MISSED OPPORTUNITIES FOR DIAGNOSIS OF ACUTE MALNUTRITION IN CHILDREN AGED 1-23 MONTHS AT PAEDIATRIC EMERGENCY UNIT AT KENYATTA NATIONAL HOSPITAL

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DECLARATION

This dissertation is my original work and has not been published elsewhere or presented for a degree in any other university.

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ABBREVIATIONS

ATP- Adenosine Triphosphate

EBM- Expressed Breast Milk

HIV/AIDS- Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome

IAP- Indian Academy of Paediatrics

KDHS- Kenya Demographic Health Survey

KEMRI- Kenya Medical Research Institute

KNH- Kenyatta National Hospital

KNH-UoN ERC- Kenyatta National Hospital/University of Nairobi- Ethics and Research Committee

MOH- Ministry of Health

MUAC- Mid upper arm circumference

OPD- Outpatient Department

OTP- Outpatient Therapeutic Programme

PEM- Protein Energy Malnutrition

PFC- Peadiatric Filter Clinic

RUTF- Ready to Use Therapeutic Food

SAM- Severe Acute Malnutrition

SFP- Supplementary Feeding Program me

UNICEF- United Nations International Children's Emergency Fund.

WHO- World Health Organization

WHZ- Weight for Height Z- Score

OPERATIONAL DEFINITIONS

Acute Malnutrition: It refers to a weight/height Zscore <-2SD, MUAC < 12.5cm or any oedema of malnutrition. It includes severe and moderate forms. Mild, non-severe or at risk are not considered as malnutrition

Moderate Acute Malnutrition (MAM)/ wasting: An intermediate form of acute malnutrition defined as weight for height of-3SDs to -2SD z scores below the median of the WHO reference population or mid-upper arm circumference (MUAC) between 115 millimeters and <125 millimeters without bilateral pitting oedema .(1)

Severe Acute Malnutrition (SAM)/wasting: Is defined as weight for height below -3SD below median of the WHO reference population or presence of visible severe wasting, MUAC of less than 115millimeters or the presence of bilateral pitting edema of nutritional origin(2)(1)

MUAC- MUAC is used for the assessment of nutritional status. It is usually taken on the left side for purposes of standardization. A MUAC less than 125mm but more than 115mm indicates moderate acute malnutrition. A MUAC < 115mm indicates severe acute malnutrition. This will be the dominant anthropometric measurement used in this study.

Missed opportunities- It is when an individual seeks health care services at a health facility from health care professionals but the contact does not result in the diagnosis of acute malnutrition. If acute malnutrition was not identified and/or proper action was not taken, it will be defined as a "missed opportunity."

Linkage to care – Referral of children to the right nutrition service (in this case OTP) once diagnosis of acute malnutrition is made.

Growth Charts – a graphical display of growth, where height, weight and head circumference are plotted at every clinic visit. It demonstrates progressive changes regarding growth in children. The growth charts present in the mother to child booklet will be used,which plots the weight against the age and helpful in assessing growth.

Correctly plotted growth charts It involes 3 major criteria. It entails to check whether weight is plotted every 2 months in the first year and 3 months in the second year (a time allowance is given for 1 month extra in the first and second years). The dots need to be

joined to form a child's growth curve and lastly ensuring the months are correctly plotted in the growth chart.

MOH Form 204 A – This is a Kenya Ministry of Health register used in children under 5 years (0-59 months) who are sick and visit the facility for care. It includes demographics, revisit, danger signs, duration of illness, nutritional assessment, diagnosis and classification, treatment and follow up and if it is a referral.

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ABSTRACT

Background:

In children under the age of five years acute malnutrition has remained a major health concern, with poor progress made towards achieving the desired reduction in prevalence. Currently 17 million children globally are severely malnourished. (3) The current prevalence of wasting in Kenya is at 4% among children under five with severe wasting at 1% (4). The lack of recognition and emphasis on diagnosis (especially the moderate form) and failure to recognize the mortality risks associated with wasting may be an indicator that policy makers are not aware that wasting is a priority health problem in children.

Study Justification/Utility:

The aim of this study was to better understand the gap with regard to timely diagnosis of acute malnutrition and linkage to appropriate care in a hospital based setting

Primary Objective

To determine the prevalence of missed opportunities for diagnosis of acute malnutrition in children aged 1-23 months at Pediatric Emergency Unit (PEU) at Kenyatta National Hospital (KNH).

Methodology

A cross sectional study carried out to determine the prevalence of missed opportunities for diagnosis of acute malnutrition among children aged 1-23 months presenting to the Pediatric emergency unit (PEU) of Kenyatta National Hospital.

Results

Forty-two children were found by the researcher to have acute malnutrition giving a proportion of 10.4% (95% CI 7.6 to 14%).

Of the 42 malnourished children, only 1 was correctly identified by the registrar on duty while 97.6% (41/42) (95 CI 87 to 99%) were missed.

Twenty-four percent (86/358) of the participants had correctly filled growth charts.

The MOH register 204A is not being utilized at PEU, in place a KNH coded register is being used which does not record routine anthropometry for all patients.

Conclusion

Missed opportunities for diagnosis of malnutrition is 97.6% with only one case correctly identified.

Twenty four percent of the participants had correctly filled growth charts.

MOH Form 204A outpatient register is not utilized by the PEU at KNH

CHAPTER 1

1.1 Introduction

Good nutrition is a prerequisite for a child's growth and development with a large impact on child survival and long term well-being. Adequate nutrition and food is recognized as a basic human right under the 2010 Constitution of Kenya. It states that every child has the right to basic nutrition, no child should experience hunger and has the right to adequate food of justifiable quality. In order to achieve Sustainable Development Goals (SDGs 1, 2, 3) for no poverty, zero hunger and for good health and well being, it is essential to cause reduction of infant and young child malnutrition.(5)

The World Health Organization (WHO) refers to malnutrition as "A reduction in intake with the inability to utilize the energy and nutrients required, leads to failure of the body cells to function optimally to perform their physical functions." This implies that it is not merely reduced food intake or food without nutrients, it is rather the failure of cells to perform their physiologic functions due to inability to utilize the nutrients required.

Acute Malnutrition is a public health problem of global concern. Acute malnutrition is associated with high morbidity and mortality and necessitates early diagnosis as well as preventive interventions and is reversible if diagnosed within the first 2 years. The progress towards overcoming the high burden of acute malnutrition worldwide has remained unacceptably slow.(6) Currently 17 million young lives are still at risk due to severe acute

malnutrition. Malnutrition rates although showing declining trends, still remain dormant with wasting still having negative repercussions on the well-being of far too many young children.(7)

Improving the nutrition of children and early identification of acute malnutrition will contribute to overcoming some of the greatest health challenges facing the world.(8). It is well known that the risk of dying is inflated among children with severe acute malnutrition (SAM), but when one considers the high prevalence of MAM (which contributes to about 64% of all those diagnosed with acute malnutrition) and its rapid progression to SAM, it is evident that the higher mortality due to under nutrition is attributable to MAM rather than SAM.(9)(10) A study done by Gachau *et al* in 13 Kenyan hospitals showed that 17% of the patients were being diagnosed retrospectively through documented anthropometric measurements which were consistent with SAM but diagnosis had been missed in the inpatient setting and this put children at risk death. There is the possibility that many more patients with moderate malnutrition were also missed with risk of progression to SAM.(11) A study done in March 2014 in Rural Ethiopia in children living with MAM in an area without supplementary feeding programme (SFP) who were followed up over a 7 month period in the absence of nutrition support from a supplementary feeding program reported 7.8% children with an initial MUAC between 12-12.4 deteriorated to SAM and throughout the study period, 9.3% of the children experienced at least 1 episode of SAM. It brings out the importance to re-assess the current approach for addressing MAM in an area with no availability to SFPs who experience an unusually high incidence of SAM and a slow recovery rate.(10) Compared to well-nourished

children, children with MAM have a three-fold increased risk of mortality, increased risk of infections and impaired physical and cognitive development.(12)

Cross-sectional studies done estimate a prevalence of 32%-38% of missing the diagnosis for malnutrition in children in developing countries further confirming that indeed missed opportunities of diagnosis of malnutrition may be partly responsible for the high prevalence of malnutrition in the Kenya.(13)(14). Although several studies have been done to determine prevalence of malnutrition, very few have specifically looked at missed opportunities for diagnosis of malnutrition hence more research on this will provide useful data on the link between prevalence of malnutrition and missed opportunities for diagnosis. Early identification of acute malnutrition and linkage to appropriate care is important in scaling down on the prevalence of acute malnutrition.

The focus of this study is acute malnutrition which is correlated with increased risk of mortality when left untreated. When identified within the first 2 years of life and appropriate treatment instituted, the effects are usually reversible and children have better outcomes.(15). The goal is to identify children early and to ensure effective linkage to care.

CHAPTER 2

2.0 Literature Review

2.1 Overview

Normal child growth (progression of weight, height and head circumference according to the standards for a given population) is an overall indicator of good health and nutritional status. The most powerful tools for growth assessment are the growth charts used in combination with accurate measurements of height, weight and head circumference.(16) Nutritional assessment is the first step in the identification and treatment of malnutrition and anthropometry is used to assess nutritional status through body measurements.

WHO classifies malnutrition broadly into under-nutrition and over-nutrition, however the focus of this study is primarily on under-nutrition. Under-nutrition is further divided into wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age).Wasting indicates a more current and critical process of weight loss that is often associated with a short period of starvation and/or severe disease.(17) The immune system function is impaired in the presence of wasting and this can lead to increased susceptibility to prolonged and severe infectious diseases and increased risk of death. (18)

Moderate acute malnutrition refers to WHZ score >-3 to ≤-2 or mid upper arm circumference between 11.5 to 12.4 cm. Many previous studies have focused mainly on severe acute malnutrition(SAM), however the prevalence of MAM has remained high with minimal change in recent decades.(19). It is noted that both moderate and severe acute malnutrition are

associated with grave consequences, and interventions should therefore also consider early MAM identification and management. Gaps still remain in the current understanding in the treatment and prevention of MAM and studies done around MAM report inconsistent findings with regards to detection of MAM.(19). Further studies need to be conducted to identify missed cases of malnutrition as they directly affect the prevalence and specify each case as moderate or severe.

2.2 Burden of acute malnutrition

The most frequent cause of child mortality throughout the world remains malnutrition. Globally in the year 2017, a total of 52 million children under the age of five years were identified to be wasted and 17 million from the total were severely wasted. This translates into a prevalence of 32% for severe wasting.(20)

In Africa, according to the data obtained between 2007 and 2015, the prevalence of wasting among children was at 6.3%. Seventeen countries including Kenya reported of acceptable prevalence at < 5%, 19 countries reported of prevalence of 5-9%, 6 countries reported 10-15% prevalence while 3 countries reported critical levels >15%.(21). A study done in Madagascar (2016) showed a prevalence of wasting of 10.3% which was comparable to a study done in South Ethiopia with a prevalence of 9%, but different from the findings from India which estimated a prevalence of wasting of 21%.(22)(23)

According to KDHS 2014 (Kenya Democratic Health Survey), over one-quarter of children under five are stunted at 26%, 4% are wasted (1% are severely wasted, 3% are moderately

wasted) and 11% are underweight. North Eastern region was reported to be the highest prevalence of 13% while a prevalence of 2% was reported to be the lowest and was noted in Western, Nyanza, and Central regions. A Study done by Gachau *et al* in 2018, analysed 54140 case records of children aged 0-59 months from 13 Kenyan Hospitals and it was noted that 5306 (9.8%) had severe acute malnutrition (SAM) in the inpatient settings.(11)

The figure below shows (data below was obtained at one point in time) nutritional status of children aged 0-59 months in Kenya in 2014. The graph shows stunting has the highest prevalence with wasting least. The peak age of developing malnutrition is noted past 2 years (2 ½ years). National and Regional estimates of the burden of malnutrition put forward important information on preventable ill health and this enables resources to be directed to the most vulnerable segments of the population and ensuring better utilization of the resources to overcome the burden of malnutrition.(6)

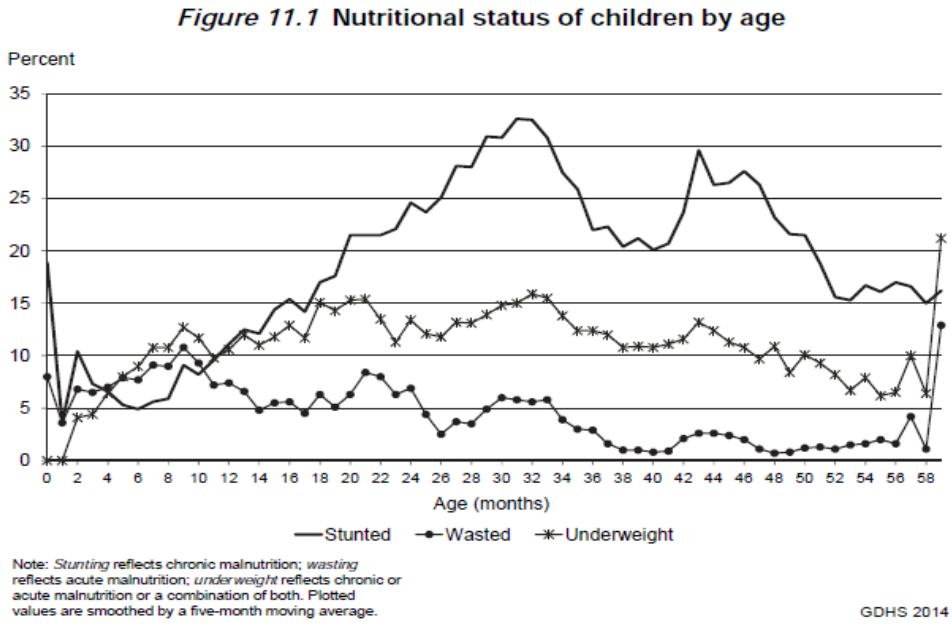


Figure 2.1: Prevalence of malnutrition in children up to 5 years of age.

2.3 Diagnosis of Acute Malnutrition

WHO recommends use of either the mid-upper arm circumference (MUAC) measurement or weight-for-height Z score (WHZ) and/or presence of nutritional edema to make a diagnosis of acute malnutrition in children. MUAC measures the fat free mass and it is the circumference of the upper arm, midway between the olecranon process and acromion on the left arm. It is used for rapid screening of acute malnutrition in children aged 6 to 59 months. MUAC is less cumbersome, requires less expertise and is faster to perform even in the sickest of children compared to WHZ score. Studies using MUAC as a diagnostic criteria for wasting demonstrated a higher risk of death if it is below 115mm. The elevated risk of death below this cut-off means children in this category require intensive nutritional and medical support.(24)(25) The WHZ-score measures body weight in relation to body height/length to outlines the current nutritional status.(26) Both MUAC and WHZ are regarded as proxy measures of acute malnutrition in resource limited settings where routine assessment of biomarkers such as hormonal and metabolic markers are not feasible. MUAC relies on a single cut-off point regardless of age, gender and height and as a child grows there is increase in weight, height and MUAC albeit at different rates and hence a child who is shorter or younger with the same WHZ can still be below the universal cut off for MUAC.

Studies conducted across several countries have shown that MUAC and WHZ score identify wasting among different groups of children(27). A study done by Fernandez *et al*. in children aged 6-59 months reported that 75% of children with WHZ < -3SD did not have a corresponding MUAC of < 115mm and similarly another study done by Grellety *et al*. reported mortality of 32% in children admitted with a WHZ < -3SD but all had a MUAC > 115mm. In the study by Grellety, if MUAC had been used as the single criterion for diagnosis, these

children would have been managed as no malnutrition and would not have been linked to appropriate care. (28)(29). The sitting to standing ratio is a factor to be considered as it may influence the diagnosis of acute malnutrition through WHZ independent of MUAC.(30) Thus the 2 indicators MUAC and WHZ should be used as additive to each other rather than discrete measure and this is supported by the observation that children with both deficits in MUAC and WHZ are noted to have a bad prognosis than with a single deficit in anthropometry.(31)

Growth monitoring involves routine measurements (monthly follow up in the first year, then 2 monthly in the second year) of growth parameters (weight, height and head circumference) to be able to detect abnormalities in growth after plotting the growth chart and adopt measures if growth faltering is noted. The aim of regular growth monitoring is to reduce nutritional related child morbidity and mortality and lead to health promotion.(32) Routine growth monitoring is also able to identify feeding difficulties in children, underlying chronic illness which maybe affecting normal growth, social deprivation and poverty leading to poor nutritional intake and failure to thrive which leads to poor weight gain due to psychosocial causes. (32). Once abnormalities in growth is detected, the interventions includes counselling of mother with aid of growth charts, investigation and treatment of underlying chronic disease and referral to OTP for better nutritional follow up.

2.4 Impact and consequences of acute malnutrition

Scientific documentation has exhibited that once a child is above 2 years of age, the effects of malnutrition are difficult to reverse. This means, to break the vicious cycle of poverty

malnutrition and infection, children at risk must be reached and diagnosed within the first two years of life.(33) Children who do not achieve their optimum height or suffer life-long consequences, it is therefore important that health workers ensure that each and every child has an opportunity to have their nutritional status assessed at any contact with a health facility.(33)

Nutritional deprivation in early childhood is associated with harmful long term effects including poor cognitive function that affects education attainment and achievements, and ultimately low adult productivity and wages. (Adelman,2009).

The risk of mortality is increased by 9 fold in children who have a weight for height below -3SD compared to weight-for-height above -1 SD.(34) Moderate Acute Malnutrition (MAM) which is WHZ score between -3 and -2 also corresponds to the increased risk of mortality. Adequate aid should be provided to those children who are moderately malnourished together with prompt treatment to avoid death. That being so, the management and diagnosis of MAM should be taken for a matter of greatest importance. (WHO). Overall prevention of complications and initiation of prompt treatment in primary health care begins with early detection. This improves health outcomes and maximizes effectiveness of nutrition therapy in achieving recovery.(25)

Acute malnutrition mainly affects low and middle income countries with significant public health impacts. The relationship between malnutrition and infection is often described as a vicious cycle that begins with malnutrition which increases their susceptibility to infections due to reduce immunity and prolonged illness which causes further deterioration in nutritional

status.(35). The consequences of MAM may not be alarming as the children do not yet show the signs regarding the same degree of wasting as well as other clinical consequences as seen in those with SAM, however patients with MAM are also in an increased susceptibility state and need to be treated promptly before a advancement is noted to the severe form of malnutrition.

2.5 Missed Opportunities for diagnosis of Acute Malnutrition

The universal purpose of any health worker is to make accurate and timely diagnosis of any condition, yet it signifies to be one of the most difficult aspects of primary care. Below are some of the factors associated with missed opportunities for diagnosing malnutrition that were alluded to the studies mentioned in the table below.

The study done by Gachau *et al*. and Dave *et al*. on documentation of signs and symptoms and anthropometric measurements. Poor/No documentation was noted to be an important contributing factor for missing the opportunity for diagnosis. The authors noted that there was negligence and lack of perception towards importance of nutrition in children and burden of malnutrition. The lack of assessment of nutritional status by the admitting doctors showed that malnutrition was not regarded as a priority measure. Gachau's study also stated that 6.3% of all infants (1-5months) included in the study had SAM and contributing factors included low rates of breastfeeding and incorrect complementary feeding. It was also noted that clinicians rely on clinical signs of malnutrition (visible wasting) and hence probably not including those with edema hence missing the diagnosis.

Mwinyishee was determining why health workers missed diagnosis and contributing factors include lack of knowledge on how to make a diagnosis, a primary focus on the presenting complaints, poor clinical assessment of patients, nutritional status of the patients not recorded, understaffing, lack of equipment for taking anthropometric measurements, and lack of knowledge of the mother on the nutritional status of their children (not carrying MCH booklet at every visit). Knowledge was addressed through a researcher administered questionnaire where mothers were unaware about the child's weight gain/loss, child's appetite and clinical changes such as visible wasting noted on the child. Focusing on presenting complaint entails clinicians focus on the disease and do not take into account the nutritional aspect. It also distracts the clinician from making a diagnosis of malnutrition.

Other factors that may be contributory include failure to fill MOH Form 204A which is an outpatient register that takes in to account the weight, height, and nutritional status with classification. Filling this form will make it easy for routine follow up with data on anthropometry which will entail the burden of malnutrition.

Only a few studies have been carried out to identify the missed opportunities of malnutrition however malnutrition levels remained have largely unchanged in the recent years. Most have focused on prevalence of malnutrition and causes of malnutrition. Most studies done on missed opportunities for diagnosis was to determine the prevalence of missing diagnosis however the aspect of linkage to care and follow up after identifying malnutrition still needs to be tackled.

The studies on missed opportunities for diagnosis of malnutrition have been summarized in the table below.

AUTHOR/ YEAR OF STUDY/ LOCATION	STUDY POPULATION/ SAMPLE SIZE	STUDY DESIGN/ ANTHROPOMETRIC MEASUREMENTS USED FOR ASSESSMENT	OUTCOMES
Sampson *et al.* OPD Clinic at Komfo Ankonye Hospital, Ghana 2008	Children aged 3-5 years. n = 1182	Cross-sectional study WHZ score	251 (21.2%) noted to be wasted, 48 (4.1%) of them had SAM. 15 (5.9%) OUT of the 251 children with wasting were correctly identified by the physician on duty. Missed opportunity was 236/251(96%) for wasted children.
Pooja *et al.* Surgical wards in Shree Krishna Hospital, India 2016	Children under 0- 59 months n = 154	Retrospective study . Weight and Height records for WHZ score	Weight and height were mentioned in 116 (75.32%) and 8 (5.19%) records. Missed opportunity for identification was 38/154 (26.4%) for lack of documentation of both weight and height.
Akugizibwe *et al.* Health centres in Wakiso District, Uganda. 2013	Children under 0-59 months n = 225	Cross sectional descriptive study. WHZ Score, WAZ score and MUAC .	Only 21 (9%) children with malnutrition were diagnosed correctly, while researchers found 94 (31.9%) with malnutrition.73 (32.9%) of the children missed opportunity to have malnutrition diagnosed at the health facility.
Malik S *et al.* Paediatric OPD at Kolkata medical college, India. 2006	Children under 0-59 months n = 150	Cross sectional study Weights were plotted on the growth chart and IAP classification was used for grading malnutrition.	51% were correctly diagnosed to have malnutrition. Of all those malnourished children, no action was taken immediately i.e linking to nutritional clinic or nutritional education hence considered a missed opportunity to linkage to care after diagnosis of malnutrition was made.
Maigua Paediatric wards at Kenyatta National Hospital 2012	Children under 0-59 months n = 180	Cross-sectional study WHZ and MUAC.	It was noted that 109/180 (61%) of children were missed for the diagnosis of both severe and moderate malnutrition in those with pneumonia.
Mwinyishee Paediatric OPD at Mbagathi District Hospital 2013	Children aged 6-59 months n = 255	Cross sectional study WHZ and MUAC	Malnutrition was missed in 88 of the 255 children which gave a prevalence of 38.3%
Gachau *et al* Paediatric wards of 13 (county/district) Kenyan Hospitals, 2018 (Prevalence and outcomes of SAM in CIN Hospitals)	Children aged 1-59 months n = 54140	Longitudinal hospital based observational study WHZ Score and MUAC	Prevalence of malnutrition 5306/54140 = 10.1%. A Subgroup of 17% of patients did not have a documented SAM diagnosis and was diagnosed retrospectively using stated anthropometric measurements

Table 2 1 Summary of studies done on missed opportunities of malnutrition

2.6 Justification and Utility

Acute Malnutrition is a common condition among children presenting in Kenyan hospitals yet is underdiagnosed. Globally, approximately 60 million and 13 million of children are affected by moderate and severe acute malnutrition, respectively. The prevalence of underweight and stunting among young children are highest in Sub-Saharan African countries. Moreover, 51% of under-five deaths are associated with malnutrition where its causes are multifaceted.(36) Several studies have shown that health care workers often miss the diagnosis of malnutrition in children despite the fact that malnutrition is associated with approximately 45% of childhood mortality. The national guidelines on integrated management of acute malnutrition were developed with an aim of ensuring health workers successfully diagnose and treat malnutrition. The aim of this study is to determine the extent to which health care workers at the Paediatric Emergency Unit (PEU) in KNH conduct and document anthropometric measurements among children. Since scientific evidence indicates beyond 2-3 years the effects of malnutrition are irreversible, this study will focus on children below 2 years of age for whom undernutrition should be identified early before they progress to the state of irreversibility and will also assist in reduction of progression of MAM to SAM. Local studies on prevalence of malnutrition and missed opportunities for diagnosis have focused on children under five and there is limited data on children below the age of 2 years. Data obtained from the study will identify gaps in documentation of nutritional assessments of children and will provide useful information on areas to target to enhance timely diagnosis of malnutrition as well as to facilitate linkage to care. This will help to ensure no chance is missed by a child to have their nutritional status assessed and hence reducing missed diagnosis.

CHAPTER 3

3.1 Research Question

What is the prevalence of missed opportunities of diagnosis of acute malnutrition in children aged 1-23 months at the Paediatric emergency unit in KNH?

3.2 Study Objectives

3.2.1 Primary objective

- To determine proportion of children with missed opportunities for diagnosis of acute malnutrition among in children aged 1-23months seen at the Paediatric Emergency Unit (PEU) in KNH.

3.2.2 Secondary objectives

- To determine the proportion children whose mothers have the Mother to Child Handbook (MCH) during their visit to PEU and whose growth monitoring charts in MCH booklets are correctly filled.
- To determine the proportion of children whose nutritional status is documented in the MOH form 204A at KNH.

CHAPTER 4

RESEARCH METHODOLGY

4.1 Study design

This was a cross-sectional study.

4.2 Study location

Patients were recruited from Paediatric emergency unit at KNH.

Kenyatta National Hospital is a tertiary hospital with a capacity of 2000 beds and attends to an annual average of 70,000 inpatients and 600,000 outpatients comprising both adults and children.(37) As a referral hospital, KNH provides health care to patients from all over Kenya as well as Eastern and Central African region. The hospital also provides training facilities for the University of Nairobi and Kenya Medical Training College. It also engages in research to enhance evidence based health care and influence national health policies.

The Peadiatric emergency unit on average receives about 90-150 patients daily out of whom 5-20 are admissions and 3-10% are referrals. At the PEU there is 1 registrar who sees the acutely ill patients and all the referrals and a clinical officer who sees the stable cases and outpatients. After registration the triage nurse sorts out children within the queue into emergency, priority cases and non- urgent cases. Emergency cases and referrals are immediately taken to the doctors room for urgent review and no anthropometric measurements are taken for these children. Those in priority and non-urgent queues have their weights routinely taken while height and MUAC are not performed routinely. Once the WHZ score is calculated it is classified using the basic paediatric protocols. As per KNH

treatment guidelines all children with a MUAC of < 11.5 or WHZ < -3SD with medical complications (including acute gastroenteritis, severe pneumonia, anemia, convulsions) and edema are admitted. Those children diagnosed with MAM (who are often missed) are referred to the nutrition clinic but if has medical complications are also considered as an admission. The outpatient notes are recorded in patients outpatient cards which have a card number on it. The card remains in the hospital and is kept at the records office and retrieved during revisits making it easier for the health workers to review the patient. The nutrition clinics are specialist clinics run by nutritionists who sees the stable children who either have MAM or SAM without medical complications and records weight height and MUAC at every visit. The children are on feeds prescribed by the nutritionist, RTUF and specialized enriched flours to make porridge and are available most of the times. MCH booklets are given to pregnant mothers at their first antenatal clinics and are free in public hospitals.

4.3 Study population

The study population included children aged 1-23 months (and their caregivers) at the Paediatric Emergency Unit (PEU) at Kenyatta National Hospital, who meet the inclusion criteria.

4.4 Inclusion and exclusion criteria

4.4.1 Inclusion Criteria

- All children aged 1-23 months attending pediatric emergency unit whose mothers provide informed consent for their children to be enrolled in to the study.

4.4.2 Exclusion Criteria

- Children On follow up at nutritional clinic for nutritional rehabilitation.
- With chronic illness resulting from organ dysfunction, for example cardiac, renal or malignancy on follow up in health facility.

- Whose parents/guardians do not consent to their child's participation in the study

4.5 Sample size calculation

Sample size calculation was calculated using the Fischer's formula.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

n= sample size

z= standard normal deviate for 95% confidence level

p= estimated prevalence of missed opportunities for diagnosis of malnutrition (The prevalence value used is 38% based on the study done at Mbagathi District Hospital by Sofia *et al*.)

d= desired margin of error allowed by researcher 5% (0.05)

$$n = \frac{1.96*1.96*0.38(1-0.38)}{0.05*0.05},$$

n=360

With an expected non response rate of 10%, the sample size was adjusted upward:

1/1-0.1*360=1.11*360=400 participants

4.6 Sampling Technique

Consecutive sampling of children was carried out until the desired sample size is achieved. This was carried out in 6 hourly blocks of the day/night. Participants were enrolled over a period of 6 hours at the PEU daily. The 6 hour blocks were chosen after dividing the 24 hours into four 6 hourly blocks. Data was entered into Microsoft Excel spreadsheet where different columns were used to identify the 4 blocks and data from the different dates of the study were provided within the rows. Randomization was done with the RAND function in excel which will generated random numbers on the day of the study between 0 and 3. The block that was assigned the highest random number for the study dates was selected. This was to minimize selection bias.

4.7 Study period

The study was carried out over a 4 month period beginning in November 2019 and ended February 2020.

4.8 Subject recruitment procedure

Children's recruitment procedure

All eligible patients aged 1-23 months at the PEU were enrolled into the study. The study was carried out in 6 hourly blocks either day or night at PEU depending on the block that was randomized for the day. The recruitment procedure was carried out on a daily basis (6 hours in a day) and performed as an exit assessment. Two research assistants were utilized for the study, one who covered the morning block (if the randomized block of the day was either

6am-12 midday or 12midday to 6pm) and the other who covered at night (if the randomized block of the day was 6pm to 12 midnight or 12 midnight to 6am).

Informed written consent was obtained from caregivers of eligible children at initial contact before looking at their records or performing anthropometric measurements. Consent was given on a pre-designed consent form which was availed to the caregiver at that point in time. The consent form described the purpose of the study, the study procedure, including performance of anthropometric measurements. The consent did not dwell on benefits of the study in the beginning to allow participants to make an informed choice on whether to participate or not. (Annex 2)

The investigator explained the study procedure to potential participants and counter checked to ensure the parent/guardian comprehends the information provided on the consent form. If any pertinent questions regarding the study from the parent guardian were answered at this point prior to signing the consent form and enrollment. Consent obtained was voluntary and free from coercion. Records were also be kept regarding the reasons for non-participation of eligible participants.

Exit interviews were then conducted using a structured questionnaire which were be used to obtain the following information:

- Sociodemographic characteristics including age, sex, residence.
- Anthropometric measurements were performed both MUAC, weight and height by a trained research assistant as part of exit assessment. Patient was classified as no acute malnutrition, moderate acute malnutrition and severe acute malnutrition using

MUAC. (WHZ score will be calculated and compared to the table in Basic Paediatric Protocols 2016)(38)

Classifying malnutrition
(for WHZ values see pg 51 to 52)

Acute Malnutrition *(severity)*	MUAC *(mm)*	WHZ
None	>135	> - 1
At Risk	125 to 134	> - 2 to ≤ 1
Moderate	115 to 124	> - 3 to ≤ - 2
Severe	< 115	≤ - 3
	Kwashiorkor	

Figure 4.1: Assessment of nutritional status and classification of malnutrition (39)

- Data on patients' clinical assessment, anthropometric measurements, nutritional status, diagnosis, treatment and outcome of clinical encounter (for example linkage to nutrition care if malnourished) was abstracted from children's medical records and entered into the study tool. Since it was an exit assessment after they have been seen by the clinician, the caregivers were informed about the nutritional status at this point if acute malnutrition is present and were linked to care ideally to the nearest facility.
- The caregivers were asked for the Mother Child Handbook. The handbook was assessed and the growth monitoring charts of children was studied to determine if they were plotted correctly. (It entails monthly monitoring for the first year, then two monthly monitoring in the second year, the dots should be joined into a growth curve and the months to be indicated correctly. Knowledge of caregivers/parents on growth

monitoring charts was assessed, regarding purpose and importance of growth monitoring and whether their child was growing normally or not (basic knowledge).

- At the end of every shift of the study, the researchers assessed MOH Form 204A to check if data on anthropometric measurements was being filled in correctly (A correctly filled form entails recording all required anthropometric measurements on the form) . This is an outpatient register which takes into account the nutritional assessment, age, sociodemographic characteristics, diagnosis, referral for children under five years of age.
- Calculation of missed opportunities for diagnosis as follows:
- $\frac{\text{No of cases diagnosed by the researcher} - \text{No. of cases diagnosed by clinician}}{\text{Total no of malnutrition cases}} \times 100$

Control of errors and biases:

The following measures were taken to reduce different forms of bias and errors;

- The questionnaire was pretested to reduce insensitive measure bias, ensuring the questions are sensitive enough to detect what might be important differences in the variable of interest.
- Participant enrollment was done both at night and day in 6 hourly blocks and all blocks will be covered equally to avoid sampling bias.
- Since it is an exit assessment interview, the caregivers were informed about the nutritional status if malnutrition was present and were linked to care. This did not influence the clinician in any way.

- Standard case definitions and study terminologies were used by every interviewer when administering the study questionnaire to ensure uniform interpretation of terms.
- The principal investigator reviewed the responses provided within the questionnaires on a daily basis and oversee data entry to ensure validity of collected data. Referring patients to the nutritional clinic reduced the Hawthorne effect.

4.9 Data Management and Analysis

Following selection of the study subjects who met the eligibility criteria, data was collected from the parents/ guardians using a pre-tested questionnaire as well as the anthropometry measurements were documented and Uploaded into a password protected excel sheet.

Cleaned data was analyzed using SPSS v 23 software

Descriptive statistics:

- Means(SD) or medians(IQR) were reported for continuous variables (e.g - mean age of the participants)
- Missed opportunity was calculated as the percentage of number of children newly diagnosed to have malnutrition by the researcher (excluding the children newly diagnosed by the clinician) / total number of children with acute malnutrition in the study.
- Frequencies and proportions were reported for categorical variables (for example proportion of children with missed opportunities; proportion of study population with correctly filled growth monitoring charts, proportions of patients with nutritional status documented in the MOH form 204A).

- Children and mothers' characteristics were compared between the children with missed acute malnutrition and those with no malnutrition using chi-square or Fisher's exact test for categorical variables or Wilcoxon rank-sum test for the medians. To examine factors associated with missed acute malnutrition, logistic regression analysis were used and the results reported as the odds ratios and their 95% confidence intervals. Statistical significance was considered at alpha<0.05. Independent variables were retained in the multivariate model if they had a P-value <0.10 using a backward stepwise approach. Statistical analysis was performed using Stata version 15.1 (StataCorp, College Station, TX, USA)
- Descriptive data was presented using bar graphs/pie charts and tables.

4.10 Ethical Considerations

1.Authorization was sought from Kenyatta National Hospital- University of Nairobi (Department of Paediatrics) Ethics and Research Committee (KNH-UoN ERC) to collect and analyze data collected in the study as part of the Thesis Dissertation.

Copies of this protocol, the informed consent form as well as any subsequent modifications to either document was presented to the above named committee for written approval prior to commencing the study.

2. Permission was sought from KNH administration to conduct the study within PEU at KNH.

3. The purpose of the study was carefully explained to the children's parents/guardians with a view of obtaining written informed consent prior to enrolling any child in the study.

No experimental investigations or products were employed in this study. Permission to take height and weight as well as MUAC measurements of children was obtained from the mothers/caregivers. These measures were non invasive and pose no acute or long term risk to the participants.

4. Benefits that participants accrue from the study included receiving education regarding various components of nutrition as well as enable diagnosis which would have otherwise been missed. Malnourished children were enrolled in a nutritional clinic to enable follow up which will result in overall better outcomes for their children.

5. Strict confidentiality was observed throughout the entire study period, held in trust by participating investigators, research staff and the study institutions. The study participants was given study identification numbers and no personal identification data was recorded.

6. Feedback on the study findings was and will be provided to the relevant authorities at KNH and also to the faculty and students at the Department of Paediatrics and Child Health.

CHAPTER 5

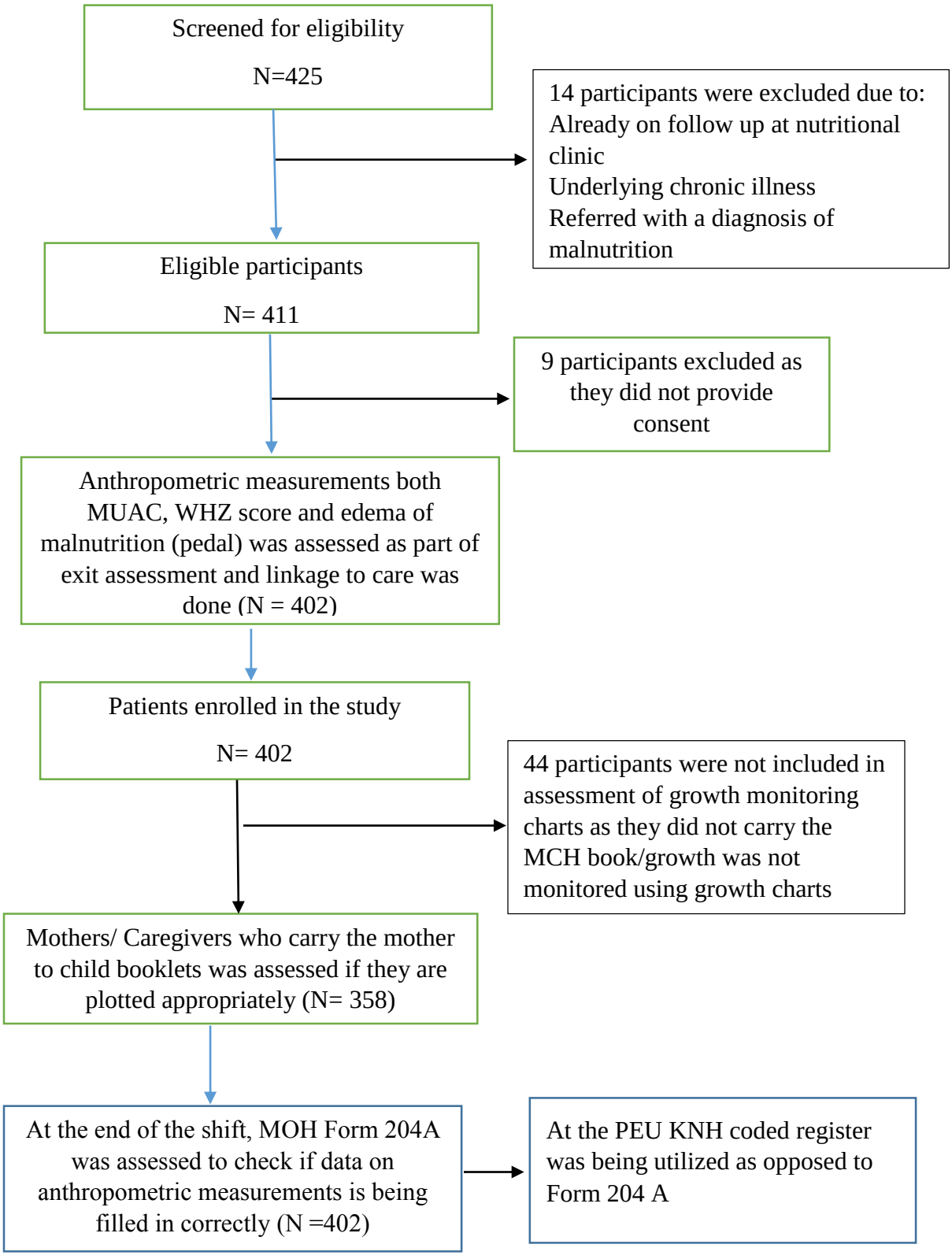
RESULTS

A total number of four hundred and twenty five children between the ages 1-23 months who presented at the Paediatric Emergency Unit, between December 2019 and February 2020 were screened for eligibility. Fourteen participants were excluded as they did not fit the inclusion criteria and a further 9 were excluded as they did not provide informed consent.

Four hundred and two child and caregiver pairs were enrolled into the study. From the 402 participants, only 358 were assessed for growth monitoring charts.

Below is the study flow chart showing patient enrolment:

Figure 5.1: Flow chart showing enrollment of participants in the study



5.1 Demographic Characteristics of study participants

A total of 402 children were recruited with a median age of 7 (IQR(4 to 10)) months. The table below shows demographic characteristic of the children.

Table 4.1 Children's Demographic characteristics

Demographic characteristics	Frequency N = 402	Percentage (%)
Age		
Below 6 months (1- <6months)	156	38.8
6months - 11months	144	35.8
12 months- 23 months	102	25.3
Gender		
Male	194	48
Female	208	52
Residence		
Rural	33	8
Urban	369	92
Birth Place		
Home	9	2.2
Facility	392	97.5
Born before arrival	1	0.2
Birth weight		
Normal (2.4 - 4kg)	321	80
Low birth weight	67	16
Above 4 kg	14	3.5

As per **Table 4.1** 52%(208/402) of the children were female and 92% (369/402) resided in urban areas. Only 2.2% (9/402) were born at home and 0.3% before arrival to hospital. Children below the age of 6 months contributed to 39% of all the children the study and majority of the children were born with birth weight in the normal range (80%).

Table 4.2 Mother's demographic characteristics

Caregiver Demographic Characteristics	Frequency N = 386	Percentage (%)
Mother's age in years		
<20	25	6.5
20-29	208	53.8
30-39	163	42.2
≥ 40	6	1.5
Number of children		
One	103	26.6
Two	174	45
Three	79	20.4
Four	34	8.8
Five	12	3.1
Education level		
None	3	0.8
Primary	103	26.6
Secondary	186	48
Tertiary	110	28.4
Occupation		
Domestic worker (House-help)	192	49.7
Self employed	156	40
Formal employment	46	11
Student	8	2
Marital Status		
Married	326	84.4
Single	70	18
Divorced	5	1.2
Widowed	1	0.3

House-help – a domestic worker who is involved in any household tasks (e.g washing, cleaning, cooking) in one or more than one household.

Regarding **Table 4.2** majority of the mothers were aged between 20 to 29 years (52%) and those that had two children were at 43% (174/402). Forty six percent (186/402) of the mothers had secondary level education and from the number of caregivers interviewed 48% (192/402) were domestic workers (househelps). Majority of the mothers were married at 84%.

5.2 Children's anthropometric measurements performed by the research team

All the 402 children had a W/L Z score performed. In addition MUAC was performed for 246 children who were above the age of 6 months. 6.7% (27/402) had a W/L Z score < -2, with 4.5% (18/402) and 2.2% (9/402) having W/L Z score between -3 and -2 and ≤ -3.

In total, 27/402 (6.7%) children had WLZ<-2 and 15/246 (6%) low MUAC<12.5Cm. No child had pedal oedema. 5.2% (21/402) had either WLZ <-2 OR low MUAC < 12.5cm

Table 4.3 Children's anthropometric measurements.

Anthropometric measurements	**N=402**	**Percentage (%)**
Absolute values		
Weight (kg) – median (IQR) N= 402	8 (6.6 to 9)	
Height/Length (Cm) – median (IQR)N=402	67.9 (62.3 to 73.4)	
MUAC (Cm) – median (IQR) N=402	13.8 (13.6 to 14.1)	
Edema – N=402	0	
Derived Z-scores (absolute values)		
Weight-for-length/height – Mean (sd)	0.10 ±1.65	
Weight-for-age – Mean (sd)	0.26 ±1.36	
Height/Length-for-age – Mean (sd)	0.57 ±2.51	
Grouped anthropometrics		
MUAC (Cm) – N (%) for ages > 6 months (N=246)		
≥ 13.5	180	45
12.5 to 13.5	39	9.7
11.5 to 12.5	11	2.7
<11.5	4	1.6
Weight-for-length/height z-score – N (%)		
≥ -1	326	81
-2 to -1	49	12.1
-3 to -2	18	4.5
≤-3	9	2.2

MUAC- mid-upper arm circumference

Table 4.3 shows 15 of the 246 children had a MUAC measurement of less than 12.5cm. Median MUAC measurement for children above 6 months was 13.8 (IQR 13.6 to 14.1). Four

percent (11/246) and 1.6% (4/246) had MUAC measurements of between 11.5 to 12.4cm and <11.5 cm representing moderate malnutrition and severe malnutrition respectively.

5.3 Missed opportunity for diagnosis of acute malnutrition

Forty-two children were found by the researcher to have acute malnutrition giving a proportion of 10.4%. Of the 42 malnourished children, only one was correctly identified by the registrar on duty while 97.6% (41/42) were missed shown in **Figure 4.2**.

Figure 5.2: Proportion of missed diagnosis of acute malnutrition

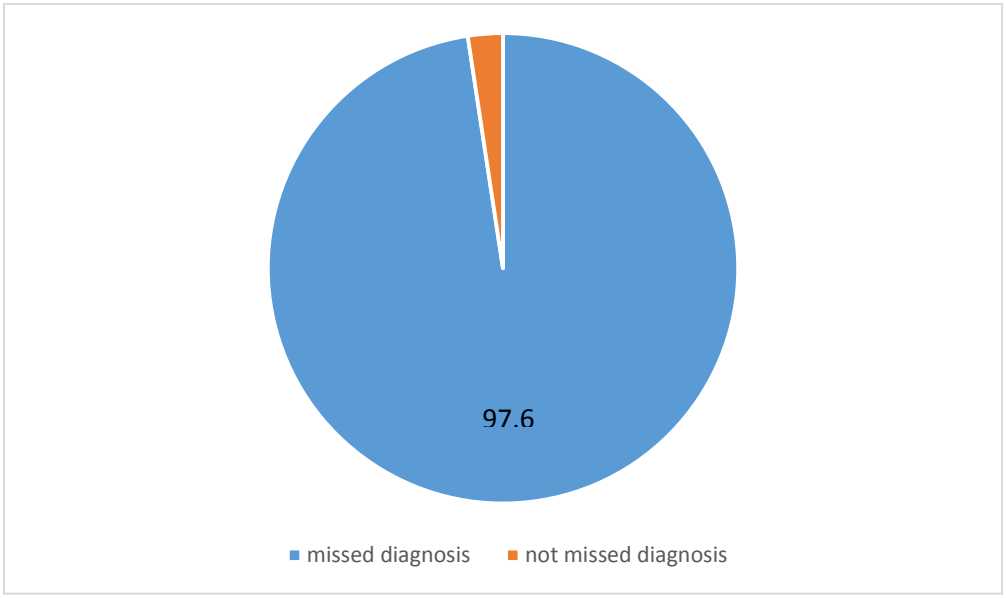


Table 4.4: Number of children with the classification of acute malnutrition in each age group

Age Group	Frequency N = 42	Percentage (%)
Below 6 months	**11**	**26**
WLZ score >-3,≤-2	9	82
WLZ score ≤-3	2	18
Above 6 months	**31**	**74**
MUAC < 12.5 cm	***15***	***48***
11.5-12.4cm	11	73
< 11.5cm	4	27
WLZ score < -2	***16***	***52***
>-3,<-2	9	56
<-3	7	44
WLZ score< -2 AND MUAC < 12.5cm	**5**	16.1

Derived from **Table 4.4** above, among the malnourished children, 26% (11/42) were aged < 6 months and 74% (31/42) were ≥ 6 months. For those **below 6 months**, 81% (9/11) had moderate acute malnutrition and 18% (2/11) had severe acute malnutrition. For those **above 6 months**, 48% (15/31) were diagnosed to have acute malnutrition based on WHZ<-2, and 52% (16/31) were diagnosed based on MUAC < 12.5cm. 16.1% (5/31) had WL Z < -2 AND MUAC < 12.5cm.

5.4 The proportion of children whose growth was monitored using growth charts

A correctly plotted growth chart was defined as one where the child's weight was plotted monthly (criteria 1) and where the dots were joined to form a curve (criteria 2). If the growth charts met either one of the criteria or did not meet both criteria they were regarded as incorrectly filled growth charts. 'Basic knowledge' of parents or caregivers on growth charts refer to knowing importance and purpose of growth monitoring and if their child is growing

normally or not. ‘No knowledge’ referred to when parents/caregivers had no knowledge on purpose or importance of growth monitoring and charts.

Table 4.5 Summary of data on the MCH booklets and growth monitoring charts

MCH BOOKLET	ALL CHILDREN (n= 402)
Mothers who carried the MCH booklet – N (%) N=402	
Yes	367 (91)
No	29 (7.2)
Booklet unavailable	6 (8.7)
MCH booklet available but growth chart not plotted- N (%) N=367	
Plotted	358 (89)
Not plotted	9 (2.2)
Growth chart correctly plotted – N (%) N=358	
Yes	86 (24)
No	272(78.6)
Mother’s knowledge of growth charts	
Has basic knowledge	95 (23)
No knowledge	307 (76)

From Table 4.5, 91% (367/402) of mothers had carried the mother to child booklet to the clinic and 89% (358/367) of the children whose caregivers had the MCH booklet had their

weight measurements plotted on their growth charts Twenty-four percent (86/358) met both criteria hence a correctly filled growth chart. In total 76% (272/358) did not have a charts that were filled correctly. Seventy-six percent of caregivers (307/402) did not understand the reasoning behind growth chart plotting and their interpretation.

Growth chart assessment regarding plotting was done as per age group and was divided into those below the age of 6 months and those above 6 months.

Table 4.6 table showing number of correctly and incorrectly filled growth charts as per age group

Growth chart characteristics	Frequency N = 358	Percentage
Correctly plotted based on criteria 1 AND 2	86	24
Met either criteria 1 OR 2	16	4.4
Did not meet any criteria	256	71.5
GROWTH CHART ASSESSMENT FOR AGE BELOW 6 MONTHS (N = 140)		
Correctly plotted growth charts	62	44
Not correctly plotted	78	56
GROWTH CHART ASSESSMENT FOR AGE ABOVE 6 MONTHS (N=218)		
Correctly plotted growth charts	24	11
Not correctly plotted	194	89

From **Table 4.6**, 4% (16/358) met one criterion and 71.5% (256/358) did not meet both criteria. For children below 6 months, 39% (140/358) were assessed for growth monitoring from which 44% (62/140) had correctly filled growth charts. Those above 6 months, 61%

(218/358) were assessed for growth monitoring and only 11% (24/218) had correctly filled growth charts

5.5 Filling of MOH Form 204A

MOH Form 204A is an outpatient under 5 register which records anthropometric measurements including MUAC for all children seen at the paediatric outpatient department. This gives all children a chance for their nutritional status to be assessed and prevent missed diagnosis of malnutrition.

MOH Form 204A was not available and hence not being utilized at the Paediatric Emergency Unit at KNH. The alternate form that was utilized at PEU was the KNH coded register in which nurses recorded the children's sociodemographic details, vital signs, weights, date of clinic attendance, and diagnosis. Although weight was recorded for most of the patients, other anthropometric measurements such as height and MUAC including growth indicators such as WLZ were not performed routinely on all patients and were not recorded within the KNH coded register.

CHAPTER 6

6.1 Discussion

The assessment of growth is an important part of pediatrics and community child health. The salient components in growth assessment include a comprehensive nutritional history, anthropometry, and a correctly plotted growth chart. The process of growth assessment incorporates measurements of height and/or weight, and additional measurements such as MUAC which are compared to reference standards to determine whether the child is growing normally or not. Use of anthropometry is superior and a more sensitive marker in detecting malnutrition in comparison to clinical features such as edema and laboratory markers. (40)

This study aimed to find out the prevalence of missed opportunities for the diagnosis of acute malnutrition. To determine the prevalence of missed opportunities, it was of significance to determine the prevalence of acute malnutrition using WHZ and MUAC which was 42(10.4%) children of the 402 children admitted in the study. There was a high prevalence of missed opportunities for diagnosis of acute malnutrition at 97.6% and only 1 case was newly diagnosed by the clinician on duty. This prevalence was much higher than reported in the study done by Sofia *et al* at Mbagathi Hospital where the prevalence of missed diagnosis was at 38.3%, the study done by Antwi *et al* in Ghana where attending physician recognized only 5.9% of cases and another study done by Maigua *et al* where missed diagnosis of malnutrition among children with pneumonia was at 61%. This high prevalence is worrisome as clinicians being the frontline workers in contact with patients missed the diagnosis and in consequence methods of improvement are warranted. Some of the major reasons for missed diagnosis was only weight was being measured at triage while other anthropometric

measurements were not performed and growth charts were not being plotted or assessed regularly at contact. Some of the reasons for not performing regular anthropometric measurements included, KNH being a tertiary referral hospital with high patient load and understaffing of health workers, and presence of well-baby clinic (clinic 66) where growth monitoring and other anthropometric measurements are performed routinely. Since weight is a composite measure, it needs to be compared with other anthropometric measurements such as height to enable accurate classification of malnutrition or whether the child is below the median because of short parental height but growing normally or if the child is thin and wasted or if there is stunting.

The children who were newly diagnosed with malnutrition, who were managed as outpatients were linked to care through nutritional clinic to their nearest facilities.

Secondly, the mother to child booklet is a guide to assist clinicians to assess growth of the children upto the age of 5 years and to detect any growth faltering, and if present much earlier. From this study, the proportion of mothers who carried their booklet were 91%. Those who had growth charts filled were 97% and those with correctly filled charts were 24%. The proportion of children with correctly filled growth charts is much lower than the set coverage indicator of 80%. This translates to poor growth monitoring and reason why children present to the hospital with severe forms of malnutrition, which could have been prevented if the growth trends were noted earlier. Hence there is a strong need for regular trainings of health workers and nurses on how to plot growth charts, their interpretation and to take action when a growth disturbance is noted. From this study it was also noted, that 76% did not understand the interpretation of growth charts.

The concept of Integrated Management of Childhood Illnesses (IMCI) is based on the premise that sick children usually present with more than one medical condition to health facilities. It is therefore expected of health practitioners that all children who present to health facilities are well assessed so that the child could be managed in a holistic manner.(41) From this study it was noted that weights are routinely recorded in the patient cards at the outpatient department however heights/lengths and MUAC are not routinely performed. This hinders computation of WHZ scores necessary for detecting malnutrition. Moreover if the child is severely ill, anthropometry is delayed and in most cases a follow up anthropometry is not performed once the child is out of acute phase of illness, contributing to missed diagnosis. Previous surveys done on management of sick children at many health facilities revealed that most of these children are not adequately assessed and treated. (42). For public health purposes, malnutrition associated mortality will therefore not be reduced if nutritional programmes were directed solely towards treatment of the severely malnourished children and not on prevention and early identification.(42) To achieve a substantial reduction in mortality, attention should also focus on the less severe forms of malnutrition especially the moderate forms which rapidly progress to severe forms. This appropriate identification is only possible if routine anthropometry is performed on all children visiting the outpatient department.

KNH Paediatric Emergency Unit does not utilize the MOH Form 204A however they use Kenyatta coded outpatient register. This register records socio-demographic details, vitals and weight, date of clinic visits and diagnosis. The reasons for using this alternate register was not clearly stated however it was noted to compromise nutritional assessment of children

and early identification of malnutrition. Routine anthropometry and nutritional classification was not done and reasons for this included, KNH is a tertiary and referral hospital with high patient load therefore emphasis is based mainly on presenting complaint and acute management of patients. Understaffing and long patient queues prevents routine anthropometry measurements for all patients as well as rouine growth chart monitoring. This was noted to be one of the major contributing factors for missed diagnosis of acute malnutrition.

The implications of these findings suggest that health workers are not regarding anthropometry as a priority in all children visiting the outpatient department. Equipments of anthropometric measurements were present but they were under-utilized. This is supported by height/length and MUAC which was not routinely performed making it difficult to classify nutritional status and the register not recording all anthropometric measurements. If these areas are well addressed through feedback provision and possibly training of health workers on diagnosis and evaluation of malnutrition, it will overly reduce the missed diagnosis and eventually lead to a reduction in morbidity and mortality and take a step forward in an aim to meet our health related millennium development goals.

6.2 Conclusion

- Missed opportunities for diagnosis of malnutrition is 97.6% with only one case correctly identified and this was largely because MUAC, Length/Height measurements were not routinely being measured.

- 91% of the mothers carried the mother to child booklets but only 24% of these were correctly filled. This study shows that the proportion of children with correctly filled growth charts is much lower than the set coverage indicator of 80%.
- MOH Form 204A outpatient register is not utilized by the PEU at KNH which would be beneficial in picking up cases much earlier.

6.3 Limitations

- This study took into account only those missed in outpatient department hence the result is not a full representative of all the patients within the age group 1-23 months at KNH.
- The study identified that the missed opportunities were due to inadequate records of routine anthropometry including health workers not routinely performing the anthropometry but did not take into account knowledge and training in classification of malnutrition.
- This study relies on self reported data through the questionnaires and can affect accuracy of the results to some extent.
- Since this study did not do a follow up on linkage to care, it may be difficult to assess if the newly diagnosed cases are actually on a follow up program or not.

6.4 Recommendation

- Emphasis on routine anthropometry measurements (MUAC, height/length) should be done to enable diagnosis. Nutritional assessment should be carried out for all children seen by the clinicians and the nutritional status should be recorded.

- All mothers should be explained on importance of carrying the booklets and should be educated on the growth of their children using growth monitoring charts.
- The KNH coded outpatient register should be revised to include anthropometry and nutritional classification which are missing from the register.
- All the above mentioned is particularly important as more clinical nutritionists turn out of the country's universities so that their expertise could be utilized in the management of malnutrition even as the country strives to achieve the sustainable development goals. Hence there is the need to update health practitioners/clinicians in the recognition and management of malnutrition

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APPENDIX 1 :

INFORMATION AND CONSENT EXPLANATION FORM

CONSENT FORM

Study Title: MISSED OPPORTUNITIES FOR DIAGNOSING ACUTE MALNUTRITION IN CHILDREN AGED 1-59 MONTHS.

Patients study identification number:

Principal investigator: Dr. Binal Chauhan, Paediatric Resident University of Nairobi.

Introduction

The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear.
This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form.
The researchers listed above are interviewing caregivers of children who are missing an opportunity for diagnosis of malnutrition at hospital level. The purpose of the interview is to find out more about the nutritional history and perform nutritional assessment and hence pick up the number of children with malnutrition who were not otherwise picked.
There will be approximately 400 participants in this study randomly chosen. We are asking for your consent to consider participating in this study.
This study is voluntary and you may wish to withdraw at any time of the study.
May I continue? YES / NO

This study has approval by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No. ____

Benefits

You will receive adequate nutritional education and the nutritional assessment will help identify whether your child is malnourished or not.
The results of this study will be shared with you and your doctor
If any form of malnutrition is found, the child will be linked to care at the nutritional clinic.
Caregivers will be shown how to interpret growth charts and their importance.

Risks

There will be no risks imposed to you or your child during the study period.

No invasive procedures are going to be performed.

Refusal to participate in the study will not cause any bias and level of care to the patient will remain unchanged.

Confidentiality

Confidentiality will be strictly observed.
Specific findings about your child will be discussed with you, I and your doctor.
General findings of all children will be discussed in the study but nothing specific will be discussed about your child's nutritional status.

Consent Form : Participant's statement

I have read this consent form or had the information read to me. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw any time. I freely agree to participate in this research study. I understand that all efforts will be made to keep information regarding my personal identity confidential.
By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

Participant printed name:
_____Participant signature /
Thumb stamp _____ Date _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: _____

Date: _____ Signature _____

Researcher's contact: Mobile No: +254736605287, Email: binalchauhan99@gmail.com

KNH-UoN Ethics and Research Committee: Email: uonknh_erc@uonbi.ac.ke, Tel: 726300-9

Fomu ya idhini

Kichwa cha masomo: MFUMO WA KIUMBUSHO KWA KUPATA DALILI ZA KIWANGO KWA AJILI YA MTOTO MIAKA 1-59 Miezi

Nambari ya kitambulisho cha wagonjwa wanaosoma:

Upelelezi mkuu: Dk. Binal Chauhan, Chuo Kikuu cha Wakazi wa watoto cha Nairobi.

Utangulizi

Madhumuni ya fomu hii ya idhini ni kukupa habari utahitaji kukusaidia kuamua ikiwa sio mshiriki katika utafiti. Jisikie huru kuuliza maswali yoyote juu ya madhumuni ya utafiti, nini kinatokea ikiwa unashiriki katika utafiti, hatari na faida zinazowezekana, haki yako kama kujitolea, na kitu kingine chochote kuhusu utafiti au fomu hii ambayo haij wazi.
Utaratibu huu unaitwa 'ridhaa iliyo na habari'. Mara tu utakapoelewa na kukubali kuwa katika masomo, nitakuomba utie saini jina lako kwenye fomu hii.
Watafiti waliotajwa hapo juu wanahoji walezi wa watoto ambao wanakosa nafasi ya utambuzi wa utapiamlo katika kiwango cha hospitali. Madhumuni ya mahojiano ni kujua zaidi juu ya historia ya lishe na kufanya tathmini ya lishe na kwa hivyo kuchukua idadi ya watoto wenye utapiamlo ambao hawakuchaguliwa vinginevyo.
Kutakuwa na washiriki takriban 400 katika utafiti huu waliochaguliwa kwa nasibu.
Tunaomba idhini yako kufikiria kushiriki katika utafiti huu.
Utafiti huu ni wa hiari na unaweza kutaka kujiondoa wakati wowote wa masomo.
Naweza kuendelea? NDIO/LA

Utafiti huu umedhibitishwa na Itifaki ya Kamati ya Maadili ya Kitaifa ya Kenya ya Chuo Kikuu cha Maadili na Utafiti cha Nairobi

Faida

Utapokea elimu ya kutosha ya lishe na tathmini ya lishe itasaidia kubaini ikiwa mtoto wako ni lishe au la.
Matokeo ya utafiti huu yatashirikiwa na wewe na daktari wako
Ikiwa aina yoyote ya utapiamlo hupatikana, mtoto ataunganishwa na utunzaji katika kliniki ya lishe.
Walezi wataonyeshwa jinsi ya kutafsiri chati za ukuaji na umuhimu wao.

Hatari

Hakutakuwa na hatari yoyote iliyowekwa kwako au kwa mtoto wako wakati wa masomo.
Hakuna taratibu za uvamizi zitafanywa.
Kukataa kushiriki katika utafiti hautasababisha upendeleo wowote na kiwango cha utunzaji kwa mgonjwa kitabaki bila kubadilika.

Usiri

Usiri utazingatiwa kwa umakini.
Matokeo maalum juu ya mtoto wako yatajadiliwa na wewe, mimi na daktari wako.
Matokeo ya jumla ya watoto wote yatajadiliwa kwenye utafiti lakini hakuna chochote maalum kitajadiliwa juu ya hali ya lishe ya mtoto wako.

Fomu ya idhini: Taarifa ya mshiriki

Nimesoma fomu hii ya idhini au habari imenisoma. Nimepata maswali yangu kujibiwa kwa lugha ambayo naelewa. Hatari na faida zimeelezwa kwangu. Ninaelewa kuwa ushiriki wangu katika utafiti huu ni wa hiari na kwamba naweza kuchagua kujiondoa wakati wowote. Nakubali kwa bure kushiriki katika utafiti huu. Ninaelewa kuwa juhudi zote zitafanywa kuweka habari kuhusu siri yangu ya kibinafsi.
Kwa kusaini fomu hii ya idhini, sijapeana haki yoyote ya kisheria ambayo mimi kama mshiriki wa utafiti wa utafiti.

Mshiriki aliyechapishwa jina:

_____

Saini ya mshiriki / kidole gumba kwenda stempu _____

Tarehe _____

Taarifa ya mtafiti

Mimi, aliyetengwa, nimeelezea kikamilifu maelezo muhimu ya utafiti huu kwa mshiriki aliyetajwa hapo juu na ninaamini kwamba mshiriki ameelewa na ametoa ridhaa yake kwa hiari na kwa hiari yake.
Jina la mtafiti:_____

Tarehe: _____ Saini _____

APPENDIX 2

1. QUESTIONNAIRE

Mother to child paired questionnaire

You are rest assured that any information will be held in confidence. Please tick ()Yes /No or explain where necessary.

STUDY NUMBER:

DATE OF REVIEW:

Demographic Information

1. Child identity Number……..

2. Date of birth/age ……...

3. Birth weight and current weight……...

4. Residence

5. Birthplace ……..
   a) Delivered at home
   b) Delivered at a health facility
   c) Born before arrival

6. Age of mother

a. <20) b. 20-29 c. 30-39 d. 40 and above

7. How many children do you have?

a. 1 b. 2 c. 3 d. 4 e. 5 and above

8. Mother's education level

a. Primary

b. Secondary

c. College/ University

d. No schooling

9.Mother's Occupation…….

10. Marital Status of the mother

a. Married

b. Single

c. Divorced

11. Who is the primary caretaker of the child?

a. Mother

b. Father

c. Househelp/ Nanny

d. Grandmother

e. others

12. Who prepares food for the child?

a. By cooking myself

b. By buying

c. From relatives

d. Others (specify)

Nutritional Status of the Child.

13. How is your child's appetite?

a. poor

b. average

c. good

d. very good.

NOTE: Poor- feeds only a few mouthfuls, Average- feeds only about a third of the meal, Good – Finishes more than half of the meal, Very Good- finishes almost everything most of the times)

14.How many times does your child feed in a day?

a. Once a day

b. Twice a day

c. Three times a day

d. Any time the child is hungry

15. Did you exclusively breastfeed your child or (if child < 6 months) planning to exclusively breastfeed?

a. Yes b. No

If No, explain why?
.....
.....

16. When did you start weaning off your child?.....

17. What food did you begin weaning with?

a. Baby Porridge

b. blended feeds (mixed vegetables)

c. Mashed potatoes and pumpkin

d. Other

18. Do you carry the mother to child booklet at every contact with the health system?

a. Yes b. No

19. Is the child's weight being monitored using the growth chart? (Check mother to child booklet)

a. Yes b. No

20. Is the child up to date with his immunization? (Check mother to child booklet)

a. yes b. no

Mother's knowledge on malnutrition and disease status of the child.

21. What do you think causes malnutrition in children?

22. Do you understand the interpretation of growth charts in the mother to child booklet?

a. yes b.no

If yes, explain how.

23. What would you do if you notice your child has poor weight gain or not gaining weight at all?

24. How often does your child fall ill?

a. Once in a week

b. Twice in a week

c. Never fallen sick

d. Once in a month

25.What do you do when your child falls ill?
a.Go to the clinic

b. Buy drugs from drug store

c. Consult traditionalist

d. go the hospital

26. How often do you bring the child for growth monitoring?

a. monthly

b. every 2 months

c. every 3 months

d. during immunization

e. when child is ill

27. Does the mother have the mother to child booklet?

a. yes

b. no

28. Is the growth chart correctly filled? . Describe

Nb. monthly plotting in the first year then alternate plotting in the second year , join dots to form a curve

Chart for recording anthropometric measurements

WEIGHT	
HEIGHT	
MUAC	
WHZ- SCORE	
FINAL CLASSIFICATION	

Presence of edema a. yes b. no

Overall nutritional status: a) normal

b) at risk of malnutrition

c) moderate malnutrition

d) severe malnutrition

Clinicians diagnosis:

If malnutrition was present, was the diagnosis made? A) yes B) No

If yes which one was picked up by the clinician: a) at risk

b) moderate

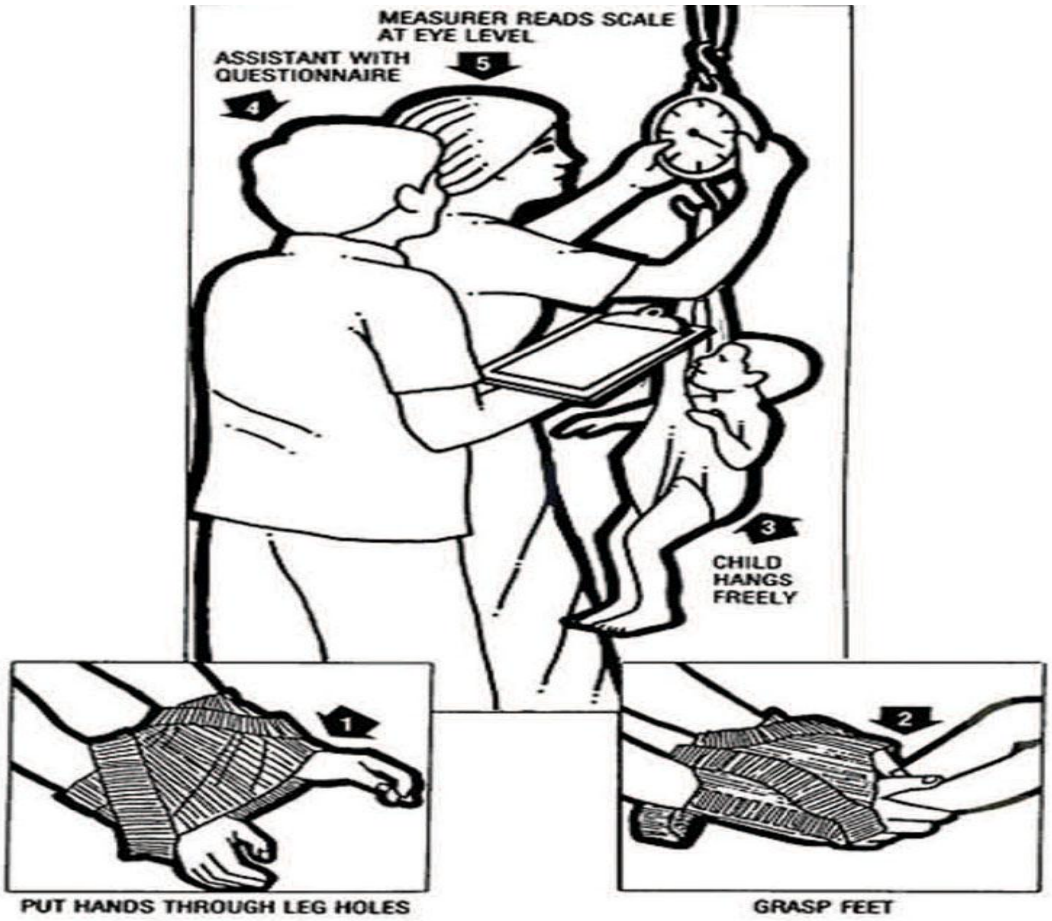
c) severe

APPENDIX 3:

1. TAKING ANTHROPOMETRIC MEASUREMENTS

1.1TAKING A CHILD'S WEIGHT

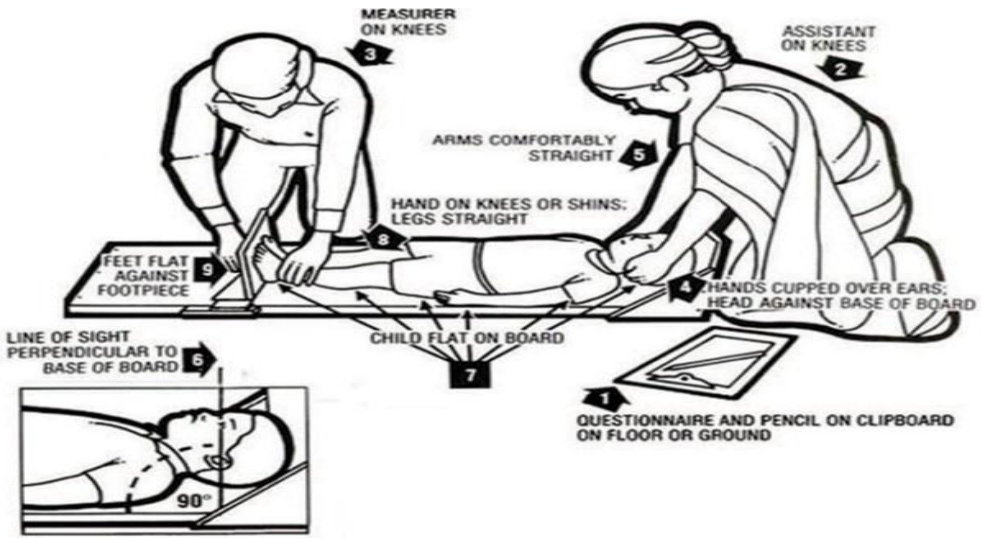
1. Before weighing the child takes off all his/her clothes.
2. Zero the weighing scale
3. Place the child on the weighing scale
4. Making sure the child is not holding on to anything
5. Ready the childs weight and the arrow must be steady
6. Record the weigh in kg to the nearest 100g
7. Do not hold the scale while reading the weight.



1.2 TAKING A CHILDS LENGTH

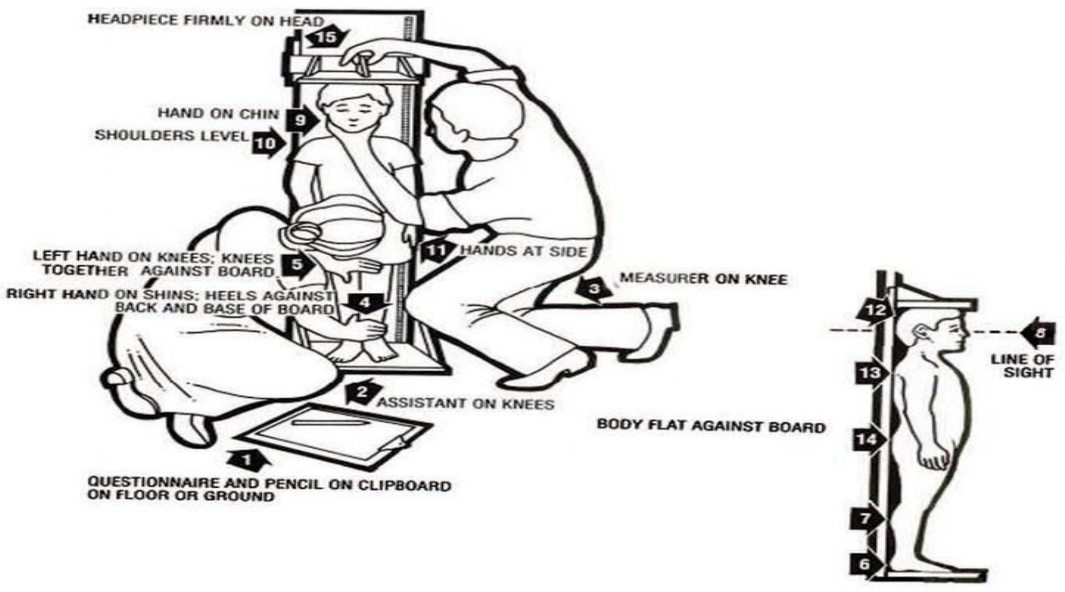
For children less then 87 cm, the measuring board is placed on the ground.

1. The child is placed lying down along the middle of the board
2. The assistant holds the sides of the child's head and positions the head until it firmly touches the fixed headboard with hair compressed
3. The measurer places the hands on the childs legs, gently stretches the child and then keeps one hand on the thighs to prevent flexion
4. While positioning the childs legs the sliding foot plate is pushed firmly against the bottom of the childs feet.
5. To read the height measurements the foot-plate must be perpendicular to the axis of the board and vertical
6. The height is read to the nearest 0.1cm.



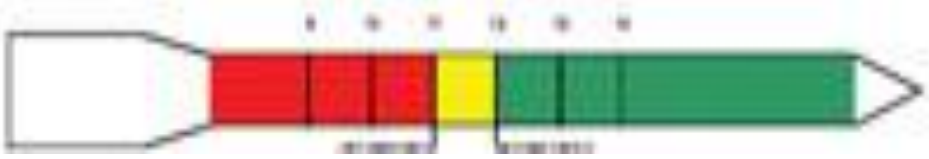
1.3 TAKING THE CHILDS HEIGHT

1. The child stands, upright against the middle of the measuring board.
2. The child's head, shoulders, buttocks, knees and heels are held against the board by the assistant.
3. The measurer positions the head and the cursor.
4. The height is read against the nearest 0.1cm
5. Measurement is recorded immediately

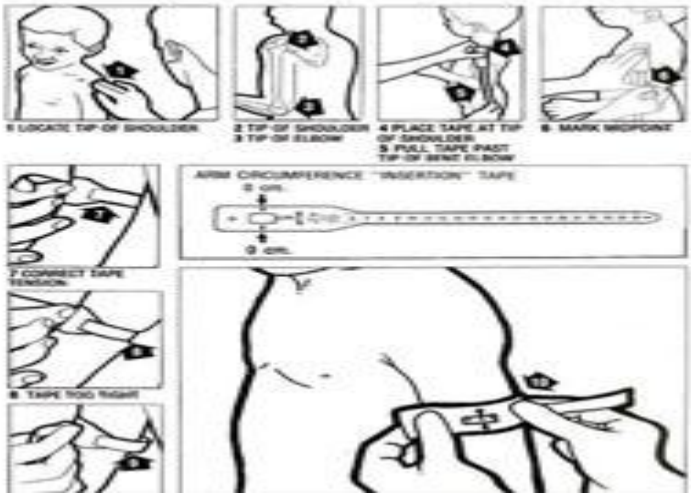


1.4 HOW TO MEASURE MUAC

1. Ask the mother to remove any clothing covering the child's left arm
2. Calculate the mid point of the child's left upper arm, first locate the tip of the child's shoulder with your fingertips
3. Place the tape at zero on the tip of the shoulder and pull the tape straight down past the tip of the elbow.
4. Read the number at the tip of the elbow to the nearest centimeter. Divide this number by 2 to estimate the midpoint.
5. Mark the midpoint with a pen on the arm.
6. Straighten the child's arm and wrap the tape around the arm at the midpoint. Make sure the numbers are right side up and the tape is flat around the skin.
7. Inspect the tension of the tape on the child's arm.
8. With the tape in correct position on the arm with the correct tension, read and call out the measurement to the nearest 0.1 cm
9. Immediately record the measurement.



MUAC measurement tape



1.5 EQUIPMENTS FOR ANTHROPOMETRIC MEASUREMENTS

It will include purchase of child weighing scales, infant weighing scales, MUAC Tapes all of which are necessary in carrying out the study outlined. Heights will be taken using measuring boards which has a maximum height of 130cm. A non stretch MUAC tape was used to measure MUAC values.

APPENDIX 4: KNH ETHICAL APPROVAL LETTER

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

KENYATTA NATIONAL HOSPITAL APPROVED 10 SEP 2019 KNH/UoN-ERC P. O. BOX 20723 - 00202 NAIROBI

Ref: KNH-ERC/A/348

18th September, 2019

Dr. Binal Chauhan
Reg. No.H58/6654/2017
Dept. of Paediatrics and Child Health
School of Medicine
College of Health Sciences
University of Nairobi

Dear Dr. Binal

RESEARCH PROPOSAL : MISSED OPPORTUNITIES FOR DIAGNOSIS OF ACUTE MALNUTRITION IN CHILDREN AGED 1-23 MONTHS AT PAEDIATRIC EMERGENCY UNIT AT KENYATTA NATIONAL HOSPITAL (P540/07/2019)

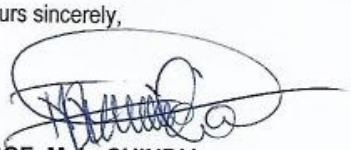
This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 18th September 2019 – 17th September 2020.

This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Dean, School of Medicine,UoN
The Chair, Dept.of Paediatrics and Child Health, UoN
Supervisors: Prof. Grace Irimu(UoN), Dr. Beatrice Mutai(UoN, Mrs. Veronica Kirogo(MoH)