SHORT TERM OUTCOMES AMONG CHILDREN FROM 6 MONTHS TO 59 MONTHS OF AGE ADMITTED FOR SEVERE ACUTE MALNUTRITION AT PRINCE REGENT CHARLES HOSPITAL, BUJUMBURA

BY
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DECLARATION

This dissertation is my original work and has not been presented for the award of a degree in any other university.

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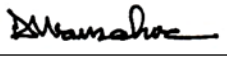
Signed  Date: 11/11/2021

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DEDICATION

To my God, The Almighty

To my parents,

To my husband,

To my siblings and friends,

Thank you for your endless love, sacrifices, prayers, supports and advices.

ACKNOWLEDGMENT

The completion of this thesis could not have been possible without the participation and assistance of so many people whose names may not all be enumerated. Their contributions are sincerely appreciated and gratefully acknowledged.

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Above all, to the Great Almighty, the author of knowledge and wisdom, my heart is so grateful.

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ABBREVIATIONS

AHR: Adjusted Hazard Ratio

HAZ: Height for Age Z score

MUAC: Mid Upper Arm Circumference

OR: Odds Ratio

RUTF: Ready to Use Therapeutic Food

SAM: Severe Acute Malnutrition

SD: Standard Deviation

SDG: Sustainable Development Goals

WAZ: Weight for Age Z score

WHO: World Health Organization

WHZ: Weight for Height Z score

DEFINITION OF TERMS

Chronic Malnutrition: Malnutrition resulting from a long period of nutrition deficit and is identified as low height for age.

Acute Malnutrition: Malnutrition due to short term nutritional deprivation, identified as a low weight-for-height, or *wasting.*

Mid-upper Arm Circumference (MUAC) is the circumference of the left upper arm, measured mid-way between the tip of the shoulder (acromion) and the tip of the elbow (olecranon); used for screening wasted children aged 6 to 59 months.

Body mass index (BMI) is calculated by dividing a person's weight in kilograms by the square of height in meters. For children, BMI is age- and gender-specific. BMI-for-age can be used from birth to 20 years and is a screening tool for thinness (<−2 SD), overweight (between +1 SD and +2 SD), and obesity (>+2 SD).

Z-score: A standard way of saying how far an individual measurement is from the group mean. The standards are relevant to all children, having been derived from a large multicountry study reflecting diverse ethnic backgrounds and cultural settings.

ABSTRACT

Background: Severe Acute Malnutrition (SAM) remains one of the major global health problems, contributing to childhood morbidity and mortality throughout the world. Regardless of the availability of standard protocol for the management of SAM, the case-fatality rate in sub-Saharan Africa remains unacceptably high.

Objectives: The objectives were to determine the mortality rate and length of hospital stay among children aged from 6 months to 59 months admitted for Severe Acute Malnutrition at Prince Regent Charles hospital (Bujumbura-Burundi) and to determine the factors associated with mortality.

Study methodology: This was a retrospective cross-sectional study of children from 6 months to 59 months of age admitted in the nutritional care center for Severe Acute Malnutrition at Prince Regent Charles Hospital (Bujumbura-Burundi) from 1st January 2015 to 31st December 2019. All the medical records of children aged from 6 months to 59 months of age admitted from 1st of January 2015 to 31st December 2019 with Severe Acute Malnutrition were reviewed. The variables of interest were: Patient's characteristics (Sex, Age, anthropometric measurements (MUAC, Weight, Height), HIV status, breastfeeding status, signs and symptoms at admission, comorbidities at admission, length of hospital stay) and outcome (discharged or died).

Results: A total of 168 records were reviewed and analyzed. The mortality was found to be at 10.1% [95% CI, 6-16%] (n=17) with 35.3% (n=6) of all deaths occurring in the first 3 days of admission. The median duration of hospitalization was 8 days (IQR: 6,12). Vomiting was associated with a statistically significant increase in the risk of mortality [OR 5.46(1.45-20.6), p=0.022). Also, high risk of mortality was associated with gastroenteritis [OR 3.2(1.15-8.87), p=0.044]. There was an increased risk of death in the first 72 hours of admission [OR 14.45(8.17-25.56), p=0.001].

Conclusion: Mortality was found to be at 10.1% among children admitted with severe acute malnutrition. Median duration of hospitalization was 8 days. Gastroenteritis, more specifically vomiting, was significantly associated with increased risk of mortality. The first 72 hours of admission were also significantly associated with a high risk of death.

As recommendation, severely malnourished children presenting with vomiting should be sub-triaged earlier for more intensive care to further decrease mortality rate.

CHAPTER 1: INTRODUCTION

1.1 Background

Severe Acute Malnutrition is described, in children aged from 6 months to 59 months, as a weight for height below -3SD of the WHO median growth standards, bilateral pitting edema of the nutritional origin or MUAC of less than 115 mm (1).

Malnutrition is a cellular imbalance where there is a lack or disproportion of energy, proteins and/or other nutrients in the body. It also means that the normal function of the body is disrupted to the point where a person is unable to perform regular physiological activities such as growth, recovering from diseases,… (10).

Malnutrition is responsible for reduced intellectual capacity, poor adult work performance, and susceptibility to diseases. It affects all age groups, but most infants and young children (under-five) (2).

Children with SAM are more likely to die (nine times) than well-nourished children.

The global nutrition report (2017) published that approximately 52 million children, mostly from South East Asia and sub-Saharan Africa, were wasted which is the major issue in the achievement of sustainable development goals.

Furthermore, it contributes to approximately 50% of 11 million deaths every year and a major contributor to the global burden of disease(4)(5).

Severe Acute Malnutrition is also the main leading cause of pediatric inpatient admission in developing countries (6)(7).

Despite the availability of standard WHO protocols for the treatment of SAM, case fatality rates in developing nations remains unacceptably high at 20-30%; especially for edematous cases, children complicated by HIV and in several diseases that often accompanies children with malnutrition and increase mortality such as diarrhea 60.7%, pneumonia 52,%, measles 44.8% and malaria 57.3% (9)(4).

CHAPTER 2: LITTERATURE REVIEW

2.1. Introduction

Childhood malnutrition remains one of the main public health issues, responsible for pediatric hospital admissions and deaths throughout the world (2)(3).

In Burundi, the under-five mortality rate is 3.8 per 1000/day (2018). The prevalence rate of acute malnutrition of under-five children at a national level is estimated at 4.5% (4.2-4.8).

However, there are big discrepancies between regions of the country where the rates of acute malnutrition among under-five children are as high as 7-10%.

SAM is extremely rare with a national figure of 0.4% (0.3-0.5) (8).

World Health Organization (WHO) recommends the treatment of uncomplicated SAM as outpatient and studies have shown that the outcome of this approach yields good results. On the other hand, in-patient management of SAM involves very sick children who are at high risk of dying compared to their peers treated as outpatient. Some centers from developing countries have reported mortality rates as high as 20% (11).

This is surprising given that clinical management protocols which have been there for more than 30 years should be able of decreasing mortality rates to 1-5%.

The reasons behind this persistent high mortality are not clear, but it is thought that adherence to the management protocols alone may not be enough to decrease the mortality rates, but some of the factors like lack of resources, inadequate training of health workers together with high prevalence of HIV and tuberculosis are playing a significant role (11).

Children with SAM are discovered by health care providers when they seek health facilities in case of illness.

Severe forms of SAM are aggravated by coexisting comorbidities, especially acute pulmonary infections, diarrhea, and septicemia (12). A detailed and meticulous approach is necessary to decrease case fatality rates related to malnutrition and improve survival status (10).

HIV co-infection is a major factor of increased inpatient mortality, which is present in approximately one-third of children admitted for Severe Acute Malnutrition in sub-Saharan Africa (13).

Even with standardized management protocols, inpatient deaths are nearly four times higher in HIV-positive children with SAM (also called HIV-SAM) compared with severely malnourished children without HIV (30.4% vs 8.4%). For unknown reasons, this mortality is three times higher than would be expected from anthropometric measurements alone (13).

2.1.1 Categories of Severe Acute Malnutrition

SAM is divided into two classes: Marasmus and Kwashiorkor. Children can present with features of both conditions (Marasmic Kwashiorkor). Patients with Kwashiorkor are severely malnourished and at high risk of mortality (14).

Table 2.1 Features of Kwashiorkor and Marasmus (14)

Marasmus	Kwashiorkor
Severely wasted	Bilateral edema and fluid collection
Protruding ribs	Poor appetite
Very thin limbs	Breakable thin hair
Wasted muscles	Change of hair color
Good appetite may be present	Indifferent and irritable
Good prognosis with adequate management	Swollen face
	Greater risk of death

2.1.2 Assessment of undernutrition

The term *malnutrition* includes both undernutrition and overweight.

Anthropometry is frequently used as a tool for assessing nutritional status:

Table 2.2. Classification of undernutrition (15).

CLASSIFICATION	INDEX	GRADING
Gomez (underweight)	90-75% of median weight for age 75-60% <60%	Mild (Grade 1) Moderate (Grade 2) Severe (Grade 3)
Waterlow (wasting)	90-80% of median weight for height 80-70% <70%	Mild Moderate Severe
Waterlow (stunting)	95-90% of median height for age 90-85% <85%	Mild Moderate Severe
WHO (wasting)	<-2 to >-3 SD of weight for height <-3 SD of weight for height	Moderate Severe
WHO (stunting)	<-2 to >-3 SD of height for age <-3 SD of height for age	Moderate Severe
WHO (wasting) for age group 6-59months	115-125 mm MUAC <115 mm MUAC	Moderate Severe

2.1.3. Outcome of SAM

Despite the application of the WHO protocols on the management of SAM in most health facilities in the developing countries, it has not led to satisfactory declines in case-fatality rates. The high mortality rate is frequently due to inadequate management as a result of lack of knowledge (12).

The WHO standards describe a treatment as effective if the case fatality rate is less than 10% while case fatality rates greater than 20% as unacceptable (16) .

Table 2.3: WHO grading of case fatality rates for severely malnourished children

CASE FATALITY RATE	GRADING
<1%	Excellent
1-4%	Good
5-10%	Moderate
11-20%	Poor
>20%	Unacceptable

2.2 Literature Review

In 2018, *Guesh et al* conducted a cohort study on predictors of mortality and survival status among children with SAM admitted to hospitals in Tigray, North Ethiopia. The cohort comprised 569 inpatient children hospitalized in different stabilizing centers. During that period, 456 [82%] children achieved full recovery, 37 [6.65%] escaped and 21 [3.8%] died. The mean survival period was 41.93 [95% CI] days.

The high risk of mortality was seen in children with decreased level of consciousness [AHR = 6.69, 95% CI], medical complications after hospitalization [AHR 12.71, 95% CI] and urban residence [AHR = 2.73, 95% CI]. The researchers suggested that actions to reduce mortality should concentrate on children with a decreased level of consciousness and who develop complications after hospitalization (4).

Nabukeera et al, in 2018 in a prospective study reviewed the factors associated with mortality in children (6-59 months) hospitalized with SAM in Uganda. Of 400 children, 39 (9.8%) died during hospitalization. They found out that diarrhea at admission (HR: 2.19, 95% CI) , lack of appetite (HR: 4.50, 95%CI), suspected sepsis (HR: 2.23, 95% CI), skin ulcers (HR: 4.23, 95% CI), chest indrawing (HR: 5.0%, 95%), oxygen saturation below 94% (HR: 3.92, 95% CI) and confirmed HIV infection (HR: 3.62, 95% CI) predicted higher mortality. As conclusion, the infections were major contributors to mortality which emphasises the need of improving prevention and management of these infections (11).

Wagnew et al (2018) in a retrospective cohort study assessed the factors associated with mortality among children under the age of five with SAM (Northwest Ethiopia). 527 under-five children who were admitted for SAM were enrolled. The follow-up period was 10 days. During that period 66 children died (12.52%) and the underlying factors were: Pallor (AHR: 2.3, 95% CI), Shock (AHR: 7.9, 95% CI), poor intake of antibiotics (AHR: 2.3 95% CI), being on IV-Fluid (AHR: 3.2, 95% CI), poor intake of F75 (AHR: 6.6,95% CI) and poor intake of F100 (AHR: 3, 95% CI). As with the previous studies, it was established that the recovery rate of children under the age of five with SAM was lower than the WHO standard protocol (5).

Another retrospective study was done in Sudan in 2012 by Mahgoub et al on morbidity and mortality of SAM among children from Sudan (New Halfa Hospital). 1097 children were selected to participate in the study, 796 children were less than 2 years. Out of the 1097 children, 780 had diarrhea and 112 had malaria.

Sixty-one (5.5%) children died. Of the 61 children who died 11 had septicemia, diarrhea and acute pulmonary infections. The case fatality rate was not different with sex or with presence/absence of oedema (3).

In a retrospective study done in Ethiopia in 2018 looking at the co-morbidities, management, outcomes, and factors contributing to the survival status of children less than five years with SAM, Derseh et al found that out of 413 children, 231 (55.9%) recovered, 24 (5.8%) died and 16.3% were defaulted from Therapeutic Food Centers. Rickets (21.4%), pneumonia (54.8%), and diarrhea (41.8%) were the conditions associated with Severe Acute Malnutrition. Pneumonia and oedematous form of malnutrition were associated with poor recovery rates (10).

Kusnandi et al in 2018 conducted a cross-sectional study in Indonesia that evaluated the factors associated with Outcomes of Children admitted with SAM. It included 195 children admitted for SAM. A complete immunization (p value <0.001) and provision of other types of antibiotics (p value 0.001) were directly associated with the survival status of patients with SAM. Comorbidities decreased survival rates such as pneumonia (Crude OR 0.619), tuberculosis (Crude OR 0.606) and HIV (p-value 0.08). Their findings were consistent with other studies in the fact that despite the establishment of standard protocols for the management of SAM, the morbidity and mortality rates are still high (9).

Another retrospective longitudinal study was done in 2016 by Adal et al evaluating the incidence and predictors of mortality among children under the age of five admitted for SAM to Dilla University Referal Hospital. The sample size was 450 children under the age of five admitted to stabilization centers. During that period, 56(12.4) children died making an incidence density rate of 7.57 per 1000 Person day. The main complications found were: Altered pulse rate [AHR =5.85, 95% CI], altered body temperature [AHR= 6.94 (95 % CI], Shock (AHR=3.15 (95 % CI), IV infusion (AHR=3.24 (95 % CI) and septicemia/meningitis (AHR=2.88(95 % CI). They found that the incidence of death and treatment outcomes were in acceptable ranges. Actions to decrease mortality has to concentrate on children with medical complications (comorbidities) and altered general status (2).

In an observational study done in Nepal in 2017 looking at the determinants of SAM in children less than five years, Pravana et al found that the prevalence of SAM was 4.14%. The determinants of Severe Acute Malnutrition were: poor socioeconomic background; mother's age less than 20 years and more than 35 years; birth spacing less than 2 years; use of nursing bottle; uneducated dad; and no supplementary feeds from 6 months of age. Maternal illiteracy, colostrum intake, and exclusive breastfeeding were independently linked to Severe Acute Malnutrition (7).

Amsalu et al conducted a case-control study (2008), where they reviewed the determinants of SAM in children less than five years of age.

The risk factors for Severe Acute Malnutrition were illiterate mother (OR=3.44,), illiterate father (OR=2.04), family revenue of less than 50 USD/month (OR=3.44) and family size with a greater number of children (>3) (OR=1.96).

Inadequate child feeding habits were frequently seen in severely malnourished children. The inadequate feeding habits were prelacteal feeds supplementation (OR=2.31), no exclusive breastfeeding in the first six months of age (OR=3.00), late initiation of complementary feeding (>12months) (OR=4.03, 95% CI) and use of nursing bottles (OR=3.01).

Further analysis has shown that lack of exclusive breastfeeding in the first 6 months of life (OR=3.22, 95% CI) and lack of supplementary feeds from 6 months of age (OR=3.39) were not considerably linked to SAM. Studies confirmed that inappropriate child feeding habits are associated with Severe Acute Malnutrition (17).

Fondo et al, in a prospective study done at Mbagathi district hospital (Kenya) in 2013, looked at the clinical outcomes of children aged 6 to 59 months with Severe Acute Malnutrition. He found that the overall case fatality rate was 8% with 77% of deaths occurring the first week of admission. Diarrhea was significantly associated with increased risk of mortality (p=0.04). Pneumonia and HIV infection were not significantly associated with increased risk of mortality (18).

Table 2.4 Summary of the Litterature review

Author/Year	Study objective	Design	Sample	Results
Guesh et al, North Ethipia 2018	Predictors of mortality and survival status among children with SAM	Retrospective cohort study	569	3.8% died. The high risk of mortality was associated with: decreased level of consciousness, urban residence and comorbidities after admission.
Nabukeera et al, Uganda 2018	Factors associated with mortality in children (6-59months) admitted with SAM	Prospective study	400	9.8% died. Factors associated to mortality were: comorbidities,lack of appetite, skin ulcers and HIV
Wagnew et al, Northwest Ethiopia 2018	Factors associated with mortality among children under the age of five with SAM	Retrospective cohort study	527	12.52% died. The underlying factors were: Pallor, shock, IV Fluids, poor intake of antibiotics, F75 and F100.
Mahgoub et al, Sudan 2012	Morbidity and mortality of SAM among children	Retrospective study	1097	5.5% died. Mortality was associated with; septicemia, diarrhea, acute respiratory infections.
Derseh et al, Ethiopia 2018	Comorbidities, management, outcomes and factors contributing to survival status of children less than five with SAM	Retrospective study	413	5.8% died. Poor recovery rates were associated with: Pneumonia and oedematous form.
Kusnandi et al, Indonesia 2018	Factors associated with outcomes of children admitted with SAM	Retrospective study	195	They found out that comorbidities such as: pneumonia, tuberculosis and HIV decreased survival rates.
Pravana et al, Nepal 2017.	Determinants of SAM in children less than five years.	Observational study	N/A	The determinants of SAM were: poor economic background, mother's age less than 20 and more than 35 years, birth spacing less than 2 years, use of nursing bottle, uneducated dad and no supplementary feeds from 6 months.
Fondo et al, Kenya 2013	Clinical outcomes of children aged 6 to 59 months with Severe Acute Malnutrition	Prospective study	164	The case fatality was at 8% and diarrhea significantly increased the risk of mortality.

2.3. Study Justification and Utility

Burundi has the highest prevalence of chronic malnutrition in the world and malnutrition is the main leading cause of under five mortality.

This study will help us audit ourselves with the best practices so that we could get a baseline for quality improvement. One of the best ways to measure our performance is by analyzing the outcomes of SAM.

Prince Regent Charles Hospital being one of the major referral hospitals in Burundi and the only one with a specialized nutritional rehabilitation center means that they receive many patients from lower level hospitals for further management.

The results of this study will determine the short term outcome of children aged from 6 months to 59 months admitted for SAM. They will also elucidate the precipitating factors of mortality among SAM children and will guide the interventions.

Also, this study will contribute to the limited literature about children's mortality in Burundi.

2.4. Study Objectives

2.4.1. Primary Objective

To determine the short-term outcome among children aged from 6 months to 59 months admitted for Severe Acute Malnutrition in the nutritional care center at Prince Regent Charles Hospital and to determine the duration of hospital stay. The outcomes of interest were dead and discharged.

2.4.2. Secondary Objective

To determine the predictors of mortality among children from 6 to 59months of age admitted for Severe Acute Malnutrition.

- Factors of interest were: age, sex, MUAC/WHZ, signs/symptoms at admission, diagnosis at admission (physician diagnosis documented in the file), HIV status, breastfeeding status, maternal age.

CHAPTER 3. METHODOLOGY

3.1. Study design

Retrospective Cross-sectional analysis

3.2 Study Site

The study was conducted in the pediatric Nutritional care center at Prince Regent Charles Hospital. Prince Regent Charles Hospital is located within Bujumbura (Mukaza district), the capital city of Burundi and inaugurated in 1949. The Prince Regent Charles Hospital is a gift from Prince Regent Charles of Belgium, a colonizing country of Burundi. It was offered in 1949 after two years of construction to help the indigenous people gain access to care. It was a public hospital until 1992 when it became a Custom Administration of the State (APE) with management autonomy entrusted to a team of directors acting under the supervision of the Board of Directors. It is one of the largest referral hospitals in Burundi with a total of 600 beds and the only one with a nutritional rehabilitation center. The department of pediatrics include pediatric wards, pediatric clinic, pediatric and adolescent HIV care and treatment, Neonatology and pediatric nutritional center. The pediatric nutritional center receives a maximum of 10-15 admissions/month.

Admission criteria for inpatient care in the nutritional rehabilitation center include:

- Infants less than 6 months with WHZ<-3 SD
- Children from 6 months to 18 years with WHZ<-3 SD or MUAC less than 11.5cm in children from 6 to 59 months of age with an associated comorbidity (vomiting, hypothermia with temperature<35C (axillary), fever>39C, pneumonia, very weak, unconscious, convulsions, severe dehydration, any condition that requires an infusion or NG tube feeding, anemia, severe diarrhea,…)
- Children with WHZ<-3 SD with open skin lesions
- Children with bilateral pitting edema of nutritional origin
- Children who failed the appetite test
- Children who are not improving from the outpatient care

3.3 Study Population

The study population were children aged 6 months to 59 months with a diagnosis of SAM admitted to the Nutritional Care Center at Prince Regent Charles Hospital.

3.4 Inclusion Criteria

Records of all children aged from 6 months to 59 months admitted in the nutritional care center with a diagnosis of SAM between the 1st of January 2015 and 31st of December 2019.

3.5 Exclusion Criteria

Children with no full records particularly the date of admission, date of death or discharge.

3.6 Sample Size Calculation

The sample size was obtained by using the Fisher's Formula: $n = \frac{Z^2 p (1-p)}{d^2} = 168$

n= estimated sample

Z= standard normal deviate for 95% CI (1.96)

P= 12.52% (value determined by Wagnew et al (Ethiopia, 2018) that showed the mortality rate among under five children admitted for Severe Acute Malnutrition (11).

D= the desired level of precision set at 5%.

3.7 Study Period

This study was carried out on medical records of children admitted from the 1st of January 2015 to 31st of December 2019.

3.8 Patient Recruitment Procedure

The researcher reviewed all the records of children admitted from 1st of January 2015 to 31st of December 2019 in the Pediatric Nutritional care center at Prince Regent Charles Hospital with a diagnosis of Severe Acute Malnutrition at admission.The medical records in Prince Regent Charles hospital are filed according to the date of admission and per department and are kept in a particular room designed to store old records. The records retrieved were reviewed only by the principal researcher. Each eligible record during the study period had a study serial number allocated. The data was abstracted into a standard study questionnaire (Appendix 1). The questionnaire contained abstracted information from the medical records. The medical records were kept in a locked cabinet to the discretion of the researcher alone until the collection of data is finished and then sent back to the record office. Computers with passwords were only accessible by the research. After all data collection and cleaning, the database of serial study numbers and medical file allocation were thoroughly cleaned and left with abstracted data.

3.9 Data Collection

Following identification of the study participants and waiver of informed consent obtained, a questionnaire was filled to get patients' characteristics (Sex, Age, anthropometric measurements (MUAC, Weight, Height), HIV status, breastfeeding status, signs and symptoms at admission, diagnosis at admission) and outcome (discharged or died); mother/caretaker's data was also collected (Age, marital status, residence, level of education) and the length of stay in the Nutritional care center.

3.10 Data Analysis

The data from the questionnaire was exported and cleaned in Excel, coded and analyzed using SPSS version 21.

The study population was characterized using descriptive statistics to determining sociodemographic and clinical parameters. Continuous data was analyzed and presented using means (standard deviation) and medians and interquartile ranges (IQR), while categorical data was analyzed and presented as frequencies and percentages.

The outcomes were computed as follows:

- mortality was calculated and presented as a proportion of the children who died within the one month of follow-up out of the total number of children
- length of stay was computed as the median length of time in days between admission and discharge or death.
- We have used tests of association to determine factors associated with mortality. Bivariate and multivariate survival analysis were done at 95% confidence interval.
- The level of statistical significance was set at 0.05 and values were expressed with 95% confidence limits.

3.11 Ethical Consideration

Approval to conduct the study was sought from the University of Nairobi pediatrics department, the KNH/UoN and Burundi Ministry of Health Ethical Committee. Waiver of informed consent was obtained and confidentiality was maintained throughout the study. All the data received from the medical records was treated with the utmost

confidentiality. Protection of the data from the health records was achieved by abstraction of identifiable data and securing of the medical records in a safe location until the end of the study.

3.12 Dissemination of the Study Findings

The results of the study were presented at first to the UoN pediatric registrars and the KNH/UoN pediatric consultants during result presentation and a copy will be provided to the pediatric nutritional care center at Prince Regent Charles Hospital.

After completion of the manuscript, it will be sent to an academic journal for approval of publication to reach a wider public. Arrangements will be made as well to send the abstract to upcoming medical conferences for further dissemination and discussion and as well, with hospital administration and local policymakers.

CHAPTER 4. RESULTS

4.1 Baseline characteristics

A total of 168 medical records were analyzed. 82 were male (48.8%) and 86 were female (51.2%). The median age was 15 months (IQR: 12,24). The majority of children were severely wasted (WHZ<-3SD) (75%, n=126) with a median Mid-Upper Arm Circumference (MUAC) of 10 cm (IQR: 9,11) and 74 children (44%) of the 168 presented with Oedema. HIV infection was present in 4 children (2.5%).
On admission, most of the children failed the appetite test (65.6%, n=101). The median maternal age was 22 years (IQR: 20,26).

Table 4. 1: Descriptive analysis (n=168)

Characteristic	Frequency (%) Median (IQR)
Age (months)	15 (12, 24)
Gender Male Female	 82 (48.8) 86 (51.2)
WHZ score Severe (<-3) Moderate [-3,-2] Mild [-2,-1] Normal (>-1)	 126 (75.0) 14 (8.3) 19 (11.3) 9 (5.4)
HAZ score Stunted (< -2) Normal (> -2)	 124 (73.8) 44 (26.2)
WAZ score Underweight (< -2) Normal (> -2)	 150 (89.3) 18 (10.7)
Child's HIV status (n=160) Negative Positive	 156 (97.5) 4 (2.5)
Child exclusively breastfed (n=67) Yes No	 40 (59.7) 27 (40.3)
Hospital stay (Days)	8 (6, 12)

MUAC (cm), n= 160	10 (9-11)
Appetite test, n= 154 Failed Successful	 101 (65.6) 53 (34.4)
Mother's Age (years), n=29	22 (20-26)

Figure 4.1 below shows the signs and symptoms presented on admission in the children studied. Edema was the most common symptom followed by fevers, diarrhea,... Of the 168 children enrolled 74 (44%) were edematous, 50 (29.8%) presented with fevers and 44 (26.2%) had diarrhea.

Figure 4.1 : Signs and symptoms at admission

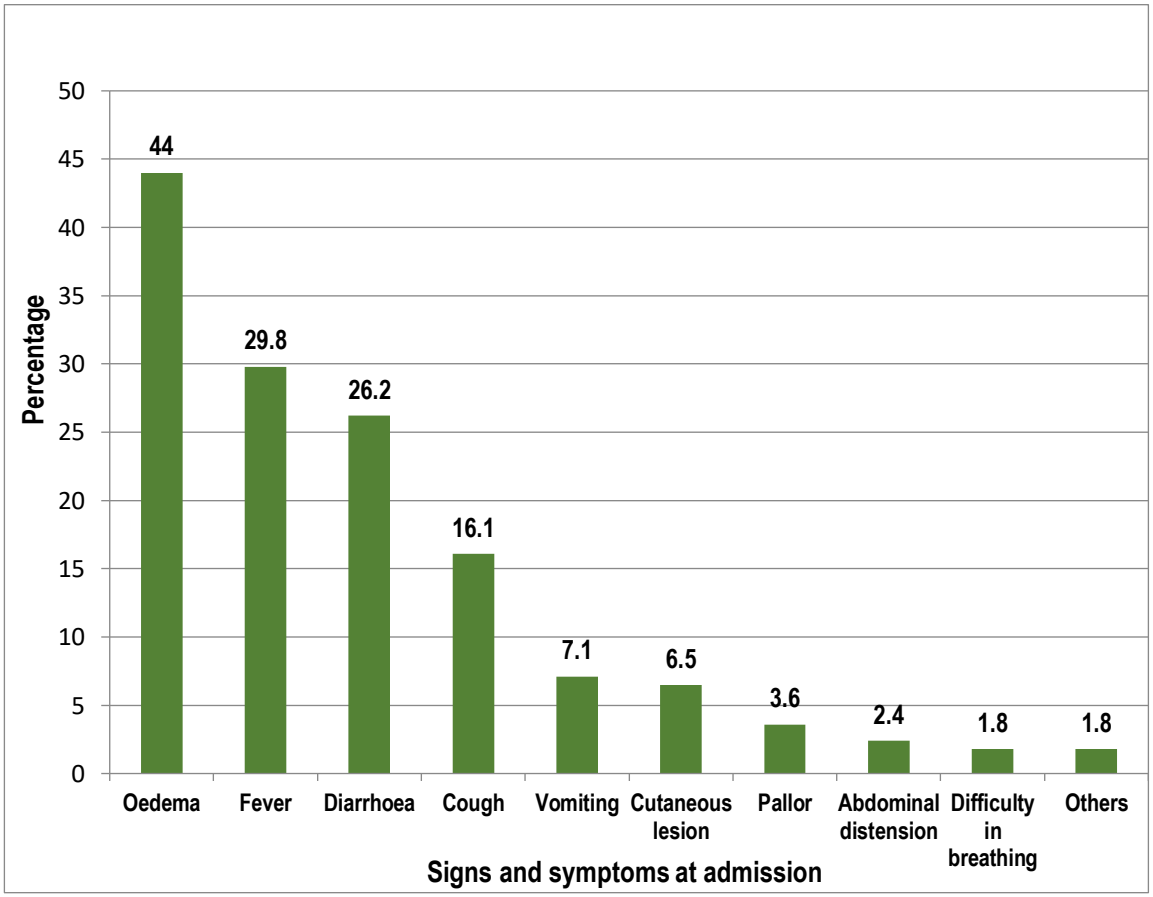


Figure 4.2 below shows the prevalence of comorbid conditions in the study population. Gastroenteritis was the most prevalent disease complicating Severe Acute Malnutrition followed by pneumonia. Out of the 168 children, 48 (28.6%) had gastroenteritis, 20 (11.9%) had pneumonia, 19 (11.3%) had septicemia, 8 (4.8%) had malaria.

Figure 4.2: Comorbidities at admission

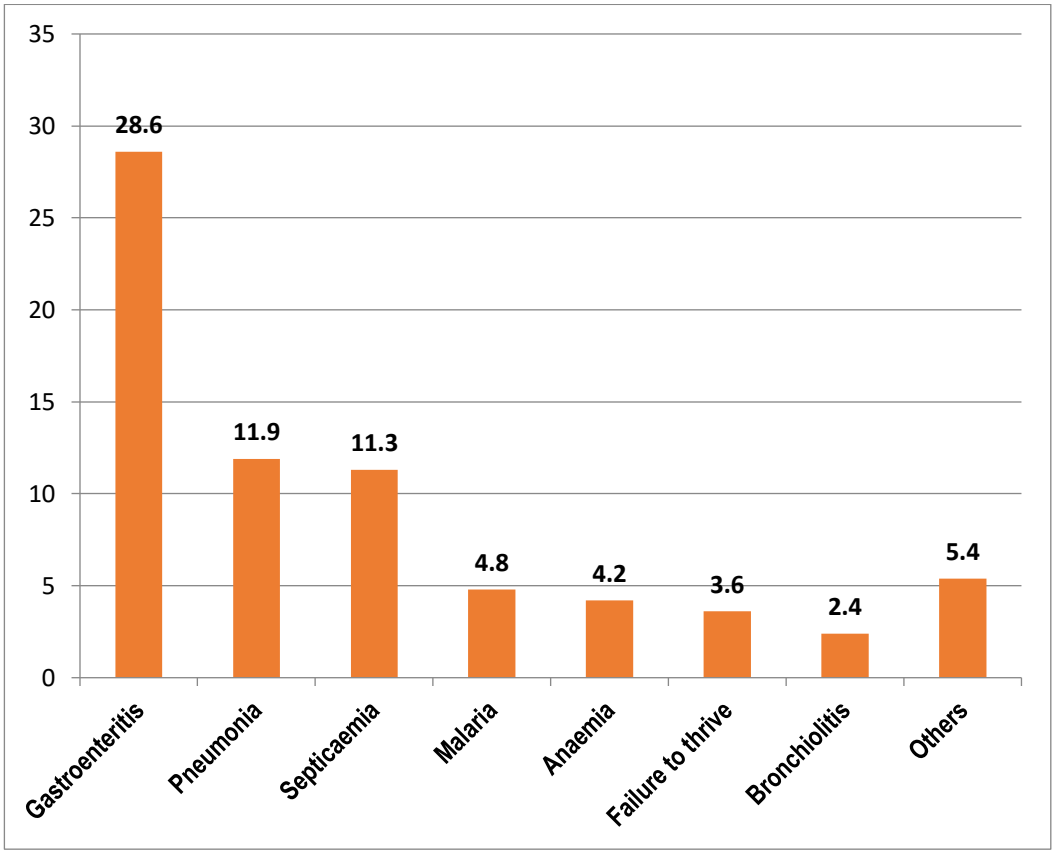
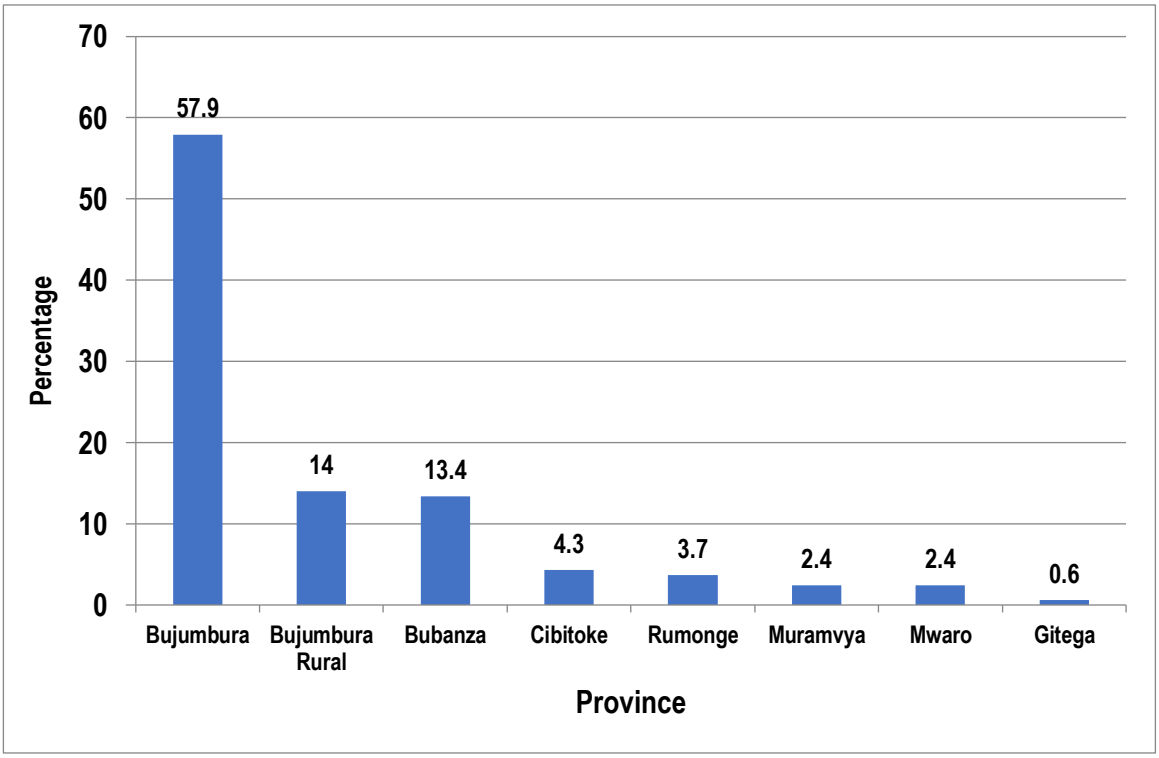


Figure 4.3 shows the residence of the enrolled children. The majority of children were residing in Bujumbura (57.9%) followed by Bujumbura Rural (14%), Bubanza (13.4%), Cibitoke (4.3%), Rumonge (3.7%), Muramvya (2,4%), Mwaro (2.4%) and Gitega (0.6%).

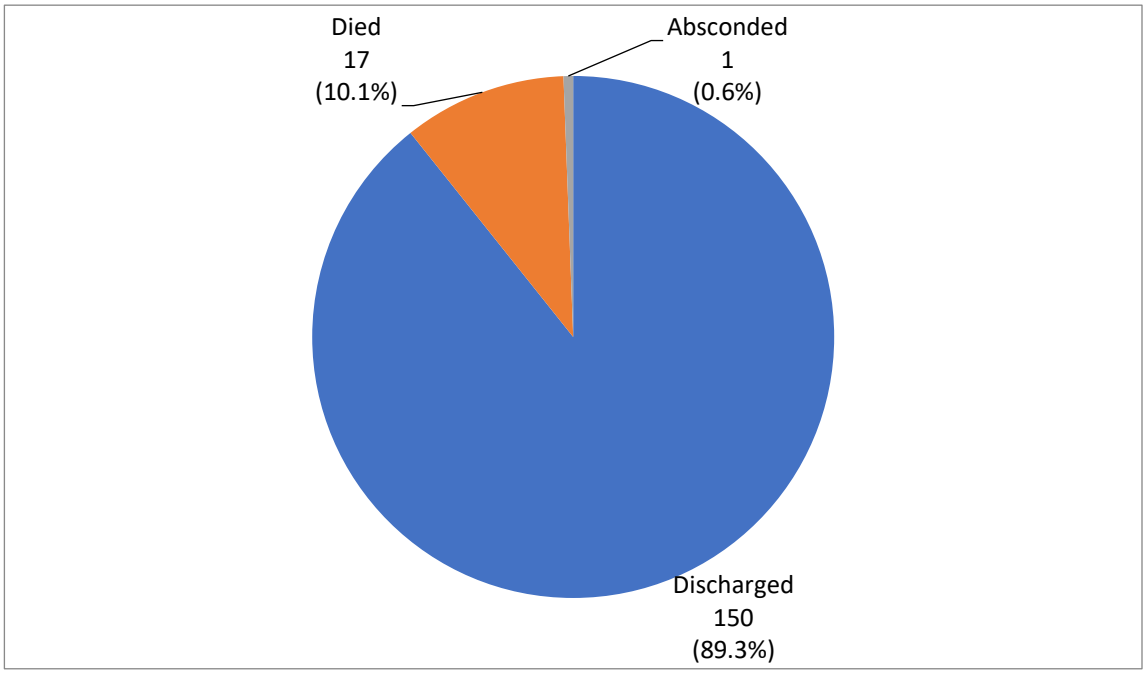
Figure 4.3: Description of provinces (residence)



4.2 Outcomes

Of the 168 children enrolled into the study 17 (10.1%) [95% CI, 6-16] died, 150 (89.3%) were discharged and 1 (0.6%) absconded. Figure 4 below illustrates the outcome of the study participants.

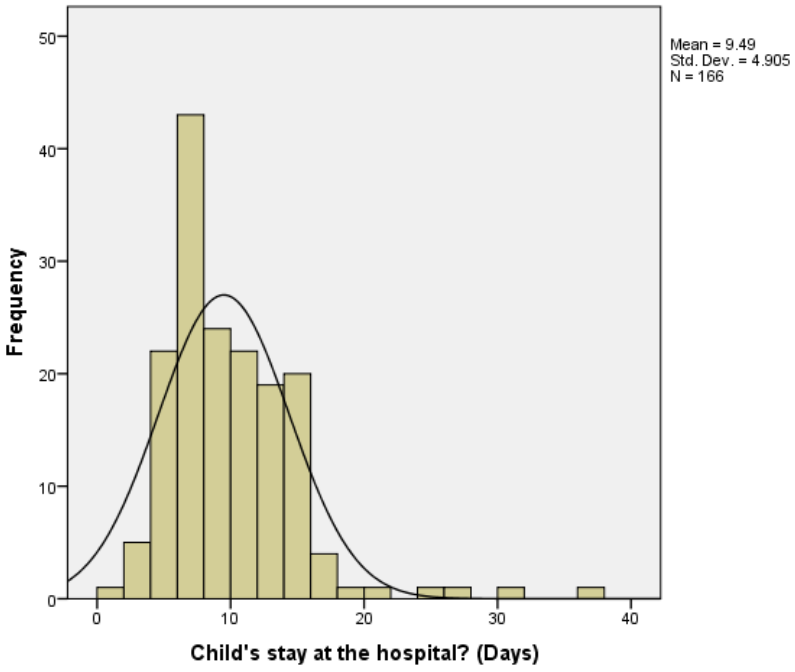
Figure 4.4: Outcome of children admitted with Severe Acute Malnutrition at Prince Regent Charles Hospital, Bujumbura.



4.2.3 Length of hospital stay

This figure below illustrates the length of hospital stay of children enrolled in the study. The curve is skewed towards the left. It means that the duration of hospital stay was not a normal distribution. The median hospital stay was 8 days (IQR: 6,12) with a minimal duration of hospital stay of one day and the maximum being 36 days.

Figure 4.5: Length of hospital stay



4.2.4 Factors associated with mortality

The association of different factors with the outcome were studied. The Table below shows that the odds of a child admitted with Severe Acute Malnutrition (SAM) to die in *the first 72 hours of admission* were significantly higher compared to a child admitted for more than 3 days [OR 14.45(8.17-25.56), p=0.001].

Table 4.2: Factors associated with mortality

Variables	*Dead* *N =17*	*Alive* *N = 151*	*OR (95% CI)*	*P Value*
Age <24 months 24-59 months	 11 (64.7) 6 (35.3)	 105 (70) 45 (30)	0.79 (0.27-2.26)	0.79
Gender Female Male	 8 (47) 9 (53)	 78 (52) 72 (48)	1.219 (0.45-3.33)	0.8
MUAC <11.5 cm >11.5 cm	(n=17) 13 (76.5) 4 (23.5)	(n= 142) 119 (84) 23 (16)	0.63 (0.19-2.42)	0.45
WHZ score <-3 SD >-3 SD	 12 (70.6) 5 (29.4)	 113 (75.3) 37 (24.7)	0.79 (0.26-2.38)	0.77
Exclusive breastfeeding Yes No	(n=3) 2 (66.7) 1 (33.3)	(n=64) 38 (59.4) 26 (40.6)	1.37 (0.12-15.8)	1
Appetite test Failed Successful	(n=16) 11 (68.7) 5 (31.3)	(n=137) 89 (65) 48 (35)	1.19 (0.39-3.61)	0.76
Length of stay 0-3 days >3 days	 6 (35.3) 11 (64.7)	 0 148 (100)	14.45 (8.17-25.56)	< 0.001
HIV Status Positive Negative	 1 (5.9) 16 (94.1)	 3 (2.1) 139 (97.9)	2.9 (0.28-29.51)	0.37

The table below is studying the association of different signs and symptoms on admission with mortality. 4 (33.3%) out of 12 children admitted with vomiting died as compared to only 13 (8.4%) of 155 children who did not present with vomiting. Vomiting showed a statistically significant increase in risk of death [OR 5.46 (1.45-20.6), p=0.022].

Table 4.3: Bivariate analysis of signs and symptoms on admission

Variables	Dead	Alive	OR (95% CI)	P Value
Edema				
Yes	10 (58.9)	64 (42.7)	1.92 (0.63-5.32)	0.30
No	7 (41.1)	86 (57.3)		
Fever				
Yes	4 (23.5)	46 (30.7)	0.7 (0.21-2.25)	0.78
No	13 (76.5)	104 (69.3)		
Diarrhea				
Yes	7 (41)	37 (24.7)	2.14 (0.76-6.02)	0.154
No	10 (59)	113 (75.3)		
Cough				
Yes	2 (11.8)	25 (16.7)	0.67 (0.14-3.1)	1
No	15 (88.2)	125 (83.3)		
Vomiting				
Yes	4 (23.5)	8 (5.3)	5.46 (1.45-20.6)	0.022
No	13 (76.5)	142 (94.7)		
Skin lesions				
Yes	3 (17.6)	8 (5.3)	3.8 (0.9-15.99)	0.087
No	14 (82.4)	142 (94.7)		
Pallor				
Yes	1 (5.9)	5 (3.3)	1.81 (0.2-16.49)	0.48
No	16 (94.1)	145 (96.7)		
Abdominal distension	1 (5.9)	3 (2)	3.06 (0.3-31.2)	0.35
Yes	16 (94.1)	147 (98)		
No				
Difficulty in breathing	0	3 (2)	1.12 (1.06-1.17)	1
Yes	17 (100)	147 (98)		
No				

Table 4.4 is showing the association of different comorbidities on admission with mortality. Gastroenteritis was the only one which had a statistically significant association with mortality [OR 3.2 (1.15-8.87), p=0.044].

Table 4.4: Bivariate analysis of Diagnosis at admission

Variables	Dead	Alive	OR (95% CI)	P Value
Gastroenteritis				
Yes	9 (53)	39 (26)	3.2 (1.15-8.87)	0.044
No	8 (47)	111 (74)		
Pneumonia				
Yes	2 (11.8)	18 (12)	0.98 (0.2-4.63)	1
No	15 (88.2)	132 (88)		
Septicemia				
Yes	1 (5.9)	18 (12)	0.46 (0.06-3.67)	0.696
No	16 (94.1)	132 (88)		
Malaria				
Yes	1 (5.9)	7 (4.7)	1.28 (0.15-	0.585
No	16 (94.1)	143 (95.3)	11.05)	
Anemia				
Yes	1 (14.3)	6 (85.7)	1.5 (0.17-13.26)	0.535
No	16 (10)	144 (90)		
FTT				
Yes	0	6 (4)	1.12 (1.06-1.18)	0.4
No	17 (100)	144 (96)		
Bronchiolitis				
Yes	0	4 (100)	1.12 (1.06-1.18)	0.4
No	17 (10.4)	146 (89.6)		

Table 4.5 below is showing a multivariate analysis of factors associated with mortality among children admitted with SAM. Vomiting alone had a significant association with mortality. Children admitted with SAM presenting with vomiting are almost 2 times more likely to die compared to children admitted without vomiting.

Table 4.5 Multivariate analysis of factors associated with mortality among children admitted with SAM

Variables	OR (95% CI)	P-value
Age (<24, 24-59 months)	0.54 (0.13-2.25)	0.4
WHZ (<-3, >=-3)	2.65 (0.4-17.58)	0.31
Diarrhea	0.35 (0.12-1.24)	0.1
Edema	0.51 (0.12-2.17)	0.36
Fevers	1.58 (0.35-7.05)	0.54
Cutaneous lesion	0.19 (0.03-1.25)	0.08
Malaria	0.34 (0.02-5.64)	0.44
Pneumonia	0.37 (0.05-2.65)	0.32
Vomiting	1.6 (1.3-8.5)	0.03
Appetite test	1.02 (0.27-3.75)	0.98

4.3 Discussion

In this retrospective study, 168 medical records of children admitted with a diagnosis of Severe Acute Malnutrition (SAM) were reviewed. The aim of the study was to determine the short term outcomes of severely malnourished children aged 6 to 59 months admitted to Prince Regent Charles Hospital, Bujumbura. The median age of enrolled children was 15 months (IQR: 12,24). The majority of children were severely wasted (WHZ<-3SD) (75%, n=126) with a median Mid-Upper Arm Circumference (MUAC) of 10 cm (IQR: 9,11) and 74 children (44%) of the 168 presented with edema.

The mortality was found to be 10.1% which differs from the other studies reviewed. In 2018, Nabukeera et al (a prospective study from Uganda) found that the mortality among children aged 6-59 months admitted for SAM was 9.8% and on the other hand, Guesh et al found in their 2018 retrospective cohort study (North Ethiopia) the mortality among all severely malnourished under-five children admitted in the hospital to be as low as 3.8%. Fondo et al in their prospective study done in 2013 at Mbagathi hospital (Kenya) reported a mortality rate of 8% among children from 6-59 month of age admitted for SAM. Another retrospective study done by Wagnew et al done in 2018 (Northwest Ethiopia) showed a higher mortality rate of 12.52% in under-five children admitted with SAM.

The mortality rate found in our study was higher compared to most of other studies reviewed which were done in our region. According to the WHO grading of case fatality rates for severe acute malnutrition, our study showed moderate performance which differs from most of the studies reviewed that fell into the effective performance category with the exception of the study done in Northwest Ethiopia by Wagnew et al which also fell into the moderate category. Given the similar socioeconomic features of all the settings considered, similar results were expected in our study. Some of the factors which could have contributed to higher mortality rates can be attributed to the severity of presentation of the patients, poor compliance to inpatient treatments and the uptake of the WHO guidelines by healthcare workers. As recommendation, frequent trainings of Health Care

Workers on the management of Severe Acute Malnutrition according to the WHO guidelines are highly encouraged.

In this study, 35.3% of all deaths occurred within the first 72 hours of admission. This is comparable to the findings of Fondo et al in a prospective study done in Kenya where 38.5% of all deaths occurred within 48 hours. Early recognition and intervention of very sick patients in the first 3 days of admission is needed to further decrease the mortality rate.

The median duration of hospitalization in our study was 8 days (IQR 6,12) which is in keeping with the other studies reviewed from our region (from settings with similar socioeconomic status). Derseh et al in Ethiopia (retrospective study) reported a median duration of hospital stay of 12 days among under-five children admitted for SAM and Wagnew et al (in their retrospective study done in Northwest Ethiopia) found a median length of hospitalization of 10 days in children under the age of five admitted with SAM. This duration of hospitalization is much shorter than the 3-4 weeks of therapeutic feeding within which nutritional recovery is expected to occur as per WHO Standards. The factors that are likely to have contributed to shorter duration of hospitalization include inadequate knowledge of WHO standard discharge criteria for severely malnourished children, inpatient care settings far from patient's homes and preference for outpatient nutritional rehabilitation due to socio-economical constraints. Decentralization of treatment centers to facilitate compliance is recommended.

The case fatality rate among children with vomiting (33.3%) was higher than that of children without vomiting (8.4%). This coincides with the most common comorbid condition being Gastroenteritis (28.6%). High risk of mortality was associated with gastroenteritis (p=0.044) and vomiting (p=0.022). There was also an increased risk of death in the first 72 hours of admission (p=0.001). This is in contrast with the findings in Wagnew et al retrospective study done in 2018 (Nortwest Ethiopia) which reported that mortality among under-five children admitted with SAM was associated with anemia,

shock, no intake of antibiotics, IVF use, no intake of F75. Nabukeera et al in their prospective study (2018) looking at predictors of mortality among children from 6 months to 59 months of age admitted with SAM showed that high risk of mortality was associated with diarrhea, lack of appetite, sepsis, skin ulcers, signs of pneumonia and HIV infections. Another prospective study done by Fondo et al (Kenya) reported that high mortality rate among children aged from 6 months to 59 months admitted for SAM was associated with diarrhea. The difference in the findings could be explained by the small sample size of the study compared to other studies. Severely malnourished children presenting with vomiting should be sub-triaged earlier for more intensive care to reduce case fatality rate.

4.4 Study limitations

1. The study was a retrospective study therefore we analyzed already available data. Documentation of the medical records was not up to standards and some important information were missing or not fully recorded.
2. Associated factors were not well analyzed due to a small sample size.

4.5 Conclusion

1. Mortality was found to be at 10.1% among children admitted with severe acute malnutrition
2. Median duration of hospitalization was 8 days
3. Gastroenteritis, more specifically vomiting, was significantly associated with increased risk of mortality (33.3% of all deaths were among children presented with vomiting).
4. The first 3 days of admission were also significantly associated with a high risk of death

4.6 Recommendations

Severely malnourished children presenting with vomiting should be sub-triaged earlier for more intensive care to further decrease mortality rate.

REFERENCES

1. Statement AJ. WHO child growth standards and the identification of severe acute malnutrition in infants and children. Available from: http://apps.who.int/iris/bitstream/10665/44129/1/9789241598163_eng.pdf?ua=1
2. Adal TG. Incidence and Predictors of Mortality among Severe Acute Malnourished Under Five Children Admitted to Dilla University Referal Hospital : A Retrospective Longitudinal Study. 2016;6(13):114–27.
3. Mahgoub HM, Adam I. Morbidity and mortality of severe malnutrition among Sudanese children in New Halfa Hospital, Eastern Sudan. Trans R Soc Trop Med Hyg. 2012;
4. Guesh G, Degu G, Abay M, Beyene B, Brhane E, Brhane K. Survival status and predictors of mortality among children with severe acute malnutrition admitted to general hospitals of Tigray, North Ethiopia: A retrospective cohort study. BMC Res Notes [Internet]. 2018;11(1):1–7. Available from: https://doi.org/10.1186/s13104-018-3937-x
5. Wagnew F, Tesgera D, Mekonnen M, Abajobir AA. Predictors of mortality among under-five children with severe acute malnutrition, Northwest Ethiopia: an institution based retrospective cohort study. Arch Public Heal. 2018;76(1):1–10.
6. Yohannes T, Laelago T, Ayele M, Tamrat T. Mortality and morbidity trends and predictors of mortality in under-five children with severe acute malnutrition in Hadiya zone, South Ethiopia: a four-year retrospective review of hospital-based records (2012–2015). BMC Nutr. 2017;3(1):1–8.
7. Pravana NK, Piryani S, Chaurasiya SP, Kawan R, Thapa RK, Shrestha S. Determinants of severe acute malnutrition among children under 5 years of age in Nepal: A community-based case-control study. BMJ Open. 2017;7(8):1–7.
8. The ministry of Public health and the Fight against AIDS-Burundi, et al. National survey on nutritional status and mortality using the SMART methodology. 2018;73-77.
9. Rusmil VK, Wiramihardja S, AP A, Gurnida DA. Factors Influencing Outcomes of Children Hospitalized with Acute Severe Malnutrition. Althea Med J. 2018;5(2):87–92.
10. Derseh B, Mruts K, Demie T, Gebremariam T. Co-morbidity, treatment outcomes and factors affecting the recovery rate of under -five children with severe acute malnutrition

admitted in selected hospitals from Ethiopia: Retrospective follow up study. Nutr J. 2018;17(1):1–8.

11. Nabukeera-Barungi N, Grenov B, Lanyero B, Namusoke H, Mupere E, Christensen VB, et al. Predictors of mortality among hospitalized children with severe acute malnutrition: a prospective study from Uganda. Pediatr Res [Internet]. 2018;84(1):92–8. Available from: http://dx.doi.org/10.1038/s41390-018-0016-x
12. Kolsteren P, Roberfroid D, Huybregts L, Lachat C. Management of severe acute malnutrition in children. Lancet. 2007;369(9563):740.
13. Bwakura-Dangarembizi M, Amadi B, Bourke CD, Robertson RC, Mwapenya B, Chandwe K, et al. Health Outcomes, Pathogenesis and Epidemiology of Severe Acute Malnutrition (HOPE-SAM): Rationale and methods of a longitudinal observational study. BMJ Open. 2019;9(1):1–15.
14. Kimani F, Sharif O. National Guideline for Integrated Management of Acute Malnutrition. Clint Found HIV/AIDS Initative. 2009;(June):1–51.
15. Nelson Textbook of Pediatrics.
16. Knoop KJ, Dillon EC. Pediatric vomiting. Vol. 3, Academic Emergency Medicine. 1996. 77–81 p.
17. Article 16.Pdf.
18. JOHN KALAMA FONDO. Clinical Outcomes of Children Aged 6 To 59 Months With Severe Acute Malnutrition Admitted To Mbagathi District Hospital Department of Paediatrics & Child Health. Arch Dis Child. 2013;94(April):512–516.

TIME FRAME

The following is the expected timeframe of the study process:

Activity	Estimated Time
Development of Proposal and Presentation	November 2019 to February 2020
Proposal Submission for ethical approval	February-March 2020
Data Collection	June -November 2020
Data Analysis	September-December 2020
Thesis writing	February 2021
Poster Presentation	March 2021
Thesis Submission	April 2021

APPENDICES

APPENDIX I: STUDY QUESTIONNAIRE

STUDY TITLE: Short-term outcomes among children (6-59months) admitted for Severe Acute Malnutrition at Prince Regent Charles Hospital, Bujumbura.

PATIENT DATA:

1. What is the age of the child? Months/ years

2. What is the sex of the child? a) Male b) Female

3. Where is the residence?

4. What are the anthropometrics? a) MUAC(Mid-Upper Arm Circumference):

   b) Weight:

   c) Height:

5. What is the HIV Status of the child? a) Negative b) Positive c) Unknown

6. Has the child exclusively breastfed? a) Yes b) No c) Unknown

7. What are the signs and symptoms at admission?

8. What are the diagnosis at admission?

9. What is the outcome? a) Discharged b) Died c) Absconded

10. How long did the child stay at the hospital?

11. Appetite test: a) Failed b) Successful c) Unknown

MOTHER/CARETAKER DATA:

1. How old is the mother?
2. What is the mother's marital status? a) Married b) Single c) Separated/Divorced
3. What is the mother's level of education? a) None b) Primary c) High-school d) College/university

Appendix II: CONSENT

Hospital Information for enrollment in the study

Study title: SHORT TERM OUTCOMES AMONG CHILDREN FROM 6-59 MONTHS ADMITTED FOR SEVERE ACUTE MALNUTRITION AT PRINCE REGENT CHARLES HOSPITAL, BUJUMBURA.

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Introduction:

I am currently a post-graduate student at the University of Nairobi, Department of Paediatrics and Child Health. I would like to inform you about the study I am doing and request for your hospital to participate in the research study. The purpose of this consent form is to give you the information you will need to help your hospital administration decide whether or not to be a participant in the study. Please read this form carefully. Feel free to ask any question about the study. The investigator will be available to answer any questions that may arise during the study and afterward.

Objectives of the study:

To define short-term (within 1 month) outcomes among children (6-59 months) admitted for Severe Acute Malnutrition in the nutritional care center at Prince Regent Charles Hospital. The outcomes of interest will be mortality and length of hospital stay.

To determine the predictors of mortality among children (6-59months) admitted for Severe Acute Malnutrition.

Benefits:

The study will benefit the hospital involved and the ministry of health in terms of availability of data about mortality in under-five children presenting with malnutrition.

Practicality:

This research would not be able to be done without a waiver because we are analyzing already documented data before the time of collection of data and getting informed consent of the subjects is not feasible either from the fact that contact information may be missing, have changed and the subject may live too far from the site of the study.

Risk:

The research will pause no risk to the patient as we will not come into contact with them. The waiver of consent will be used to collect data already documented. As the review of subjects' medical records is for limited information and data are derived from clinically indicated procedures, this further limits the risk to the patient. Coding of data will be used to prevent the primary risk that is a breach of confidentiality.

Confidentiality:

Information obtained will be kept in strict confidentiality and not be released to any other person without permission other than the concerned authorities. The rights and welfare of the subject will be respected by abstracting identifiable personal data and omitting any unnecessary data. This will furthermore prevent any breach of confidentiality.

Problem/Question:

If any problem or question about the study, you can contact the principal investigator, Dr. Arcella KANEZA by calling +254720418158.

If any inquiry on the rights and ethical considerations about this study, you can contact Prof. M.L Chindia, Kenyatta National Hospital – University of Nairobi Ethics and

Research Committee Secretary by calling 2726300 Ext. 44355. Email: uonknh_erc@uonbi.ac.ke

Investigator Signature: _____ Date: ……