ADHERENCE TO WHO GUIDELINES ON MANAGEMENT OF SEVERE ACUTE MALNUTRITION AMONG CHILDREN ADMITTED AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA

INVESTIGATOR: Dr. Chepng'etich Rispher

SM/PGCHP/07/14

A dissertation submitted in partial fulfilment of the requirement for the degree of Master of Medicine in Child Health and Pediatrics, School of Medicine, College of Health Sciences, Moi University.

DECLARATION

Student's Declaration

This dissertation is my original work submitted in partial fulfillment of the requirement for the degree of Master of Medicine in Child Health and Pediatrics. It has not been presented for a degree award in any other university.

Dr.Chepng'etich Rispher
SM/PGCHP/07/14
Sign……...Date……

Supervisors' Declaration

This dissertation has been submitted for examination with our approval as University supervisors.

Prof. Fabian Esamai
Professor, Child Health and Pediatrics
Ag. Principal
Alupe University College
Sign……Date……..

Dr. Paul Kiptoon
Senior Lecturer
Department of Child Health and Pediatrics
School of Medicine, College of Health Sciences,
Moi University

Sign……Date……

DEDICATION

I dedicate this dissertation work to my family. Special feelings of gratitude to my lovely husband, Osborn Koech and my children; Felix, Olivia and Elvis for their material, financial, emotional and spiritual support during the course of my studies. I also dedicate this dissertation to my mother for her constant prayers throughout the process.

ACKNOWLEDGEMENT

I wish to thank my supervisors Prof. Fabian Esamai and Dr. Paul Kiptoon for their intellectual guidance and support, Henry and Caleb Lagat for guiding me in statistical work. I would also like to thank the Department of Child Health and Pediatrics for their intellectual support. I would also thank my family for their understanding and social support towards the development of my dissertation and finally thank my colleagues for their intellectual, social and material support.

I appreciate Mathew Koech and Wycliffe Lwanga, my research assistants who worked closely with me during data collection and special appreciation to the children who participated in this study.

ABSTRACT

Background: World Health Organization (WHO) defines Severe Acute Malnutrition (SAM) in children as those requiring hospital management with weight for height ≤ -3 Z scores or presence of bilateral edema or left mid upper arm circumference of < 11.5cm. WHO guidelines entailing 10 steps of management were developed in an effort to reduce case fatality rates. These have been adopted globally and where these have been implemented, case fatality rates of SAM have reduced drastically. The Ministry of Health in Kenya has incorporated these into the Basic Pediatric Protocols but their implementation and impact on case fatality locally remain unknown. This study therefore aimed at evaluating the level of adherence to WHO treatment guidelines in management of children aged ≤ 60 months with SAM at Moi Teaching and Referral Hospital (MTRH).

Objective: To evaluate the adherence to WHO guidelines on management of SAM among children admitted at MTRH, Eldoret, Kenya.

Methods: This was a prospective hospital based study conducted between March and August 2016 at the MTRH pediatric wards located in the Shoe for Africa Children's Hospital. Children aged ≤ 60 months admitted to pediatric wards with SAM were recruited into the study. Consecutive sampling was used till the estimated sample size of 89 was attained. Participants were then managed as per the Hospital protocols then the medical records were reviewed at the end of the treatment period. Data was collected using a structured questionnaire. Analysis was done using the statistical package for social sciences (SPSS) version 14 at 95% level of confidence. Frequency tables were used to summarize data. Descriptive statistics including median was used in continuous variables while percentages and frequency listings were used in description of discrete variables. Mann - Whitney U test was used to test for associations between the adherence to the steps of management and the median length of hospital stay. P values < 0.05 were considered statistically significant at 95% confidence interval.

Results: Of the 89 children, 56 (63%) were males, 37(41.7%) were aged between 7-12 months with a median age of 13 months (IQR 10.5, 23.0). Random blood sugar was documented for 35(39.3%), presumptive 10% dextrose prescribed in 6(6.7%) and median feeding time from admission was 6 hours. Hypothermia was noted in 3 (3.4%) and warmth was provided in 32 (69.5%). ReSoMal was prescribed in 41 (46%). All children received antibiotics. Initial feed types were appropriate for both < 6months and ≥ 6 months. Catch up growth feeding was also appropriate for those < 6 months and F100 was prescribed in 61(72.6%) of those aged ≥ 6 months, however, feed increment was documented in 24(28.6%). Overall adherence level was 4.5%, median length of hospital day was 10 days and the case fatality rate was 3.4%. Bivariate analysis showed no statistical significance between adherence and the median length of hospital stay.

Conclusions: Adherence to WHO guidelines on management of SAM at MTRH was low at 4.5%. Case fatality was high at 3.4% and the median length of hospital stay was long at 10 days.

Recommendations: MTRH to ensure adequate supply of the essential commodities required in the management of SAM. Further studies need to be carried out to determine factors affecting this adherence and length of hospital stay and adoption of the WHO structured protocol for documentation of care given to children with SAM at MTRH.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS / ACRONYMS

BMI	Body Mass Index
CFR	Case Fatality Rate
F100	Formula 100
F75	Formula 75
HSD	Half Strength Darrow's.
IMCI	Integrated Management of Childhood Illnesses
KDHS	Kenya Demographic Health Survey
LMUAC	Left Mid Upper Arm Circumference
MAM	Moderate Acute Malnutrition
MTRH	Moi Teaching and Referral Hospital
NCHS	National Center for Health Statistics
NGT	Nasogastric Tube
ORS	Oral Rehydration Solution
RBS	Random Blood Sugar
ReSoMal	Rehydration Solution for Malnutrition
RUTF	Ready to Use Therapeutic Food

SAM Severe Acute Malnutrition

SD Standard Deviation

SPSS Statistical Package for Social Sciences

WHO World Health Organization

WHZ Weight for Height Z scores.

KEY DEFINITIONS

Adherence – Documentation of management of children with severe acute malnutrition in comparison with the WHO guidelines.

Anthropometry – Patients' body measurements and proportions for example: weight, length, height, head circumference and mid- upper arm circumference.

Clinical presentation – combination of physical signs or symptoms associated with a particular disease process.

Edema –clinical condition characterized by an increase in interstitial fluid volume and tissue swelling that can either be localized or generalized.

Hypoalbuminemia – serum albumin concentration of < 3g/dl

Hypoglycemia –Random blood sugar of < 3 mmol/l

Hypothermia – Axillary temperature < 35.0^0C or rectal temperature ≤ 35.5^oC

Moderate acute malnutrition –Weight for height ≤ -2 Z scores

Severe acute malnutrition- Weight for height ≤ -3 Z scores or LMUAC < 11.5 cm or presence of bilateral pedal edema.

Presumptive diagnosis of SAM – Documented diagnosis of SAM in the ward admission registers.

Short term outcomes – length of time from admission to discharge or death or duration of management up to ≤ 6 weeks

Underweight – low weight for age

Wasting – low weight for height

CHAPTER ONE: INTRODUCTION

1.1 Background Information

World Health Organization (WHO) defines severe acute malnutrition in children as those requiring hospital management with weight for height ≤ -3 Z scores or ≤ 70% of the NCHS/WHO reference values (severe wasting) [WHO,2000] or bilateral pedal oedema [WHO,2000]. Left Mid Upper Arm Circumference (LMUAC) below 11.5 cm is another indicator for Severe Acute Malnutrition (SAM) in the age category of 6-59 months [WHO, 1999]. WHO recommends the use of weight for height, but these parameters are less utilized due to various difficulties in measuring children. Weight measurement is dependent on the availability of functioning and calibrated scales, which sometimes are unavailable.

Malnutrition has been shown to contribute significantly to preventable morbidity as well as global burden of mortality, the deaths approximated at 60% of the estimated 10 Million deaths per annum among children aged ≤ 5 years in developing world [WHO,1999; Black R.E., *et al*,2003; Scholfield C., *et al*, 1996; Rice A.L., *et al*,2000]

WHO estimates that approximately 45% of all deaths, which occurs in children less than 5 years in developing world, can be attributed to malnutrition in low- and middle- income countries [w.w.w.who.int,May 2017]. In sub-Saharan Africa, mortality associated with protein energy malnutrition ranges from 25-35% [Gernaat H.B.,*et al*,1998; Rutherford G.W.,*et al*,1985] while in Nigeria it is 22-40% [Ibekwe V.E., *et al*,1994]

In developing countries, there is a high prevalence of malnutrition occurring with different spectra of co-morbidities and thus contributes to majority of premature death in children. Malnutrition is postulated to play a role in approximately a third of the 8.8 million deaths

occurring per year in children below 5 years of age. Children with malnutrition are at increased risk of dying [Black R.E., *et al*, 2008]. Malnutrition is not one disease, there are underlying medical conditions which vary in presentation and could manifest as acute or chronic, interfering with the child's growth and development . It results from interaction of many factors such as environmental, nutritional, clinical, socio-economic and cultural thus there is need to address these factors so as to reverse the processes that result in clinical disease.

Classification of malnutrition can be done using: Wellcome's classification, Gomez, height for age and weight for height by Waterlow's classification. None of the above classification considers all the 3 parameters; stunting, wasting and underweight therefore WHO recommended the use of Z score to classify malnutrition where the 3 parameters are expressed in standard deviation unit [WHO,1999]

SAM often is complicated by co-morbid conditions such as malaria, anemia, diarrheal illnesses, and lower respiratory tract infections including pneumonia and tuberculosis [Ejaz M.S., *et al*, 2010; Le Roux1 I.M., et al 2010]. The management approach for SAM is tedious and complex involving multidisciplinary team and long hospital stay [Nhampossa T., *et al*, 2013]

Global studies revealed that poor hospital management of children with severe acute malnutrition has been associated with a high case fatality rates [Ashworth A., et al,2003; Rice A.L., et al, 2000; Ashworth A., et al, 2004; Nzioki C., *et al*, 2009; Maitland C., *et al* 2006; Deen J.L., *et al*,2003; Bhan M.K., *et al*, 2003; Bernal *et al*, 2008], WHO clinical treatment guidelines were developed in an attempt to reduce the case fatality rates and

improve the quality of care given to the severely malnourished children [WHO, 1999] .These guidelines entails 10 steps, published in 1999 , various revisions have been made with the latest done in 2016 and these have been adopted by the Ministry of Health in Kenya and incorporated into the Basic Pediatric Protocols [MoH, Basic Pediatric Protocols, 2016]

The rationale for observing the 10 principles of management was based on evidence from studies that showed care improvement and reduction in case fatality following the implementation of the WHO guidelines. A study in Bangladesh showed a reduction in mortality rate from 17% to 9% after the implementation of the WHO guidelines [Iqbal H., *et al*, 2009]

Bhan *et.al* reviewed 140 studies on management of severe malnutrition in perspective of developing countries which revealed that careful assessment and initiation of appropriate management using standard protocols lowered the morbidity and mortality rates to as low as 6% from high rates of 40-50% [Bhan M.K., *et al*,2003]. A prospective study in South Africa [Ashworth A., *et al*, 2004] showed reduction in mortality after the implementation of the WHO guidelines at Mary Theresa hospital from 46 % to 21% and Sipetu hospital where the reduction was from 25% to 18%.

Nzioki *et.al* in their study at the Kenyatta National Hospital reported deficiencies in the management of children with SAM and they documented a case fatality rate of 38% while a study at Mbagathi Hospital [Fondo *et.al*,2013] recorded a case fatality rate of 8% after the implementation of the WHO guidelines. There is paucity of information locally at MTRH regarding the impact of the WHO guidelines in management of SAM

This study therefore aimed at evaluating the level of adherence to WHO treatment guidelines in the management of severe acute malnutrition among children aged ≤ 60 months admitted to pediatric wards at MTRH.

1.2 Problem Statement

There is a high prevalence of malnutrition in the developing countries estimated at 40% compared with 2-10% in developed countries [Getaneh T., *et al* 1998; Abidoye R.O., *et al* 2000], WHO estimates that approximately 45% of all deaths, which occurs in children less than 5 years in developing world, can be attributed to malnutrition in low- and middle-income countries [www.who.int , May 2017] and according to Kenya Demographic Health Survey (KDHS) 2014; the overall rating of malnutrition at the National level among children below 5 years of age is 1% severely wasted and 2% severely underweight while in Uasin-Gishu county, the rating is severe wasting 1.1% and severe underweight 2.8% [KDHS 2014]

There is a high prevalence of severe wasting in Uasin-Gishu at 1.1% compared with that in Western Kenya regions at 0.4% [KDHS 2014]. According to the study by Bett *et.al*, there is a high prevalence of malnutrition in MTRH at 41.7% [Bett *et al*, 2010]. SAM often is complicated by co-morbid conditions such as malaria, anemia, diarrheal illnesses, and lower respiratory tract infections including pneumonia and tuberculosis [le Roux1 IM, *et al*, 2010; Ejaz MS, *et al*, 2010]. The management approach for SAM is tedious and complex involving multidisciplinary team and long hospital stay [Nhampossa *et al*, 2013]

Global studies revealed that poor hospital management of children with severe acute malnutrition has been associated with high case fatality rates [Ashworth A., *et al*, 2003 ; Rice A.L., *et al*, 2000; Ashworth A., *et al*, 2004 ; Nzioki C., *et al* 2009 ; Maitland C, *et al*

2006; Deen J.L., *et al*, 2003; Bhan M.K., *et al*, 2003; .Bernal, *et al*, 2008; WHO,1999]. WHO clinical treatment guidelines were developed in an attempt to reduce the case fatality rates and improve the quality of care given to the severely malnourished children [WHO, 1999], Thus, WHO guidelines are a lifeline for SAM if applied appropriately in the management of the affected children,

The Kenyan Ministry Of Health has adopted the WHO management guidelines and incorporated into the Basic Pediatric Protocols, however, it remains uncertain whether these are adhered to in MTRH. There was a high case fatality rate at 38% at Kenyatta National Hospital post the implementation of the WHO guidelines [Nzioki C., *et al*, 2009] while at MTRH the case fatality rate and the level of adherence to these guidelines is unknown.

This study therefore aimed at evaluating the level of adherence to the WHO treatment guidelines in management of children aged ≤ 60 months with severe malnutrition at MTRH pediatric wards.

1.3 Study Justification

Although the risk factors for severe acute malnutrition have been well documented, the prevalence and case fatality rates remain high both locally and internationally.

WHO estimates that approximately 45% of all deaths, which occurs in children less than 5 years in developing world, can be attributed to malnutrition in low- and middle- income countries [www.who.int , May 2017]. In sub-Saharan Africa, protein energy associated mortality ranges from 25-35% [Gernaat H.B., *et al*, 1998] while in Nigeria it is 22-40% [Ibekwe V.E., *et al*, 1994]. A study in Uganda showed a mortality of 11.9% [Nyeko R., *et al*, 2016] while Nzioki C., et.al at Kenyatta National Hospital documented a higher case

fatality of 38% .Careful assessment and appropriate treatment using WHO standardized protocols has been shown to reduce morbidity and mortality from 40-50% to as low as 6% [Bhan M.K., *et al*,2003] in developing countries.

The WHO management guidelines of SAM addresses doctors and other Health care workers with procedural explanations of what can be done in order to save lives, attain successful outcome, prevent relapse and ultimately give a chance to recovery [WHO, 2013].

The Kenyan Ministry of Health has incorporated these guidelines into the Basic Pediatric Protocols [MoH. Basic Pediatric Protocols; 2016]. No study has been done in MTRH to evaluate adherence to WHO treatment guidelines in management of malnourished children at MTRH pediatric wards. Furthermore there is a high prevalence of malnutrition (41.7%) [Bett *et al*, 2010] in MTRH and there is paucity of information regarding treatment outcome.

This study therefore aimed at evaluating the care given to children admitted with SAM to MTRH pediatric wards and to identify the level of adherence to the WHO guidelines.

1.4 Research Question

What is the level of adherence to the WHO treatment guidelines for severe acute malnutrition among children aged ≤ 60 months at MTRH pediatric wards?

1.5 Study Objectives

1.5.1 Broad Objective

To evaluate adherence to the WHO treatment guidelines in the management of SAM among children admitted to pediatric wards at MTRH.

1.5.2 Specific Objectives

1. To determine the proportion of children aged ≤ 60 months with severe malnutrition who received appropriate treatment as per WHO guidelines at MTRH pediatric wards.
2. To describe the treatment outcomes in children with severe malnutrition admitted to pediatric wards at MTRH.

CHAPTER TWO: LITERATURE REVIEW

SAM is the commonest form of malnutrition seen during transitional period of weaning, results from deficiency of protein or calories in the diet [WHO, 2000].

2.1 Prevalence

Prevalence of under-nutrition is assessed by weight for age, height for age and wasting (weight for height irrespective of age) for under- five children [Ramachandran P., *et al*,2011]. Of these, weight for age is the most widely used indicator for assessment of nutritional status because of ease of measurement [Ramachandran P., *et al*, 2011]

Internationally it is estimated that 55 million children below 5 years of age are wasted, out of whom 35% (19 million) are severely wasted [UNICEF, 2008]. The estimation of malnutrition worldwide showed that 35.8% of preschool children are underweight in developing countries, 42.7 % being stunted and 9.2% are wasted [Muller O.,*et al*, 2005], also in developing countries the prevalence of severe acute malnutrition is 40% compared with a range from 2% up to 10% in developed countries [MoH. Basic pediatric protocols; 2016, Ramachandran P., *et al* , 2011]. In India, there is a reported high prevalence of under-weight children (World Bank, 2014). The malnutrition burden among the under five children in various parts of the country was rated as: under- weight at 39% -75% and wasting at 10.6% - 42.3% [Thakur J.S., *et al*, 2011; Espie *et al*, 2011; Anurag S., *et al*, 2012; World Bank, 2006]

According to Kenya Demographic Health Survey (KDHS) 2014 [KDHS, 2014],the overall rating of malnutrition at the National level among children below 5 years of age, is 8% severely stunted, 1% severely wasted and 2% are severely underweight. From the KDHS

2014 statistics, the nutritional status of a proportion of children has been classified based on various background characteristics. For age below 6 months with severe wasting is 1.4% compared with the age group of between 48-59 months where severe wasting was rated at 0.6%. For males, severe wasting is 1% compared to 0.8% for females. In terms of residence, rural setting rating showed increased incidence of malnutrition compared to the urban settings. Other factors such as: maternal level of education and the household wealth were considered and the conclusion drawn was that the degree of malnutrition is inversely related to the mothers' level of education and the household wealth [KDHS 2014]

The KDHS 2014 [KDHS 2014] statistics are unique in that the rating of malnutrition has been done at the county levels in contrast to KDHS 2008/2009 where it was done in terms of provincial boundaries. In Uasin-Gishu County, the level of severe wasting 1.1% compared to the neighboring counties where the ratings were:

- Elgeyo Marakwet: severe wasting 1.2%
- Trans-Nzoia: severe wasting 2.0%

Clinical surveys done at MTRH showed a prevalence of malnutrition at 41.71% [Bet *et al*, 2010]

2.2 Classification of Malnutrition

The use of Z scores as recommended by WHO under the assessment of malnutrition has an advantage over percentage of the reference used in Wellcome classification [WHO, 2013]. WHO recommends the use of the Z score system which is important for identifying all facets of under-nutrition.

2.3 Physiological Basis for Management [Saunders E., 2011]

Malnutrition affects various systems of the body. The acute phase response to infection is silenced in SAM in part of a process of reductive adaptation where the structure and function of tissues cannot be preserved due to the limited supply of energy and nutrients due to reduction in intake. This subsequently affects the cytokines such as IL-1, IL-6 and tumor necrosis factor that are involved in the acute phase reaction. Therefore children with SAM are immunosuppressed thus cannot mount adequate immune response to infections.

Visceral organs and muscles are broken down and hence reduction in weight. Various theories have been postulated to try and explain the physiologic processes resulting in malnutrition such as; inadequate protein and / or energy intake resultant adaptive mechanisms: such as; Reduced protein stores leading to: reduced skeletal muscle mass, reduced heart muscle mass ,reduced respiratory muscle mass and reduced protein reserve. These physiological processes were used as a basis for the formulation of the WHO management guidelines for malnutrition.

2.3.1 Cardiovascular

There is reduced cardiac output, stroke volume, blood pressure, renal perfusion and circulation time therefore IV fluids given only in case of shock, restriction of blood to 10mls /kg with an administration of a diuretic.

2.3.2 Liver

There is reduced synthesis of all proteins thus gluconeogenesis leads to hypoglycemia. The metabolic and excretory functions of the liver are severely reduced thus small frequent meals and avoiding or reducing doses of hepatotoxic drugs.

2.3.3 Renal

Glomerular filtration is reduced resulting in reduced sodium excretion and decreased capacity of the kidneys to excrete excess water and acids thus restrict dietary sodium.

2.3.4 Gastrointestinal tract

There is decreased intestinal motility, reduced production of gastric acid and reduced absorption of nutrients due to atrophy of gastrointestinal mucosa and pancreas thus the need for small amount of frequent feeds.

2.3.5 Immune System

The resultant atrophy of lymph glands, thymus and tonsils leads to severe depression of cellular mediated immunity, IgA secretion and complement components, ultimately the acute phase immune response is diminished thus typical signs of infection such as fever or increased white cell counts are absent. Hypoglycemia and hypothermia are signs of severe infection or septic shock. Therefore treat all children with broad spectrum antimicrobials

2.3.6 Cellular functions

Na^+/K^+ pump activity is reduced and cell membrane becomes more permeable leading to increase in intracellular sodium and a reduction in intracellular potassium and magnesium. Therefore there is need for supplementation of potassium and magnesium and restriction of sodium intake.

2.3.7 Skin

The skin and subcutaneous tissue are atrophied resulting in loose folds of the skin (baggy pants) hence the need for the provision of warmth.

2.4 Assessment of Degree of Malnutrition

In the initial assessment, a focused patient history is paramount. This history comprises: the child's diet, comorbidities and social circumstances. Diet should include the usual diet of the child before the current ill-health, recent intake in terms of fluid and foods, duration of breast feeding including the period of exclusive breastfeeding, weaning age, the type of complementary foods introduced. Dietary survey can be done to determine content of the food consumed in a day, this can be done by: taking a diet history, diet diary, inquiring about food frequency, 24 hour recall [WHO, 2013]

Since tuberculosis has a high prevalence in our set up [MTRH health records, 2016] any child with a cough requires more details in the history including the duration, any associated progressive weight loss, contact with suspected or open TB case, recent contact with a person with measles and the HIV status should be known [WHO, 2013].

Anthropometric measurements include: weight for age to assess under nutrition, weight for height a measure of wasting and height for age an indicator for stunting, other measures include LMUAC, Head circumference, skin fold thickness and Body Mass Index (BMI) [WHO, 2013].

Physical examination include: features of dehydration, pallor, bilateral pitting edema, temperature $<35.5^{o}$C (rectal), oral sores or thrush, eyes signs for vitamin A deficiency for example corneal ulceration and keratomalacia. Local signs of skin and hair changes, any signs of throat and ear infections and abdominal examination to assess if there is hepatomegaly [WHO, 2013].

2.5 Management of Severe Acute Malnutrition

WHO management guidelines are Global recommendations of clinical practices that result in the best health outcome possible in resource limited areas [WHO, 2013].

There are two ways of management; community based and in- patient management:

Community based therapeutic care (CTC)

It is a new approach to manage malnourished children in their rural communities. It involves the use of ready to use therapeutic food (RUTF) to rehabilitate children in their homes or communities. Severely malnourished children are monitored and treated at home. Community health workers or volunteers easily identify children affected by measuring MUAC. There after children are seen by a health worker who decides whether they can be treated at home or referred for in patient management [WHO, 2013].

WHO guidelines 2013 on in - patient management of SAM [WHO, 2013].

These guidelines were published by WHO in 1999 [WHO, 1999] and have been adopted by the Ministry Of Health in Kenya and incorporated into the basic pediatric protocols [MoH. Basic Pediatric Protocols; 2016]. In- patient management is based on 10 steps principles of management done in two phases: stabilization phase from day 1 –7 days and rehabilitation phase from 2nd week to the 6th week (**see Appendix 6).**

2.5.1 Hypoglycemia

Hypoglycemia defined as random blood sugar of <3 mmol/l. 10% dextrose should be given at a dose of 5ml/kg as a bolus. Frequent feeding- 2-3 hourly is important day and night.

RBS monitoring and repeat after 30 minutes if the initial was low.

Intravenous (IV) or Nasogastric tube glucose for those who are unconscious or very severely ill with no glucose measurement. Immediate nasogastric tube feeding for conscious children with blood glucose < 3mmol/l.

2.5.2 Hypothermia

Hypothermia defined by axillary temperature of $<35^{o}C$ or rectal temperature $\leq 35.5^{o}C$

All new admissions with malnutrition should be kept warm by nursing in warm rooms (25-$30^{o}C$, free of draughts) and separated from infectious children until there are signs of recovery.

2.5.3 Dehydration

It can be over diagnosed in case of severe acute malnutrition. Assumption of some dehydration is made in case of no signs of shock.

IV fluid plans only in case of shock and the fluid of choice is Ringers lactate in 5% dextrose alternatively Half-Strength Darrow's with 5% dextrose if none of these are available then 0.45% saline with 5% dextrose is given.

For oral rehydration, should rerceive ReSoMal at 5ml/kg for the first 2 hours. Then 5-10 ml/kg per hour for the next 4-10 hours on alternate hours with F75. Monitoring of dehydration progress every 30 min for 2 hours then hourly for the next 4-10 hours. Feeding must be started by 12 hours. Continue feeding throughout if the child is breastfeeding.

2.5.4 Electrolyte imbalance

If pre-packaged F75 / F100 are available they contain potassium, minerals, trace elements and vitamins and if pre-packaged feeds are NOT available;

– All should receive an extra 3- 4mmol/kg/day of oral potassium (after stopping ReSoMal) and extra magnesium 0.4-0.6mmol/kg/day.

2.5.5 Infection

Up to 1/3rd children with malnutrition who die have septicaemia or bacteraemia [Bhan MK, et al, 2003].Malnourished children present commonly with infection without the typical signs such as; fever and increased white cell count, there it is assumed that children with SAM have infections and should routinely be initiated on broad- spectrum antibiotics for the presumed infection and also treated for oral thrush if any.

2.5.6 Micronutrient deficiencies

Vitamin A:

– With Eye signs: 200,000 IU on admission, on day 2 and on day 14 (50.000 IU if less than 6 months, 100,000IU if aged 6- 12 months and 200,00iu if > 12months).

– Without Eye signs: stat dose appropriate for age.

Pre-packaged F75 / F100 and RUTF contains adequate amount of; minerals, electrolytes and micronutrients therefore there is no need for supplementing the micronutrients in case a child is getting these feeds. Anaemia is common among malnourished children and iron should be supplemented in the rehabilitation phase of treatment.

2.5.7 Initial feeding- F75 100ml/kg per day if severe oedema or 130ml/kg/day if no or moderate edema, to be given 3 hourly including at night. Then switch from F75 to F100 based on return of appetite, no episodes of hypoglycemia and reduction of oedema. NGT feeding recommended if child consumes ≤ 80% of the expected volume per feed for two

consecutive feeds. For children below 6 months of age they are fed with expressed breast milk or by use of diluted F100, where 35mls of water is added to every 100mls 0f F100.

2.5.8 Catch up growth- can be done 2-3 days after admission if there was no oedema, 5-7 days after admission in those with severe lethargy, initially a gradual transition recommends, same volume as F75 for about 48hours to avoid risk of heart failure, then increase by 10 mls per feed till some feed remains uneaten, this point is about 200ml/kg/day. If F100 is not available, change to RUTF.

2.5.9 Sensory stimulation

Parental involvement is necessary in provision of tender love and care, toys, structured play and provision of a cheerful environment are useful in the stimulation of the child**.**

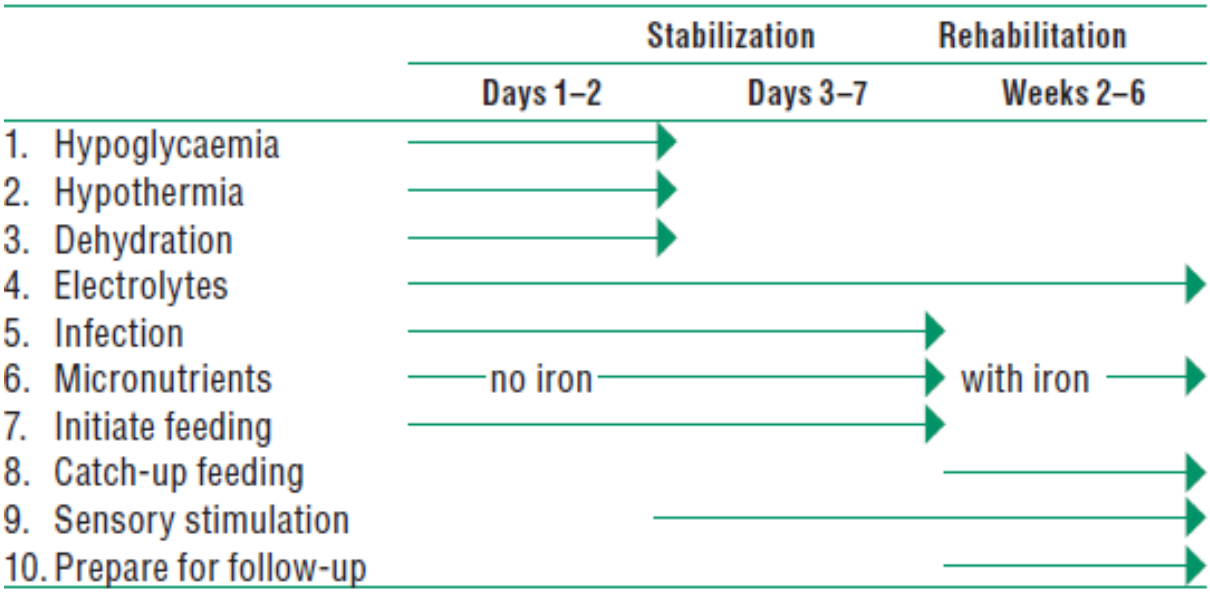
2.5.10 Plan for discharge and follow up.

Plan for discharge done when: Edema has resolved or the child is clinically alert and well and resolving underlying medical conditions, child is feeding or breast feeding well and there is satisfactory weight gain. Weight gain rating as follows: poor: ≤ 5g/kg/day, moderate:5-10g/kg/day and good ≥10 g/kg/day. Treatment failure can be considered when: death occurs within 24 hours of management and the likely causes are; hypoglycaemia, hypothermia, septicaemia, dehydration or incorrect rehydration fluid given or severe anaemia. Death occurring within 72 hours: could be due to increased volume of feed or wrong formulation given, while death at night could be due to hypothermia.

Missed vaccinations should be given before discharge and the parents or the caregivers linked with available support groups for follow up and to continue the community based therapeutic care by use of RUTF to rehabilitate children in their communities.

The rationale for observing the 10 principles of management was based on evidence from studies that showed care improvement and reduction in case fatality following the implementation of the WHO guidelines. A study in Bangladesh showed a reduction in mortality rate from 17% to 9% after the implementation of the WHO guidelines [Igbal H., *et al*, 2009]. Bhan et.al reviewed 140 studies on management of severe malnutrition in perspective of developing countries which revealed that careful assessment and initiation of appropriate management using standard protocols lowered the morbidity and mortality rates to as low as 6% from high rates of 40-50% [Bhan M.K., *et al*, 2003]. A prospective study in South Africa [Ashworth A., *et al*, 2004] showed reduction in mortality after the implementation of the WHO guidelines at Mary Theresa hospital from 46 % to 21% and Sipetu hospital where the reduction was from 25% to 18%.

Table 1: Time frame for management of children with SAM [WHO, 2013] **Adapted from the WHO guidelines, 2013 Edition.**



CHAPTER THREE: METHODOLOGY

3.1 Study Design

This was a prospective descriptive hospital based study.

3.2 Study Site

MTRH pediatrics wards located in the Shoe for Africa Children's Hospital in Uasin-Gishu county, Eldoret, Kenya, approximately 320km North West of Nairobi. It is the second largest Referral hospital in Kenya following Kenyatta National Hospital, serving Western Kenya region (Nyanza, North and Southern Rift-Valley, Western regions) and parts of Southern and Eastern Uganda. The catchment population is approximately 13 million people which are about 32.5% of Kenyan population. The general pediatric wards, has a bed capacity 105 with bed occupancy of > 100%, admissions included children aged between 6 weeks to 14 years. MTRH receives patients from other facilities as referrals and self- referrals from various homes.

3.3 Study Population

The **target population** was children aged ≤ 60 months admitted to pediatric wards at MTRH with **presumptive** diagnosis of malnutrition.

The **study population** was children aged ≤ 60 months with **confirmed** SAM by the Principal Investigator and the research assistant, admitted to pediatric wards at MTRH.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

1. Children age ≤ 60 months admitted to pediatric wards with Severe Acute Malnutrition.

3.4.2 Exclusion Criteria

1. Children with underlying malignancies

3.5 Study Period

Data collection was between March 2016 and end of August 2016

3.6 Sample Size Estimation

Was determined by the **Fisher's Formula**

$$N = \frac{Z^2_{\alpha} P (1-P)}{e^2}$$

Z_{α} - Standard normal distribution critical value (1.96 for 95% confidence interval)

P- Is the proportion of children receiving appropriate care adherent to WHO guidelines, not known from the previous studies hence was assumed to be 50%.

e- Level of precision (5%), i.e. 0.05

Substitution,

$$\frac{1.96^2 X 0.5(0.5)}{0.05^2} = 384$$

Adjustment for finite population, children aged ≤ 60 months with Severe Acute Malnutrition (SAM) admitted to general pediatric wards at MTRH, from medical records, an average of 17 per month, for 6 months therefore was equal to (17x6) = 102 So, **N=102**

Thus; $n_f = n_o / (1+n_o/N)$

N= population size while n_f = was the final sample size

$$n_f = \frac{384}{1+ 384/102} = 80$$

Adjustment for non- response and missing data, 10 % more were recruited.

Final sample size was therefore:

80/0.9 = 89

3.7 Sampling Technique

Consecutive sampling of all admissions who met the inclusion criteria was employed till a minimum sample size of **89** was achieved.

3.8 Study Procedure

The Principal Investigator recruited 2 research assistants; one was a nutritionist and the other was a nutritionist intern who had previously rotated in the pediatric wards, the selection was on the basis of their knowledge, commitment and reliability. They were trained on the study procedures and expectations and the specific training on the WHO guidelines on nutritional assessment and management. This included training on: anthropometric measurements, ten steps of management and ethical consideration surrounding research.

The Principal Investigator then sensitized the pediatrics team including nurses, medical officer interns, colleagues, clinical officers, social workers and nutritionists at the pediatric wards about the study, informing them on the purpose of the study and how the study findings will benefit the department.

Children with presumptive diagnosis of SAM were identified using the ward admission register. The research assistant then transferred these children to the procedure room for confidentiality. Screening for eligibility was done through focused nutritional history taking, physical examination and the taking of the anthropometric measurements geared towards confirming a diagnosis of SAM. This was done daily in the wards between 8am to

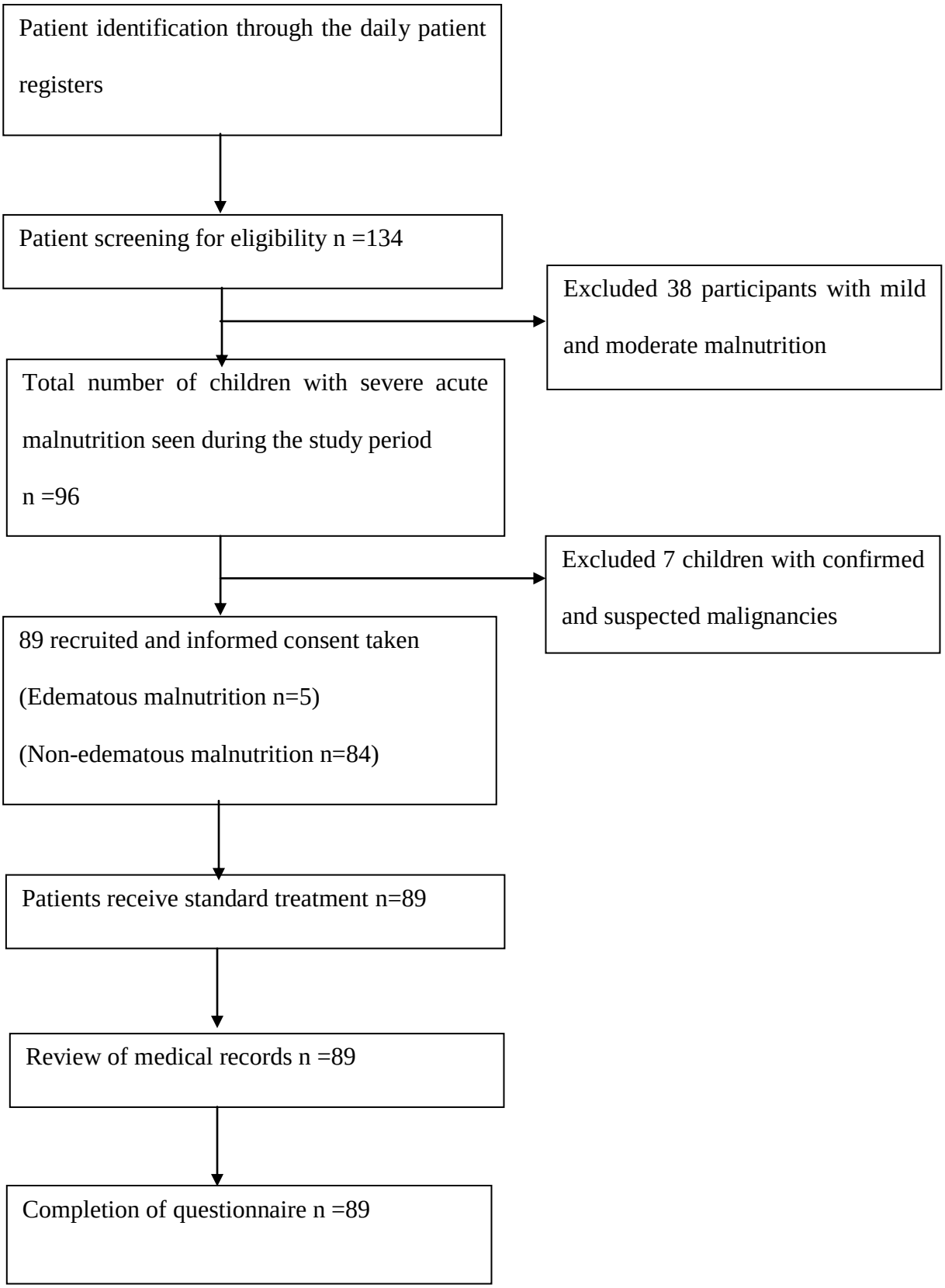
8pm. Anthropometric measurements included; weight, height for >2 years of age or length for ≤ 2 years, LMUAC for those ≥ 6 months and pedal edema assessed including level.

The anthropometric measurements including; LMUAC, weight, length for those aged ≤ 2 years and height for those aged > 2 years were measured according to the procedure outlined in the **appendix 5** and Z scores estimated as per the WHO reference values.

The Principal Investigator and the Research assistant used measuring equipment including the weighing scales, measuring boards, stadiometers and the LMUAC tapes belonging to the wards, which are usually used in the standard care of the patients.

In case of admissions beyond 8 pm research assistant would go to the wards by 8am the following day to identify those who were admitted beyond 8 pm then notified the Principal Investigator so as to screen these children and recruit them into the study in case they met the criteria. The process was repeated daily from the 1st day of the study period until the estimated sample size of 89 was attained at the 6th month of the study. A total of 134 children were screened, out of whom 38 were diagnosed with mild and moderate malnutrition and thus were not recruited into the study, therefore 96 children were confirmed as SAM and 7 were excluded due to underlying malignancies. Verbal and written informed consent was sought from the parents / guardians of the 89 children who were recruited in to the study. Study participants each received standard treatment as per the hospital protocols. The files and other treatment records were then reviewed at the end of the treatment process (discharge, death or end of the 6th week of treatment).The Study participants' progress in the wards were checked against WHO treatment guidelines and information captured was documented on the structured questionnaire, **see appendix 4**.

STUDY FLOW ALGORITHM



3.9 Data Collection

The structured data collection tool (questionnaire) was pretested by the Principal Investigator, in the pediatric wards at the Kericho County and Referral Hospital, Kericho, Kenya.

A pretested questionnaire was used to collect data. The demographic data included: age in months or years, the relationship of the informant to the child and gender. It also contained details of clinical presentation and anthropometric measurements. Other details included the management that was instituted at the sick child clinic and in the wards, **see appendix 4.**

3.10 Data Management

3.10.1 Data Entry, Analysis and Presentation

Data entry, coding, cleaning and analysis was done using SPSS version 14. Descriptive statistics was done to summarize the data. For categorical data such as; gender, frequencies and proportions were tabulated and graphs plotted to show the distribution. For numerical data such as; age, length of hospital stay, measures of central tendencies and dispersion such as median, standard deviation/ interquartile range were reported and presented in tables and graphs.

In some cases numerical data were categorized in clinically meaningful categories and summarized as categorical variables. Mann- Whitney U test was used to test for associations between numerical variables and binary categorical variables. The study was conducted at a level of significance of ≤ 0.05.

3.11 Ethical Considerations

Research protocol was reviewed and approved by the Institutional Research and Ethics Committee of Moi University and Moi Teaching and Referral Hospital, verbal and written consent was sought from the parents or care takers and confidentiality was maintained. No names were included in questionnaire; serial numbers and inpatient numbers were used. The standard treatment protocol was adhered to and a patient whose parent or guardian declined consent or withdrew from the study received standard treatment protocol as well. However, neither coercion nor incentives were provided for one to participate in this study, no extra benefits or risks to those who consented for the study or for those who declined consent to the study and finally the findings of this study will be shared with MTRH management and other stakeholders. I hope to publish my findings after completion of the study period depending on the approval by IREC.

CHAPTER FOUR: RESULTS

4.1 Sociodemographic and clinical characteristics of the participants

4.1.1 Demographic characteristics

A total of 89 children were recruited into the study. Out of these 56 (63%) were males, giving a male to female ratio of 1.7:1.Thirty seven (41.6%) were aged between 7-12 months with the median age being 13 months (IQR 10.5, 23.0) (Figure 1).

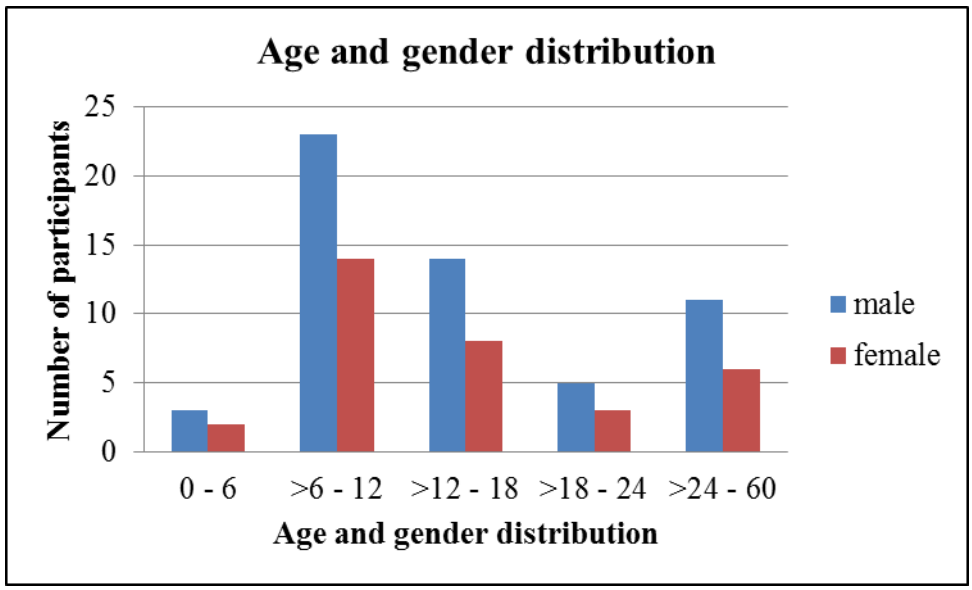


Figure 1: Bar graph showing age- gender distribution among children with SAM

Five children (6%, n=89) presented with edematous form of severe malnutrition, all of them being males while 84 (94%) presented with non- edematous form.

4.1.2 Anthropometric measurements

Seventy three (87%, n=84) children had a LMUAC of less than 11.5cm.

The median weight among the study participants was 5.8kgs (IQR 5, 7.1), median height was 68cm (IQR 63.1, 75) and mean LMUAC 10.5cm (SD ±1.1).

Eighty seven (98%, n=89) of participants had a WHZ score of ≤ - 3 SD while the 2(2%) who had a Z score of -2 SD had a LMUAC of less than 11.5cm.

Table 2: Anthropometric measurements versus age.

ANTHROPOMETRIC MEASUREMENT	**AGE GROUPING IN MONTHS:**				
	0-6	**>6 - 12**	**>12 – 18**	**>18 – 24**	**>24 – 60**
WHZ SCORE					
≤-3 SD	5	36	21	8	17
-2 SD	0	1	1	0	0
LMUAC IN CM					
<11.5	N/A*	32	19	6	14
≥11.5	N/A	5	3	2	3
TOTAL	5	37	22	8	17

*** Not applicable**

4.1.3 Frequency of co-morbidities among the study participants.

Pneumonia (21%) and diarrhoea (20%) were the most common comorbidities among the participants followed closely by tuberculosis at 8%.

Regarding the HIV status of the participants; majority 78(88%) were seronegative, **5(6%) were seropositive** with 4 sero - exposed infants and the sero -status for 2 children was not documented see Table 3.

Table 3: Frequency of co-morbidities among the study participants.

Co-morbidity (n=89)	Frequency (%)
Pneumonia	19 (21%)
Diarrhoea	18(20%)
Anemia	9(10%)
Sepsis	7(8%)
Tuberculosis.	**7(8%)**
Malaria	5(6%)
Rickets	5(6%)
HIV	**5(6%)**
Meningitis	3(3%)
None	11(12%)

4.2: Adherence to WHO management guidelines for severe acute malnutrition.

Step 1: Treatment and prevention of hypoglycemia

Random Blood Sugar (RBS) was documented in 35 (39.3%) children

Two (2%, n=89) received their first feed within 2 hours of admission (Table 4).

The median time of initiating first feed from the time of admission was 6 hours (IQR 5.5, 12)

Table 4: Step 1: Treatment and prevention of hypoglycemia.

Variable (n=89)	Yes	No
RBS was documented	**35(39.3%)**	54(60.7%)
Presumptive 10% dextrose was prescribed on admission	**6 (6.7%)**	83(93.3%)

Step 2: Treatment and prevention of hypothermia

Initial temperature was recorded in all cases, hypothermia was noted in 3 (3.4%) children while hyperthermia was noted in 43 (48.3%) children (Table 5).Warmth was provided in 32(69.6%, n = 46) of participants

Table 5: Initial temperature recorded among participants (n=89).

Temperature in degrees centigrade	**Number of participants (%)**
$<35^0$C	3(3.4%)
35^0C - 37.2^0C	43(48.3%)
$>37.2^0$C	43(48.3%)

Step 3: Treatment and prevention of dehydration

ReSoMal was prescribed in 41(46%) of participants (Table 6).

Table 6: Treatment and prevention of dehydration

Variable (n=89)	Yes	No
Diagnosed with shock	**2(2%)**	87(98%)
Shock appropriately managed (n=2)	**2(100%)**	0(0%)
Intravenous fluids initiated inappropriately in patients not in shock (n=87)	0(0%)	87(100%)
Resomal prescribed	**41(46%)**	48(54%)

Step 4: Correction of electrolytes imbalances.

Urea, electrolytes and creatinine were done on 82(92%) of study participants. Two children with hypokalemia both received potassium chloride. Seventy two (81%) were initiated on commercially prepared F75 which contains: minerals, electrolytes and micronutrients.

Step 5: Routine treatment of infections

All study participants were initiated on first line antibiotics; crystalline penicillin and gentamicin appropriate for weight on admission. Subsequently 17 (19%) children received second and third line antibiotics which included: ceftriaxone, meropenem and vancomycin based on blood culture results and clinical assessment of non-response to the first line of antibiotics.

Step 6: Correction of micronutrient deficiencies.

Iron was inappropriately prescribed (12%) in the acute phase of management

Zinc was given to all children who presented with diarrhoea (Table 7).

Table 7: Correction of micronutrient deficiencies

Parameter assessed (n=89)	**WHO guidelines**	**Yes**	**Comment**	**Compliance**
Vitamin A prescribed	Administer on admission, days 2 &14 if presence of eye signs	20(22%)	Stat dose given-yet no eye examination documented	No
Zinc prescribed	Administer in case of diarrhoea	44(49%)	Children with diarrhoea were 44	Yes
Folate prescribed	2.5mg alternate days if no RUTF or F75/F100	10(11%)	Administered despite availability of RUTF/F75/F100	No
Multivitamin prescribed	For at least 2 weeks if no RUTF of F75/F 100	46(52%)	Administered despite availability of RUTF/F75/F100	No
Iron prescribed	Only when child gaining weight & if no RUTF.	33(37%)	11(12%) administered in acute phase 22(25%) administered in rehabilitation.	No

Step 7: Initial feeding.

All children aged below 6 months received appropriate initial feed (Table 8a)

Table 8: Initial feeding

Table 8 a: Initial feed for age < 6 months (n=5)

Parameter assessed n=5	**WHO guidelines**	**Adherence**	**Non adherence**
Appropriate feed type	EBM/term formula/diluted F100*	5(100%)	0%
Appropriate volume	100- 130mls/kg/day*	5(100%)	0%
Specified route of feeding	Cup/Nasogastric tube	5(100%)	0%
Feed intake monitored daily and documented	Every 2-3 hours	**5(100%)**	0%

*each 100mls F100 add 35mls clean water

* 100mls/kg/day for those with severe edema and 130mls/kg/day for the rest

Initial feed for age ≥ 6 months

A total of 72(82%, n=84) received an appropriate initial feed. Monitoring of daily feed intake was inappropriate (table 8b).

Table 8 b: Initial feed for age ≥ 6 months (n=84)

Parameter assessed n=84	**WHO guidelines**	**Adherence**	**Non adherence**
Appropriate feed type	F-75	72 (86%)	12(14%)
Appropriate volume	100-130mls kg/day*	71(84.5%)	13(15.5%)
Specified route of feeding	Cup/nasogastric tube	72(85.7%)	12(14.3%)
Feed intake monitored daily and documented	Every 2-3 hours	**35(41.7%)**	49(58.3%)

*100mls/kg/day if presence of severe edema and 130mls/kg/day for the rest

Step 8: Catch up growth feeding.

All children aged below 6 months received appropriate catch up growth feeding.

Appropriate feed type for 61(72.6%, n=84) children.

Twenty four children (28.6%, n=84) received an appropriate feed increment after transition period (Table 9).

Table 9: Step 8: Catch up growth feeding (n=84)

Parameter assessed	**WHO guidelines**	**Adherence**	**Non-Adherence**
Appropriate feed type	F-100	61(72.6%)	23 (27.4%)
Appropriate volume	Same volume as F-75 for 48 hours	59(70.2%)	25 (29.8%)
Appropriate increase in feed volume after transition period	Increase by 10mls each subsequent meal*	**24(28.6%)**	60 (71.4%)

* Until some remain uneaten (200mls/kg/day).

Step 9: Sensory stimulation

Sensory stimulation sessions were recorded in 29 (32.6%, n=89) cases

Step 10: Plan for discharge and follow up.

Discharge and follow up plans were documented for 85/86 (99 %,).

The discharge criteria including the weight on discharge were not documented for all of them.

4.3: Treatment Outcomes.

4.3.1 Case fatality rate (CFR)

The total number of deaths were 3, representing a case fatality rate of 3.4%.

4.3.2 Length of hospital stay

Overall median length of stay was 10 days (IQR 7, 15) (Table 10).

Table 10: Showing the length of hospital stay in relation to the co-morbidities.

Variable	Frequency (n=89)	Cumulative length of stay	Median length of stay
Pneumonia	19	257	14.0
Diarrhoea	18	207	11.5
Anemia	9	101	12.0
Sepsis	7	97	14.0
Tuberculosis	7	79	8.0
Malaria	5	53	8.0
Rickets	5	74	14.0
HIV	5	72	14.5
Meningitis	3	90	8.0
None	11	137	8.0
Grand Total	**89**	**1095**	**10.0**

4.4 Adherence Level

Adherence was considered when all the steps 1-10 were adhered to, each step was scored as 1, therefore a score of 10 out 10 for each child was considered adherent while a score of < 10 was deemed as non- adherent. Therefore, out of the 89 children, 4 had scores of 10/10. Therefore, overall, management guidelines were completely adhered to from admission to discharge or death for **4.5% (4, n=89)** of the participants.

At bivariate analysis;

We compared adherence to some principles of management and the median length of hospital stay.

Table 11: Adherence associated with treatment Outcome

Variable	Median length of stay (IQR)	P value
Hypoglycemia management		
Adherence	9(7-14)	0.4758
Non adherence	10 (7-15)	
Hypothermia management		
Adherence	8(7-14)	0.3545
Non adherence	10.5(7-15)	
Dehydration management		
Adherence	10(5-15)	0.4063
Non adherence	11(8-14)	
Electrolytes management		
Adherence	8(7-11)	0.3875
Non adherence	10.5(7-15)	
Initial feeding		
Adherence	10(5-16)	0.9343
Non adherence	9.5(7-14)	
Catch up growth feed		
Adherence	13(7-15)	0.4154
Non adherence	9(7-14)	
Sensory stimulation		
Adherence	9(5-14)	0.0830
Non adherence	14(8-15.5)	

There was no statistical significance between adherence and the median length of hospital stay.

CHAPTER FIVE: DISCUSSION.

5.1 Demographic Characteristics

A total of 89 children participated in this study. Out of these, majority were males. These findings are similar to the findings in Garissa former Provincial General Hospital where 63.5% of the participants were males [Warfa O., *et al*, 2014] and at St.Mary's hospital lacor (Northern Uganda) where males contributed 61 % of the total [Nyeko R., *et al*, 2016]. However, this is in contrast to the findings in India [Gupta R.K., *et al*, 2015] where males contributed 42.5%.

In this study the median age of the participants was 13 months with an interquartile range of 10.5 – 23 months. This is similar to the findings at Kenyatta National Hospital where the median age was 13 months [Nzioki C., *et al* ,2009] and at Mbagathi former district Hospital where the median was 13.5 months with an IQR of 9-18.8 months [Fondo *et al*, 2013]. This was in contrast to findings at St. Mary's Hospital Lacor where the median age was 21.0 months [Nyeko R., *et al*, 2016]

5.2 Types of Malnutrition

In this study, majority of children were admitted with non- oedematous form of malnutrition. Similar findings were reported in Garissa hospital [Warfa O., *et al*, 2013] where the non-odematous form was 93.8 % of participants and in Ghana it was reported that non- edematous form of malnutrition was more prevalent [Saaka *et al*, 2015]. This is in contrast to the findings in Zambia where non- edematous form was reported at 21.6% [Tendai M., *et al*, 2013]

5.3 Adherence to WHO management guidelines for Severe Acute Malnutrition.

Step 1: Treatment and prevention of hypoglycemia

Children with SAM are at high risk of hypoglycemia due to reduced glucose reserves, therefore a RBS should be done on admission, where this is not feasible the children should be given 10 % glucose as an intravenous bolus or should be fed as soon as possible. In this study, this step was not adequately observed; RBS was documented in less than half of children. This is similar to the findings at Busia County Referral Hospital [Mbugua *et al*, 2015] where RBS was done for 16.7% of the children

In this study, a minority of participants received their initial feed within 2 hours of admission with the median waiting time being 6 hours. This is similar to the findings in Mbagathi Hospital [Wangechi *et al*, 2013] where there were reported delays in initiating feeds with a median waiting time of 12.3 hours .This is in contrast to the report at Busia County Referral hospital [Mbugua *et al*, 2015] where 77.1% of the children received their initial feed immediately after admission. Poor diagnosis, treatment and prevention of hypoglycemia could be attributed to lack of essential supplies, unavailability of the WHO guidelines charts in the hospital patients' records and also in the wards or due to staff reluctance or both. However, our study differed from the Mbagathi and the Busia hospitals in that, our set up was a tertiary teaching hospital while the other two were carried out in lower level health facilities, also the other studies included interviews and direct observation in the wards which was not the case in this study.

Step 2: Treatment and prevention of hypothermia.

Children with SAM are prone to hypothermia and should be kept warm and nursed in specialized rooms [WHO, 2013]. In this study, there was a good documentation of an initial temperature at admission. This is similar to the finding at Mbagathi previously a district Hospital [Wangechi *et al*, 2013] where temperatures were recorded at 90.3% at casualty and 96% in the ward. However, subsequent temperature was not monitored on regular basis. This is similar to findings at Kenyatta National Hospital [Nzioki C., *et al*, 2009]. In this study, two thirds of the children were kept warm. This is in contrast to findings in Garissa [Warfa O., *et al*, 2013] where 11.1% were kept warm in the Out Patient Department and 10% in the ward. The study design was prospective in both the MTRH study and the study in Garissa Hospital. However, the Garissa study was over a 4 month period in a former provincial Hospital while our study was over a 6 month period in a tertiary Health facility. Hyperthermia was noted in almost half of our study participants and this was a unique finding in that in the previous studies this was not documented. Therefore, the pediatric team managing children with SAM should check temperature on regular basis and provide warmth based on need so as to avoid the deleterious effects of hyperthermia.

Step 3: Treatment and prevention of dehydration

It is difficult to make a diagnosis of dehydration among children with SAM. Therefore due to the challenges in estimating the severity of dehydration, intravenous fluids should be restricted only to those children in shock and oral ReSoMal should be used to rehydrate the children who are not in shock to reduce the risk of cardiac overload [WHO, 2013]. In our study, few children were in shock and they were rehydrated appropriately with Ringer's

lactate in 5% dextrose and the amount of fluids given was appropriate. This was in contrast to the findings in Garissa former provincial Hospital [Warfa O., *et al,* 2014] and in S. Africa rural Hospitals [Ashworth A., *et al*, 2003] where appropriate amount was given to a low proportion of the study participants. Our study findings also showed that a minority of the children received intravenous fluids despite no shock, comparable to the findings in Garissa Hospital where 6 children with no shock were rehydrated with intravenous fluids [Warfa O., *et al*, 2014]. However, a higher number of children received intravenous fluids despite no shock at Kenyatta National Hospital (KNH) [Nzioki C., *et al*, 2009] and the case fatality recorded in their study was 38%. In my study, close to half of the children received ReSoMal. This is in contrast with the report by Wangechi et.al in Mbagathi Hospital [Wangechi *et al*, 2013] where Resomal was correctly prescribed at 97.7% at casualty and 100% in the ward. These findings at MTRH could be attributed to clinicians' reluctance on fluid management among children with SAM and unavailability of fluid management charts in wards and in patients' files.

Step 4: Correction of electrolyte imbalance

Children with SAM have electrolyte deficiencies including potassium and magnesium, the correction of these deficiencies may take up to $\geq$ 2 weeks. In our study, majority of participants were investigated for electrolyte imbalance. This is similar to the finding in Pakistan where the electrolyte investigation was at 93% [Younas M., *et al*, 2012]

However, a lower rate (5.2%) of electrolyte investigation was reported in Busia county and referral Hospital [Mbugua *et al*, 2015]. The Busia study differed with our study in that was a cross-sectional study in a county hospital unlike ours which was a prospective study in a tertiary teaching and referral Hospital. In our study, there were few children with low

potassium levels (hypokalemia) and this was corrected by administration of potassium chloride. This compares with the study in Busia [Mbugua *et al,* 2015] where 3 children with hypokalemia all received potassium supplementation. A majority of the children received F75 which contains: minerals, electrolytes and micronutrients. This is similar to findings in Garissa [Warfa O., *et al*, 2014] where 92% of children received F75. However, in contrast with findings at KNH [Nzioki C., *et al,* 2009] where 55% of children received F75. There were differences in the studies in that the KNH and the Garissa studies, an inventory on the availability of the essential supplies was done but in our study the inventory of the supplies was not done, so F75 was always available in Garissa Hospital [Warfa O, *et al,* 2014] and at Kenyatta National Hospital [Nzioki C., *et al*, 2009] at 93.7% and at 80% respectively.

Step 5: Routine treatment of infections

Malnourished children present commonly with infection without the typical signs such as fever [Bhan M.K., *et al*, 2003].It is therefore assumed that children with SAM have infections and should be routinely initiated on antibiotics for presumed infection [Bhan M.K., *et al*, 2003]. In our study, all children received first line antibiotics on admission; crystalline penicillin and gentamicin appropriate for weight and subsequently, a fifth of the participants received other antibiotics based on the blood culture results and clinical assessment of non- response to the first line antibiotics which is in line with the WHO guidelines. This is similar to the findings in Parkistan [Younas M., *et al*, 2012] where all children with SAM received antibiotics at admission. However, in contrast to 46% reported in S, Africa [Ashworth A., *et al*, 2003] where it was attributed to reluctance by doctors to prescribe antibiotics and there was an associated increase in deaths due to possible sepsis.

Step 6: Correction of micronutrient deficiencies.

Children with SAM have vitamin and mineral deficiencies contributed by dietary insufficiency and losses through diarrhoea [Saunders E., et al, 2011] WHO recommends F75, F100 and RUTF which contains adequate amount of; minerals, electrolytes and micronutrients. In this study, there was supplementation of Vitamin A at admission without any documentation of eye signs of severe deficiency of vitamin A. Similarly, there was supplementation of folate (11%) and multivitamins (52%) despite the administration of commercially prepared F75 which contains minerals, electrolytes and micronutrients; this is contrary to the WHO recommendations (WHO, 2013). This is similar findings reported in Garissa Hospital [Warfa O., *et al*, 2013], where there was a higher rate of: vitamin A (81%), multivitamin (90%) and Folate (66%) supplementation. There were similarities between the two studies in that both were carried out after the revision of the guidelines which recommends that micronutrients should only be supplemented based on the presence signs of deficiencies in case of vitamin A and in cases where F75 or RUTF is not available.

Anemia is common among malnourished children and iron should be supplemented in the rehabilitation phase of management [WHO, 2013]. From this study, a minority of the children received iron in the rehabilitation phase of treatment contrary to the WHO guidelines. This is similar to findings at Mbagathi district hospital [Wangechi *et al*, 2013] where 3.9% of participants received iron in the rehabilitation phase. In the Mbagathi study an inventory of supplies was done which showed that iron was always available in the hospital at 5% but in our study the inventory of the supplies was not done.

Step 7: Initial feeding.

Due to the fragile physiological state of malnourished children, initial refeeding should be done with caution by use of low osmolality recipe such as F75. This formula contains low calories and proteins for the maintenance of the basic physiological processes [WHO, 2013] WHO recommends that feeding should be initiated after the first 2 hours of admission. In this study, there were delays in initiating feeding; a minority of children received their initial feed within 2 hours of admission with the median waiting time being 6 hours. This is similar to findings at Mbagathi Hospital [Wangechi *et al*, 2013] where the median waiting time was 12.3 hours. However, in contrast to the finding in Busia [Mbugua *et al*, 2015] where 77.1% of children received their initial feed immediately after admission. The delay in initiating feeds could be due to the lack of feeding charts with clear prescriptions on the amount to give and the frequency of feeding and also inadequate communication from the clinicians and nutritionists to the nurses and the caregivers.

In this study, majority of the eligible children received F-75 for the initial refeeding and the rest were fed on porridge, diskettes and routine ward diet. This is similar to the findings in Garissa [Warfa O., *et al*, 2013] where 92% of the children received an appropriate amount of F-75. This is in contrast to the findings in South Africa where severely malnourished children were given adult meals [Ashworth A, *et al*, 2003]. However, in this study, feed intake were monitored and documented daily for a minority of participants and this is similar to findings in South Africa [Karaolis N., *et al*, 2006] and at Kenyatta National Hospital [Nzioki C., *et al* ,2009]

Step 8: Catch up growth monitoring.

In the rehabilitation phase of treatment, a high caloric feed should be introduced on the basis of: reduction of edema and/or improvement of appetite [WHO, 2013]. In this study, the indicators for switching from the initial refeeding were not documented. Out of the 72 children who were on the initial feed, majority progressed to catch up feed either F100 or RUTF. This is similar to the finding in Busia where 87.5% of children who had received F75 progressed to F100 [Mbugua *et al*, 2015]. However, a minority received appropriate feed increment after the transition phase. This is similar to the findings in South Africa [Karaolis N., *et al*, 2007] and at Mbagathi district Hospital [Wangechi *et al*, 2013].However, in contrary to the WHO guidelines [WHO, 2013] where subsequent amount of feed should be increased by 10mls up to a point where some remains uneaten. The failure to increase feeds could be attributed to unavailability of the feeding charts in patients' files which gives clear instructions regarding the feed increment and feeding frequency and also lack of communication among the clinicians, nurses, nutritionists and care givers.

Step 9: Sensory Stimulation.

Sensory stimulation should be provided through a multidisciplinary approach involving the Health care workers and the care givers. In this study, 33% of the children received sensory stimulation as per the records. However, the frequencies of the therapy were not documented. This is contrary to the WHO recommendations where structured play therapy and provision of toys are recommended [WHO, 2013]

Step 10: Plan for discharge and follow up.

The 10th principle of treatment entails planning for discharge and follow up care. This phase of treatment should be instituted based on good weight gain of >10g/kg/day, presence of good appetite and the readiness of the caretaker for home based therapeutic care [WHO, 2013]. In this study, the discharge plans were done for majority of the children although the indicators for discharge were not documented contrary to the WHO recommendations.

5.5 Treatment Outcomes

Case fatality rate

In this study, the case fatality rate (CFR) was high. According to WHO grading of CFR in children with severe malnutrition, a CFR of < 1% is considered as an excellent outcome. This finding is similar to findings at Mbagathi District Hospital [Wangechi *et al*, 2013] where the CFR was 4.9%. Fondo et.al in their study documented a CFR of 8% at Mbagathi District Hospital [Fondo *et al*, 2013]. However, higher case fatality rates were reported at Kenyatta National Hospital (38%) [Nzioki C., *et al*, 2009], in Swaziland (40.1%) [Benyera O., *et al*, 2013] and in Nigeria (50.9%) [Ubesie C., *et al*, 2012].

Median length of hospital stay

The overall median length of hospital stay in this study were 10.0 days. This is similar to the findings in Swaziland [Benyera O., *et al*, 2013] where the median length of hospital stay was 10 days. However, this was longer than the WHO recommendation of an inpatient therapeutic care of between 4 to 7 days depending on the severity of complications and the time it takes to regain appetite. Average length of stay could be used as an indicator of efficiency, shorter length of hospital stay reduces on the in patient management cost and

shifts care to community based therapeutic care which is cheaper than the inpatient settings.

5.6 Overall Adherence level

Overall, adherence level to guidelines in this study was low. This is similar to findings reported at Kenyatta National Hospital [Nzioki C., *et al*, 2009] where he demonstrated gaps in care although they didn't indicate an overall level of adherence. However, their case fatality rate was high at 38% [Nzioki C., *et al*, 2009]

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Adherence to the WHO guidelines in management of SAM at MTRH is low at 4.5%.

Case fatality rate was high at 3.4% in comparison with the WHO grading of case fatality rate in children with severe malnutrition where a CFR rate of < 1 % is considered as an excellent outcome and the median length of hospital stay was long at 10 days.

6.2 Recommendations

MTRH to ensure adequate supply of the essential commodities required in the management of SAM.

Further studies need to be carried out to determine factors affecting this adherence and length of hospital stay at MTRH

Adoption of the WHO structured protocol for documentation of care given to children with SAM at MTRH.

REFERENCES.

Abidoye R.O. and Sikabofori (2000). A study of prevalence of protein energy malnutrition among 0-5 years in rural Benue Nigeria. *Nutrition and Health*; 13: 235-247.

Anurag S., Kumar B., Esam M.S., Ved Prakash S., Payal M.S., Iram S., (2012). Nutritional status of under- five children in urban slums of Bareilly. *Indian Journal of Maternal Child Health*; 14:1-7

Ashworth A., Chopra M., McCoy D., Saunders D., Jackson D., Karaolis N,…Schofield C. (2004). WHO guidelines for management of severe malnutrition in rural South African hospitals: effect on case fatality and the influence of operational factors. *Lancet* ; 363(9426):1110-1115. PubMed | Google Scholar

Ashworth A., Khanum S., Jackson A., Claire Schofield C. (2003). Guidelines for the inpatient treatment of severely malnourished. Geneva 27, Switzerland, *World Health Organization*. .Google Scholar

Ayaya,S.O, F.O.Esamai, J.Rotich and A.R.Olwambula (2004) .Socio-economic factors predisposing under 5 year – old children to severe protein energy malnutrition at Moi Teaching and Referral Hospital, Eldoret, Kenya. *East Africa Medical Journal* vol. 8

Benyera O., Hyera F., (2013). Outcomes in malnourished children at a tertiary Hospital in Swaziland after the implementation of the World Health Organization treatment guidelines.

Bernal C., Velásquez C., Alcaraz G., Botero J., (2008) Treatment of Severe Malnutrition in Children: Experience in Implementing the World Health Organization Guidelines in Turbo, Colombia. *Journal of Pediatric Gastroenterology & Nutrition*; 46 (3): 322-328. PubMed | Google Scholar

Bett W., (2010): Biochemical and hematological profiles of children aged 6-60 months with protein energy malnutrition admitted to the Moi Teaching and Referral Hospital, Eldoret, Kenya: https:// www.researchkenya.or.ke

Bhan M. K., Bhandari N., Bahl R., (2003) Management of severely malnourished child: perspective from developing countries. *British Medical Journal*; 326(12):146-151. PubMed |Google Scholar

Black R.E., Cousens S., Johnson H.L., Lawn J., Rudan I. Bassani D…Mathers C (2010) Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet* 375, 1969–1987.

Black R.E., Morris S.S., Bryce J., (2003). Where and why are 10 million children dying every year? *Lancet*; 361:2226–34. [PubMed: 12842379]

Cogil B., (2003). Anthropometric Indicators Measurement Guide, Connecticut Family Health International, Retrieved from: https://www.fantaproject.org February 2018.

Deen J.L., Funk M., Guevara V.C., Salooje H., Doe J.Y., Palmer A., Weber M.W., (2003). Implementation of WHO guidelines on management of severe malnutrition in hospitals in Africa. *Bull WHO* ; 81(4):237-243. PubMed | Google Scholar

Ejaz M.S., Latif N. (2010): Stunting and micronutrient deficiencies in malnourished children. *Journal of Pakistan Medical Association* 2010, 60(7):543–547.

Espié E., Pujol C.R., Masferrer M., Saint-Sauveur J.F., Urrutia P.P., Grais R.F., (2011). Acute malnutrition and under-5 mortality, northeastern part of *India. Journal of Tropical Pediatrics* ;57:389-91.

Fondo J., Wasunna A.O., Walmalwa D., (2013). Clinical outcomes of children aged 6-59 months with severe acute malnutrition admitted to Mbagathi district hospital, Kenya. *erepository.uonbi.co.ke*

Gernaat H.B., Dechering W.H., Voorhoeve W.H., (1998): Mortality in Severe Protein energy Malnutrition at Nchelenge, Zambia. *Journal Tropical Pediatrics*, 44(4):211– 217. [Online]. Available from :http://tropej.oxfordjournals.org.ezproxy.liv.ac.uk/content/44/4/211.abstract.

Getaneh T., Assefa A. and Tadesse Z, (1998). Protein energy malnutrition in urban children: prevalence and determinants. *Ethiopian Medical Journal*; 36:153-166

Gupta R.K., Nagori G.L., Nagori P., Patidar R.P., (2015). Pattern of Co-morbidities in Children with Severe Acute Malnutrition admitted in MTC of a teaching hospital of South East Rajasthan, India**.** *Journal of Pharmacology and Biomedical Sciences* ; 05(05): 403-407

Ibekwe V.E., Ashworth A., (1994): Management of protein energy malnutrition in Nigeria: an evaluation of the regimen at the Kersey Nutrition Rehabilitation Center, Nigeria. *Transactions of the Royal Society of tropical medicine and hygiene* ; 88:594–595.

Iqbal H., Nina S., Tahmeed A., Golam M., Kazi M., Jamil … Mahmood C., (2009) . Experience in Managing Severe Malnutrition in a Government Tertiary Treatment Facility in Bangladesh *Journal of Health Population and Nutrition*; 27(1): 72–79

Karaolis N., Jackson D., Ashworth A., Saunders D., Sogaula N., McCoy D … Schofield C., (2007): WHO guidelines for severe malnutrition: are they feasible in rural African Hospitals? *Archives of Disease in childhood* ,92(3):198-204.

Kenya Demographic and Health Survey 2014, Key Indicators, https:// dhsprogram.com/pubs/pdf/SR27.pdf

Le-Roux I.M., Le-Roux K., Scott W.C., Greco E.M., Desmond K.A., Mbewu N., Rotheram-Borus M.J., (2010): Home visits by neighborhood Mentor Mothers provide timely recovery from childhood malnutrition in South Africa: results from a randomized controlled trial. *Nutrition Journal*, 9:56. [Online].Available from: http://www.nutritionj.com/content/9/1/56.

Maitland C., Mohammed S., Peshu N., English M., Newton CRJC (2006). Children with Severe Malnutrition: Can Those at Highest Risk of Death Be Identified with the WHO Protocol. *PLOS Medicine*; 3(12) e500 doi:1371//journal pmed 0030500.

Mbugua S., Kirui A., Muiva M., (2015). Utilization of guidelines for management of severe acute malnutrition in children aged 6-59 months in Busia County Referral Hospital, Kenya. *erepository.uonbi.co.ke*

Ministry of Health (2016): Basic pediatric protocols:25-29.

Moi Teaching and Referral Hospital Medical Records (2016): Monthly morbidity and Mortality data. Eldoret, Kenya (*Unpublished Health records*).

Muller O., Krawinkel M., (2005): Malnutrition and health in developing countries. *Canadian Medical Association Journal*:173(3):279–286. Available from: http://www.cmaj.ca/cgi/ content/full/173/3/279.

Saunders E., (2011): *Nelson Text book of pediatrics* (19th ed), Chapter forty three page 174-179.

Nhampossa T., Sigau´que B., Machevo S., Macete E., Alonso P., Bassat Q., Mene´ndez C. and Fumado´ V., (2013). Severe malnutrition among children under the age of 5 years admitted to a rural district hospital in southern Mozambique. *Public Health Nutrition*;16(9): 1565-74

Nyeko R., Calbi V., Ssegujja.O.B. and Ayot.G., (2016). Treatment outcome among children under- five years hospitalized with severe acute malnutrition in St. Mary's hospital Lacor, Northern Uganda. *BMC Nutrition*

Nzioki C., Irimu G., Musoke R., (2009). Audit of Care of Children aged 6 to 59 months admitted With Severe Malnutrition at Kenyatta National Hospital, Kenya. *International Health.*; 1(1):91-96.

Ramachandran P., Gopalan H.S. (2011). Assessment of nutritional status in Indian preschool children using WHO 2006 Growth Standards. *Indian Journal Medicine Research*; 134:47-53.

Rice A.L., Sacco L., Hyder A., Black R.E. (2000). Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. *Bull WHO*; 78:1207–21.[PubMed: 11100616]

Rice A.L., Sacco L., Hyder A., Black R.E., (2000). Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. *Bull WHO*; 78(10):120721.

Rutherford G.W., Mahanjane A.E., (1985): Morbidity and Mortality in the Mozambican Famine of 1983: Prevalence of Malnutrition and Causes and Rates of Death and Illness among Dislocated Persons in Gaza andInhambane Provinces. *Journal of Tropical Pediatrics* , 31:143–149.

Saaka.M., Osman.M.., Amponsem.A., Ziem.B., Alhassan Abdul-Mumin, Akanbong.P., Yirkyio.E., Yakubu.E. and Ervin.S. (2015). Treatment Outcome of Severe Acute Malnutrition Cases at the Tamale Teaching Hospital, Hindawi, Ghana. *Journal of Nutrition and metabolism*. Volume 15.

Scholfield C., Ashworth A., (1996). Why have mortality rates for severe protein energy malnutrition remained high? *Bull. WHO*; 74:223–29. [PubMed: 8706239]

Tendai M., Choolwe J., Lungowe S., Rosalia D. and Charles M., (2013) Mortality and morbidity patterns in under-five children with severe acute malnutrition (SAM) in Zambia: a five-year retrospective review of hospital-based records, Zambia. *Archives of public health*.

Thakur J.S., Prinja S., Bhatia S.S., (2011). Persisting malnutrition in Chandigarh: Decadal underweight trends and impact of ICDS program. *Indian Pediatrics* ;48:315-8.

Ubesie C., Ibeziako S., Ndiokwelu I., Uzoka M., Nwafor A., (2012). Under -five Protein Energy Malnutrition Admitted at the University of in Nigeria Teaching HospitaL, Enegu: a 10 year restrospective review, Nigeria. *Nutrition journal*.

UNICEF, 2008: The State of the World's Children 2009.Maternal and Newborn Health. New York, USA: UNICEF.

Wangechi K.A., Were F., Kariuki N., Laving A., (2013)**.** Audit of the current standard of care for children admitted to Mbagathi district hospital with severe malnutrition, Kemya. *erepository.uonbi.co.ke*

Warfa O., Njai D., Ahmed L., Admani B., Were F., Wamalwa D., Osano B., Mburugu P., and Mohamed M., (2013). Evaluating the level of adherence to Ministry of Health guidelines in the management of Severe Acute Malnutrition at Garissa Provincial General Hospital, Garissa, Kenya. *The Pan African Medical Journal*. 2014; **17**:214

WHO guidelines for the management of common childhood illnesses, 2013 Edition, WHO.

World Bank. India, Undernourished children (2006): A call for reform and action. http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,contentMDK:20916955~pagePK:146736~piPK:146830~theSitePK:223547,00.html [Last accessed on 2014 Apr 05].

World Health Organization (1999). *Management of severe malnutrition: a manual for physicians and other health workers.* WHO; Geneva.

World Health Organization (2000). *Management of the Child with a Serious Infection or Severe Malnutrition: Guidelines at the First Referral Level in Developing Countries.* Geneva, Switzerland: World Health Organization.

World Health Organization. Management of Severe Malnutrition (1999): *A Manual for Physicians and Other Senior Health Workers. Geneva: World Health Organization.* . Google Scholar www.who.int > mediacentre > factsheets. Updated May 2017.

Younas M., Khan M.A., Khan J., Shah F. and Munir A., (2012). Systematic Analysis of In-Patients' Care of Severely Malnourished Children at Hayatabad Medical Complex Peshawar: A Tool to Improve Quality of Care. *Gomal Journal of Medical Sciences*, Vol. 10, No. 1

APPENDICES

Appendix 1: Consent Information Form for Parents and Guardians

IP NO ……..

SERIAL NO……..

DATE……

BACKGROUND

We are carrying out a study to evaluate care offered to children admitted with severe malnutrition at MTRH pediatric wards. Your daughter / son have been diagnosed to have severe acute malnutrition therefore we are requesting you to join our study. This form contains information that will guide you decide or decline to participate in the study.

The purpose of the study.

This study will describe treatment offered to children in the wards with the diagnosis of severe malnutrition.

It will reveal areas in need of improvement and this will help us manage your child and other children with similar illness in a better way.

Study Procedures

No laboratory investigations will be done for the purposes of this study; any investigations/ procedures will be standard for all patients irrespective of their participation in the study and will be in accordance with the hospital treatment protocols. I will also look at your child's treatment records at the end of the treatment period.

You are allowed to raise questions regarding the study at any given stage.

Rights

You are not under any pressure to participate in this study, it is voluntary and you may withdraw at any given point if you wish to, the decision to participate or not in this study shall not affect the treatment of your child in any way.

Any questions regarding the study are entertained at any stage for example; before, during and after joining.

The purpose of the study is identify the strengths and weaknesses in the treatment of severe malnutrition at pediatrics wards at MTRH and this will guide in improving the care accorded to children with similar illness(es) in future and this may not benefit your child in the current management.

Risks

There will be no invasive procedures done on your child for the purpose of the study and the treatment shall not be delayed or withdrawn from your child.

Confidentiality

Confidentiality shall be upheld and no information identifying your child shall be discussed in public or published.

You are allowed to ask questions and seek clarification about the study at any given stage.

My contacts are as given below: Dr. Chepng'etich Rispher mobile phone no 0721157617, email address chepngetich74@gmail.com.

Institutional Review Board

This study has been approved by the Institutional Research and Ethics Committee (IREC) of Moi University/Moi Teaching and Referral Hospital. Contact IREC if you have questions regarding your child's right as a participant, and also if you have complaints or

concerns which you do not feel you can discuss with the investigator. Contact IREC using the address; The Chairman IREC, Moi Teaching and Referral Hospital, PO BOX 3, Eldoret, Kenya. Tel. 33471/2/3

Appendix 2: Consent form for Parent's/Caregiver's Statement

The principal investigator and / research assistant have explained to me about the study. I understand the purpose of the study, my and my child's rights in the study.

I have been given an opportunity to ask questions and I NOW understand that the information shall be kept confidential and that am allowed to asking questions at any stage during the study, I have also understood that I can withdraw from the study and still my child shall receive standard treatment as per the hospital protocol.

I agree to participate in the study voluntarily.

I the participant do confirm that explanations have been made to me regarding the study, I therefore have understood and voluntarily consent to participate in the study.

My contacts are as given below: Mobile phone no ----------

Parent's /care giver's signature ----------Date----------

I the investigator do confirm that I have explained all the relevant information regarding the study and the participant has consented voluntarily.

Investigators signature----------Date----------

Witness signature ----------Date----------

Appendix 3: Fomu ya Ridhaa Kwa Mzazi/Mlezi

NAMBARI---------- TAREHE----------

UTANGULIZI

Tunafanya utafiti kutadhmini kiwango cha huduma wanaopokea watoto ambao wanalazwa na ugonjwa wautapia mlo katika hospitali hii.

Mtoto wako anakabiliwa na ugonjwa wautapia mlo.

Nakuomba wewe kujiunga katika utafiti huu.Hii fomu ina taarifa zote zinazohusiana na huu utafiti ilikukuwezesha wewe kuamua kama utajiunga au la. Kushiriki kwako ni kwa hiari yako

MADHUMUNI YA UTAFITI

Utafifi huu utaelezea matibabu hali ya matibabu wanayo pokea watoto waliolazwa kwa hospitali hii na ugonjwa wautapia mlo.Nitaweza kutambua sehemu ambazo zinahitaji kuboreshwa.Hii itawezesha hospitali kuhudumia mtoto wako na wengine waliona ugonjwa huu bora zaidi.

TARATIBU ZA UTAFITI

Hakuna vipimo vya maabara ambazo zitachukuliwa kwa madhumuni ya utafiti huu.

Nitaangalia pia zile kumbukumbu za hospitali za mtoto wako.

Ukona uhuru kuuliza maswali yoyote juu ya huu utafiti katika hatua yoyote.

HAKI

Ushiriki wako wote ni kwa hiari yako.

Unaweza kuamua kujiondoa kwenye utafiti huu katika hatua yoyote.

Uamuzi wako wakushiriki au kutoshiriki ama kujiondoa katika utafiti huu hakutaathiri kwa njia yoyote matibabu ya mtoto wako.

Utafiti huu utawezesha hospitali kutathimini udhaifu katika matibabu ya ugonjwa wautapia

mlo. Hii itasaidia kuboresha huduma wanayopokea watoto waliona ugonjwa huu.Inawezekana hali hii haita faidi mtoto wako kwa wakati huu.

MADHARA

Mtoto wako hatanyimwa au kuchelewe la kutibiwa kwa sababu ya utafiti huu.

Hakuna damu itakaochukuliwa ama taratibu zozote ila zile madaktari wanaotibu mtoto wako watakao agiza.

Matibabu yote ambayo mtoto wako anahitaji atapokea.

USIRI

Taarifa zote zitakuwa za siri.Hakuna habari yoyote ambayo inaweza kutambua mtoto wako itachapishwa au kujadiliwa hadharani.

Iwapo kama utakuwa na swali kuhusu utafiti huu au namna ambayo majibu ya utafiti huu

Yatatumika unaweza kuwasiliana na mchunguzi mkuu: Daktari Chepng'etich Risper kupitia nambari y asimu 0721157617.

Barua pepe-chepngetich74@gmail.com

IDHINISHO KUTOKA KWA BODI

Utafiti huu umekubaliwa na kamati ya chuo ya utafiti na maadili (IREC) ya chuo kikuu cha Moi na hospitali ya mafunzo na Rufaa ya Moi Eldoret.

Julisha idara hii ukiwa na swali kuhusu haki ya mtoto wako kuhusishwa katika utafiti au kama una malalamishi au jembe una onelea huwezi kujadiliana na mtafiti kupitia kwa anwani hii:

Mwenyekiti kamati ya chuo ya utafiti na maadili (IREC) ya chuo kikuu cha Moi na hospitali ya mafunzo na Rufaa ya Moi Eldoret,

S.L.P. 3, ELDORET, Kenya. Nambari ya simu: 3371/2/3

CHETI CHA RIDHAA

TAARIFA YA MZAZI/MLEZI

Nimeelezewa kikamilifu juu ya utafiti huu.Nimeelewa mathumuni yake na haki zangu kama mshiriki.Nimepatiwa nafasi ya kuuliza maswali na nimehakikishiwa nikiwa na swali juu ya huu utafiti ama haki zangu kama mshiriki ninaweza kumuuliza mpelelezi mkuu wakati wowote.Nimeelewa kuwa ninawezakujiondoa kutoka kwa utafiti huu wakati wowote.

Nimeamua kwa hiari kushiriki kwenye utafiti huu

Nambari langu la simu ni: …….

Sahihi ya Mzazi----------Tarehe----------

Nadhibiti ya kwamba nimepeana maelezo thabiti kuhusu utafiti huu, naye mhusika ametoa uamuzi wa kushiriki bila ya kulazimishwa.

Sahihi ya Mchunguzi----------Tarehe----------

Sahihi ya Shahidi----------Tarehe----------

Appendix 4: Data Collection Form.

Severe malnutrition case study (Comment 13)

INTERVIEWER NAME: ----------

STUDY NO ----------

IPNO ----------

WARD ----------

INFORMANT: ----------

DATE ----------

CONSENT Yes ☐ No ☐

FILL IN THE APPROPRIATE RESPONSE IN THE SPACES PROVIDED.

A) Demographic characteristics of children

1. Name initials ☐

2. Date of Birth ☐

3. Age in months [ ] (Comment 8)

4. Sex M ☐

F ☐

5. Birth weight ☐

B**) Anthropometric measures at the sick child clinic**

6. Height in cms ☐

7. Weight kgs ☐ gms ☐

C) **Clinical evaluation of nutritional status at the sick child clinic**

8. Visible severe wasting YES ☐

NO ☐

9. Bilateral pedal edema

YES ☐

NO ☐

10. W/H Z score ≤ -2SD ☐

≤ -3SD ☐

11. Classification of severe malnutrition: Kwashiorkor ☐

Marasmus ☐

Marasmic- kwashiorkor ☐

Non Severe ☐

D) **Management of the child at the sick child clinic**

12. How was the child triaged? Emergency ☐

Priority ☐

Not urgent ☐

13 Why was the child admitted? Malnutrition ☐

Severe infection ☐

14 **Step 1: Treat/prevent hypoglycemia, (Comment 10)**

(i) Was the child alert? YES ☐

NO ☐

(ii) Was RBS done? YES ☐

NO ☐

iii) If yes, what were the results? [------mmol/l]

(iv) If hypoglycemia, was treatment given? YES ☐

NO ☐

(Hypoglycemia=RBS<3mmol/l)

If yes, what was given? 10% Dextrose ☐

Other (specify ☐

(v) Was the correction of hypoglycemia done correctly? YES ☐

NO ☐

(10%dextrose at 5mls/kg and oral/NG tube feeds within 30 minutes)

15. **Step 2: Treat/prevent hypothermia**

i) Was the temperature documented on admission? YES ☐

NO ☐

If yes, what was the temperature? [----^{o}C]

(ii) If hypothermia what was done Kangaroo care ☐

Heater ☐

Warm blankets ☐

Others ☐

(Hypothermia = axillary temp.≤ 36.5◦c, rectal temp. ≤ 35.5 ◦c)

16. **Step 3: Treat/prevent Dehydration, (Comment 11)**

i) Did the child have diarrhea? YES ☐

NO ☐

Not documented ☐

(ii) Was the child dehydrated? YES ☐

NO ☐

No information ☐

(iii) If yes, what was the level of dehydration? SHOCK ☐

SEVERE ☐

SOME ☐

If the child was in shock, proceed to (iv) if not skip to (xi)

(iv)Was IV fluids prescribed? YES ☐

NO ☐

(v)Was the choice of IV fluid correct? YES ☐

NO ☐

(vi)Was the amount of IV fluid given in the first 1 hour correct? YES ☐

NO ☐

(Vii)Was the fluid monitored and fluid recorded? YES ☐

NO ☐

(viii)Was the child re- assessed by a clinician after 1 hour? YES ☐

NO ☐

(ix) Was the child out of shock after 1 hour? YES ☐

NO ☐

(x)If no, was the child transfused? YES ☐

NO ☐

(xi If yes, was the amount of blood transfused correct? YES ☐

NO ☐

(xi)Did the child have resomal prescribed? YES ☐

NO ☐

(xii)Was the correct amount of resomal prescribed? YES ☐

NO ☐

(E) ASSESSMENT IN THE WARD

i)What were the diagnoses made in the ward? (Comment 9)

ii) Anthropometric measurements:

Weight: ----------kgs ---------gms

Height/ Length: ----------cm

Left upper mid- arm circumference (LUMAC): ----------cm

(iii)Did the child have visible wasting? YES ☐

NO ☐

(iv)Did the child have bilateral edema? YES ☐

NO ☐

(v) Classification of malnutrition? Marasmus ☐

Kwashiorkor ☐

Marasmic kwashiorkor ☐

Non severe ☐

(Vi) Other co morbid conditions specified by the clinicians?

a)

b)

c)

F**) MANAGEMENT IN THE WARD**

17. STEP 1; Treatment /Prevention of hypoglycemia

(i) Was RBS done? YES ☐

NO ☐

(ii)If yes, what were the results? [-------mmol/l]

(iii)If hypoglycemia, what was given? 10 % Dextrose ☐

NG tube feeds ☐

Others ☐

(Hypoglycemia=RBS<3 mmol/l)

(iv)How soon after admission was the first feed given? [----- hrs]

18. STEP 2; Treatment /prevention of hypothermia

(i)What was the temperature on admission? [-------◦C]

(ii)Was the child kept warm? YES ☐

NO ☐

If yes how? Kangaroo care ☐

Heater provided ☐

Warm clothing ☐

Others ☐

19. STEP 3 Treatment /prevention of Dehydration

: (i) Did the child have diarrhea? YES ☐

NO ☐

Not documented ☐

(ii)Was the child vomiting? YES ☐

NO ☐

Not documented ☐

iii) Was the child dehydrated? YES ☐

NO ☐

No information ☐

(iv) If yes, what was the level of dehydration? SHOCK ☐

SEVERE ☐

SOME ☐

If the child was in shock, proceed to (iv) if not skip to (xiii)

(v) Was IV fluids prescribed? YES ☐

NO ☐

(Vi)Was the choice of IV fluid correct? YES ☐

NO ☐

(Vii)Was the amount of IV fluid given in the first 1 hour correct? YES ☐

NO ☐

(15mls/kg of HSD 5% Dextrose)

(Viii)Was the fluid monitored and fluid recorded? YES ☐

NO ☐

(ix) Was the child re- assessed by a clinician after 1 hour? YES ☐

NO ☐

(x) Was the child out of shock after 1 hour? YES ☐

NO ☐

(xi)If no, was the child transfused? YES ☐

NO ☐

(xii)If yes, was the correct amount of blood prescribed? YES ☐

NO ☐

(xiii)Did the child have resomal prescribed? YES ☐

NO ☐

(xiv)Was the correct amount of resomal prescribed? YES ☐

NO ☐

(xv) Was the intake of resomal monitored? YES ☐

NO ☐

20.**STEP 4; correct electrolyte imbalance**

(i)Was U/E/Cs done? YES ☐

NO ☐

(ii)Was extra potassium prescribed? YES ☐

NO ☐

If yes, how much was prescribed per kg body weight? [------]

21.**STEP 5; Routine treatment of infections**

(i)Were antibiotics prescribed? YES ☐

NO ☐

If yes which one? Crystalline penicillin ☐

Gentamicin ☐

Metronidazole ☐

Other ☐

(ii)Was Mebendazole given? YES ☐

NO ☐

If yes after how many days was it given? [--------]

22. STEP 6; correct micronutrient deficiencies

(i)Was Vitamin A given? YES ☐

NO ☐

If yes, was the dose correct? YES ☐

NO ☐

ii) Was folic acid given? YES ☐

NO ☐

(iii)Was Zinc Sulphate given? YES ☐

NO ☐

(IV)Were multivitamins given? YES ☐

NO ☐

(V)When iron, if necessary was started? Acute phase Rehabilitation ☐

Not given ☐

23).**STEP 7; initial re-feeding**

(I)Was starter formula F75 prescribed? YES ☐

NO ☐

(ii)Is F75 commercially prepared? YES ☐

NO ☐

(iii)After what duration in hours after admission was the first feed given? [ ], (Comment 12)

(iv)What was the frequency of feeding? 2hrly ☐

3hrly ☐

Not specified ☐

(v)What was the route of feeding? NGT ☐

Cup ☐

(vi)Was the feed intake monitored daily and documented? YES ☐

NO ☐

(vii)For how many days was the child on F75? [----]

(Viii)Was the child given other feeds in addition? YES ☐

NO ☐

If yes, specify----------

24).**STEP 8; catch- up growth feeding**

i)Was transition F100 prescribed? YES ☐

NO ☐

(ii)Was the initial volume correct? YES ☐

NO ☐

(iii)Was the volume increased appropriately after transition period? YES ☐

NO ☐

25.Was a full blood count done? YES ☐

NO ☐

(i)If yes, what was the Hb [-------] g/dl.

(ii)Did the child receive blood transfusion? YES ☐

NO ☐

If yes, was it required? YES ☐

NO ☐

(iii)Was the correct volume given? YES ☐

NO ☐

(iv)Was frusemide given? YES ☐

NO ☐

26) **STEP 9) Sensory stimulation**

i) Was it done? YES ☐

NO ☐

Not documented ☐

27) **STEP 10) – Plan for discharge and follow up.**

i) Was the discharge plan documented? YES ☐

NO ☐

26 How often were the vital signs measured in the first 2 days? [------]

28) **Measurements of daily weights** - YES ☐

NO ☐

Partially ☐

29) **Any additional treatment of note for example blood transfusion [----------**

----------]

30) **What was the treatment outcome?**

Discharged YES ☐ , what was the length of stay in hospital?

Died YES ☐ , On what day of management? ☐

Conclusion

Full adherence----------what are the outcomes----------

Partial adherence----------1) what are the outcomes---------

2) Reasons for partiality----------

Appendix 5: Anthropometric Measurements (Cogil B.,2003).

1) TAKING A CHILD'S WEIGHT.

1. At the start of the process the child's clothing will be removed.

2. Weighing scale will be balanced to zero (i.e.to make sure the arrow is on 0).

3. Placement of the child on the weighing scale.

4. Making sure the child is not holding onto anything.

5. Reading the child's weight. The arrow must be steady.

6. Recording the weight in kg to the nearest 100g e.g. 6.6kg for an older child or 50grams e.g.2350grams for infants or incase of the Seca machine's use.

7. The scale shall not be held while reading the weight

8. Two measurements will be taken, one by the Principal Investigator and another by the research assistant then the average calculated and recorded in the data collection form.

2) TAKING A CHILD'S LENGTH.

For children less than 87 cm, the measuring board will be placed on the ground.

1. The child will be placed lying down along the middle of the board.

2. The assistant will hold the sides of the child's head and positions the head until it firmly touches the fixed headboard with the hair compressed.

3. The measurer will then places her hands on the child's leg, gently stretches the child and then keeps one hand on the thighs to prevent flexion.

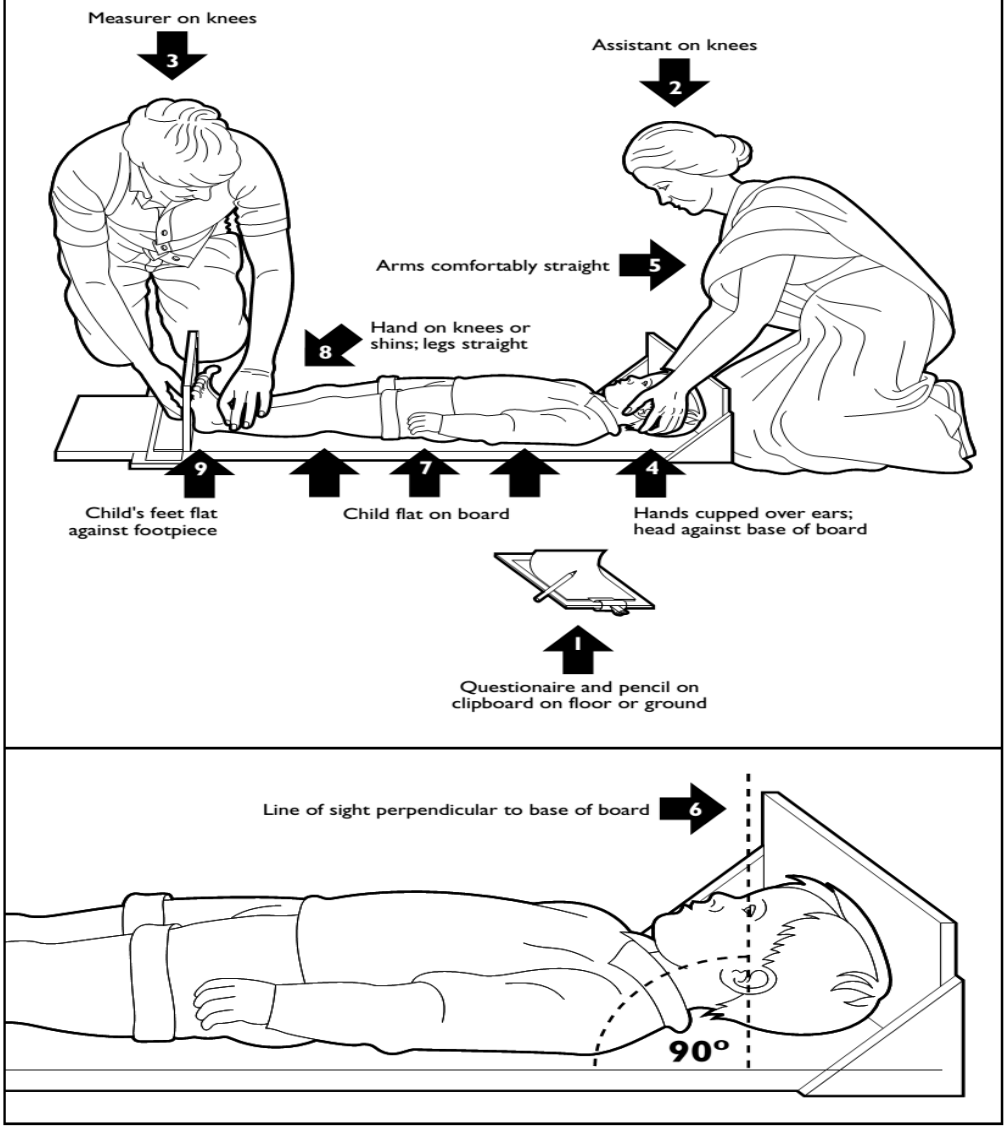
4. While positioning the child's legs, the sliding foot-plate will be pushed firmly against the bottom of the child's feet.

5. For reading of the height measurement, the foot-plate must be perpendicular to the axis of the board and vertical.

6. The height will be read to the nearest 0.1 cm.

7. Two measurements will be taken, one by the Principal Investigator and another by the research assistant then the average calculated and recorded in the data collection form.

Figure 5.2. Child Length Measurement - For Infants and Children 0-23 Months



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, United Nations, 1986.

3) TAKING A CHILD'S HEIGHT.

1. The child will stand, upright against the middle of the measuring board.

2. The child's head, shoulders, buttocks, knees, and heels will be held against the board by the research assistant.

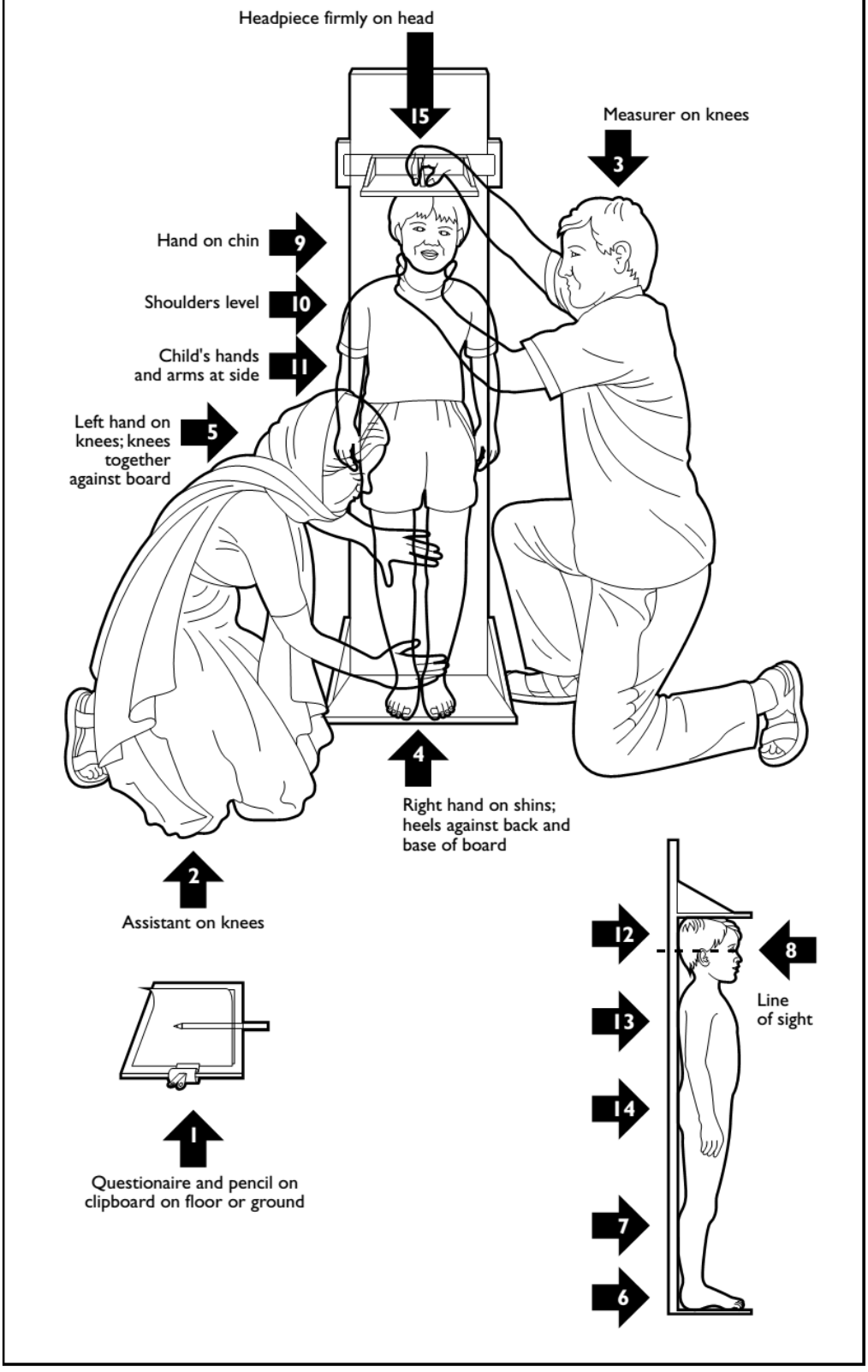
3. The measurer will then position the head and the cursor.

4. The height will be read to the nearest 0.1 cm.

5. Measurement recorded immediately.

6. Two measurements will be taken, one by the Principal Investigator and another by the research assistant then the average calculated and recorded in the data collection form.

Figure 5.1. Child Height Measurement Height for Children 24 Months and Older



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, United Nations, 1986.

4) TAKING A CHILD'S LEFT MID UPPER ARM CIRCUMFERENCE (LMUAC).

MUAC is an alternative way to measure thinness (alternative to weight for height). It is especially used for children ≥6 months to 5 years old.

How to Measure LMUAC.

1. Asking the mother to remove any clothing covering the child's left arm.

2. Calculating the midpoint of the child's left upper arm: first locate the tip of the child's Shoulder (Acromion process) with your fingertips.

3. Bending the child's elbow to make the right angle.

4. Placing the tape at zero, on the tip of the shoulder and pulling the tape straight down past the tip of the elbow (Olecranon process)

5. Reading the number at the tip of the elbow (Olecranon process) to the nearest centimeter. Division of this number by two to estimate the midpoint.

6. Marking the midpoint on the arm with a pen

7. Straightening the child's arm and wrap the tape around the arm at the midpoint. Making sure the numbers are right side up and the tape is flat around the skin.

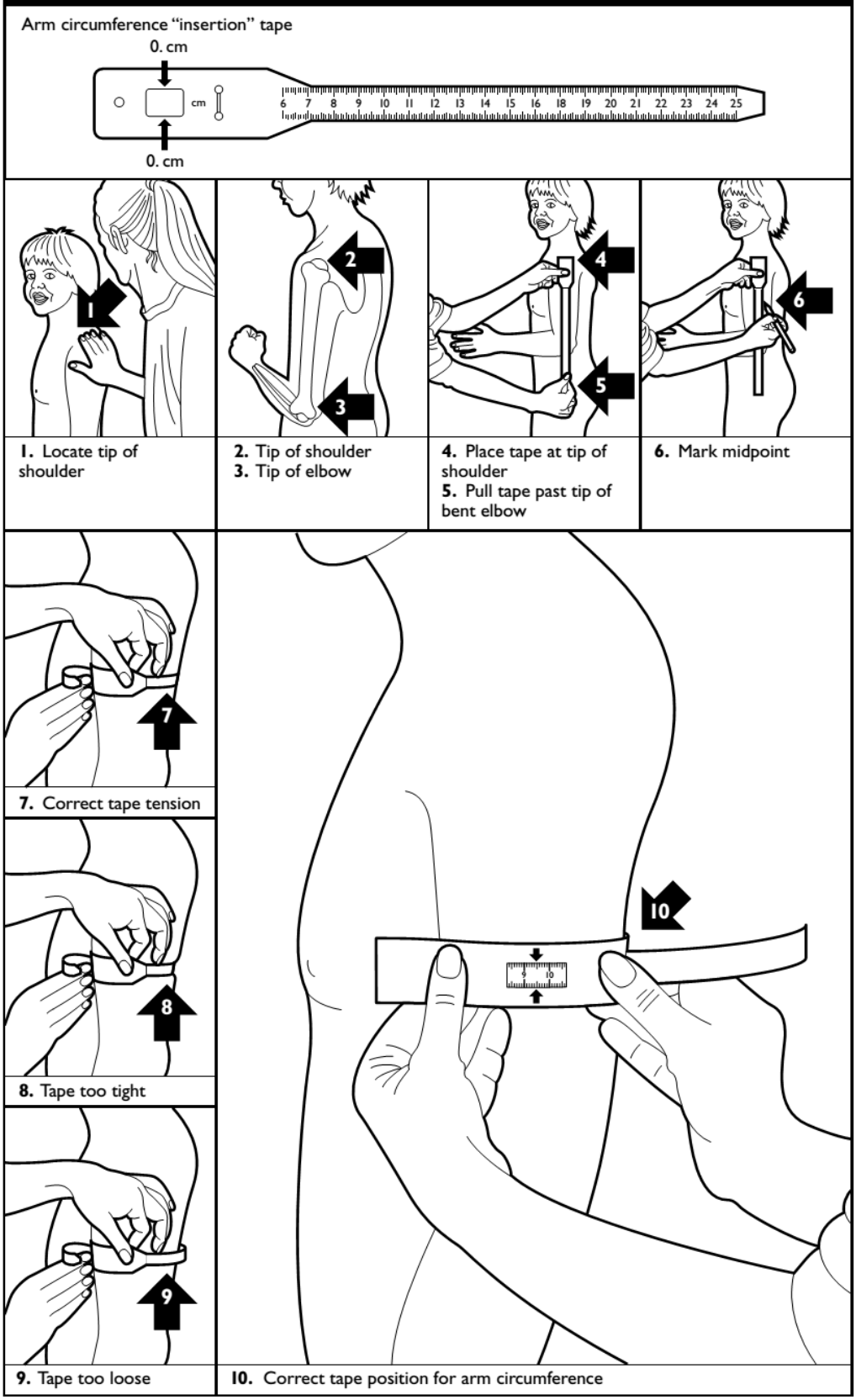
8. Inspecting the tension of the tape on the child's arm to make sure the tape has the proper tension and is not too tight or too loose.

9. With the tape in correct position on the arm with the correct tension, the measurement will be read to the nearest 0.1cm.

10. Recording of the measurement.

11. Two measurements will be taken, one by the Principal Investigator and another by the research assistant then the average calculated and recorded in the data collection form.

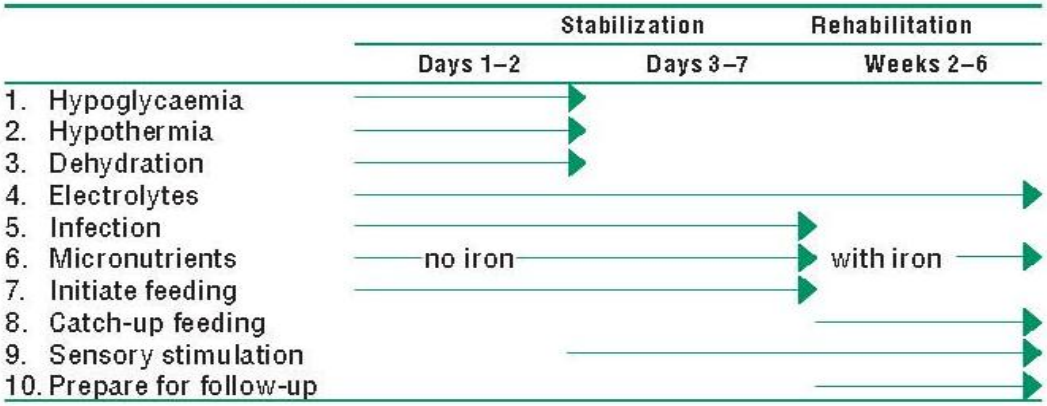
Figure 5.5. Child Mid-Upper Arm Circumference Measurement



Appendix 6: World Health Organization (WHO) Treatment Guidelines

General treatment involves 10 steps in two phases: initial stabilization and rehabilitation (see Table 21).

Table 21. Time frame for the management of a child with complicated severe acute malnutrition



Appendix 7: IREC Approval:

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference IREC/2015/147
Approval Number: 0001449

31st March, 2016

Dr. Chepng'etich Risper,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
31 MAR 2016
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Dr. Chepng'etich,

RE: APPROVAL OF AMENDMENT

The Institutional Research and Ethics Committee has reviewed the amendment made to your proposal titled:-

"Adherence to World Health Organization Treatment Guidelines in Management of Severe Malnutrition among In-Patients Aged ≤ 60 Months in Moi Teaching and Referral Hospital".

We note that you are seeking to make amendments as follows:-

1. To reformat the questionnaire to ensure ease of reference and for ease of analysis in future.
2. Some additions were made to the management steps; these were informed by the WHO guidelines and the current basic pediatric protocol.

The amendments have been approved on 31st March, 2016 according to SOP's of IREC. You are therefore permitted to continue with your research.

You are required to submit progress(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc: Director - MTRH Dean - SPH Dean - SOM
Principal - CHS Dean - SOD Dean - SON

Appendix 8: Hospital Approval

MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
Fax: 61749
Email: director@mtrh.or.ke

P. O. Box 3
ELDORET

Ref: ELD/MTRH/R.6/VOL.II/2008

10th August, 2015

Dr. Chepng'etich Risper,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:

"Adherence to World Health Organization Treatment Guideline in the Management of Severe Malnutrition among In-Patients Aged≤ 60 Months in Moi Teaching and Referral Hospital."

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

DR.JOHN KIBOSIA

DIRECTOR
MOI TEACHING AND REFERRAL HOSPITAL

CC - Deputy Director (CS)
- Chief Nurse
- HOD,HRISM