtained from records of children.

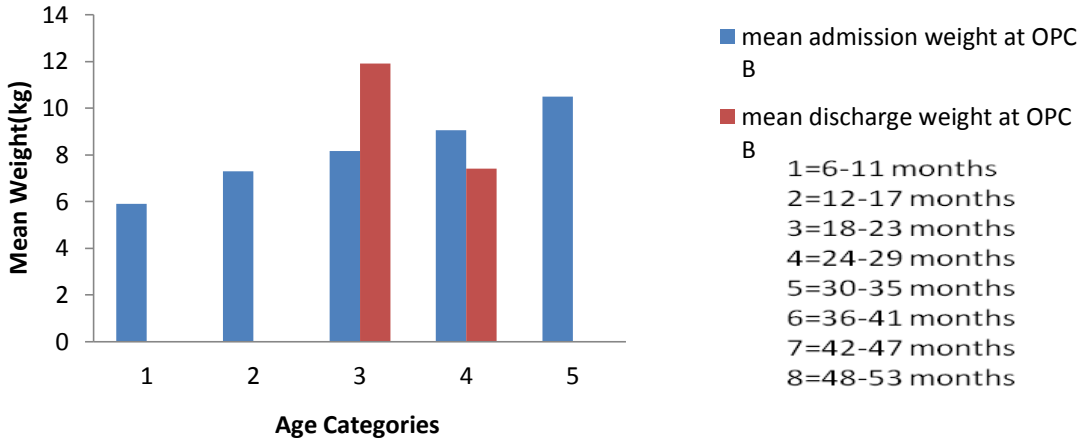


Figure 4.11-Comparison of OPC B mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.7 Comparison of mean weight at OPC C discharge with mean weight recorded at OPC C on admission

Figure 4.12 gives a presentation of the weights noted on admission and discharge at OPC C. The highest weight of 8 kg attained on admission was located within the 30-35 and 36-41 months. The lowest weight on admission of 5 kg was 6-11 months. The only weight noted on discharge was 7 kg for the 6-11 months age groups and was higher than the weight recorded on admission. Test for significance could not be run on the weights at admission and discharge at OPC C. This was possibly due to few data points as was obtained from records of children.

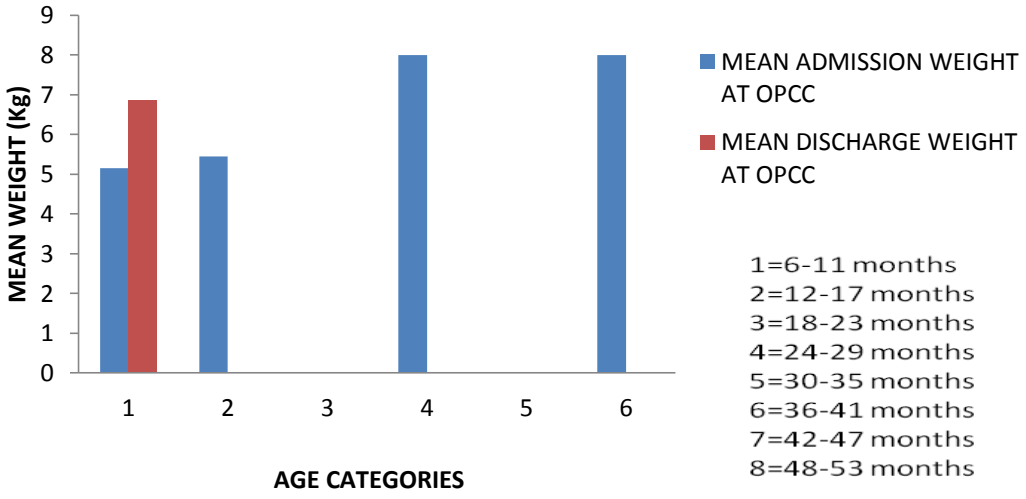


Figure 4.12 - Comparison of OPC C mean weight on admission and discharge

Source: Author's construct, 2015

4.3.2.8 MUAC gain on discharge at IPC

From the study it was realized that only one child recorded an increase in the MUAC of 1.17mm/cm at IPC and this specifically occurred at IPC A.

4.3.2.9 MUAC gain on discharge at OPC

Similar to the findings from IPC, only one child recorded a MUAC gain of 2.63mm/cm at the OPC. This specifically occurred at OPC C

4.3.2.10 Differences in height recorded on admission and discharge at IPC and OPC

It was realized from the study that the height of the children were not usually measured on discharge both at IPC and OPC. As such, no increase in height was noted among any of the children managed at the IPC or OPC.

4.3.2.11 Average weight gain at IPC

Figure 4.13 shows the average weight gain at IPC (*representing all IPC's sampled*) by age. It is evident from the figure that, the highest average weight gain of 357.1g/kg was recorded for infants aged 0-5 months. Within the same age bracket the highest average weight gain was obtained by those at IPCB. The lowest average weight gain of 10.2g/kg was obtained by children aged 36-41 months. Within the same age group, no weight gain was recorded for children at IPC A. No weight gain was recorded for children within the age groups of 30-35 and 48-53 months who were at IPC B.

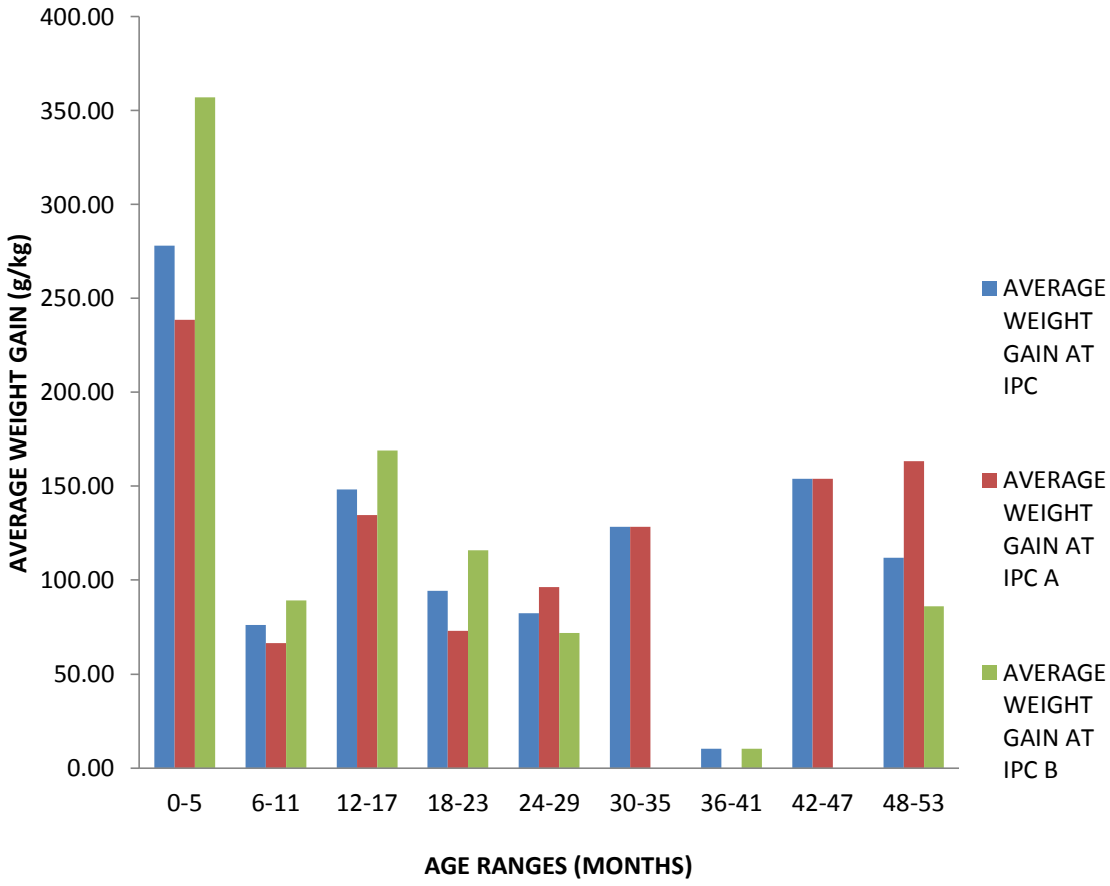


Figure 4.13 -Average weight gain at IPC with respect to ages

Source: Author's construct, 2015

4.3.2.12 Average weight gain at OPC

Figure 4.14 presents the average weight gain at the OPC (*representing all OPC's sampled*) by age. No weight gain was recorded for children aged 0-5 months and ≥30months. Furthermore, no weight gain was recorded for any child managed at OPC B. The highest weight gain of 344.8g/kg was obtained by children within the age bracket of 24-29 months at OPCA.

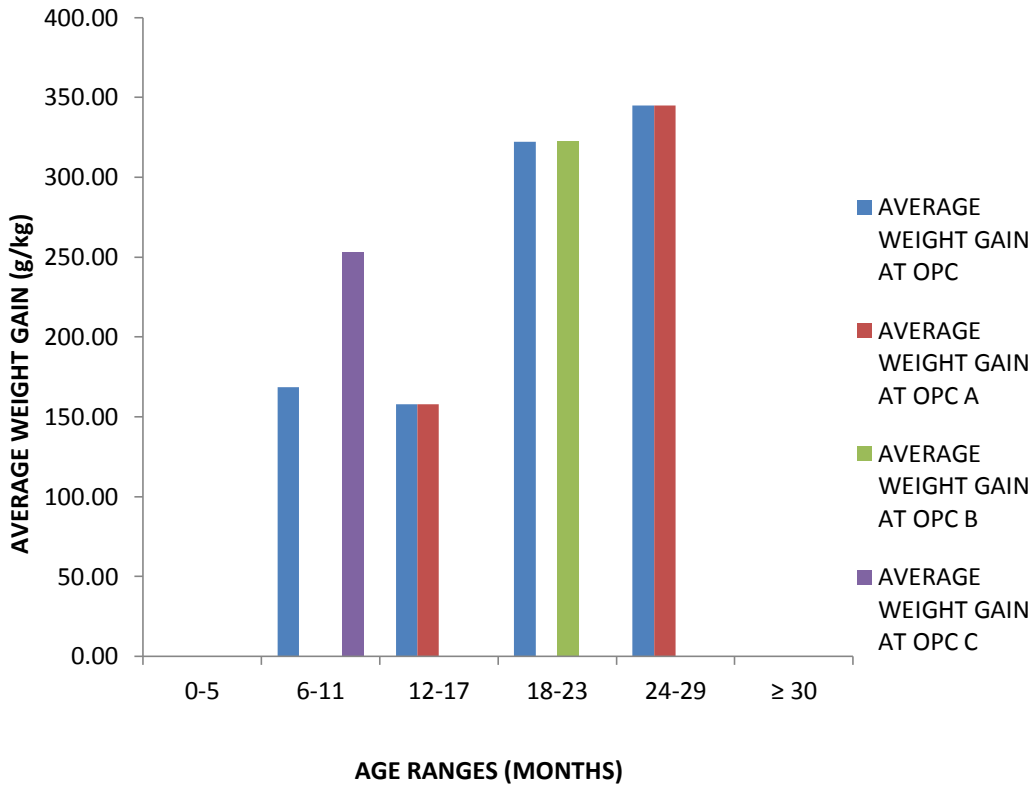


Figure 4.14 -Average weight gain with respect to ages at OPC

Source: Author's construct, 2015

4.3.2.13 Length of stay at IPC

At the IPC majority of the children (37%) spent 8-14 days in treatment. The lowest number of days spent were 1-7 days by 26% of the children whereas the longest time span recorded was 71 to 77 days by a child. This is shown on figure 4.15 below.

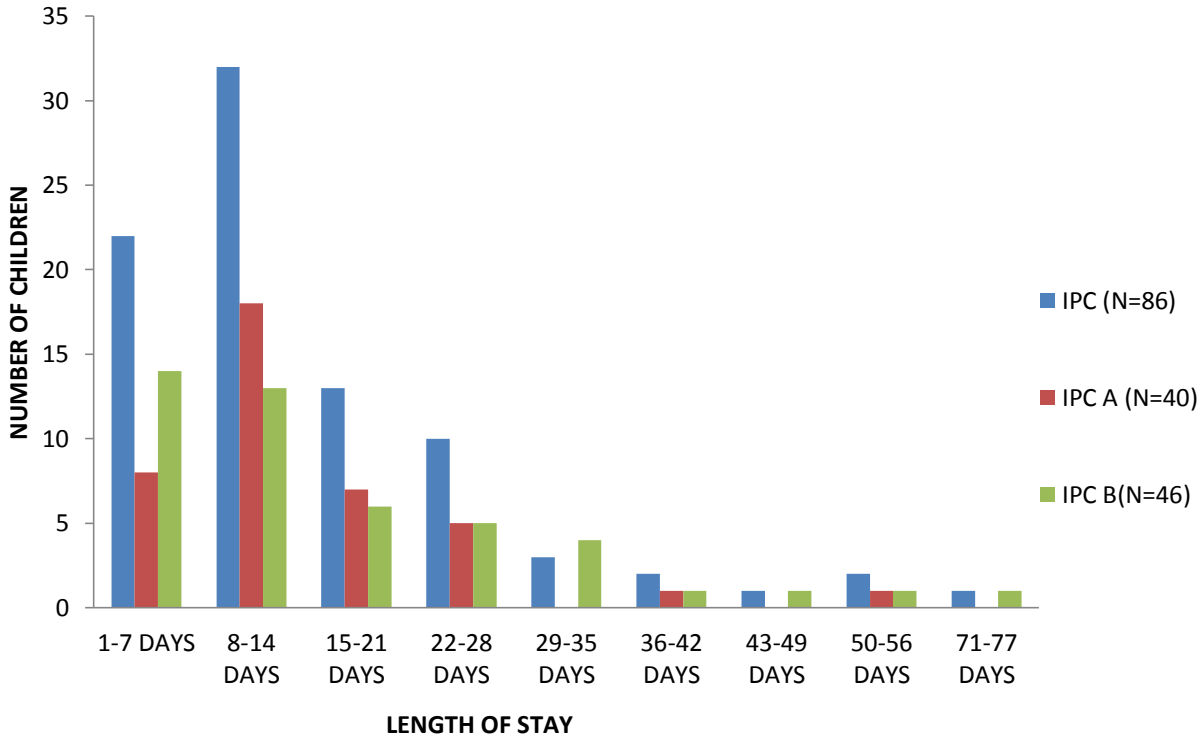


Figure 4.15 - Length of stay at IPC

Source: Author's construct, 2015

4.3.2.14 Length of stay at OPC

Figure 4.16 presents the number of weeks spent by subjects at the OPC (representing all OPC's sampled. It can be observed from the figure that majority of the children (18) spent one week at the OPC. It is also clear from the figure longest time spent at the OPC was 25 weeks and this specifically occurred at OPC A.

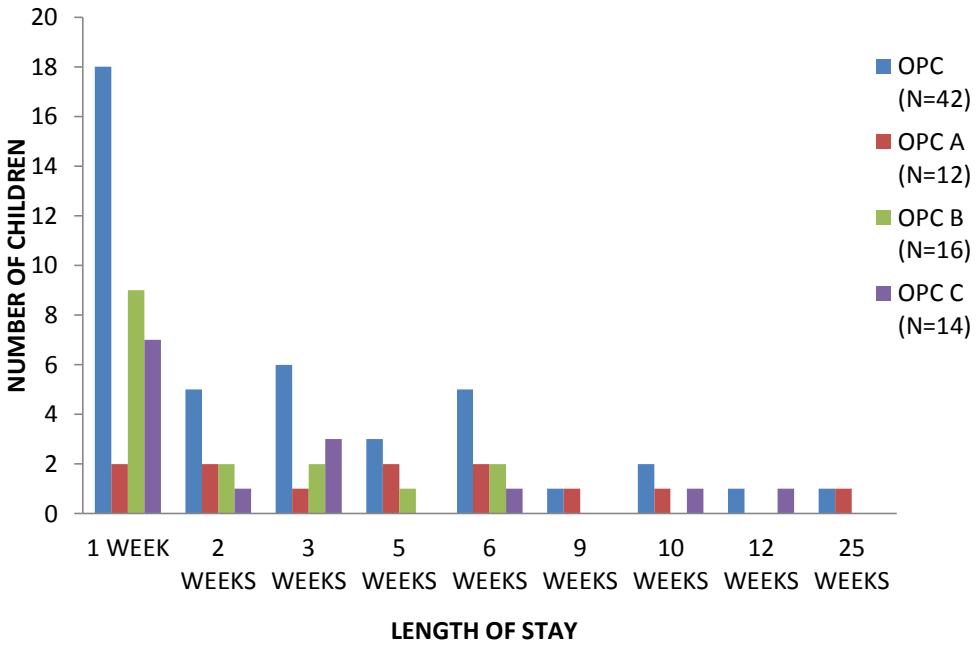


Figure 4.16 - Length of stay at OPC

Source: Author's construct, 2015

4.3.2.15 Comparison of Anthropometric indices of study population with WHO Standards

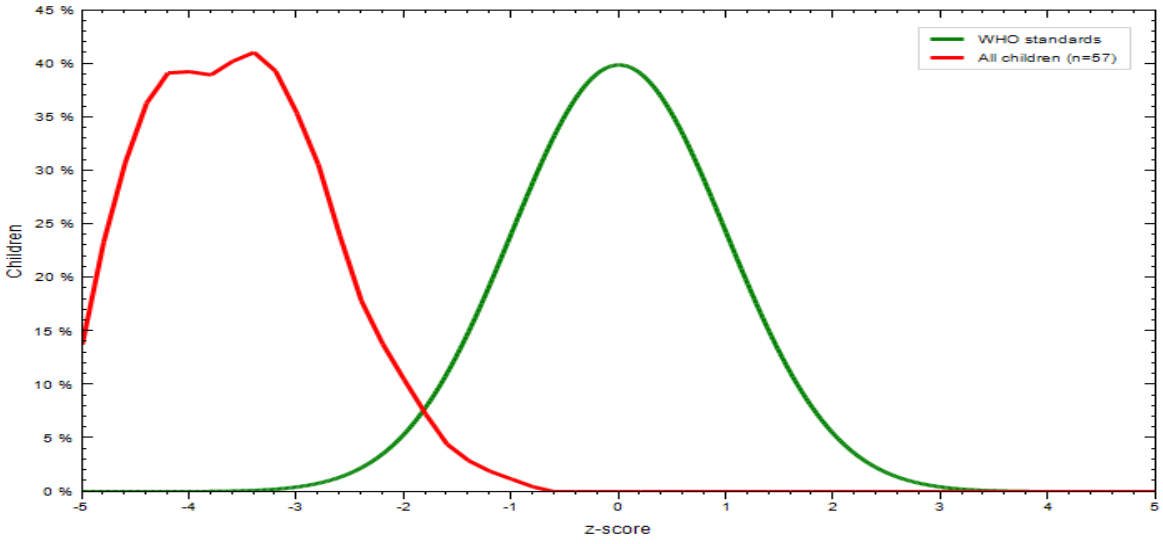
Figures 4.17-4.30 gives a comparison of the WHO standards (in green) with that of the study population (in red) on admission and on discharge for the various anthropometric indices. These graphs were generated using the WHO Anthro software for children below 5 years.

4.3.2.16 Weight-for-Height/Length z-scores at In-Patient Care (IPC)

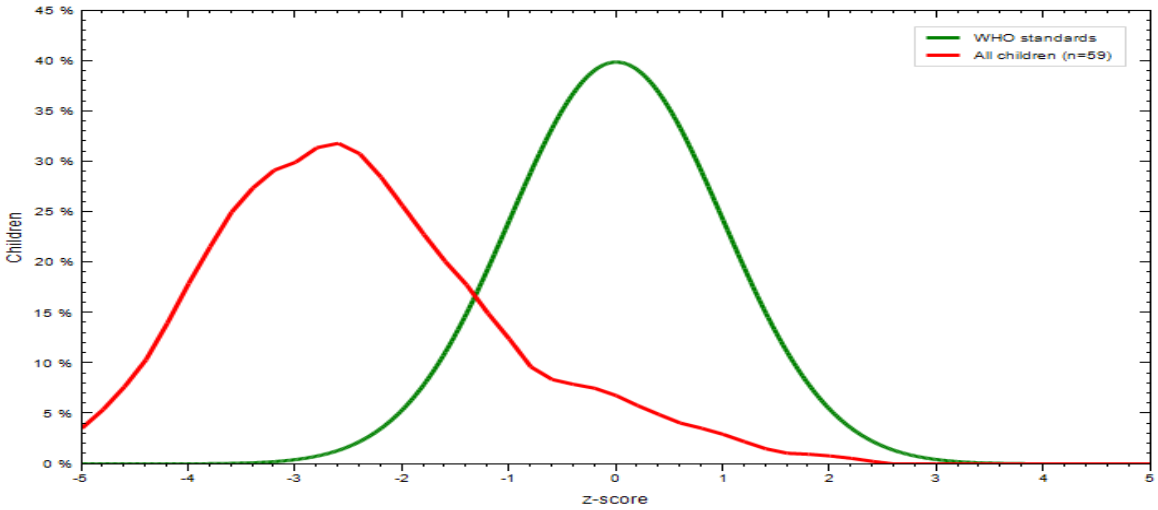
Figure 4.17A and B indicate the weight for height/length z-score for the study population at IPC on admission and discharge respectively. It should be noted that since changes in height/length were not usually found in children on admission over short periods of time, measurements of height/length taken on admission were repeated for children during discharge at all the in-patient care sites (since the staff of the sites mostly did not measure height/length on discharge) and put against their appropriately measured weights on discharge to generate the weight-for-height/length z-score graphs on discharge. From fig 4.17A, it can be observed that the weight for height curve on admission was generally skewed towards the z-score of about -3.4 s.d, indicating that, majority of children attended to at the IPC were severely acutely malnourished on admission. However, on discharge the curve was skewed towards the -2.6 s.d. direction showing that there was an improvement in the weight-for-height/length of the children managed upon discharge.

It can be observed from Fig 4.18A that the weight-for-height/length z-score deviated to the left of the population mean on admission at IPC A with a z-score of about -3.6. On discharge as depicted by Fig 4.18B, the greatest percentage of children fell within the -3.0 s.d. but a number of the children also fell within the -2 and +2 s.d. ranges showing that there was improvement in the weight for height/length z-scores of the children at IPC A after management. Figure 4.19A and B also compared the weight-for-height/length Z-score of the study population on admission and at discharge at the IPC B. It can be observed from Fig. 4.20A that the curve was greatly skewed towards the left of the population mean with the highest percentage of children (approximately 43%) recording -3s.d. This clearly depicts that majority of the children attended to were severely acutely malnourished.

However upon discharge as shown on figure 4.20B, the greatest percentage of children (approximately 34%) recorded z-scores of -2.6 s.d. with a considerable number of the children also recording z-scores within the -2 to +1s.d range. This shows that there were improvements in the weight for height/length z-scores of the children managed at IPC B upon discharge.



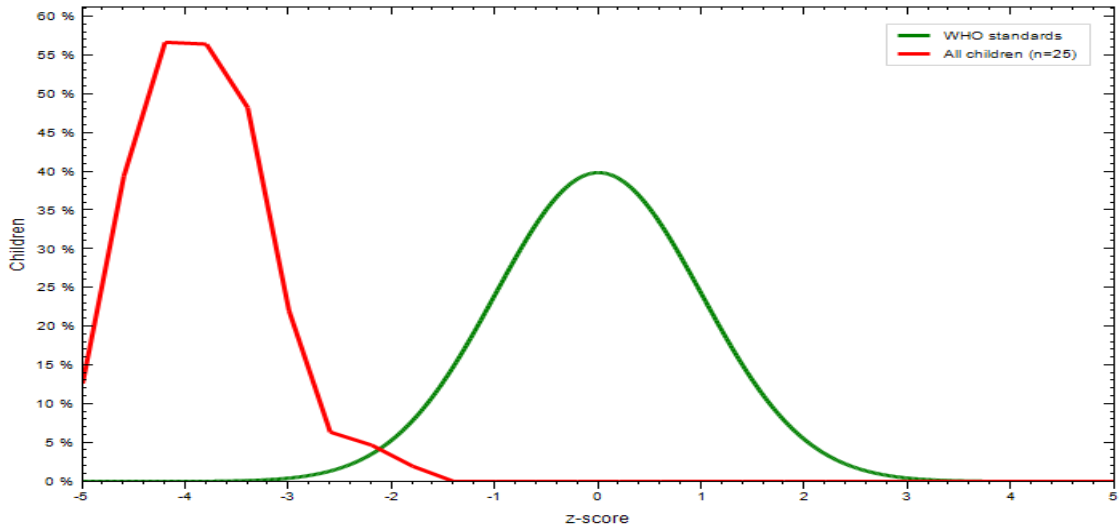
A



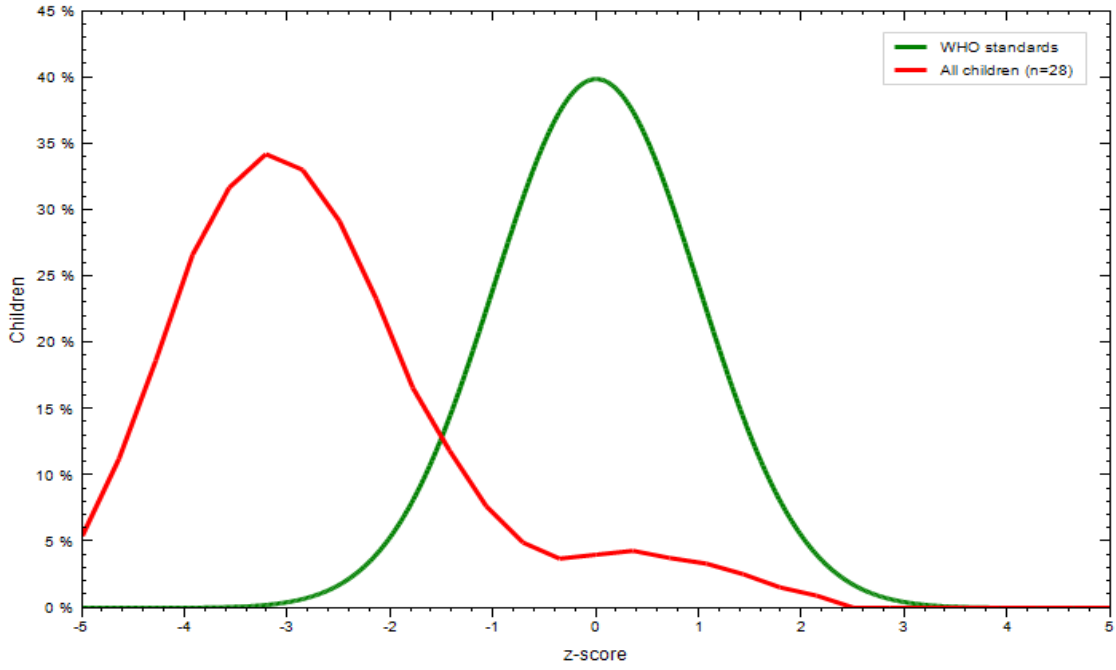
B

Figure 4.17: Relationship between WHO standards and study population for weight for height/length Z-scores at IPC for A (admission) and B (discharge)

Source: WHO Anthro, 2015



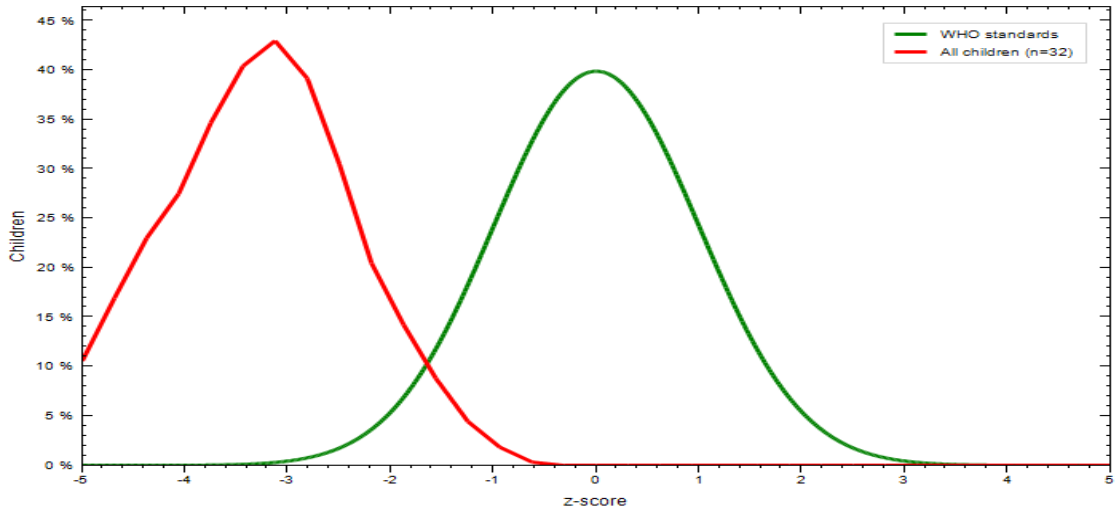
A



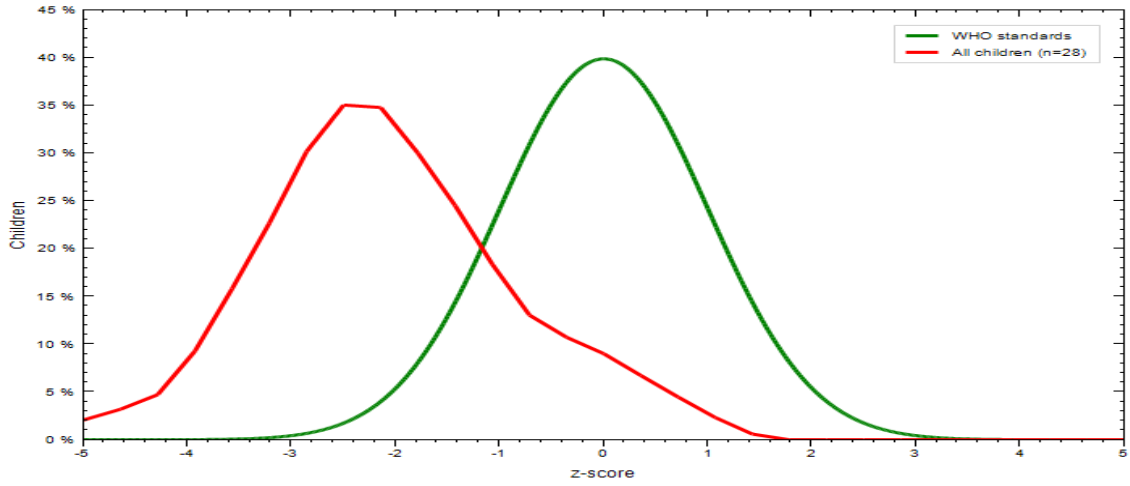
B

Fig 4.18: Relationship between WHO standards and study population for weight for height/length Z-scores at IPC A for A (admission) and B (discharge)

Source: WHO Anthro, 2015



A



B

Figure 4.19 - Relationship between WHO standards and study population for weight for height/length z-scores at IPC B for A (admission) and B (discharge)

Source: WHO Anthro, 2015

4.3.2.17 Weight-for-Height/Length z-scores at OPC

The weight for height/length z-score on admission at OPC was found to be distributed between -2.2 and -2.8 as seen in figure 4.20, implying that majority of the children were moderately acutely malnourished when admitted to the OPC. However, the weight for height/length z-score at discharge could not be drawn since exits were only seven but the software required 12 valid entries.

Figure 4.21 also compared the weight for height/length z-score on admission at OPC A with the WHO standard. From the graph it can be realized that majority of the children fell within the z-score of -3.2s.d showing that majority of the children attended to at OPC A were severely acutely malnourished. Again, the weight for height/length Z-score at discharge of OPC A could not be computed because there were only three exits as against the least number of 12 entries required for entry into the software.

It can be seen from figure 4.22 that the weight for height/length z-score on admission at OPC B deviated to the left from the population mean. Majority of the children (approximately 34%) recorded z-scores of -2s.d. showing that many of the children were moderately acutely malnourished on admission at OPC B. The weight-for-height/length z-score at discharge however could not be computed because there were only two exits as against the least number of 12 entries required for generation of the graph.

A graph on the weight-for-height/length at OPC C admission could also not be derived because there were only 11 records as against the least number of 12 entries required. Furthermore on discharge at the OPC C, the graph on the weight-for-

height/length could not also be derived because there were only 2 records on exits as against the 12 entries required.

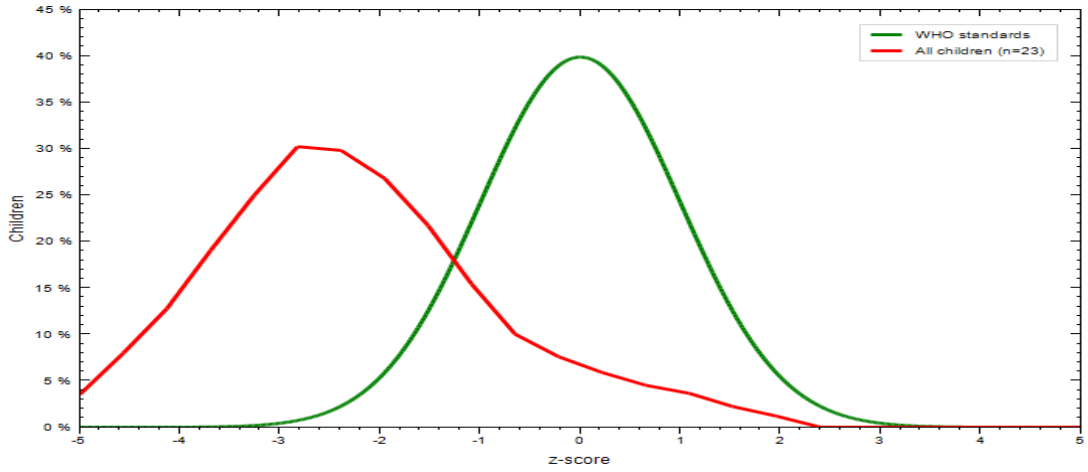


Figure 4.20: Relationship between WHO standards and study population for weight for height/length Z-scores at OPC on admission

Source: WHO Anthro, 2015

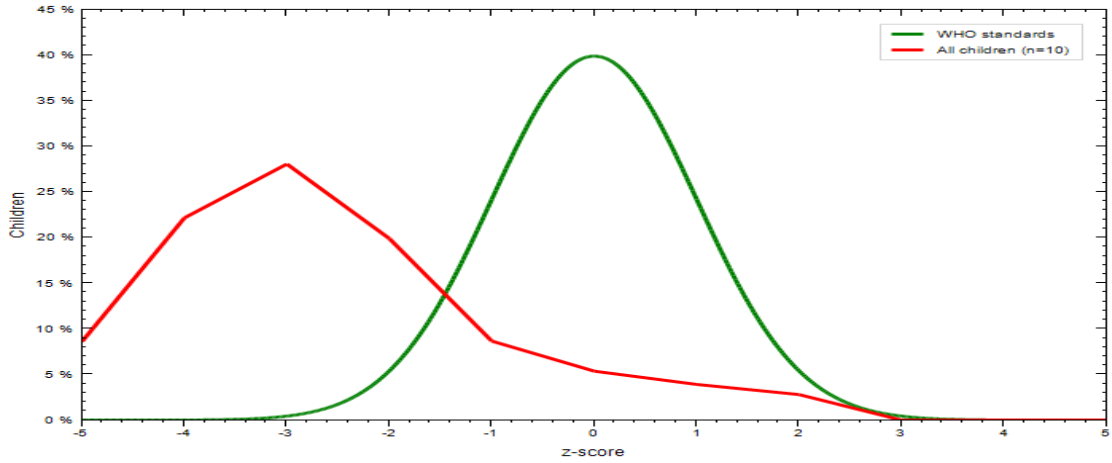


Figure 4.21: Relationship between WHO standards and study population for weight for height/length Z-scores at OPC A on admission

Source: WHO Anthro, 2015

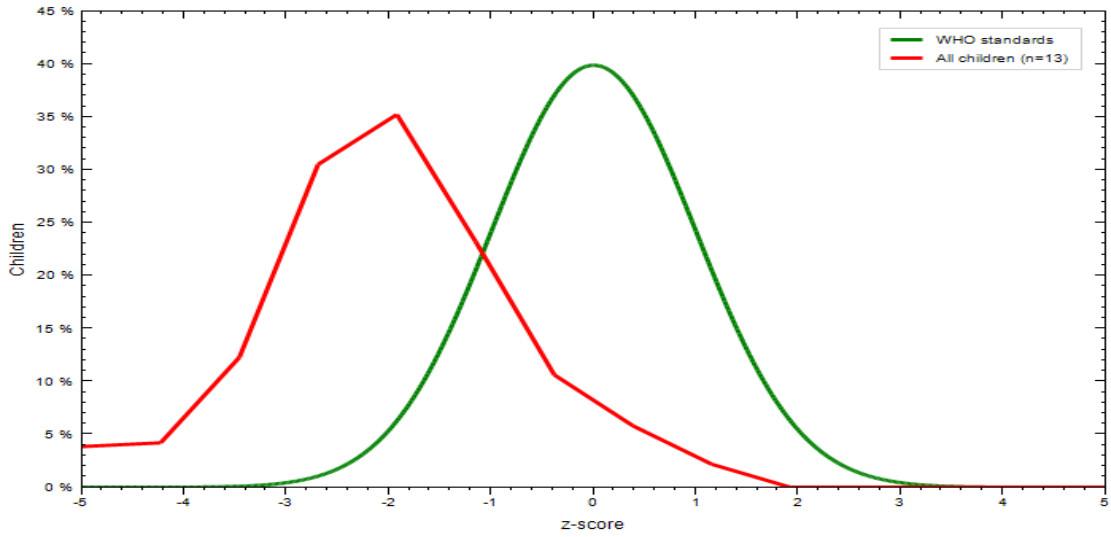


Figure 4.22: Relationship between WHO standards and study population for weight for height/length Z-scores at OPC B on admission

Source: WHO Anthro, 2015

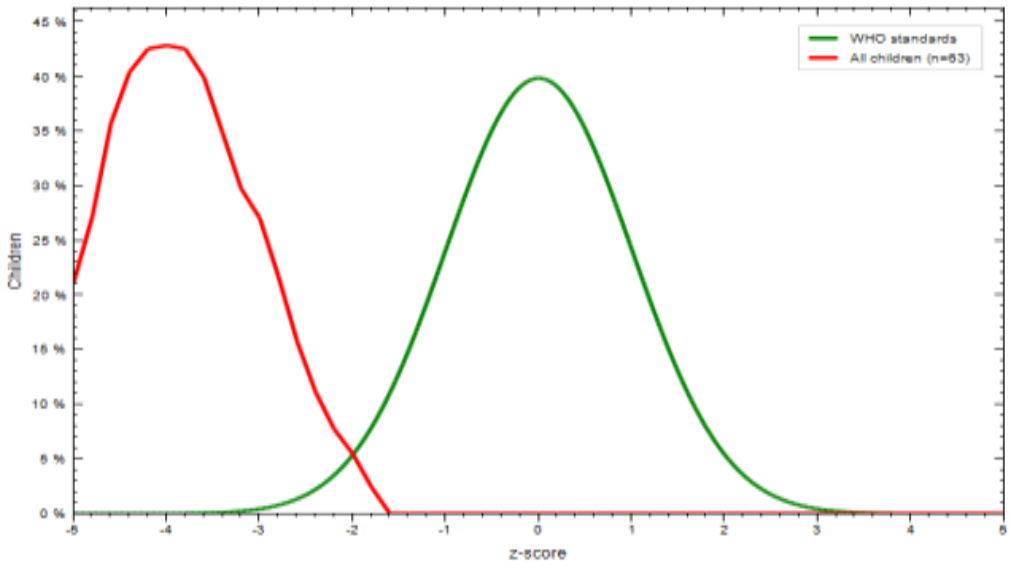
4.3.2.18 Weight-for-Age z-scores at IPC

Figures 4.23 -4.26 give the comparison of the WHO standards (in green) with that of the study population (in red) on admission and at discharge for weight-for-age indices at the IPC sites.

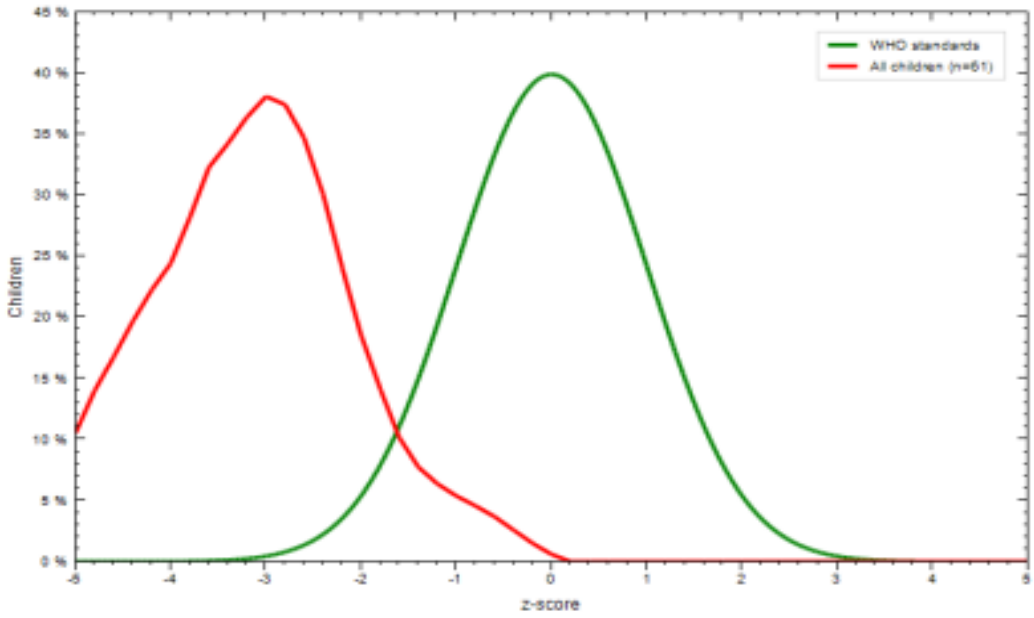
It can be observed from figure 4.23A that on admission at IPC, majority of the children (approximately 44%) had weight-for-age z-score of -3.8s.d. The curve was generally skewed towards the left of the population mean giving a clear indication that most of the children were severely underweight when admitted at IPC. Figure 4.23B however shows that on discharge, the greatest percentage of severely underweight children reduced to about 38% at a reduced modal z-score from -3.8 to -3s.d. Generally many children fell within the -3 to median z-score ranges. This shows that, the children recorded marked improvement in their weights in comparison to their ages upon discharge from IPC.

From figure 4.24A, it was identified that majority of the children (approximately 40%) recorded a weight for age z-score of -3.8s.d on admission with the curve generally deviating toward the left of the population mean. This depicted that majority of the children were severely underweight upon admission at IPC A. However, upon discharge as shown on Figure 4.24B, there was a reduction from 40% to 30% in the percentage of children who were severely underweight shown at the -3.4 z-score mark. There was however a general spread in a number of children attaining z-scores from -3 to the median. This shows that majority of the children gained weights upon discharge from IPC A.

As noted at IPC A, the weight for age z-score curve for IPC B as shown on Figure 4.25 was generally skewed towards the left of the population mean with the greatest percentage of children (approximately 45%) recording weight for age z-scores of about -3.6 depicting that majority of the children were severely underweight upon admission. On discharge, about 43% of the children recorded a z-score of -3 sd with about 8% of the children achieving less than -1 weight for age z-scores. Comparing the discharge and admission z-scores, it could be inferred that there was a slight improvement in the weight of the children attended to at IPC B with respect to their ages.



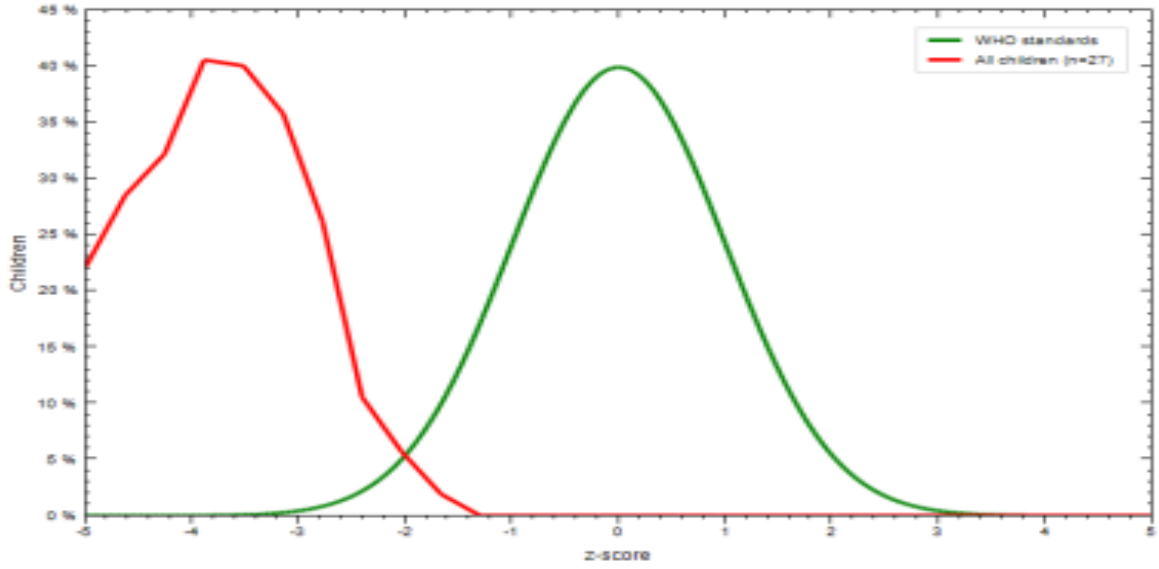
A



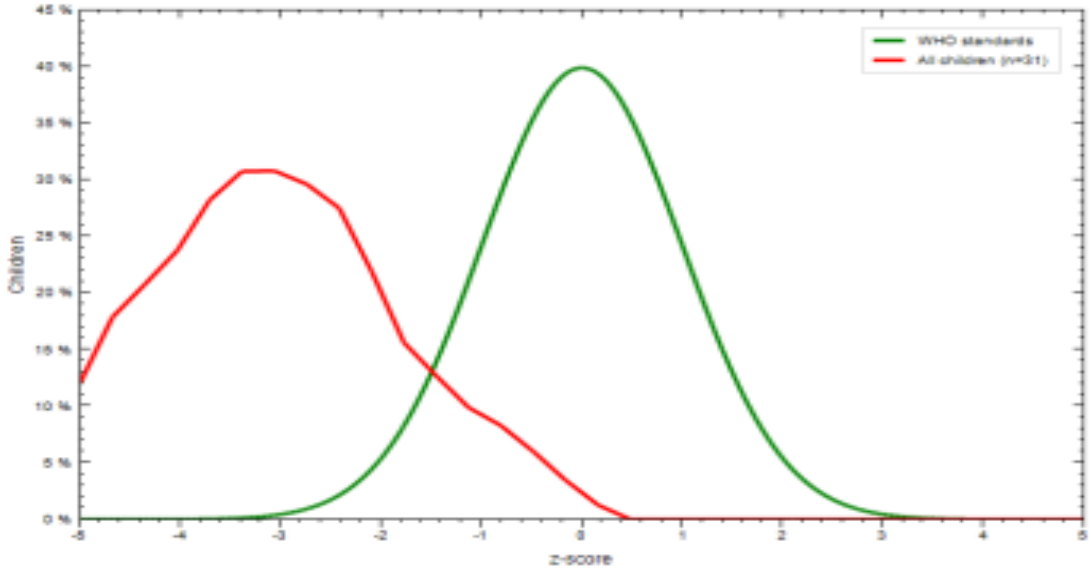
B

Figure 4.23: Relationship between WHO standards and study population for weight for age Z-scores at IPC for A (admission) and B (discharge)

Source: WHO Anthro, 2015



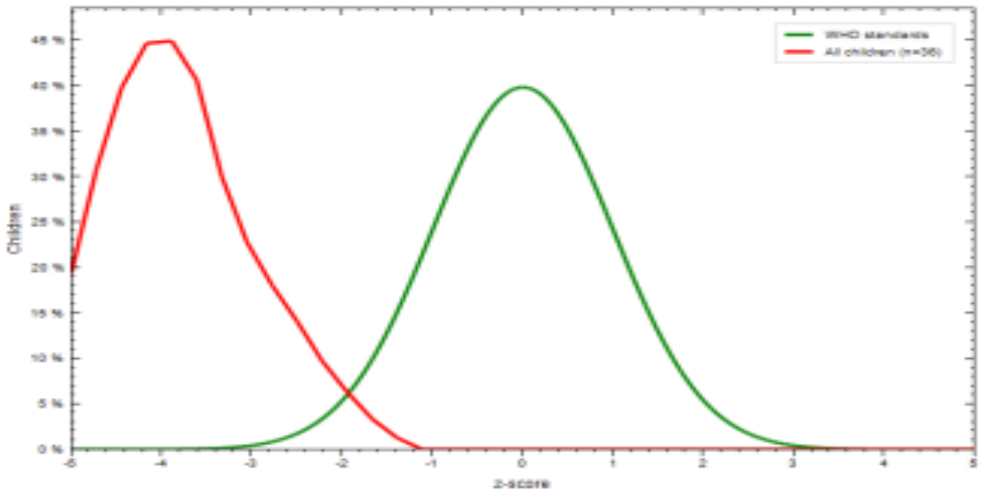
A



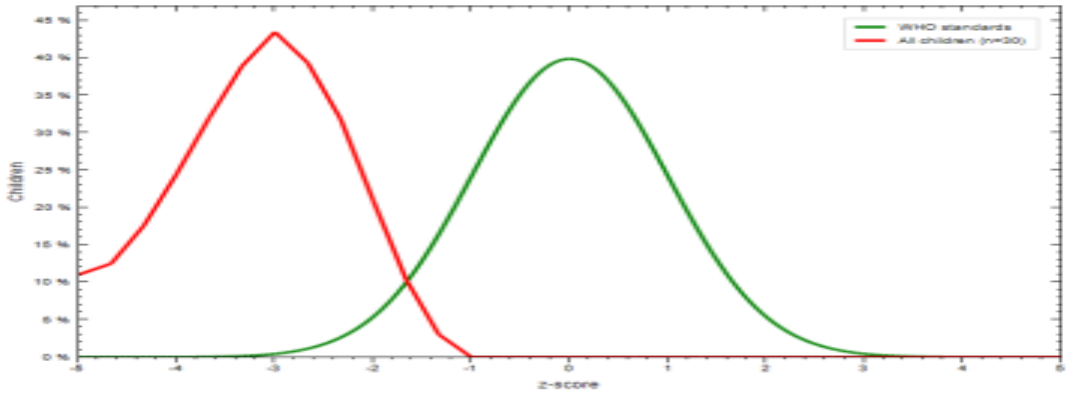
B

Figure 4.24: Relationship between WHO standards and study population for weight for age Z-scores at IPC A for A (admission) and B (discharge)

Source: WHO Anthro, 2015



A



B

Figure 4.25: Relationship between WHO standards and study population for weight for age Z-scores at IPC B for A (admission) and B (discharge)

Source: WHO Anthro, 2015

4.3.2.19 Weight-for-Age z-scores at OPC

Figure 4.26 presents the weight-for-age z-score at OPC on admission. A negative deviation from the WHO standards can be seen from the figure, with a peak z-score of about -3.2, implying that the children were severely underweight when they were admitted at the OPC. The weight-for-age z-score at discharge could not be computed as there were only 7 exits as against the required 12 entries.

The weight-for-age z-scores at OPC A and OPC B as can be seen in figures 4.27 and 4.28 respectively were below the WHO standards indicating that the children were severely underweight when they were admitted. Again, the weight-for-age z-scores at discharge for both OPC A and OPC B could not be computed as the number of exits could not meet the required number for entry into the WHO Anthro software.

It is worth noting that, the weight-for-age z-score graphs for OPC C admission and discharge could not be generated due to insufficient records on weight of children managed at the site. On admission, there were only 11 records on weight available whereas on discharge only 2 records were available. These records fell short of the required number of 12 entries required for each graph generation by the WHO Anthro software.

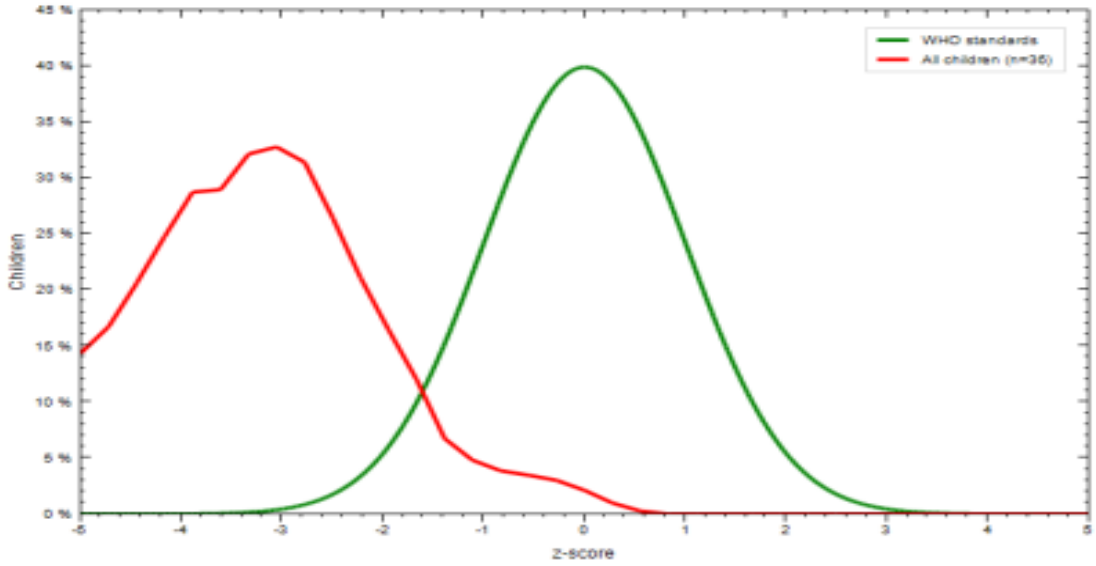


Figure 4.26: Relationship between WHO standards and study population for weight for age Z-scores at OPC on admission

Source: WHO Anthro, 2015

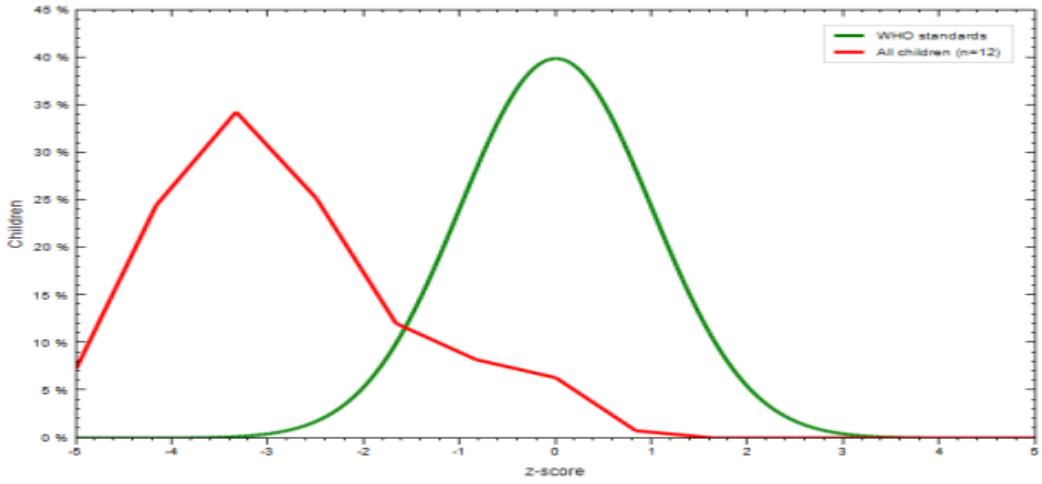


Figure 4.27: Relationship between WHO standards and study population for weight for age z-scores at OPC A on admission

Source: WHO Anthro, 2015

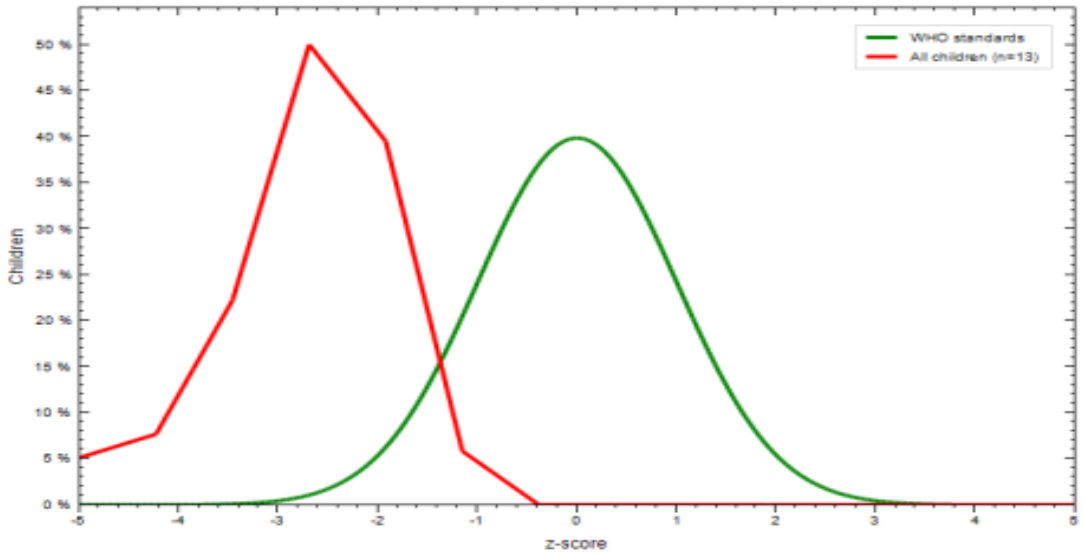


Figure 4.28: Relationship between WHO standards and study population for weight for age Z-scores at OPC B on admission

Source: WHO Anthro, 2015

4.3.2.20 Height/ Length-for-Age z-scores at IPC

Figures 4.29 -4.31 give the comparison of the WHO standards (in green) with that of the study population (in red) on admission for height/length-for-age indices at the In-Patient Care Site (IPC). It is imperative to note that since height/length measurement was not usually done on discharge at the various IPC, the height/length-for-age z-score graph on discharges could not be generated.

Figures 4.29, 4.30 and 4.31 compared the height/length-for-age z-scores on admission at IPC, IPC A and IPC B respectively with WHO standards. It can be observed from the figures that all the z-score graphs deviated to the left of the reference population indicating that all the children attended to were stunted on admission.

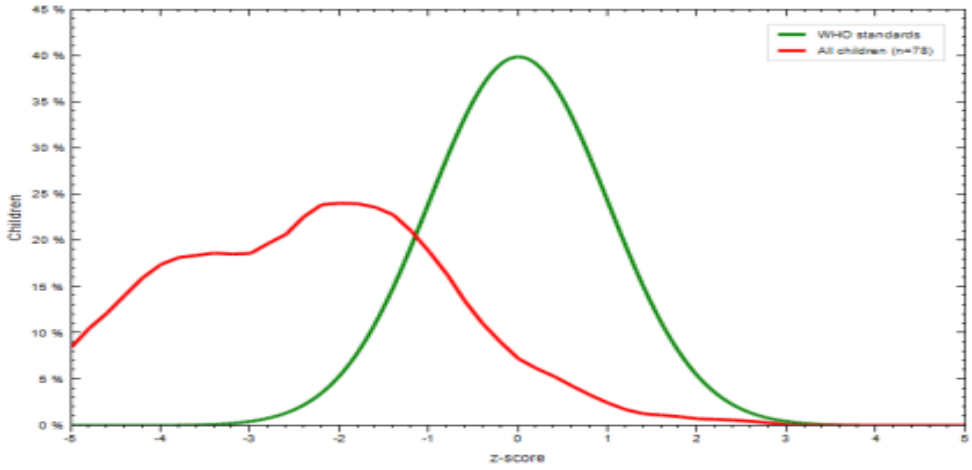


Figure 4.29: Relationship between WHO standards and study population for height/length-for-age Z-scores at IPC on admission

Source: WHO Anthro, 2015

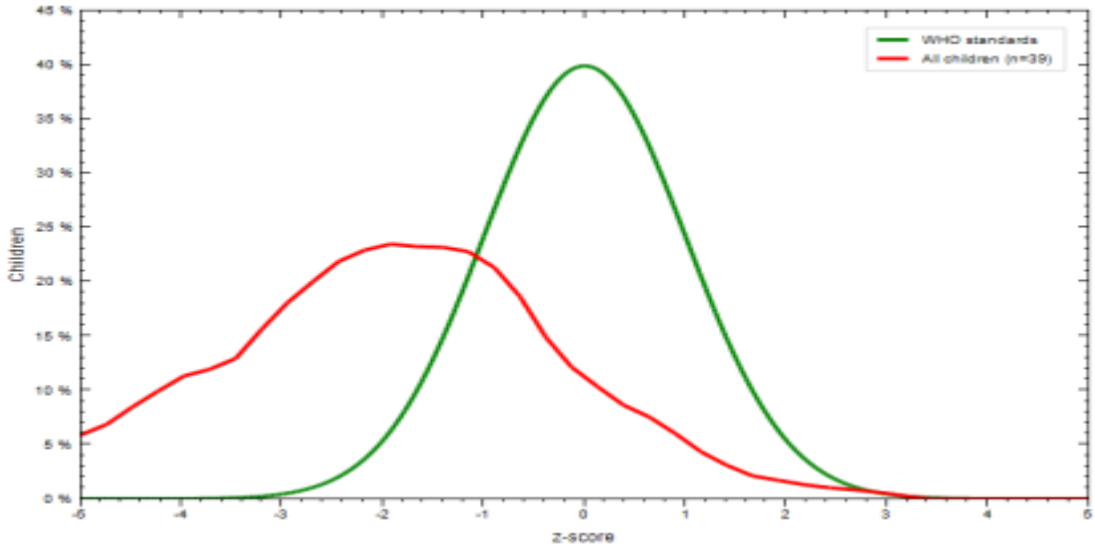


Figure. 4.30: Relationship between WHO standards and study population for height/length-for- age Z-scores at IPC A on admission

Source: WHO Anthro, 2015

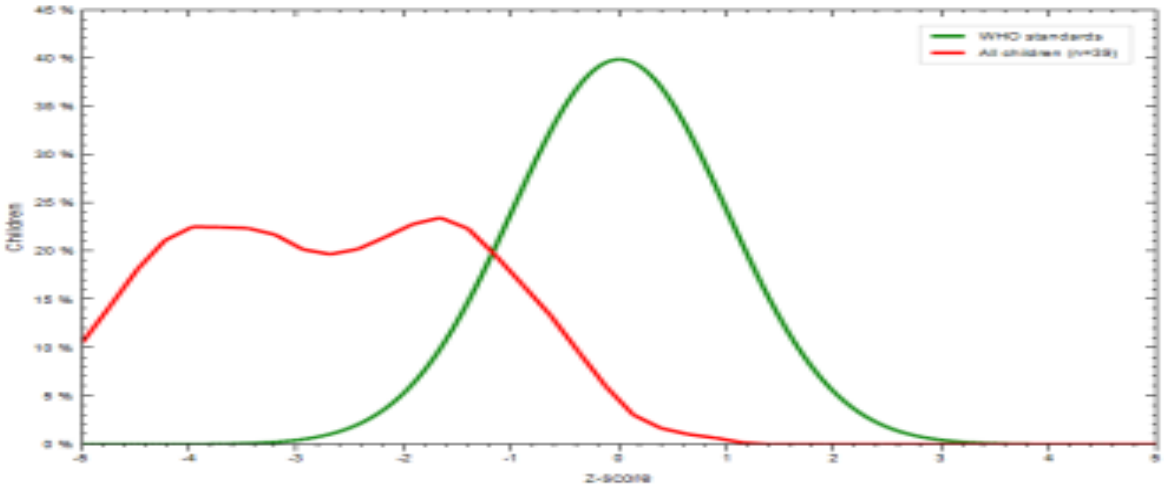


Figure 4.31: Relationship between WHO standards and study population for height/length-for-age Z-scores at IPC B on admission

Source: WHO Anthro, 2015

4.3.2.21 Height/ Length-for-Age z-scores at OPC

A height/length-for-age z-score of about -2.4, as shown in fig 4.32 was recorded for most of the children admitted at the OPC. This was below the WHO standards, indicating that the children were moderately stunted when they were admitted at the OPC. The z-scores at discharge could not be generated because there were only seven entries. At OPC A and OPC B, the height/ length for age z-scores were found to be lower than the WHO standards with about 37% of the children being moderately stunted at OPC A while the majority of children (about 25%) were moderately stunted at OPC B; this is shown in fig 4.33 and 4.34. Again, the z-scores at discharge of both OPC A and OPC B could not be generated because the number of exits did not meet the required number of entries. It is important to note that height/length for age z-score graphs could not be generated for OPC C admission and discharge. This was because there were no records available since height or length was not measured for any child at this particular treatment site.

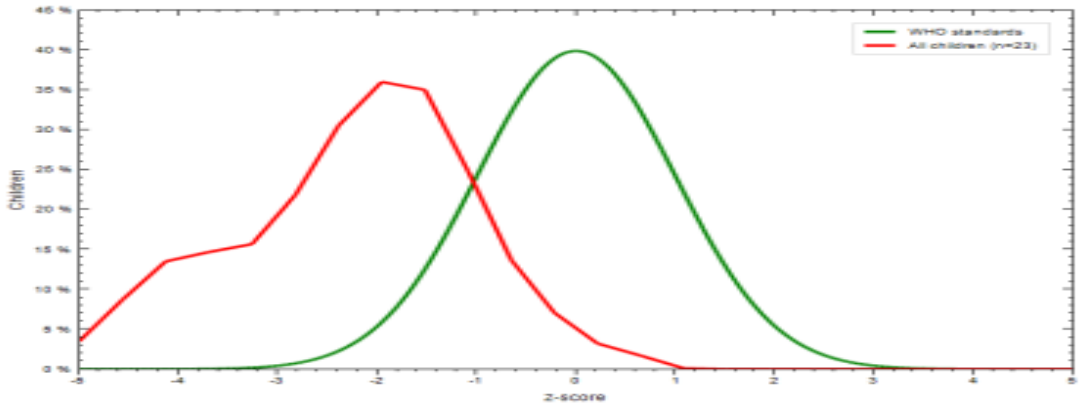


Figure 4.32: Relationship between WHO standards and study population for height/length for age Z-scores at OPC on admission

Source: WHO Anthro, 2015

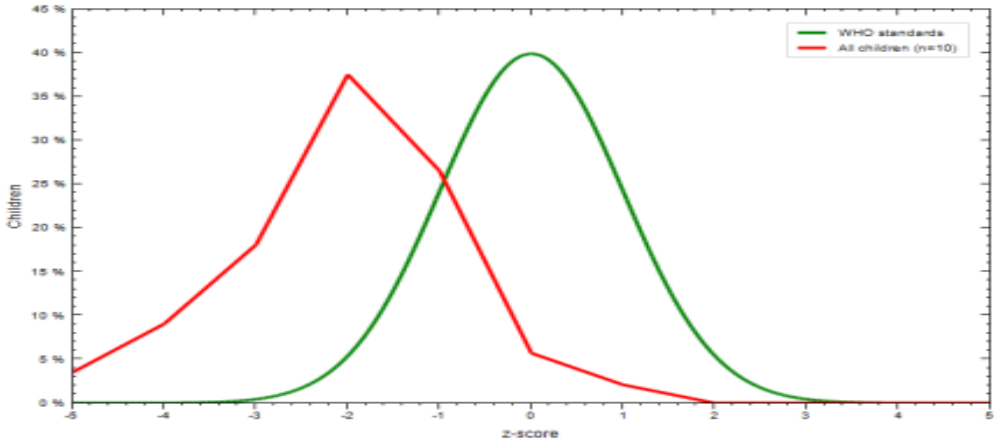


Figure. 4.33: Relationship between WHO standards and study population for height/length for age Z-scores at OPC A on admission

Source: WHO Anthro, 2015

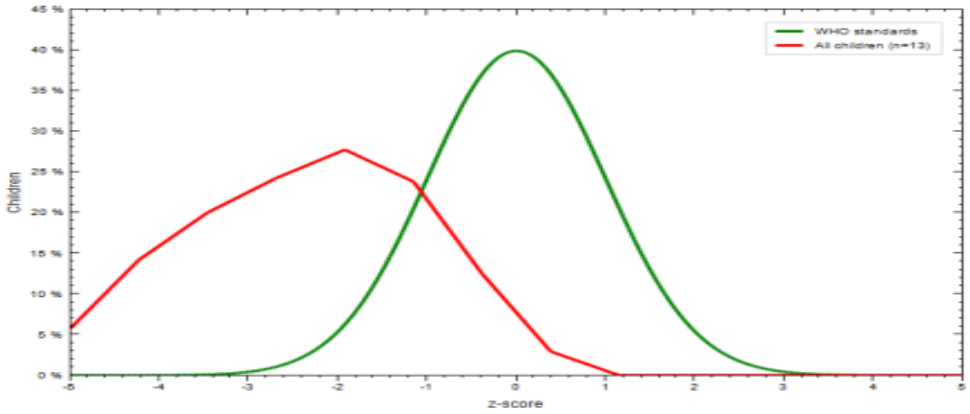


Figure. 4.34: Relationship between WHO standards and study population for height/length for age Z-scores at OPC B on admission

Source: WHO Anthro, 2015

4.3.2.22 Assessment of mortality, defaulter, recovery and non response rates at IPC

On table 4.3, the outcome indicators (mortality, defaulter, recovery and non-response rates) for each of the IPC's are compared to the Global Sphere standards. The results provided are however to be interpreted with caution due to the study's relatively low sample size. Generally, the recovery (82.6%) and default (5.8%) rates were within the acceptable ranges of the GSS (I). However, the mortality rate (11.6%) was above the acceptable range, indicating that more deaths occurred at the IPC than is accepted.

At IPC A, all the outcome indicators, precisely recovery rate (90%), mortality rate (7.5%) and default rate (2.5%) were within the acceptable ranges. Again, the recovery (76.1%) and default (8.7%) rates at the IPC B were within the acceptable ranges. However, the mortality rate (15.2%) was high. This implies that mortality rate was higher at the IPC B than at IPC A.

Table 4.3: Outcome Indicators at IPC

Outcome Indicators	N (%)	Acceptable Range for GSS	Interpretation
IPC (N=86)			
Recovery	71 (82.6%)	>75%	Within Range
Mortality	10 (11.6%)	<10%	High
Defaulter	5 (5.8%)	<15%	Within Range
Non response	0	Not applicable	Not applicable
IPC A (N=40)			
Recovery	36 (90.0%)	>75%	Within Range
Mortality	3 (7.5%)	<10%	Within Range
Defaulter	1 (2.5%)	<15%	Within Range
Non response	0	Not applicable	Not applicable
IPC B (N=46)			
Recovery	35 (76.1%)	>75%	Within Range
Mortality	7 (15.2%)	<10%	High
Defaulter	4 (8.7%)	<15%	Within Range
Non response	0	Not applicable	Not applicable

Data represents the outcome indicators at the IPCs. The outcomes are compared to acceptable ranges of the Global Sphere Standards (GSS (I)). IPC means All In-Patient Care sites sampled; IPC A represents In-Patient Care Site at KATH; IPC B represents In-Patient Care Site at APH

**Data in comparison to GSS(I) to be interpreted with caution due to relatively low sample size.*

Source: Author's calculation, 2015

4.3.2.23 Assessment of mortality, defaulter, recovery and non-response rates at OPC

Table 4.4 presents the outcome indicators (rates of mortality, defaulter, recovery and non-response) at the OPC compared to the acceptable ranges of the Global Sphere standards. It is however advised that the results indicated should be interpreted with caution due to the study's relatively low sample size. From the table, it can be seen that apart from the mortality rate (0%) which was low, the other indicators were either

higher or lower than the acceptable ranges. Specifically, the recovery rate of 21.4% was low and the defaulter rate of 71.4% was high.

OPC A, OPC B and OPC C had similar outcomes. Recovery rates noted, 25%, 25% and 14.3% respectively for OPC A, OPC B and OPC C were lower than the acceptable range of >75%. Again, the defaulter rates of 58.3%, 75% and 78.6% for OPC A, OPC B and OPC C respectively were found to be high, compared to the acceptable range of <15%. Similarly, the death rates at all the centers were very low as no deaths were recorded there.

Table 4.4 Outcome Indicators at OPC

Outcome Indicators	N (%)	Acceptable Range for GSS(I)	Interpretation
OPC (N=42)			
Recovery	9 (21.4%)	>75%	Not Within Range (Low)
Mortality	0	<10%	within Range
Defaulter	30 (71.4%)	<15%	Not Within Range (High)
			Not Applicable
Non response	3 (7.2%)	Not Applicable	
OPC A (N=12)			
Recovery	3(25.0%)	>75%	Not Within Range (Low)
Mortality	0	<10%	Within Range
Defaulter	7 (58.3%)	<15%	Not Within Range (High)
			Not applicable
Non response	2 (16.7%)	Not applicable	
OPC B (N=16)			
Recovery	4 (25.0%)	>75%	Not Within Range (Low)
Mortality	0	<10%	Within Range
Defaulter	12 (75.0%)	<15%	Not Within Range (High)
			Not applicable
Non response	0	Not applicable	
OPC C (N=14)			
Recovery	2(14.3%)	>75%	Not Within Range (Low)
Mortality	0	<10%	within Range
Defaulter	11 (78.6%)	<15%	Not Within Range (High)
			Not applicable
Non response	1(7.1%)	Not applicable	

Data represents the outcome indicators at the OPC's. The outcomes are compared to acceptable ranges of the Global Sphere Standards (GSS (I)). OPC means All Out-Patient Care sites sampled; OPC A represents Out-Patient Care Site at KATH; OPC B means Out-Patient Care Site at APH and OPC C means Out-Patient Care Site at Agogo CMAM center.

**Data in comparison to GSS(I) to be interpreted with caution due to relatively low sample size.*

Source: Author's calculations, 2015

CHAPTER FIVE

DISCUSSION OF RESULTS

This is the penultimate chapter that presents an extensive discussion on the results of the study under various subheads.

5.1 Demographics

From the data gathered, majority of the children (61%) were males whereas minority (39%) were females. This percentage is realistic of what pertains in the country as majority of those who are malnourished (9.1%) are males while 6.1% were females (GSS, 2011). This finding was however in variance to what occurred in Malawi (Chiwaula, 2011) where the majority of children (51%) were girls with the others being boys.

5.2 Trend analysis

From the study it was identified that the highest number of attendance recorded in the facilities was in November with the least being in April. From the findings, the highest attendance occurring in November could be attributed to the fact that this is the period of later rains with alternating humid and dry weather conditions which brings about a wide array of infectious conditions which could easily predispose children to malnutrition. In addition to what has been stated above, foods are relatively expensive during this particular period as farmers or food producers tend to hoard their produce for sale during the Christmas season. This high cost of purchase make food unavailable or inaccessible to many homes which thrive on meager resources. The lack of food in such homes would likely predispose the younger ones to malnutrition. The least occurrence in April would probably be due to the fact that

this is the normal rainy season during which period foods would likely be highly available and cheaper leading to greater access to foods thereby reducing the incidence of malnutrition. In comparison to a study in Malawi, contrasting findings were revealed as the months of January and February which are located in their warm-wet season comparable to the rainy season in Ghana recorded the highest occurrence whereas the least attendance occurred in July, August and September which is considered as partly a cool dry winter and hot dry season (Chiwaula, 2011). The reason for the disparities could be that unlike Ghana where later rains rather cause problems, Malawian children may be at the highest risk for infections during the rainy season.

5.3 Discussion of results from checklists

From the study it could be realized that most of the staff generally portrayed very good knowledge levels in the management of acute malnutrition. In fact the score attained at the various health centres was directly proportional to the level of recovery attained at the facilities. From the findings, it was realized that, KATH staff recorded the highest rate of recovery with 90% recovery rate at IPC A. APH staff who attained a 76.1% recovery rate at their IPC came second. It therefore comes as no surprise as recovery rates were as low as 14.3% at the OPC C where none of the staff filled out the checklist. This supports the assertion that knowledge levels of the staff would impact either positively or negatively on the outcome of management. This fact is supported by Allen *et al*, (2007), English *et al*, (2004) and Nolan *et al*, (2001).

5.4 Comparison of weights at various treatment sites

It is evident from the study that the mean weights for the children at the various IPCs were below the standard mean weight, indicating that all the children were underweight when they were admitted at the IPC's. This finding indicates that all children were malnourished and the staff of the various facilities got the admission criteria right (WHO, 2013 and WHO, 2009). It was realized from the study that higher weight gain levels were attained by KATH followed by APH and then the various OPC's.

The high weight gain levels achieved at KATH could probably be due to the quality forms of feeds and services that are offered to the malnourished children. This is because the right forms of RUTF in the right measures are offered for the children while proper medical care is also offered to the children.

This assertion of the offering of the standard based peanut which results in high weight gain were supported in a number of studies organised by Irena *et al*, (2013), Sadler *et al*, (2007), Sandige *et al*, (2004) and Bahwere *et al*, (2003). Shewade *et al*, (2013) however gave a contrasting view when a study conducted revealed that the use of locally available resources in the production of therapeutic feeds was highly sustainable and led to higher weight gains. Another reason that could be cited as a contributory factor to the high weight gain is the fact that KATH is a major referral centre for the northern and middle part of Ghana with a number of specialists who help provide quality care to clients. Due to the specialist care that would be provided, children with complications would be easily stabilized and can feed properly leading to increase in their weight.

5.5 MUAC and Height gain

From the study it was identified that records on the increase in MUAC and height levels could not be statistically ascertained due to few data points available. Clearly many differences were not expected in terms of height and length recorded on admission and discharge. This was because height or length has been identified not to increase over a short period of time (WHO, 2013). However records on height and MUAC after the treatment should have been accessible in the folders. This would have helped to show whether proper monitoring was being undertaken. The lack of information on these records clearly points to the bad record keeping system in most health facilities. This poor record keeping makes it difficult to trace information necessary to prove whether the services offered were of good quality or not.

This poor system of record keeping came to light when Navarro-Colorado (2007) organised an audit of a number of Supplementary Feeding Programmes (SFP's) in Africa and Asia.

5.6 Discussion on z-score findings

It was realized from the study that most of the children seen at the IPC recorded levels of z-score which were usually less than -3sd. This showed that when compared to children attended to at the OPC, the IPC managed children were severely malnourished. This could explain the high mortality rates that were recorded in IPC's in comparison with OPC's. This assertion was agreed to in the works of Savadogo *et al,* (2007) and Pelletier *et al*, (2004) when it was realized that the risk of death rises progressively with deteriorating nutritional status. It was however encouraging that most of the children managed at IPC recorded positive improvements in their weight-for-height and weight-for-age upon discharge. This could give an indication that the

kind of treatment offered to the children yielded positive results. Taking a look at the z-score findings at IPC, most of the children achieved remarkable improvements. However, a look at the findings from the various OPC sites showed that few children achieved improvements in their weight-for-height and weight-for-age z-scores. These limited results from the OPC were due to the high defaulter rate which made it difficult to significantly assess the impact of treatment on the malnourished children. Due to the few number of children who were discharged as cured, the real impact of the sites' management practices could not be felt on their anthropometric measures and therefore painted a negative outlook of the resultant anthropometric measures which is in variance to studies by Sadler *et al*, 2007 and Bahwere *et al*, 2003.

In the above mentioned studies, the use of RUTF in rehabilitation contributed positively to improved anthropometric measures. Unfortunately, this was not the case at the OPC's though the IPC's made remarkable improvements.

5.7 Length of stay

Results from the study indicated that, the longest period of 25 weeks was recorded by a child at the OPC whereas most of the children attended to at this facility spent the shortest time of 1week in management. This could largely be attributed to the high rate of default experienced at this site. At the IPC, the longest period spent in management was 71 – 77 days. Majority of the children spent 8-14 days while the shortest stay in management was 1-7 days. Usually the children who spent the shortest days in IPC were the ones who easily expired. This was so because most of the children who were admitted into the IPC had complications and especially for IPC A, more moribund cases were attended to leading to a lot of fatalities. For IPC it was identified that no child could be categorized as non-recovered as all the children were

stabilized and rehabilitated within the allowable limits set by the Ghana Health Service (GHS, 2010). At OPC, one of the children non-recovered as the child spent more time than allowed. Though the outcome was of the negative, it deviates from the findings churned out from a study in Malawi where it was identified that the longer the stay in treatment the higher the chance of death (Chiwaula, 2011). This disparity could be attributed to the fact that the Malawian study was organized as a facility based whereas for this particular study the site that recorded the longest stay in treatment was the OPC.

5.8 Mortality rates

5.8.1 Comparison of mortality rates between IPC and OPC

High rates of mortality were recorded at IPC in comparison to the OPC because cases that were usually brought into this facility had complications as well. The management of these children therefore requires stabilizations of their conditions before rehabilitation could take place. Usually before stabilization ends some of the children could easily expire due to their moribund nature. Though the mortality rates recorded at IPC were higher than the acceptable GSS(I) level, it was lower than the 20-30% rate of mortality usually observed for developing countries (Collins, 2007 and The Sphere Project, 2011).

5.8.2 Comparison of mortality rates between IPC A and IPC B

From the research, it can clearly be identified that rates of mortality were higher at IPC B (15.2%) in comparison to IPC A (7.5%). IPC A probably recorded this low mortality rate because this is a major referral center for the northern and middle part of the country and as such well equipped with the required human and technical resources as compared to APH IPC. Though lots of complicated cases are attended to,

the quality of resources available are put into good use. For instance, IPC A had about five Nutrition Officers as well as Paediatric specialists who attended to the children. IPC B on the other hand had no Nutrition Officer but a Nutrition Intern. In actual sense, the Intern is supposed to be under supervision from a Nutrition Officer. Though there were Paediatric specialists available to treat children, the absence of a Nutrition Officer could militate against effective treatment.

These findings of a major referral facility achieving low mortality rates was supported by the work of Ashworth, (2004) when it was brought to light that in the event of upgrade of knowledge and training of health care staff mortality cases dropped from 46% to 21%.

5.9 Recovery rates

5.9.1 Comparison of recovery rates between IPC and OPC

It was identified that, higher recovery rates (82.6%) were attained at the IPC's in comparison with the OPC's (21.4%). This could highly be attributed to the proper facility based care that was offered to these children in comparison to the OPC where children would have to be brought in by caregivers leading to high rates of default at the OPC. Furthermore, during the management at the IPC whatever a child is fed on is properly monitored by health care providers as against what happens at the OPC where no Nutritionist or Dietician would be available at the homes of their clients to ensure that the right feeds are offered to the child. The argument raised above is to an extent supported by a study conducted by Biggs (2013) where it was indicated that if health care practitioners followed the right dietetic practices in the management of malnutrition, recovery rates would be heightened. Harris *et al*, (2011) however suggested that the opposite was true. It was revealed from that research that, OPC's

were highly efficacious and usually resulted in higher recovery rates. This finding by Harris *et al,* (2011) could have been achieved because proper monitoring plans and incentives existed for caregivers and children who were brought in. This form of proper monitoring were however nonexistent at most of the OPC's as high defaulter rates were attained.

5.9.2 Comparison of recovery rates between IPC A and IPC B

The results gathered from the study showed that both IPC A and IPC B recorded 90% and 76.1% recovery rates respectively there by meeting the GSS(I) expected rate of greater than 75%. This could be attributed to the nature of services that are offered at the IPC's which may probably be labeled as being of good quality. However a closer look at the rates shows that IPC A recorded a higher recovery rate as compared to IPC B. This could be attributed to the standardized system of malnutrition management employed at IPC A in comparison to IPC B. For instance at IPC B, a facility based protocol was used in the preparation of feeds with feeds such as "fortified kooko" and "K-diet" being used in place of the highly accepted F-75 and F-100. Furthermore ORS for normal children were offered to dehydrated malnourished children at IPC B as against the approved "Resomal" which was employed at IPC A. This point was proven in a study by Ashworth (2004) and Biggs (2013) when it was stated that if the standardized dietetic practices were upheld in the management of malnutrition, recovery rates would be higher. Shewade *et al,* (2013) however averred that, if locally available resources were employed in the making of feeds, it could be highly sustainable leading to higher recovery outcomes. To an extent the stance of Shewade *et al,* (2013) was depicted in this study as well. This is because the 76.1% recovery rate attained by IPC B was within the expected rate of greater than 75% set by The Sphere Project, (2011).

5.9.3 Comparison of recovery rates among individual OPC's (OPC A, OPC B and OPC C)

The results of the study pointed out that OPC A, OPC B and OPC C attained recovery rates of 25%, 25% and 14.3% respectively. These rates were however identified to be very low when compared to the GSS(I) expected greater than 75% mark that should have been attained by all the treatment sites. The high defaulter rate noted at all the out-patient treatment facilities could largely be blamed for this occurrence. Most of the children missed out on a lot of treatment options. This similar occurrence was found when an audit was organised for a number of SFP's in Africa and Asia. High rates of defaulting reduced the recovery rates (Navarro-Colorado, 2007).

5.10 Defaulter rates

5.10.1 Comparison of defaulter rates between IPC and OPC

When study results were compared, it was identified that defaulter rates of 5.8% and 71.4% were attained at IPC and OPC respectively. This result could be a consequence of what occurred during the management of malnutrition at the various treatment sites. At the IPC children were managed while on admission. As such proper monitoring of the children could take place. Caregivers were not freely allowed to take the child out of the facility until stabilization had taken place. Situations of default occurred when a child's parent presented a signed letter stating why the child should be discharged or when a caregiver absconds with a child usually under the pretext of doing laundry or going to purchase a drug.

On the other hand, alarmingly high defaulter rates were identified at the OPC because most caregivers would not bring back their children during the next treatment due to an array of reasons ranging from long distance to be travelled, lack of funds for

transportation and the need to visit their farms or markets on appointment dates. These reasons given by the caregivers can be attributed to the lack of knowledge and understanding of the forms of care that is offered to the malnourished child. These assertions were supported by the work of Navarro-Colorado (2007) where higher defaulter rates were identified among children supposed to be part of the SFP. Perra *et al,* (1995) and Singh *et al,* (2014) however proved in their works that where facility based care was offered the risks for defaulting reduced considerably.

5.10.2 Comparison of defaulter rates between IPC A and IPC B

Results from the study pointed out that, IPC A recorded a low defaulter rate of 2.5% while IPC B attained a rate of 8.7%. Both sites attained very low levels of default which were highly commendable. These low levels of defaulter rate could be attributed to the form of care which was offered at the IPC's. Due to the regular monitoring of the admitted patients at these facilities, it made it very difficult for caregivers to abscond with their children. Furthermore due to the level of professionalism exhibited in their work, most of the children were well attended to and did not have the chance to skip treatment with the exception of few instances of absconding by care givers. This point is equally proven by the works of Nolan *et al,* (2001), English *et al,* (2004) and Allen *et al, (*2007).

5.10.3 Comparison of defaulter rates among OPC's (OPC A, OPC B and OPC C)

From the findings, it is well realized that alarmingly high defaulter rates were attained at OPC C (78.6%) followed by OPC B (75%) and then OPC A (58.3%). The reduced defaulter rate at OPC A in comparison to the other treatment sites can be attributed to the special packages offered to sick children during OPC attendance. Through the innovation of the Nutrition Officers at OPC A, they solicit for support from well-

meaning Ghanaians to provide various food supplements to these sick children to aid in their recovery.

Some of the items that are offered to the children comprise milk formulations which are given to the children based on their ages and weight. The caregivers are usually delighted to receive such forms of support from the facility. This assertion is supported by the works of Allen *et al,* (2007) and Biggs (2013) which state that when a staff is highly motivated and knowledgeable, positive results in output are attained. However this has not entirely solved the challenge. Some who may come from long distances still do not make it to review sessions. The defaulter rates are higher at OPC B and OPC C because the kind of arrangements that exist at OPC A are absent with the exception of RUTF that is an essential part of the treatment for the malnourished children. The caregivers as such usually give various excuses such as lack of funds for transportation among others as some of the reasons why they are unable to make it to the treatment facilities. In studies by Navarro-Colorado (2007) similar high defaulter rates were achieved among SFP's where malnourished children were brought in for care.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

This is the final chapter of the study which presents the conclusions made from the study. It further gives appropriate recommendations based on the conclusions. It is however imperative to note that inferences from this study should be made with caution due to the relatively low sample size.

6.1 Conclusions

Generally, the study points to the fact that the IPC approach to the management of acute malnutrition is more efficacious in the Ashanti Region and probably throughout the entire country due to the high recovery rate of 82.6% and low defaulter rate of 5.8% attained at IPC in comparison to the low recovery rate of 21.4% coupled with the high defaulter rate of 71.4% achieved at OPC.

The study also suggests that health workers involved in the management of malnutrition in the Ashanti Region are quite knowledgeable and possess requisite skills for the management of the malnourished child. This impression could be attributed to the very good scores attained from their competency assessments which are 69.5% and 63% respectively for KATH and APH staff. These encouraging scores could be linked to the high recovery rates attained in their facilities especially at the IPC.

In another regard, the study identified that if a health worker is not knowledgeable in his or her field, the outcome of management may not be favorable when compared to the National or International standards. This assertion could be attributed to the poor outcome indicators of low recovery rate and high defaulter rate attained at OPC C

which could be linked to the health workers refusal to fill checklists given to them. It may be suggested that, the staff were non-compliant due to their low levels of knowledge which could have probably affected their service output leading to such abysmal performance at the OPC C.

The study has also shown that cases of acute malnutrition especially in the severe forms still exists in the Ashanti Region and most likely in all Ghanaian communities with most young children recording weight-for-height/length z-scores and MUAC's below the expected measures for a normal population of children at the same age ranges.

Furthermore the study suggests that if a malnourished child is managed for malnutrition using different approaches there could be positive improvements in the anthropometric measurements such as weight. This could be attributed to the fact that, at IPC, there was significant difference ($p < 0.01$) between the weight gained at discharge and weight noted on admission of children managed. Also, at OPC, there was significant difference ($p<0.05$) between weight gained on discharge and weight recorded on admission for children managed there.

Added to the above, the results from the study have shown that efficient management practices could reverse rather negative situations of malnourished children. This is because most of the children who were discharged after receiving management mostly recorded improvements in their anthropometric indices such as weight-for-height/length and weight-for-age taken on admission no matter the approach of management used.

Importantly, the study brought to the fore the gaps existing in the current information retrieval system of health facilities in the Ashanti Region and most likely all the

regions of Ghana. Instances of these are when records of anthropometric measures taken on admission and discharge of a large number of children could not be located. Furthermore full records of children attended to especially with expired cases could not be found.

6.2 Recommendations

Ghana Health Service

Generally, due to the high efficacy of the IPC form of malnutrition management in comparison to that of the OPC and the Integrated form of IPC and OPC otherwise known as CMAM, the Ghana Health Service should ensure that the principles of the community-based management of acute malnutrition especially community outreaches to ensure early detection and further follow-ups are effectively undertaken at the various treatment sites in order to reduce the defaulter rates. As an example, food rations being given out at KATH could be implemented at other CMAM centers in order to encourage caregivers to bring in their children for treatment. It is envisaged that if the defaulter rates are lessened, recovery rates would possibly be heightened while mortality rates would be kept constantly at the low level.

The Ministry of Health, Ghana Health Service and other health agencies such as the Christian Health Association of Ghana (CHAG) are particularly encouraged to ensure the recruitment of more Dieticians and Nutrition Officers to provide appropriate medical nutrition therapy at all health facilities throughout the country. This would also help ensure precision of diagnosis based on the right anthropometric measurements.

Regional and District Nutrition Directorates

The Regional and District Nutrition Directorates are advised to monitor efficient book and record keeping systems at the various malnutrition treatment sites in order to ensure that all records are retained and not lost in the facilities. Particular attention needs to be given to the keeping and proper retention of mortality records. This could even aid in checking the reasons why the patients were lost during care and what could be done to improve treatment.

In addition to what has been noted above the National, Regional and District Nutrition Directorates are equally advised to ensure routine training and monitoring of staff based on the current recommendations for management of malnutrition from WHO to keep staff abreast with the appropriate approaches to treatment at any given time. This would also help to further keep mortality rates at the minimum since standardized treatment approaches would always be employed.

Further Research

For the purpose of further research, it is recommended that a prospective study or more appropriately, a randomized controlled trial should be undertaken to better assess the acute malnutrition management practices. This would help solve the problem of the unavailability of data encountered when this retrospective study was conducted.

Due to limited time, the study could not be undertaken in all management centers within the country as was intended at the start of this research. It is therefore recommended that further researches throughout the management centers across the entire Ashanti Region and the country at large should be undertaken to properly assess the efficacy of the management of the acutely malnourished Ghanaian children.

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APPENDICES

Appendix A: Questionnaire for reviewing records of patients who have been managed at an IPC/ OPC/ CMAM centre

This questionnaire is going to be used solely to assess the records of patients who have received malnutrition management and all information provided will be kept confidential.

Patient's code: ……... Residence: ……..……..

House No: ……. District……

Region……. Type of center …….

Center code……..

SECTION 1: SOCIO – DEMOGRAPHIC DATA

Tick (√)or specify where appropriate

1.1 Age …..

1. 2 Sex [1] female [2] male

1.3 Religious affiliation [1] Christian [2] Muslim [3] none [4] others (specify)

1.4 Ethic group Specify……

1.5 Distance from residence to management facility ……..

1.6How many siblings does the child have? ……..

1.7 Is the child living with the real parents / caregivers? Yes …… No ……..

Specify whether parents/caregivers …….

1.8 Are child's parents educated? Yes …….. No ……

1.9 If yes, what is their level of education? Father…….

Mother……

1.10 Is child in school Yes ……. No …….. N/A

1.11 When was the patient first attendance to the facility ……

1.12 When was the patient's last attendance? …….....

1.13 Was the cost of management and provision of feeds borne by the caregiver?

a. Yes …… b. No……

1.14 If no, who bore the cost? (specify if available)

……

……

SECTION 2 Anthropometric data

2.1 Child's weight on first visit ……

2.2 Child's height or recumbent length on first visit Height …… / Length……

2.3 Child's weight for height z-score on first visit ……s.d.

2.4 Child's weight for height on last visit ……. s.d.

2.5 MUAC measurement on first visit ……

2.6 MUAC measurement on last visit …….

2.7 Target weight ……

2.8 Was target weight reached? Yes……. No……

2.9 When was the target weight reached ……

2.10What was the weight at discharge? ……

2.11 When was patient discharged? ……..

2.12 Differences in weight observed on last visit Gained……Lost……..

SECTION 3 PHYSICAL AND LABORATORY EXAMINATION UNDERTAKEN

3.1 Did patient present with any medical condition? (Tick √) Yes …… No……

If yes, answer 3.2 if no, skip 3.2

3.2 If yes what condition/conditions did patient present (Tick √)

a. malaria …… b. dehydration …… c. diarrhoea ……

d. HIV …… e. other (specify) ……

3.3 Did patient arrive in a state of shock? (Tick √) Yes…….. No……

3.4 If no, what was the state in which the person arrived? ……

……

3.5 Were laboratory examinations undertaken on patient?

a. Yes ……. b. No ……..

3.6 If yes, what laboratory tests were carried out? (Specify)

……

3.8 State the laboratory results where applicable.

Test	Results	Range	Flag

3.9 Did the child have any under development in terms of milestones?

a. Yes …… b. No ….

3.10 If yes, what were these development challenges?

……

……

……

SECTION 4 ASSESSMENT OF NUTRITIONAL INDICATORS

4.1 Did child die? A. Yes ….. b. No……

4.2 Did child get cured a. yes …….. b.No……

4.3 How long did child spend in stabilization phase? …….

4.4 How long did child spend in the rehabilitation phas? ……..

4.5 Did the child default in treatment? A. Yes …… b. No ……

4.6 If 4.5 was yes, what was the length of default? …….

……

4.7 What was the reason for defaulting? …….

…….

SECTION 5 MANAGEMENT PRACTICES

5.1 How did patient come into the facility? (Tick √ or specify where appropriate)

a. Patient was given a referral from a health facility a. Yes ……. b. No ……

a ii. Is the referral from the same health facility or a different one? ……

b. Child was referred through early detection in the communities ……

c. Caregiver brought in child without any referral ……..

d. Other reason ……..

……

5.2 How was patient diagnosed as being malnourished? (Mention equipment used if possible)

……

……

5.3 Who diagnosed patient as being malnourished? ……

5.4. After diagnosis what was the first line of action undertaken ……

……..

5.5 Did the patient present with hypoglycaemia (Tick √) a. Yes …… b. No …….

5.6 What signs did the patient show for hypoglyceamia? (Tick √)

a. drowsy ……. b. lethargic …… c. cannot be roused ……..

d.other (specify)…….

5.7 Was the patient treated for hypoglycaemia whether present or not? (Tick √)

a. Yes …… b. No……

5.8 If yes, state what the treatment for hypoglycaemia involved.

……

5.9 Was the treatment given according to the G.H.S. in patient care protocol? Tick (√)

a. Yes ……. b. No …… c. other ……

5.10 Did patient show sign of hypothermia? (Tick √) a. Yes ……. b. No …….

5.11 If yes what were the signs?

……

……

5.12 What treatment was given for hypothermia?

……

5.13 Was the treatment given according to G.H.S. protocol? (Tick √)

a. Yes ……. b. No……..

5.14 Did patient show sign of dehydration? (Tick √) a. Yes ……. b. No ……

5.15 If yes what were the signs?

……

……

5.16 What treatment was given for dehydration?

……

……..

5.17 Was the treatment given according to G.H.S. protocol? (Tick √)

a. Yes ……. b. No……..

5.18 Did the child present with any of these signs to show an electrolyte imbalance? Tick (√)

i. oedema a. Yes ……. b. No …….

ii. apathy a. Yes …….. b. No ……

iii. weakness a. Yes …….. b. No ……

iv. poor apetite a. Yes …….. b. No …….

v. other …… (specify) …….

5.19 What treatment was offered?

a. Resomal only …….. b. Resomal plus other treatment ……

c. other …….. specify …….

5.20 State how Resomal was offered (quantity given and duration)

……

……..

5.21 Did they treat for infections? a. Yes …… b. No …….

5.22 If yes, what treatment was offered? …….

……..

……

5.23 Was iron offered during the stabilization phase? a. Yes …… b. No ……

5.24 Was child offered any feed? a. Yes ….. b. No …….

5.25 If yes, when was feeding started? (specify) ……

5.26 Which feed was given? …….. ……

5.27 Give the quantity ……

5.28 How was the quantity calculated? ……

5.29 At what intervals was it offered? ……

5.30 If child was started on F75 when was there a graduation onto F100 intake ……..

5.31 What was the amount of F100 given and at what intervals was it offered?

……..

5.32 Was there a feed monitoring chart? a. Yes ……. b. No ……

5.33 If yes, what were the key indicators on the feeding chart? (specify)

……

……

……

5.34 List other charts available as per the patient's records.

……

……

5.35 Was play therapy undertaken for the child?

a. Yes ….. b. No ….. c. No data available ……

5.36 If play therapy was undertaken, what objects were used / given?

……

……

5.37 Was care giver counseled on how to care for and support the child?

a. Yes ……. b. No ……. c. No data available ……

5.38 Did the child start reaching some milestones such as;

a. standing ……. b. sitting …… c. behavioural development…….

d. Other …….. (specify)……

5.39 Was there any plan for review or follow up?

a. Yes …… b. No ……..

5.40 What was stated in the review plan?

……

5.41 During the outpatient care what services were offered?

……

……

5.42 If feeds were offered, what kind of feed was given and what was the quantity?

……

……

5.43 Were targets set to be achieved during reviews?

a. Yes …… b. No …….

5.44 If yes, what were the targets?

……

……

5.45 Were the targets reached?

……

……

Answer the following if the programme was a CMAM intervention.

5.46 When was stabilization reached?

……

5.47 What showed that stabilization had been reached?

……

5.48 When was rehabilitation started?

……

……

5.49 Where did stabilization take place? ……

5.50 Where did rehabilitation take place? ……

5.51What did the rehabilitation involve? ……

5.52 Were supplementary feeds provided? ……

5.53 Which children were the supplementary feeds offered to?

……

……

Appendix B: Checklist for healthcare personnel

This questionnaire is intended to assess the knowledge level, skills and services offered by health care personnel to malnourished children. Please be assured that the information collected would be used solely for research purposes and high level confidentiality would be guaranteed. Thank you.

Section 1. Demographic Information

Kindly tick (√) or specify where appropriate

1.1 What is your job description?

a.Nutrition Officer …….b. Dietician …….. c. Medical Doctor …….

d. Nurse …….. e. Technical Assistant – Nutrition ……..

f. Nutrition Intern ……. g. Dietetic Intern ……

1.2 Do you live close to the treatment facility? a. Yes …… b. No ……

1.3. Kindly state the distance from your house to the treatment facility. ……

Section 2. Skills and Knowledge assessment

Kindly tick (√) or specify where appropriate

2.1What treatment module does your facility provide?

a.I.P.C ……. b.O.P.C. …….. c. Both I.P.C. and O.P.C. ……

d. CMAM …….. e. Other ……. (specify)……..

2.2 What are the tools you use to assess nutritional status? (Please state the tool and its use)

…….

……..

……..

……

2.3 How do you diagnose malnutrition? (Kindly specify stating cut-offs used)

……

……

……

2.4 What is the full meaning of the following?

a. Resomal ……..

b. CMV ……..

c. RUTF …….

2.5 Kindly state the constituents of the following at your treatment facility?

a.

Resomal……

……

b.CMV …….

……

……

c.F 75 …….

……

……

d.F 100 ……

……

……

e.RUTF ……

……

……

2.6 How are the following products made/obtained?

i. Resomal ……

……

ii.CMV …….

……

……

iii. RUTF ……

……

……

iv. F75 ……

……

……

v. F100 ……..

……

2.7 When are the following products used at your facility?

a. Resomal ……

……

b. CMV ……

……

c. F 75 ……..

……

d. F 100 ……

……

e. RUTF …….

……

……

2.8 Does your facility have various treatment plans used in offering Resomal?

a. Yes ……. b. No……

2.9 If yes, what are the treatment plans?

……

……

2.10 How do you diagnose hypoglycaemia at your facility?

..……

……

2.11 How do you diagnose hypothermia?

……

2.12 How do you diagnose dehydration?

……

2.13 How will you detect that a malnourished child has an infection?

……

2.14 How will you detect that a child has an electrolyte imbalance?

……

2.15 How will you detect that a child has a micronutrient deficiency?

……

2.16 Do you carry out cautious feeding at your center? a. Yes …… b. No ……..

2.17 When does cautious feeding start?

……

……

2.18 When do you realize that a child has achieved catch up growth?

……

……

2.19 How do you stimulate a child's senses?

……

……

2.20 Do you have any play equipment or therapy for the children?

a.Yes …… b. No ……

2.21 If yes, mention any of the equipment used or that are available?

……

……

2.22 How do you upgrade your knowledge as a care provider?

……

……

SECTION THREE ASSESSMENT OF KNOWLEDGE

Module 1

1. What is malnutrition? Select a correct statement.
   a. The term malnutrition means badly nourished and is used to describe both undernutrition and overnutrition ☐
   b. Malnutrition is the result of prolonged episodes of inadequate nutrition which leads to wasting ☐
   c. Malnutrition refers to growth faltering or over weight that is caused by inadequate feeding or disease. ☐
   d. Malnutriton can be the result of a relatively short term inadequate intake of food known as acute malnutrition ☐
2. Kindly state the main cause of death for severely malnourished children?
   a. …….. c. ……..
   b. ……... d. ……..
   e. ……
3. When a child's energy and nutrient intake is insufficient, physioloigical and metabolic changes take place in a body to conserve energy. What is this called?

   …….
4. Which of the following options best describe the differences between chronic and acute malnutrition? Select four.
   a. Chronic malnutrition is a result of prolonged periods of inadequate nutrition and/or disease whereas acute malnutrition results from relatively short periods of inadequate nutrition ☐
   b. Acute malnutrition is a result of a prolonged period of inadequate nutrition and/or infections whereas chronic malnutrition results from a relatively short period of inadequate nutrition ☐

c. Acute malnutrition results in wasting ☐

d. Chronic malnutrition results in stunting ☐

e. Underweight or low weight-for-age can result from both acute and chronic malnutrition ☐

5.List three visible changes associated with severe acute malnutrition

a.

b.

c.

6. List three invisible changes associated with severe acute malnutrition

a.

b.

c.

7. What are the clinical features associated with complicated malnutrition (Select all that apply)

a. Fever …… b. severe anaemi……. c. Indigestion …….

d. Blood poison …… e. Shock …….

f. Loss of appetite …….. g. Dehydration …….

8. Select all correct statements. Moderate acute malnutrition is defined as

a. Weight-for-length <-3 standard deviation (<3 centile) ……..

b. MUAC <110 mm for children 6-59 months …….

c. MUAC <115 mm for children 6-59 months ……

d. Children who are thin for their height but not too thin ……..

e. Absence of oedema ……..

9. The following are consequences of severe malnutrition in children and infants. Select all that are true.

a. Increasing body response to infections …….

b. Stopping to grow ……..

c. Decreasing physical activity ……..

d. Increasing the rate of sodium-potassium pump ……

e. The heart pumping faster ……

10. Severe acute malnutrition is defined as (mark all that apply):

a. Weight-for-length<-3 standard deviation (<3 centile) ……

b. Weight-for-height <-2 standard deviation (<2 centile) ……..

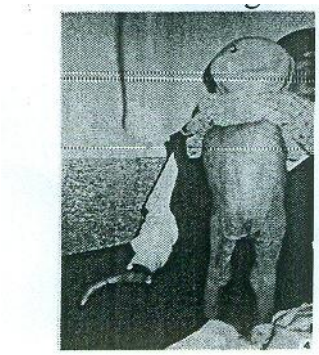
c. Visible severe wasting …….

d. MUAC <110 mm for children 6-59 months …….

e. MUAC <115 mm for children 6-59 months …….

f. Presence of bilateral oedema ……..

11. Which visible changes of SAM can you see from the child (front and back)?



	True	False
a. Moderate oedema (++)	☐	☐
b. Bones clearly showing (ribs, collar bones, facial bones, spine, shoulder blades)	☐	☐
c. Generalised oedema grade (+++)	☐	☐
	☐	☐
d. Sever wasting	☐	☐
e. Wasting		
f. Loose skin and skin folds	☐	☐
g. Skin discolouration	☐	☐
h. Moderate dermatosis	☐	☐

12. Which of the indices is best used for rapid assessment and screening of communities for acute malnutrition?

a. Mid-Upper-Arm Circumference …….

b. Weight-for-age ……..

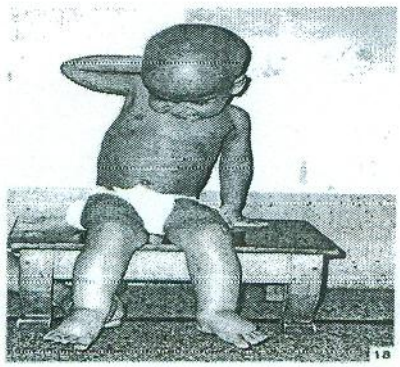
c. Oedema ……

d. Length-for-age ……..

e. Weight-for-age…….

Choose the most appropriate answer

13. This is Fatima, a girl aged 20 months. She is 67cm in length and weighs 6.5 kg. Calculate her weight-for length standard deviation (SD) score and identify how malnourished she is.



a. Not malnourished ……..

b. Mildly ……..

c. Moderately …….

d. Severely …….

14. What are the differences between length-for-age and height-for-age? List two.

a. ……..

b……

15. This is a boy age 18 months. He is 65 cm in length and weighs 4.8g. Which indicator should you use to determine if he has severe acute malnutrition/ Select two

a. Bilateral pitting oedema …….

b. Visible severe wasting ……

c. Length-for-age …….

d. Weight-for-age <-3SD ……..

e. Weight-for-height <-3 SD ……

16. Which statements below are true regarding height-for-age?
a. It reflects the growth in length or height in comparison to that of an average healthy child of the same age.

…….

b. It is used to identify children who are stunted (short). ……...

c. A low height-for-age is due to prolonged undernutrition or repeated illness……

d. It is used to identify children with acute malnutrition …….

e. Children who are tall for their age can also be identified ……

17. When is it most appropriate to use the height-for-age index? (Select two)
a. In differential diagnosis for a child with underweight ……..

b. For growth monitoring ……

c. In clinics to assess severity of malnutrition……

d. In nutritional surveys to determine levels of stunting…….

e. To assess wasting ……

18. What are the causes of oedema in severely malnourished children (Select all true answers)

a. Malfunctioning of sodium-potassium pump……

b. Movement of sodium out of the cells……

c. Movement of potassium into the cells ……

19. List three electrolytes whose movement affect oedema in severely malnourished children

a.

b.

c.

20. List two causes of lack of appetite in severely malnourished children

a.

b.

21. Why is it difficult to diagnose dehydration in malnourished children?

……..

……..

22. If you are measuring a child who is less than 2 years old, you should measure the child's

a. Length ……..

b. Height ……..

c. Length and add 0.7 cm ……..

d. Height and add 0.7 cm …….

e. A measuring board and sliding foot piece is used to measure height ……

23. The following statements are true or false regarding height measurement

	True	False
a. Two measurers are needed for accurate results	……	……
b. Always remove head or hair pieces	……	……..
c. Remove coats and shoes	…….	
d. Check heels, shoulder blade, buttocks and back touch vertical board …….		

24. What are the two phases of the management of severe acute malnutrition?

a. ……..

b. ……

25. Which of the following criteria would you use to decide if a SAM child should receive in-patient or out-patient treatment?

a. Weight –for-age standard deviation score …….

b. Signs of complications ……..……

c. grade of oedema ……..……..

d. weight-for-height SD score ……..……

e. presence of oedema ……..

26. Why should feeding severely malnourished children start slowly and cautiously?

a. The systems of the body slow down with severe malnutrition ……..…..

b. Rapid feeding or fluids would overwhelm the systems ……..…….

c. Feeding should not necessarily start slowly ……..…..

d. Because the liver of the SAM child does not function properly……

e. SAM children can tolerate usual amounts of protein and sodium ……

27. How long does the rehabilitation phase of management take?

a. 1 week ……..……

b. 2 weeks ……..….

c. 3 weeks …….…….

d. 1 month …….….

e. 4 weeks ……..

28. Arrange the WHO ten steps to malnutrition management in the right order .

a. Treat/prevent hypothermia

b.Treat/prevent dehydration

c. Start cautious feeding

d. Correct electrolyte balance

e.Treat/prevent hypoglycaemia

f. Prepare for discharge and follow up

g. Treat micronutrient deficiencies

h. Provide loving care and cognitive stimulation

I. Treat and prevent infections

j. Give catch up diet for rapid growth

29. List three signs of hypoglycaemia in severely malnourished children

a.

b.

c.

30. Fatima is severely malnourished and shows signs of hypoglycaemia. How would you gtreat it?

	True	False
a. If conscious give 50 ml of 10% glucose Solution or 50 ml starter formular or 50% of 10% sugar sugar solution	……..	……..
b. If unconscious give sterile 10% glucose Solution 5ml per kg body weight Immediately. If IV glucose Cannot be given immediately, Give sugar solution	……	……..

31. What are the reasons why SAM children with complications should be fed and rehydrated differently in the stabilization phase?

a. Severely malnourished children cannot tolerate usual amounts of protein, sodium and fat

b. F75 is needed so that the body will not be overwhelmed in the initial stages of treatment

c. When the child is stabilized he can tolerate more protein and fat

d. F-100, ready-to-use therapeutic food or nutritious family foods can be used to "catch-up" and rebuild wasted tissues

32. All severely malnourished children should be treated for infections even if they do not show signs of infections. Is the statement true or false?

a. True …….. b. False ……

33. Why should you correct electrolyte imbalance in SAM children?

a. Severely malnourished children have damaged cell walls which lead to leakage of potassium and magnesium out of cell and the body.

b. SAM children have low intakes and loss of potassium and magnesium during diarhorrhea

c. SAM children have adequate intake of electrolytes

d. There is a breakdown of muscle to make energy

e. Damaged kidney cannot excrete excess Sodium.

Appendix C: Participant Information Leaflet

This leaflet must be given to all prospective participants to enable them know enough about the research before deciding to or not to participate

Title of Research:

"Assessing the efficacy of acute malnutrition management among children from 0 to 59 months in Ghana – a case study of three Nutrition Rehabilitation Sites in the Ashanti Region"

Name(s) and affiliation(s) of researcher(s):

This study is being conducted by Miss Marian Abrafi Osei of KNUST, Kumasi

Background (Please explain simply and briefly what the study is about):

Malnutrition has been identified through various studies as one of the major contributors to childhood deaths. Survey by the Ghana Statistical Service as of 2011indicated that Ghana had cases of acute malnutrition in each of her ten regions. Due to this worrying trend, various treatment approaches such as Inpatient therapeutic care practices, Outpatient care practices and Community based management of acute malnutrition have been developed to treat children who are identified to be acutely malnourished not only in Ghana but globally. Research has however proven that if malnutrition treatment guidelines are not being properly followed and health care staff do not have the right level of competencies and knowledge there could be further deterioration of the conditions of malnourished patients. It is based on these facts that the study is being undertaken to assess whether the rates of mortality, cure, recovery, default and length of stay for children undergoing treatment for acute malnutrition using different approaches are within the acceptable ranges of the Global Sphere Standards or not.

Purpose(s) of research:

The research seeks to find out the efficacy of acute malnutrition management among Ghanaian children by evaluating whether the rates of mortality, cure, recovery, default and length of stay for children undergoing treatment for acute malnutrition using

different treatment approaches are within the acceptable ranges of the Global Sphere Standards or not.

Procedure of the research, what shall be required of each participant and approximate total number of participants that would be involved in the research:

The research would be a retrospective cohort study which would require a minimum sample size of 100 acute malnourished children managed at a malnutrition treatment center from January to December, 2013. However due to the study design the records of all children treated within the specified period at any selected malnutrition treatment center would be retrieved and used to fill out questionnaires.

The questionnaires would rely on information such as, socio-demographic characteristics, anthropometrics, intake of feeds, medical problems, routine medication intakes, recovery rate, length of stay, cure rate, mortality rate, default rate and laboratory tests conducted. A checklist would be served to health care staff such as Nutritionists/Dieticians, Doctors, Nurses, among others who collaborate to treat malnutrition to assess their level of knowledge, skill and competencies in malnutrition management.

Children for whom consent would be given by the heads of the selected treatment centers for the utilization of their records would be eligible for the study. The study outcomes will be analysed using the parametric and non parametric to test for differences and statistical significance. Relationships and associations would also be tested for.

Risk(s):

There is no known risk of the study to participants.

Benefit(s):

The findings of the research would identify whether the various malnutrition treatment approaches are being well undertaken in the country and achieving desired results based on the Ghana Health Service and Global Sphere Standards. These findings would then inform appropriate planning and implementation of nutrition interventions and malnutrition treatment approaches specific to our clinical conditions

to curb or reduce the prevalence of acute malnutrition leading to enhanced nutritional status of children in Ghana.

Confidentiality:

All information collected in this study will be given code numbers. No name will be recorded. Data collected cannot be linked to anyone in anyway. No name or identifier will be used in any publication or reports from the study. However, as part of our responsibility to conduct this research properly, we may allow officials from the ethics committees to have access to records of study participants.

Voluntariness:

Taking part in this study should be out of your own free will. You are not under obligation to. Research is entirely voluntary.

Alternatives to participation:

If you choose not to participate, this will not affect your treatment or service delivery in this hospital/institution in any way.

Withdrawal from the research:

You may choose to withdraw from the research at anytime without having to explain yourself. You may also choose not to answer any question you find uncomfortable or private.

Consequence of Withdrawal:

There will be no consequence, loss of benefit or care to you if you choose to withdraw from the study. Please note however, that some of the information that may have been obtained from you without identifiers (name etc), before you chose to withdraw, may have been modified or used in analysis reports and publications. These cannot be removed anymore. Effort would however be made to comply with participant wishes as much as practicable.

Costs/Compensation: Participants (staff) would be given fruits or fruit juices and thanked for participating in the study. Nutritional information and education would be offered freely to care providers where practicable.

Contacts: If you have any question concerning this study, please do not hesitate to contact Miss Marian Abrafi Osei on 0269179898/0208772307

Further, if you have any concern about the conduct of this study, your welfare or your rights as a research participant, you may contact:

The Office of the Chairman

Committee on Human Research and Publication Ethics

Kumasi

Tel: 03220 63248 or 020 5453785

Appendix D: Consent form

Statement of person obtaining informed consent:

I have fully explained this research to _____ and have given sufficient information about the study, including that on procedures, risks and benefits, to enable the prospective participant make an informed decision to or not to participate.

DATE: _____ NAME: _____

Statement of person giving consent:

I have read the information on this study/research or have had it translated into a language I understand. I have also talked it over with the interviewer to my satisfaction.

I understand that my participation is voluntary (not compulsory).

I know enough about the purpose, methods, risks and benefits of the research study to decide that I want to take part in it.

I understand that I may freely stop being part of this study at any time without having to explain myself.

I have received a copy of this information leaflet and consent form to keep for myself.

NAME:_____

DATE: _____ SIGNATURE/THUMB PRINT: _____

Statement of person witnessing consent (Process for Non-Literate Participants):

I ……. (Name of Witness) certify that information given to …….. (Name of Participant), in the local language, is a true reflection of what

l have read from the study Participant Information Leaflet, attached.

WITNESS' SIGNATURE (maintain if participant is non-literate): _____

MOTHER’S SIGNATURE (maintain if participant is under 18 years): _____

MOTHER’S NAME: _____

FATHER’S SIGNATURE (maintain if participant is under 18 years): _____

FATHER’S NAME: _____

Appendix E: Test of hypotheses

Hypothesis(H_O)	Statistical test run	z-score/t-score	P-value	Decision
Admission weight at IPC is not greater than standard weight for age	Wilcoxon Signed Ranks	-8.056	0.000	H_O accepted
Admission height at IPC is not greater than standard height for age	Wilcoxon Signed Ranks	-7.682	0.000	H_O accepted
Discharge weight at IPC is not lesser than admission weight	Wilcoxon Signed Ranks	-5.934	0.000	H_O accepted
Discharge weight at IPC A is not lesser than admission weight	Wilcoxon Signed Ranks	-4.295	0.000	H_O accepted
Discharge weight at IPC B is not lesser than admission weight	Paired samples t-test	-6.161	0.000	H_O accepted
OPC admission weight is not greater than standard mean weight for age at OPC	Wilcoxon Signed Ranks	-5.234	0.000	H_O accepted
OPC discharge weight is not lesser than admission weight at OPC	Wilcoxon Signed Ranks	-2.032	0.042	H_O accepted
OPC A discharge weight is not lesser than admission weight at OPC A	Wilcoxon Signed Ranks	-1.342	0.180	H_O rejected

Appendix F – Summary of the mean weights recorded on admission and discharge at treatment sites

TREATMENT SITE	MEAN WEIGHT ON ADMISSION (kg)	STANDARD DEVIATION	MEAN WEIGHT ON DISCHARGE (kg)	STANDARD DEVIATION
IPC	6.4	2.0	7.2	2.0
IPC A	6.3	2.3	7.1	2.2
IPC B	6.5	1.8	7.3	1.9
OPC	7.1	2.1	8.9	2.5
OPC A	7.8	2.6	9.8	2.7
OPC B	7.6	1.6	9.7	3.2
OPC C	5.8	1.3	6.9	0.8

Source: Author's calculations 2015

Appendix G – Comparison of average weight gains at IPC sites

Age range (months)	**Average weight gain(g/kg) at IPC (*both IPC A and B*)**	**Average weight gain(g/kg) at IPC A**	**Average weight gain(g/kg) at IPC B**
0-5	278.1	238.5	357.1
6-11	76.3	66.4	89.2
12-17	148.4	134.6	169.1
18-23	94.5	72.9	116.0
24-29	82.4	96.4	71.8
30-35	128.4	128.4	
36-41	10.2		10.2
42-47	153.9	153.9	
48-53	111.9	163.5	86.0

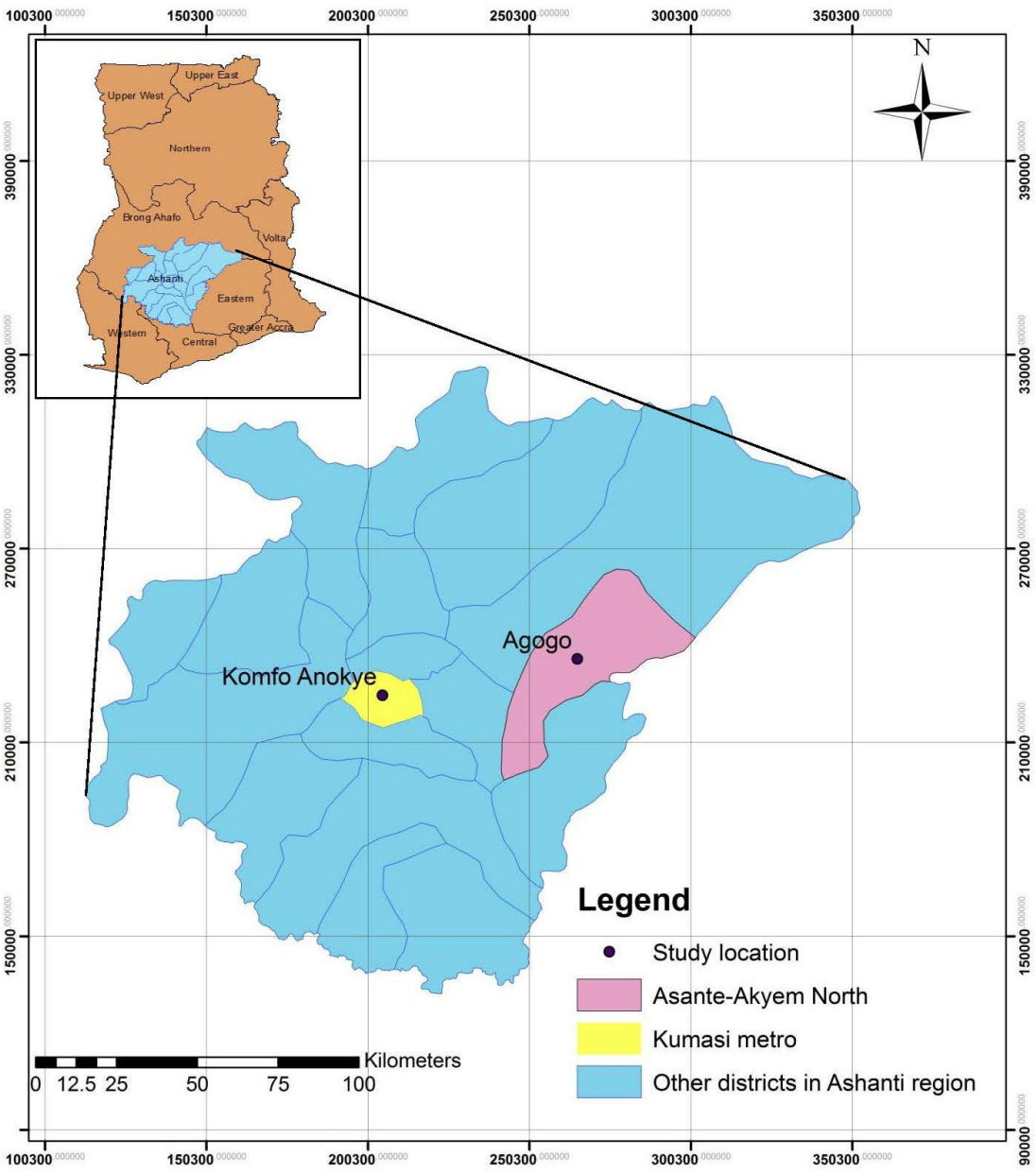
Source: Author's calculation, 2015

Appendix H- Comparison of average weight gains at OPC sites

Age range (months)	Average weight gain (g/kg) at OPC(representing all OPC's)	Average weight gain(g/kg) at OPC A	Average weight gain(g/kg) at OPC B	Average weight gain(g/kg) at OPC C
6-11	168.7	0		253.0
12-17	157.9	157.9		
18-23	322.2	322.2		
24-29	344.8	344.8		
>or= 30				

Source: Author's calculation, 2015

Appendix I: Map of study area



Appendix J: Table showing data extracted from various studies during systematic review

PUBLICATION DETAILS	STUDY DESIGN	NUMBER OF SUBJECTS AND CHARACTERISTICS	AIM OF STUDY	OUTCOME MEASURES	FINDINGS AND CONCLUSIONS
1.Title: Integrated programme achieves good survival but moderate recovery rates among children with SAM in India Authors: Aguayo *et al*, 2013 Publication date: November, 2013 Title of journal: American Journal of Clinical Nutrition Issue and volume: 98 (5):1335-42 Country of study: India	Prospective cohort study	N= 2740 Characteristics: 6 – 59 months old children with SAM	To assess the effectiveness of an integrated model for the management of SAM (IM-SAM) in India comprising facility- and community-based care and using locally adapted protocols.	Mortality rate Default rate Recovery rate Weight gain on recovery	Very high survival rates in the IM-SAM Moderate recovery rates indicate protocols currently in use need to be improved
2.Title: Effectiveness of ready to use therapeutic food in community based management of	Randomized Controlled Trial	N= N/A Characteristics: SAM children	To determine the effectiveness of indigenous RUTF in community based	-Baseline weight -Weight gain per week	-Indigenous RUTF was effective in community based management of uncomplicated SAM

uncomplicated SAM; a Randomized Controlled Trial from India Authors: Shewade *et al*, 2013 Journal: Journal of Tropical Pediatrics Date of publication: October 2013 Issue: 59(5):393-8 Country of study: India		followed in OTP and at home	management of uncomplicated SAM		
3.Title:Assessment of outpatient therapeutic programme for SAM in three regions of Ethiopia Authors: Belachew *et al*, 2007 Date of publication : December 2007 Journal; East African Medical Journal. Issue, Volume and pages: 84(12):577-88 Country of study: Ethiopia	Observational	-36 key informants -30 focus group discussants Characteristics of subjects: Participants from 13 health centres offering OTP services	To assess the strengths and weaknesses of the OTP service and suggest recommendations for future programming	-Mortality rate -Recovery rate -Knowledge level of patients, care givers and staff	-Programme effective in treating cases of SAM -Highly acceptable by planners, health care providers and beneficiaries Shortcomings: -Irregularity and incompleteness of supply availability -High attrition of trained human power

4.Title: Efficacy of outreach nutritional rehabilitation centres in reducing mortality and improving nutritional outcome of severely malnourished children in Guinea Bissau Authors: Perra *et al*, 1995 Title of journal: European Journal of Clinical Nutrition Year of publication:May 1995 Volume: 49 Issue: 5 Pages; 353-9 Country of study; Guinea Bissau	Retrospective crossectional study	N= 1038 Characteristics: -Severely malnourished children aged 6 to 47 months -354 were rehabilitated in NRC's -684 received no rehabilitation	To compare the mortality rates and nutritional status of severely malnourished children admitted to NRC's and those not rehabilitated	-Mortality rates -Weight gain	-Low cost, outreach NRC's are effective both in the short term and in the mid-term to improve the nutritional situation and reduce the mortality of severely malnourished children
5.Improving the hospital management of malnourished children by participatory research. Authors: Pouane *et al*, 2004 Journal: International Journal for quality in health care	Descriptive interventional study	N= N/A Characteristics of subjects; Admissions for severe malnutrition	To improve the clinical management of severely malnourished children in rural hospitals in South Africa	-Case fatality rates -Case management -Adequacy of resources for care -Barriers to improved quality of care	-Formation of a hospital nutrition team -Identification of shortcomings in clinical management of SAM -Improvement in quality of care -Reduction in case fatality rates

Volume 16, Issue 1, Pp. 31 – 40 Year published; 2004 Accepted: July 31, 2003 Country of study: South Africa					
6.Title:Severe malnutrition among children under the age of 5 years admitted to a rural district hospital in Southern Mozambique Authors: Nhampossa *et al*, 2013 Country of study; Mozambique Date published: May 02, 2013 Title of journal: Public Health Nutrition Journal Volume: 16 Issue: 9 Pages: 1565-74	Retrospective study of hospital based data	N= 274,813 Characteristics; Patients belonged to Manhica's Demographic Surveillance System	To describe the burden, clinical characteristics and prognostic factors of severe malnutrition in children under the age of 5 years	-Case fatality rate -In hospital mortality -Clinical manifestations -Community based incidence rate of SAM	-SAM among children was common but frequently went undetected -Measures to improve SAM recognition by clinicians at the out-patient level is urgently needed

7.Title:Management of children with SAM in India: Experience of Nutrition Rehabilitation Centers in Uttar Pradesh, India Authors: Singh *et al*, 2014 Journal: Indian Pediatrics Date of publication: Jan. 8, 2014 Country of Study: India Volume: 51 Issue: 1 Pages; 21-5	Prospective cohort study	N= 1,229	-To assess the effectiveness of facility based care for children with S.A.M. in nutritional rehabilitation centres (NRC's)	-Survival rate -Default rate -Rate of discharge -Recovery rate	-NRC's provide live-saving care for children with SAM -Protocols and therapeutic foods currently used need to be improved to ensure full recovery of all children admitted
8.Title: A short-term intervention for the treatment of severe malnutrition in a post-conflict country: results of a survey in Guinea Bissau Authors; Colombatti *et al*, 2008 Journal: Public Health Nutrition Journal Date of publication: December 2008	Prospective cohort study	N=2642	-To determine the extent of malnutrition and the risk factors for severe malnutrition -To determine the feasibility and effectiveness of a short term intervention characterized by out-patient treatment with locally produced food	-Length of stay -Mortality rate -Weight gain per day -Rate of relapse -Recovery rate	-Short term interventions performed in post-conflict countries during seasons of high burden of disease and malnutrition are feasible and successful at low cost -Day care treatment of severe malnutrition with locally produced food can be tested in other settings

Country of study: Guinea Bissau Volume 11, Issue 12 pages 1357-64			for the treatment of severe malnutrition during rainy season		
9.Title: Comparison of effectiveness of a milk free-soy-maize-sorghum based ready to use therapeutic food with 25% milk in nutrition management of severe acutely malnourished Zambian children an equivalence non-blinded cluster randomized controlled trial Authors: Irena *et al*, 2013 Date of publication: Jun 2013 Journal; Maternal Child Nutrition Country of study; Zambia	Randomized Controlled trial	N= 533 Characteristics: Kwashiorkor admissions of at least five days	To compare a local mix of soya-egg to the standard milk diet in the treatment of kwashiorkor	-Case fatality rates -Weight gain per day -Permeability ratios -Clinical manifestations(clinical sepsis)	-Milk is superior to a local maize based diet in the treatment of kwashiorkor in terms of mortality, weight gain, clinical sepsis and improvement in intestinal permeability
10.Title; Outpatient therapeutic feeding programme outcomes and determinants in treatment of S.A.M. in Tigray, Northern Ethiopia: A retrospective	Retrospective cohort study	N=628 Characteristics: Children managed for SAM under	To find out the outcomes and determinants in treatment of SAM using outpatient therapeutic feeding	-Recovery rate -Defaulter rate -Mortality rate -Rate of weight	-The OTP was partially successful -Management of children with co-morbidities under the program and partial administration of routine drugs were major threats for the

cohort study Authors; Yebyo *et al*, 2013 Year of publication; June 6, 2013 Journal; PLoSONE Volume , Issue and page; 8(6): e65840 Country of study: Ethiopia Editor; Zulfiqar A		outpatient therapeutic programme	programmes	gain	program effectiveness
11.Title; Home based treatment of acute malnutrition in Cambodian urban poor commodities Authors; Harris *et al*, 2011 Journal; Food and Nutrition Bulletin Date of publication: December 2011 Volume 32, Issue 4, Pages 333-9 Country of study: Cambodia	Cross sectional	N = 159 Characteristics: -Children were 4 years or younger and had a mean admission weight for height z-score of -3.3	-To review the outcome of a community nutrition programme designed to rehabilitate children under the age of 5 years with moderate or severe acute malnutrition	-Average weight gain per day -Case fatality rate	-The programme was an example of effective community based rehabilitation of children with moderate or severe acute malnutrition through a combination of nutritional education, regular home visiting and food support

12.Title; Antibiotics as part of the management of severe acute malnutrition Author(s): Trehan *et al*, 2013 Journal; The New England Journal of Medicine Date of publication: Jan 2013 Volume 368 Issue 5 Pages 425-35 Country of study: Malawi	Randomized double-blind controlled trial	N=2767 Characteristics: 6 to 59 months old SAM children	To assess rates of nutritional recovery and mortality	-Nutritional recovery rate -Mortality rate	Addition of antibiotics to therapeutic regimens for uncomplicated SAM was associated with a significant improvement in recovery and mortality rates
13.Title: Management of SAM in an urban nutritional rehabilitation center in Burkina Faso Authors: Savadogo *et al*, 2007 Journal: Rev. Epidemiol Sante Publique Date of publication: August, 2007 Volume 55 Issue 4 pages 265 to 274 Country of study: Burkina	Retrospective cohort study	N=1322 Characteristics: Malnourished children admitted in an urban nutritional rehabilitation centre in Burkina Faso from 1999 to 2003	Analysis of key issues of inpatient management of severe malnutrition to suggest appropriate global approach	-Rate of default -Mortality rate -Daily weight gain	-Support is needed for these nutritional rehabilitation centres as most patients attended to over there have high risks of death -Community based therapeutic care should be provided for children who are still malnourished at discharge from Nutritional Rehabilitation Centres -CBT programmes will help reduce mortality rate and number of severely malnourished children attending in-patient nutrition rehabilitation centers by prevention and early management

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14.Title; Clinical dietetic practice in the treatment of severe acute malnutrition in a high H.I.V. setting Author: Biggs, 2013 Title of Jounal: Journal of Human Nutrition and Dietetics Date published; April 2013 Volume 26, Issue 2 Pages 175 to 181 Country of study: South Africa	Cross sectional study	N=53 Dietitians working in Kwa Zulu Natal who routinely treated S.A.M.	To determine current clinical practice in management of SAM	-Recovery rate	-Dietetic practice followed current expert opinion closely rather than the WHO protocol -Omission of cautious refeeding may predispose patients to refeeding syndrome. -Limited evidence indicates that partially hydrolysed formulas are less effective than low lactose low osmolality feeds

15.Title: H.I.V. infection in severely malnourished children in Kumasi, Ghana: a cross sectional prospective study Authors: Asafo Agyei *et al*, 2013 Title of journal: BMC Pediatrics Date of publication: Nov. 9 2013 Volume:13 Page 181 Country of study: Ghana	Cross sectiona prospective study	N=246 Characteristics of subjects: SAM patient undergoing nutritional rehabilitation	To assess the disease burden, predictive clinical features and outcomes for children with SAM and concomitant H.I.V. infection	-Mortality rate -Rate of weight gain	-H.I.V. testing well accepted by parents/carers -H.I.V. testing should be offered in all NRU's -High H.I.V. sero prevalence among children with SAM -Poor outcome in mortality -Clinical features identified to be predictive of H.I.V.