Department of Pharmacology and Clinical Pharmacy

College of Health Sciences

School of Pharmacy

Treatment Outcome and Determinants of Mortality among Pediatric Patients with Severe Acute Malnutrition at Yekatit 12 Hospital, Addis Ababa, Ethiopia

By: Adugnaw Mulu (B. Pharm)

A Thesis Submitted to the Department of Pharmacology and Clinical Pharmacy, School of Pharmacy, College of Health Sciences, Addis Ababa University in Partial Fulfillment of the Requirements for the Master of Pharmacy degree in Pharmacy Practice

July, 2023

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Advisor: Solomon Mequanente Abay (PhD)

Co-advisor: Oumer Sada (Assistance professor)

June, 2023

Addis Ababa, Ethiopia

Addis Ababa University

School of Graduate Studies

This is to certify that the thesis prepared by Adugnaw Mulu entitled: Treatment Outcome and Determinants of Mortality among Pediatric Patients with Severe Acute Malnutrition at Yekatit 12 Hospital, Addis Ababa, Ethiopia and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Pharmacy Practice, complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

Treatment Outcome and Determinants of Mortality among Pediatric Patients with Severe Acute Malnutrition at Yekatit 12 Hospital, Addis Ababa, Ethiopia

Adugnaw Mulu (B. Pharm), Addis Ababa, Ethiopia, 2023

Malnutrition is categorized into two groups based on its severity: moderate acute malnutrition and severe acute malnutrition (SAM). The study aimed to assess the outcome of SAM treatment and its determinants of mortality at Yekatit 12 Hospital, Addis Ababa, Ethiopia. The study was conducted at Yekatit 12 Hospital which is one of the public teaching hospitals. A prospective follow up study was conducted from January 2020- January 2021. Each pediatric patient included in this study was followed throughout the treatment period and the outcome variable measured and declared at the end of the follow up period. The data was cleaned, coded and entered to EPI info 7 software version 7.1.4 and SPSS version 26 for analysis. Percentages, frequency, cross tabulation, odds ratio variables were determined. Bivariate and multivariable logistic regression was under taken to determine predictors of mortality among SAM patient. P-value < 0.05 was considered significant. In this study a total of 246 pediatric patients with the diagnosis of SAM were included, more than half 127 (51.6%) of them were males. Most of the study participants 104 (42.3%) were less than one year old at the time of study period and most majority of them 177 (72.0%) were residing in urban areas of the country. The most frequent co-morbid condition among study participants was pneumonia, which accounted for 39.4% of cases. Among the survived study participants, majority of them 189 (80%) were cured and discharged from the hospital. In the current study, the majority of the study participants (95.9%) survived at the end of the follow-up period. SAM patients with vomiting (AOR=24.3, 95% CI: 1.554-38.13, P=0.033), dermatitis (AOR=2.23, 95% CI: 1.082-4.612, P=0.030) and those who spent 8-12 days in phase I (AOR=2.23, 95% CI: 1.082-4.612, P=0.030) had a greater risk of death than their counterparts. On the other hand, children who got antibiotics for 15-21 and 22-28 days, as well as folic acid and ReSoMal, had a greater survival rate. Since a considerable number of SAM patients in this study were case relapses, long term monitoring and evaluation, set up procedures for keeping tracking and assessing the effectiveness of initiatives to lower SAM mortality.

Keywords: Determinants, Mortality, Sever Acute Malnutrition, Treatment Outcome

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Table of Contents

List of tables

List of figures

Abbreviations and acronyms

ESHE	Essential Services for Health in Ethiopia
MUAC	Mid-Upper Arm Circumference
NCHS	National Center for Health Statistics
NRC	Nutritional Rehabilitation Center
OTP	Out Patient Therapeutic Feeding Program
RUTF	Ready to Use Therapeutic Food
SAM	Severe Acute Malnutrition
SD	Standard Deviation
TFU	Therapeutic Feeding Unit
UN	United Nation

1. Introduction

1.1. Background

Acute malnutrition is a short-term response to inadequate dietary intake, which frequently occurs in conjunction with infections. Based on severity, it is divided into two categories: moderate and severe acute malnutrition (SAM) (Kabalo and Seifu, 2017). One of the causes of malnutrition is an insufficient supply of minerals, vitamins, protein and carbohydrate to the body's cells to meet physiological requirements (Teferi *et al.*, 2010). The international diagnostic criteria for SAM in children between the ages 6-59 months are a weight-for-height ratio of <-3 standard deviations from WHO growth standards or a Mid-Upper Arm Circumference (MUAC) of ≤11.5cm or bilateral peripheral edema (Wong, 2015).

Malnutrition can affect people of any age, but it is most prevalent in children under the age of five. It is the cause of death for 50–60% of SAM children. According to an African literature review, children with SAM who received Ready-to-Use Therapeutic Foods (RUTF) were 51% more likely than the control group to achieve nutritional recovery (Yazew *et al.*, 2019).

Childhood malnutrition continues to be among the most significant public health issues around the world, particularly in low and middle-income countries (Musa *et al.*, 2017). Annually, SAM kills approximately around 3.6 million under the age of five years old children and cause 140.5 million Disability Adjusted Life Years of children in the same age groups (Mekuria *et al.*, 2017b).

SAM is a serious crisis caused by a number of confluence factors, including as poor and inadequate nutrition, childhood illnesses, poor childcare practices, illiteracy, poverty, overcrowding, gender inequality, and challenging access to medical care (Nagar *et al.*, 2016). Despite major advances in detection and care, malnutrition remains a global issue. According to estimates, there are 19 million children under the age of five who are severely malnourished or wasted (Desalegn *et al.*, 2016).

Preliminary guidelines for the treatment of SAM proposed for hospitalized care of all cases, but this require expert healthcare practitioners and costly treatment options, which have not been feasible in settings with an increased proportion of SAM and poor populations (Ndzo and Jackson,

2018).There is indeed a global effort underway to completely eradicate extreme poverty. Nevertheless, the undernutrition remains a major public health issue, particularly in resource limited countries (Alemayehu Eshetu, 2016).

Approximately 14.3 million of these were estimated to be severely acutely malnourished in 2019 (UNICEF, WHO and World Bank, 2020). According to the UN, approximately one million children under the age of five die each year from SAM (Pravana *et al.*, 2017). SAM treatment was previously restricted to hospital-based programs with inadequate coverage. The Outpatient Therapeutic Feeding Program (OTP) carries SAM management services closer to the people by making them available at decentralized health facilities in resource-constrained countries such as Niger, North and South Sudan, Malawi, Chad, and Ethiopia. The OTP has been identified as the most important and accessible program for treating malnutrition in Ethiopia. Its operation in health centers and health posts provides life-saving treatments using RUTF, which are typically Plumpy-nut (Yebyo *et al.*, 2013). The aim of this study is to assess the treatment outcome of SAM and its predictors of mortality at Yekatit 12 Hospital. Addis Ababa, Ethiopia.

1.2. Statement of the problem

SAM accounts for roughly half of the 5.9 million deaths of children under the age of five globally. Compliance to treatment guidelines is difficult, and mortality rates of 10-40% among hospitalized children with SAM have been reported in studies from sub-Saharan Africa, despite the fact that these often represent single hospital settings (Gachau *et al.*, 2018). A recent study found that the mortality rate for inpatient treatment of SAM ranges between 3.4% and 35% despite hospitalization and the development of standardized guidelines (Kabeta and Bekele, 2017).

Despite significant advances in preventive care, malnutrition remains a wide spread issue. Many studies have shown that malnourishment has a terrible impact on the lives of children. On a world basis, approximately 9 million new born die before hit the age of five days, with malnourishment accounting for 30% of this premature mortality. Stunting and wasting caused by malnutrition affect approximately 178 million and 55 million children under the age of five, respectively (Tirore *et al.*, 2017).

In fact, SAM in children is a significant public health issue in underdeveloped countries, notably those in sub-Saharan Africa. For example, in the Dollo Ado district of the Somalia region

(Ethiopia), 42.3% of acutely malnourished with 16.3% of severely wasted children are present. In Ethiopia, SAM was the third largest cause of mortality, accounting for 8.1% of under-five child fatalities, according to Health and Health Related Indicators (HHRI) 2014 (Wagnew *et al.*, 2019).

Malnutrition continues to have a significant effect on the child mortality in Ethiopia and other nations of sub-Saharan Africa. According to previous studies carried out in Ethiopia at Mekelle, Tigray, and the University of Gondar Hospital, the death rate was considerably higher, 12.8% and 18.4%, respectively (Mekuria *et al.*,2017b). Undernutrition is still prevalent in children under age of five, especially in Africa and South East Asia. Nutrition related factors account for nearly 35% of the 7.6 million deaths among children under the age of five that occur each year, with severe wasting accounting for about 5% of such deaths (Muzigaba *et al.*,2018).

SAM contributes significantly to the overall burden of childhood morbidity and mortality, with more than 20 million children worldwide suffering from severe wasting, an unknown number suffering from type kwashiorkor, and case fatality rates among hospitalized children as high as 50%. International consensus guidelines, now recommend the use of RUTF among these group of population (Maleta, Ph and Manary, 2013).

The Sphere Standards state that mortality in children receiving inpatient treatment for SAM should be less than 10%, whereas the WHO protocol states that it should be less than 5%. Many treatment facilities have disclosed fatality rates that are higher than those predicted by this method, which are frequently within 20–25% (Rytter *et al.*, 2016). A study conducted in Wolayta Sodo Town; Southern Ethiopia revealed that 12.1 % of the children were underweight. On the other hands 22.2% were stunted and 9.8% of the children were wasted (Eshete *et al.*, 2017). A 2003 residential study by Essential Services for Health in Ethiopia found that 42% of people were underweight, 2% had severe malnutrition, 11% had moderate to severe malnutrition, and 48% of infants between the ages of 1-2 were stunted (Teferi *et al.*, 2010).

1.3. Significance of the study

Although some studies on the treatment outcome of SAM were being conducted in some Ethiopian health institutions, there is no conclusive study on the outcome of inpatient SAM treatment that includes all age groups of pediatrics. Because of the availability of products for the treatment of SAM in health centers and hospitals of varying levels, generalization of treatment outcomes in

Ethiopia is challenging, which is exacerbated by socio - economic status difference in various areas. As a result, this study contributes to assessing the treatment outcome of SAM and identifying determinants of its mortality among children attending Yekatit 12 Hospital therapeutic feeding unit (TFU).

As a result, the findings of this study will provide evidence to health-care providers and policy makers about the success of treatment and the determinants of SAM mortality in the TFU program. It will also reveal evidence about the general characteristics of patients who visit this hospital's TFU. Therefore, findings of this study will be used to improve the hospital's management of SAM, as well as for program planning, policy implementation, and as a baseline for future research.

2. Literature review

2.1. Prevalence of sever acute malnutrition

According to a study conducted in India, it was found that out of 75 patients, 63 (84%) were discharged, while the dropout rate and mortality rate were 16% and 1.3%, respectively. Among the patients, 20% remained admitted for up to one week, 40% for up to two weeks, 25.3% for up to three weeks and 14.7% remained in the therapeutic center for more than three weeks. The mean duration of stay was 14.13 ± 9.1 days (Nagar *et al.*,2016).

An Indian study that met the inclusion criteria, similar to the aforementioned, examined 100 patients in total. Of the children in the study, 90% met the weight-for-height requirement of fewer than -3 standard deviation, 45% met the criteria for MUAC less than 11.5cm, and 5% met the criteria for bilateral pitting pedal edema. The major symptoms observed in children with SAM were fever, cough, hurried breathing, loss of appetite, and loose stools, with respective frequencies of 79%, 45%, 27% ($p = 0.00$), 26% ($p = 0.00$), and 23% ($p = 0.041$). Among the 43 children with pneumonia, 8 had severe pneumonia, and the other 35 had pneumonia with no danger signs according to the WHO classification. However, all the children with pneumonia improved well with the appropriate treatment (Prashanth *et al.*, 2018).

In a Ghanaian community health setting, a study found that a significant proportion of participants had MUAC of less than 11cm (37%), while 59% had a MUAC of 11-11.5cm, and only 4% had a baseline MUAC of over 11.5cm. The majority of the children were breast feeding when they were enrolled, with an average age of 17.3 months. The most commonly reported comorbidities at the start of the study were fever (18.0%), malaria (17.6%), and vomiting (14.0%), while diarrhea (8.2%) and cough (6.0%) were less prevalent. Anemia was found to be the least frequently diagnosed illness (Akparibo *et al.*, 2017).

Similar study done in the Southern region of Ethiopia, showed that out of the 11,550 (83%) patients for whom nutritional status data was documented, 5,447 (47%) had severe wasting, while 6,103 (53%) had edematous malnutrition. The average length of stay in the TFUs was 25 days for patients with severe wasting and 21 days for those with edematous malnutrition. Of the 13,843 patients admitted to the TFUs, 11,191 (87%) were cured, 468 (3.6%) died during treatment and 1,168

(9.1%) were defaulters or non-respondents. Patients with severe wasting had an average weight gain of 14g/kg/day, while those with edematous malnutrition had an average weight gain of 13.4g/kg/day (Teferi *et al.*, 2010).

2.2. Treatment outcome of severe acute malnutrition

A study conducted in Cameron found that diarrhea was the most commonly observed symptom during hospitalization, accounting for 35.4% of cases. This was followed by cough (26%), vomiting (24.4%) and fever (24%). Malaria was present on admission in 19.7% of cases. Patients with fever were most likely to be referred for stabilization care (31.3%). Of the patients, 72.8% were discharged as fully recovered and there were no defaulters, with only one death. Complications such as poor weight gain (44.1%), anorexia (26.5%), infections (26.5%), and persistent edema (2.9%) led to 26.8% of patients being referred for further treatment. The average time to discharge was 47.1 ± 24.9 days (Ndzo and Jackson, 2018).

According to a research study conducted in Tamale, Ghana, the average length of stay in the facility was 7.0 ± 5.4 days, with a range of 1-47 days. More than 67% of cases admitted to the outpatient care were referred from the inpatient care of the same hospital. Based on MUAC, 25.5% of cases with SAM on admission progressed to a normal nutritional status, while 24.8% improved to moderate acute malnutrition. Similarly, the proportion of moderate acute malnutrition cases that converted to normal status was 40% upon discharge (Saaka *et al.*, 2015).

A study conducted in Debremarkos and Finoteselam, northern Ethiopia, found that the median recovery time for children admitted to Debremarkos Referral Hospital was 11 days, similarly the median recovery time for children admitted to Finoteselam District Hospital was also 11 days. The study's overall median survival time was 11 days (Mekuria *et al.*, 2017b).

A prospective study conducted in Jimma, Ethiopia revealed that out of the study participants, 255 patients (76.8%) had recovered, with a median recovery time of 49 days (range of 28 to 56 days). The mean rate of weight gain for these patients was 8.3 (±3.7) g/kg/day. Fifty-eight patients (17.5%) defaulted, with a median stay in the program of 28 days (ranging from 14 to 49 days). The study also showed that the mean weight for height and MUAC while defaulting was 73.3% (±6.5%) and 11.3 cm (±0.7 cm), respectively. The overall mean time to clinical resolution of edema

was 17.4 (±4.4) days and the mean rate of weight gain was 7.3 (±3.8) grams/ kg/day (Desalegn *et al.*, 2016).

A study carried out in selected hospitals of Ethiopia aimed to evaluate the outcomes of treatment for children with SAM upon discharge found that 55.9% of the children recovered, 5.8% died, and 16.3% defaulted from therapeutic feeding units. The mean weight gain for the recovered children was 15.6g/kg/day. The performance indicators for each hospital were compared to the SPHERE project reference values. After adjusting for confounding factors, the study found that being treated at Mehalmeda Hospital, having an edematous form of malnutrition, and having pneumonia were predictors of recovery rate. Children treated at Mehalmeda Hospital were twice as likely to recover compared to those treated at Debreberhan Referral Hospital. Children with edema were 41% less likely to recover compared to those without edema, and children with pneumonia were 29% less likely to recover compared to those without pneumonia (Derseh *et al.*, 2018).

A study conducted at Wolayta Primary Hospital in western Ethiopia examined the treatment outcomes of 205 children admitted with SAM. The study found that 137 (66.8%) of the cases were cured, 9 (4.4%) died due to SAM, 34 (16.6%) defaulted from SAM management, and 25 (12.2%) were transferred out from the pediatric ward of the SAM treatment center. The children's treatment response was categorized as "cured" or "not cured" to identify factors that influence treatment outcomes. After excluding 25 participants, the total sample size analyzed was 180, of which 137 (76%) were cured and 43 (24%) were not cured (Mena *et al.*, 2018).

2.3. Conceptual framework

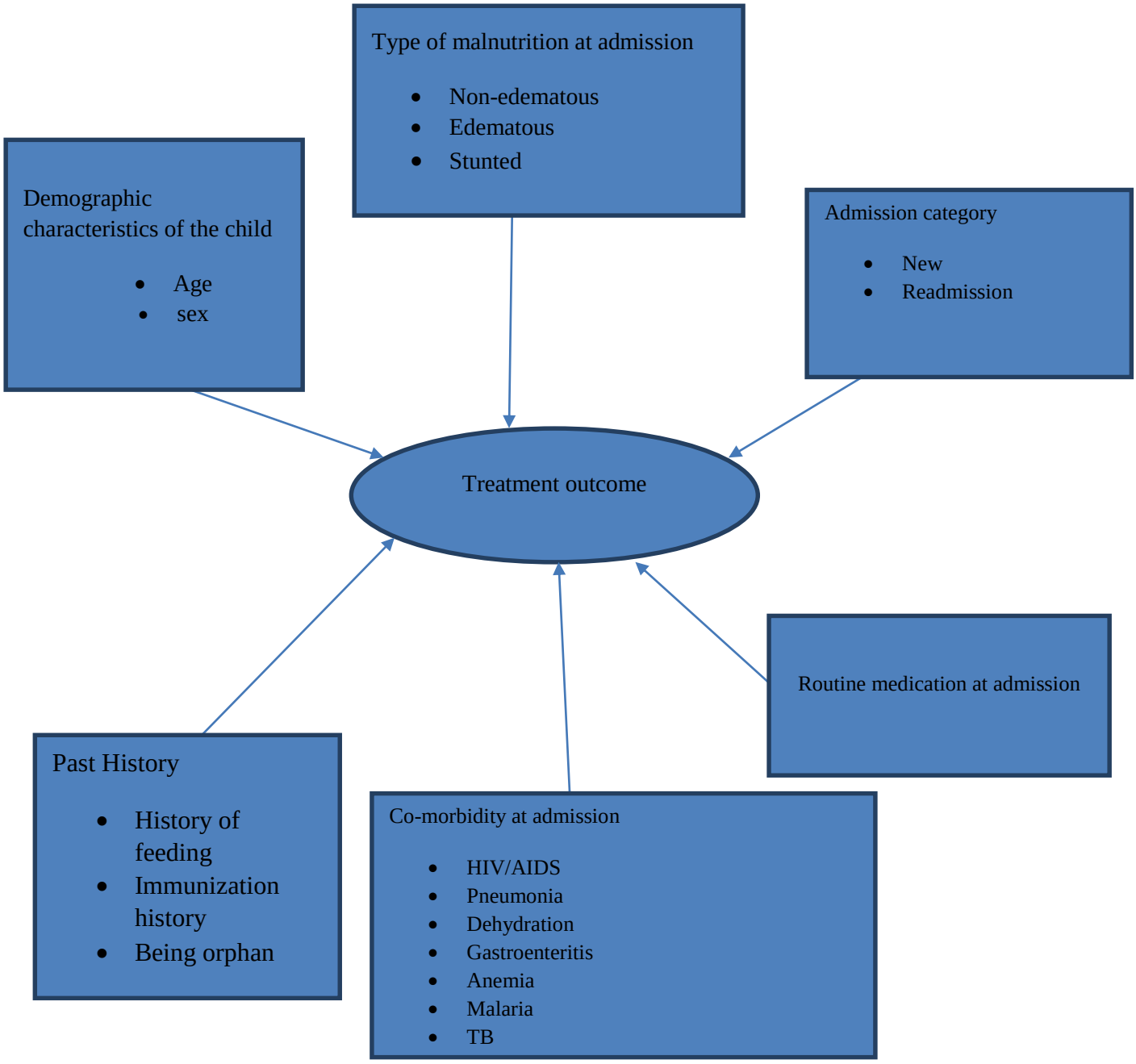

Figure 1:Schematic presentation of the conceptual framework developed by reviewing related literature

3. Objective

3.1. General objective

To assess treatment outcomes of SAM and its determinants of mortality among pediatric patients admitted at Yekatit 12 Hospital, Addis Ababa, Ethiopia.

3.2. Specific objectives

- To assess the treatment outcomes of SAM in patients admitted at Yekatit 12 Hospital, Addis Ababa, Ethiopia
- To identify possible determinants of mortality of SAM related death in patients admitted at Yekatit 12 Hospital, Addis Ababa, Ethiopia

4. Methods and Materials

4.1. Study area

The study was conducted at Yekatit 12 Hospital, which is one of the teaching hospitals in Ethiopia, located in Addis Ababa. It is one of the hospitals administered by the Addis Ababa City Administration Health Bureau. The hospital offers a wide range of healthcare services to the community at large as well as to cases that are referred from other parts of the country. The hospital provides both inpatient and outpatient services through various departments including medical, surgical, emergency, outpatient, pediatrics, Gynecology, ENT wards, pediatrics, burn unit and the like. The hospital provides annual services to more than 5 million people and serves as a catchment area for roughly 17 health centers. There are a total of 10 pediatricians and 12 trained nurses who were available for SAM management in the hospital during the study period (Berehe *et al.*, 2018; Kebede *et al.*, 2022).

4.2. Study design and period

A prospective follow up study was conducted from January 2020 to January 2021. Each pediatric patient included in this study was followed until the outcome variable occurred.

4.3. Source and study populations

Every SAM patient who was admitted at pediatric ward of Yekatit 12 Hospital was considered as source population. On the other hand, the study population included patients with SAM who met the eligibility criteria and were admitted to the pediatric ward of Yekatit 12 Hospital during the study period.

4.4. Eligibility criteria

4.4.1. Inclusion criteria's

- ✓ Children diagnosed with SAM by any one of the criteria as diagnosing tool, weight for height less than -3 Z-score or MUAC <11.5cm with length >65cm, or Presence of bilateral pitting edema either without complication or with complications and admitted in the therapeutic center of this hospital during the study period (January 2020-January 2021).

4.4.2. Exclusion criteria's

- ✓ Hospitalized SAM patients who were not voluntary to participate in the study

- ✓ Those who left the facility before starting their treatment course

4.5. Sample size determination and sampling techniques

4.5.1. Sample size determination

All SAM patients admitted at inpatient ward of Yekatit 12 Hospital during the study period and fulfilled the eligibility criterion were included. During the study period, a total of 301 pediatric patients with the diagnosis of SAM were admitted at Yekatit 12 Hospital. Among these, 246 of them fulfilled the eligibility criteria included in the study.

4.6. Study variables

4.6.1. Dependent variables

- ✓ Treatment outcomes of SAM (cure, death, defaulter, transfer out, fail to improve)

4.6.2. Independent variables

- ✓ Sociodemographic factors (gender, age, monthly income, residency and so on)
- ✓ Clinical characteristics (Diagnosis type at admission, admission type, type of SAM at admission, mode admission, sign and symptom during admission, immunization status…)
- ✓ Treatment related characteristics (type of antibiotics, duration of antibiotics, deworming agent, vitamin A, feeding formula, RUTF, folic acid….)

4.7. Data collection method and instrument

The data collection tool was developed after reviewing similar articles (Gebremichael, Bezabih and Tsadik, 2014; Desalegn *et al.*, 2016; Tirore, Atey and Mezgebe, 2017; Derseh *et al.*, 2018). Using a pre-tested questionnaire (Annex I), data from the patients' medical records and patient attendants were extracted. The questionnaire was used to obtain information on sociodemographic, clinical, and medication related factors. one Pharmacist (B.Pharm) and Two nurses (BSc) were recruited for data collection.

4.8. Data quality control and assurance

A pre-test was done among 20 hospitalized SAM patients admitted at Tikur Anbessa Specialized Hospital before the actual data collection to check for the uniformity, feasibility and understandability of the questionnaire. Two nurses (BSc) and one Pharmacist (B.Pharm) of Yekatit 12 Hospital were trained for data collection for two days on how to collect the data. Throughout

the data collection process, regular supervision and follow-up were carried out. The principal investigator performed daily cross-checks to make sure the data were reliable and consistent.

4.9. Data entry and analysis

The total number of discharges that were cured, defaulted, and the average length of hospital stay in days were examined. The number of malnourished children who were survived at the end of follow up period (Cured, defaulter and transfer out) or those who passed away as a percentage of all admitted cases was used to compute the cure and mortality rates. Data was cleaned, coded and entered to EPI info 7 software version 7.1.4 and SPSS 26 version for analysis. Percentage, frequency, cross tabulation, odds ratio of different variables was determined. Bivariate and multivariable logistic regression was under taken to determine predictors of SAM related death among SAM patients. A P-value of ≤ 0.05 was taken as having significant association.

4.10. Ethical approval

The Ethical Review Board of the School of Pharmacy, Addis Ababa University, provided ethical clearance and approved for the study (EBR/SOP/124/09/19). The study also got ethical approval by Addis Ababa Health Bureau for ethical clearance. Prior to data collection, parents or patient attendants were informed about the study and written consent was taken accordingly. Every patient attendant received information on the study's purpose, selection process and its confidentiality guarantee. Attendants were made aware that participation in the study was entirely voluntary and that they might leave at any moment without negatively affecting the care they receive from the hospital. Additionally, they were made aware that there would be no financial compensation for their participation in the study. To protect the security and anonymity of the information, the gathered data was kept in a lockable cabinet and no identifiers were utilized and data was examined in aggregate.

4.11. Operational definitions

Cure: Has reached the discharge criteria for SAM treatment.

Survived: Those SAM patients declared as cured, transfer out and defaulter

Death: SAM patient whose death was reported in the treatment logbook while the patient was still in the therapeutic unit.

Defaulter: Patients with SAM who left the treatment facility against medical recommendation were listed as defaulters or left before making a full recovery.

Transfer out: Children's with SAM who were transferred to another setting.

Fail to improve: Fail to respond to treatment or their condition may deteriorate.

5. Results

5.1. Socio-demographic characteristics

In this study a total of 246 pediatric patients with the diagnosis of SAM were included, more than half 127 (51.6%) of them were males. Most of the study participants 102 (42.3%) were less than 1-year-old at the time of study period and majority of them 177 (72.0%) were residing in urban areas of the country (Table 1).

Table 1: Socio-demography characteristics of study participants with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia, N=246, January 2020-January 20021).

Characteristics		Frequency (N=246)	Percent
Gender	Male	127	51.6
	Female	119	48.4
Age	<12 months	104	42.3
	1-2 years	102	41.5
	>2-3 years	25	10.2
	>3 years	15	6.1
Place of residence	Urban	177	72
	Rural	69	28
Did the mother alive	Yes	218	88.6
	No	10	4.1
	Not known	18	7.3
Did the father alive	Yes	217	88.2
	No	11	4.5
	Not known	18	7.3
Mothers' occupation	House wife	61	24.8
	Farmer	15	6.1
	Trading	82	33.3
	Government employee	38	15.4

	Daily laborer	23	9.3
	Unemployed	27	11.0
Fathers' occupation	Farmer	37	15.0
	Trading	96	39.0
	Government employee	51	20.7
	Daily laborer	32	13.0
	Unemployed	30	12.2
Family size	1-3	107	43.5
	4-6	94	38.2
	>6	21	8.5
	Not known	24	9.8
Average monthly income	1000-3000 ETB	106	43.1
	3000-5000 ETB	106	43.1
	5000-7000 ETB	10	4.1
	Not known	24	9.8

5.2. Clinical characteristics

Among the study participants, more than half of them 131 (53.3%) had 6-12 months of breast-feeding history and majority of them 214 (87.0%) were admitted with complicated type of SAM. More than one-fourth of SAM patients in this study had vomiting and diarrhea 78 (31.7%) and 75 (30.5%) respectively. Of the total study participants, 189 (76.8%) of them were fully vaccinated for their age. Regarding their Central Nervous System status at admission only 35 (14.2%) were alert and around half 110 (44.7%) of the study participants had fever (Table 2).

Table 2: Clinical characteristics on treatment outcome of children with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia.

Characteristics		**Frequency (N=246)**	**Percent**
Duration of breast feed	Not at all	19	7.7
	<6 months	83	33.7

	6-12 months	131	53.3
	>12 months	13	5.3
Diagnosis type at admission	Complicated	214	87.0
	Not complicated	32	13.0
MUAC at admission	<11.5cm	162	65.9
	11.5cm-12cm	1	0.4
	NA	83	33.7
Admission type	New admission	197	80.1
	Readmission	43	17.5
	Returned after defaulter	6	2.4
Type of SAM at admission	Only edematous/ Kwashiorkor	23	9.3
	Only wasting/marasmus	197	80.1
	Both edematous and wasting	26	10.6
Mode of admission	Direct from community	8	3.3
	From OPD	111	45.1
	From health center	73	29.7
	From other hospitals	32	13.0
	Others	22	8.9
Vomiting present	Yes	78	31.7
	No	168	68.3
Diarrhea present	Yes	75	30.5
	No	171	69.5
Type of diarrhea	Watery	59	78.7
	Dysentery	16	21.3
Duration of diarrhea	Acute	67	89.3
	Persistent	8	10.7
CNS condition at admission	Alert	35	14.2
	Lethargic	211	85.8
Appetite at admission	Good	25	10.2
	Poor	221	89.8

Length of hospital stay	≤10 days	8	3.3
	11-15 days	65	26.4
	16-20 days	102	41.5
	21-25 days	52	21.1
	26-30 days	13	5.3
	>30 days	6	2.4
Hypothermia present	Yes	51	20.7
	No	195	79.3
Fever present	Yes	110	44.7
	No	136	55.3
Hypoglycemia present	Yes	59	24.0
	No	187	76.0
Immunization status	Not vaccinated	4	1.6
	Not completed	53	21.5
	Fully vaccinated for their age	189	76.8

NA for MUAC= children's with <6 months of age, CNS= Central Nerves System

5.3. Environmental factors

Out of the total admitted study participants, majority of them 205 (83.3%) has a separated kitchen from their living room and in most of SAM patients 107 (43.5%) included in this study plastic jar was used as water storage. Majority of study participant's parents or attendants 232 (94.3%) reported that they have latrine in their living area (Table 3).

Table 3: Environmental factors related on treatment outcome of study participants with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia, N=246, January 2020-January 2021.

Characteristics		**Frequency (N=246)**	**Percent**
Kitchen status	Separated	205	83.3
	Attached	41	16.7
Water storage	Pot	12	4.9
	Jerica	175	71.1

	Plastic jar	107	43.5
Has latrine	Yes	232	94.3
	No	14	5.7
Hand washing with latrine	Yes	155	63.0
	No	91	37.0

5.4. Medical comorbidity

Pneumonia was the commonest medical comorbidity present among study subjects at the time of admission 97 (39.4%), followed by sepsis 59(24%), anemia 48 (19.5%) and dehydration 47 (19.1%). Furthermore, about 40 (16.3%) of patients developed hospital acquired infection during their hospital stay (Table 4).

Table 4: Distribution of medical comorbidities among study participants with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia, N=246, January 2020-January 2021.

Characteristics	Frequency (N=246)		Percent
Meningitis	Yes	28	11.4
	No	218	88.6
HIV status	Yes	15	6.1
	No	231	93.9
TB status	Yes	21	8.5
	No	225	91.5
Malaria	Yes	7	2.8
	No	239	97.2
Dehydration	Yes	47	19.1
	No	199	80.9
Anemia	Yes	48	19.5
	No	198	80.5
Pneumonia	Yes	97	39.4
	No	149	60.6
Measles	Yes	6	2.4

	No	240	97.6
Sepsis	Yes	59	24.0
	No	No	76.0
Rickets	Yes	28	11.4
	No	218	88.6
Dermatitis	Yes	11	4.5
	No	235	95.5
Medical complication during hospital stay (HAI)	Yes	40	16.3
	No	206	83.7

5.5. Medicine distribution

Regarding the route of medication administered to SAM patients, majority of them 184 (74.8%) were prescribed with parenteral antibiotics. Ampicillin and gentamycin were the commonest antibiotic parenteral medications prescribed to patients with the frequency of 136 (55.3%) and 123 (50.0%) respectively. On the other hand, the top three medication beside antibiotics prescribed for these group of patients were acetaminophen 117 (47.6%), folic acid 84 (34.1%) and vitamin A 72 (29.3%). Majority of SAM patients 121(49.2%) spent 3-7 days to transit from phase I to transition phase and 172 (69.9%) of them 8-12 days for transition to phase II (Table 5).

Table 5: Medicine distribution for study participants with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia, N=246, January 2020-January 2021.

Characteristics		**Frequency (N=246)**	**Percent**
Type of antibiotics	PO	29	11.8
	IV	184	74.8
	Both	33	13.4
Specific antibiotics	Ampicillin	136	55.3
	Gentamycin	123	50
	Moropenum	14	5.7
	Vancomycin	17	6.9
	Amoxicillin	31	12.6

	Ceftriaxone	51	20.7
	Cefepime	13	5.3
	Ceftazidime	8	3.2
	Others	19	7.7
Duration of antibiotics	≤7 days	6	2.4
	8-14 days	100	40.7
	15-21 days	121	49.2
	22-28 days	12	4.9
	>28 days	7	2.8
Vitamin A	Yes	72	29.3
	No	174	70.7
Folic acid	Yes	84	34.1
	No	162	65.9
Acetaminophen	Yes	117	47.6
	No	129	52.4
Deworming agent	Yes	59	24.0
	No	187	76.0
ReSoMal	Yes	114	46.3
	No	132	53.7
IV fluid	Yes	17	6.9
	No	229	93.1
Type of IV fluid	RL	3	1.2
	NS	6	2.4
	DNS	8	3.3
Furosemide	Yes	17	6.9
	No	229	93.1
Type of feeding formula	Only F-100	15	6.1
	Both	231	93.9
Duration of phase I to transition	Not taking (finished phase I before admission)	11	4.5
	<3 days	87	35.4

	3-7 days	121	49.2
	8-12 days	21	8.5
	>12 days	6	2.4
Duration of transition to phase II	3-7 days	56	22.8
	8-12 days	172	69.9
	13-17 days	10	4.0
	>=18 days	8	3.3
TTC eye drop	Yes	106	43.1
	No	140	56.9
Iron	Yes	46	18.7
	No	200	81.3
Discharge RUTF	Yes	48	19.5
	No	198	80.5
Discharge medication	Yes	74	30.1
	No	172	69.9

Others= ampicillin-sulbactum, cefotaxime, cotrimoxazole

5.6. Treatment outcome of severe acute malnutrition

Regarding the overall status of treatment outcome of children with SAM, about 236 (95.9%) of them survived at the end of their follow up. Among the survived study participants (236), majority of them 189 (80%) were cured and discharged from the hospital (Table 6).

Table 6: Distribution of treatment outcome for study participants with severe acute malnutrition admitted to pediatric ward of Yekatit 12 Hospital, Addis Ababa, Ethiopia, N=246, January 2020-January 2021.

Characteristics	Frequency (N=246)	Percent
Death	**10**	**4.1**
Survived	**236**	**95.9**
Cured	189	80
Defaulter	22	9.3
Transferred out	23	9.7
Fail to improve	2	0.8

5.7. Predictive factors towards treatment outcome of sever acute malnutrition

Variables with a p-value of ≤0.2 were entered in to multivariable logistic regression. The study participants with history of vomiting, dermatitis and stayed a duration of 8-12 days to change from phase I to transition phase showed increased risk towards death. On the other hand, children who received antibiotics for the duration of (15–21 days and 22–28 days), who also received folic acid and ReSoMal, and who completed their immunizations, had a higher rate of survival than their peers.

The odd of death in patients with the history of vomiting was more than 24 times higher than patients without the history of vomiting (AOR= 24.3, 95% CI: 1.554-38.13, P =0.033). Similarly, SAM patients with the diagnosis of dermatitis had about 2.23 times increased odds for mortality compared with their counterparties (AOR= 2.23, 95% CI: 1.082-4.612, P=0.030). Furthermore, SAM patients who spend 8-12 days in between phase I and transition phase, had greater than 2 times higher risks of mortality compared to patients who spend <3 days (AOR= 2.23, 95% CI: 1.082-4.612, P= 0.030).

SAM patient's received antibiotics for the duration of 15-21 and 22-28 days had 85% and 98% chance of survival compared to patients only received <7 days of antibiotics respectively (AOR= 0.15, 95% CI: 0.044-0.543, P= 0.004) and (AOR= 0.02, 95% CI: 0.006-0.131, P=0.027). In addition, SAM patients received folic acid and ReSoMal were showed improved survival with 41%, 42% respectively (AOR= 0.59, 95% CI: 0.406-0.863, P= 0.004) and (AOR= 0.58, 95% CI: 0.385-0.900) (Table 7).

Table 7: Multivariable logistic regression

Variables	Treatment outcome		COR (CI, 95%)	AOR (CI, 95%)	P-value
	Survived	Died			
Breast feeding					
Not at all	17	2	1.00		
<6 months	79	4	0.43 (0.073-2.543)	0.15 (0.013-1.847)	0.148
6-12 months	127	4	0.26 (0.046-1.574)	0.78 (0.258-2.392)	0.344
>12 months	13	0	0.18 (0.157-1.071)	0.32 (0.075-1.407)	0.326

Vomiting					
No	165	3	1.00		
Yes	71	7	5.42 (1.363-21.57)	24.3 (1.554-38.13)	0.033*
HIV					
Negative	224	7	1.00		
Positive	12	3	8.00 (1.836-34.86)	4.81 (0.120-192.8)	0.404
TB					
No	218	7	1.00		
Yes	18	3	5.19 (1.235-21.80)	14.3 (0.048-48.07)	0.369
Dermatitis					
No	225	10	1.00		
Yes	11	0	1.56 (0.849-2.866)	2.23 (1.082-4.612)	0.030*
Duration of antibiotics					
<7 days	6	0	1.00		
8-14 days	100	0	0.17 (0.076-0.419)	0.80 (0.252-2.539)	0.760
15-21 days	118	9	0.05 (0.023-0.128)	0.15 (0.044-0.543)	0.004*
22-28 days	11	1	0.01 (0.003-0.035)	0.02 (0.006-0.131)	0.027*
<28 days	1	0	1.24 (0.149-10.49)	7.56 (0.463-12.37)	0.156
Folic acid					
No	159	3	1.00		
Yes	77	7	4.81 (1.213-19.14)	0.59 (0.406-0.863)	0.004*
ReSoMal					
No	125	7	1.00		
Yes	111	3	0.48 (0.122-1.912)	0.58 (0.385-0.900)	0.014*
Immunization					
Not vaccinated	2	2			
Not completed	48	5	0.10 (0.012-0.908)	0.96 (0.572-1.624)	0.264
Completed	186	3	0.01 (0.002-0.156)	0.04 (0.001-0.345)	0.015*
Duration from phase I to transition					
<3 days	86	1	1.00		

3-7 days	120	5	0.41 (0.447-3.921)	0.74 (0.303-1.826)	0.518
8-12 days	20	3	1.50 (0.138-16.32)	2.23 (1.082-4.612)	0.030*

***Variables showed statistically significant association**

6. Discussion

The goal of the study was to provide insight about the treatment outcome and predictors of SAM related mortality in children admitted to Yekatit 12 Hospital pediatric ward. The results of SAM management in the hospital will be compared to major clinical outcomes of known international standards in this study. It's also helped us figure out what factors are linked SAM treatment outcomes in our context.

The majority of the study participants, 197 (80.1%), had marasmus type SAM at the time of hospital admission, which was consistent with a study conducted in Debremarkos and Finoteselam Hospitals, as well as a retrospective study from Gondar, which found that most of them had marasmus type SAM at the time of presentation (Mekuria *et al.*, 2017a; Wagnew *et al.*, 2019). In this study, the most common concomitant diseases were pneumonia 97 (39.4%) and sepsis 59 (24.0%). These findings were consistent with studies conducted in Illubabor zone health facilities in South West Ethiopia (Dubale, 2019). According to a study from the Comprehensive Specialized Hospital of Hawassa University, 41.5% and 46.7% of children with SAM, had a comorbid condition of pneumonia and diarrhea respectively (Fikrie *et al.*, 2019). In contrast, a retrospective research from Jimma University's specialized hospital found that diarrhea 28 (25%) was the most common concomitant disease (Misganaw *et al.*, 2014), the above discrepancy may be due to the study's setting and context.

Two hundred forty-six children with SAM were enrolled in the current study. Of this, 236 (95.9%) survived to the end of the follow-up period, while the remaining 10 (4.1%) died. The majority of the children who survived, 189 (80%), were cured and discharged. In the current study, the percentage of defaulters from the SAM management program was 22 (9.3%), which was within the acceptable range according to UNICEF and SPHERE requirements of 15%. The survival rate in this study was comparable to studies conducted in other parts of Ethiopia, such as Illubabor zone (99%), Woldiya Hospital (85%), and Jimma (85%). (Chane, Oljira and Atomesa, 2014; Misganaw *et al.*, 2014; Dubale, 2019). However, this figure was too high when compared with other studies, for instance a study from Debremarkos and Finoteselam (77.9%), Enderta Tigray region (76.8%), India (76%), Cameroon (72.8%), Uganda (66.9%), Nekemte, Oromia region (66.8%) (Desalegn *et al.*, 2016; Nyeko *et al.*, 2016; K. and C., 2017; Mekuria *et al.*, 2017a; Ndzo and Jackson, 2018).

The discrepancy could be attributed to the study design and study setting, and another possible explanation for the above variation could be due to the fact that most studies were conducted at the district level, whereas the current study is being conducted at a teaching hospital, and the quality of care in these settings could be a reason for the different survival rates.

The overall fatality rate in this study was 4.1%, which matched findings from Jimma (5.8%), Mekelle (3.6%), and Gubalafto woreda, North Wollo (2%) (Misganaw *et al.*, 2014; Tirore *et al.*, 2017; Abate *et al.*, 2020). Similarly, a study from Hawassa, Southern Ethiopia, showed that 10.8% of SAM patients admitted to the hospital were died (Fikrie *et al.*, 2019). Stabilization center characteristics such as excess caseload and a paucity of skilled staff could explain the increased death rates in the Hawassa study when compared to this study. Despite the large annual patient flow in the pediatrics department, compared to the current study (12 trained nurses), there were only three trained nurses available at the time of the study for SAM management.

Previous studies revealed that variables such as age, distance from home to health facilities, male gender, immunization status, kwashiorkor type of SAM, dermatosis of kwashiorkor , altered body temperature, anemia, tuberculosis, HIV, pneumonia, diarrhea, edema, dehydration, parenteral antibiotics, intra venous fluids, blood transfusion and using of deworming medications showed a statistically significant association towards the treatment outcome of SAM among pediatric patients treated around the globe (Gebremichael *et al.*, 2014; Desalegn *et al.*, 2016; Kabalo and Seifu, 2017; Tirore *et al.*, 2017; Mena *et al.*, 2018; Dubale, 2019; Wagnew *et al.*, 2019; Abate *et al.*, 2020). Whereas, the current study found that SAM patients with a history of vomiting, dermatitis, and days spent transitioning from phase I to phase II were more likely to die. While, SAM patients who were given antibiotics for more than 15-28 days, those given folic acid and ReSoMal were linked with better survival odds than their counterparts.

7. Study limitations

- There was no control group drawn from nearby healthcare facilities and there was no information on whether patients who experienced relapses were readmitted soon after discharge for any reason possibly due to the application of unsuitable discharge criteria or premature discharge among others.
- The study was also conducted in a single-center which could limit the generalizability.
- Due to the COVID-19 pandemic during which the study was done, there were numerous interruptions to the data collection process. In order to address this, the data collection period was prolonged.
- Due to the fact that some of the SAM patients in the current study came from orphanage groups, it has been challenging to get some of the information.

8. Conclusion

According to the SPHERE, UNICEF and WHO standard values, the nutritional recovery and defaulter rate in our study is within an acceptable range. Pneumonia was the most prevalent comorbid disease among study participants followed by sepsis, anemia and dehydration. In the current study, the majority of SAM patients survived to the end of the follow-up period. Among the survived study participants, majority of them were cured and discharged from the hospital. SAM patients with vomiting, dermatitis, and those who spent 8-12 days in phase I and transition phase had a greater risk of death than their counterparts. On the other hand, children who got antibiotics for 15-21 and 22-28 days, as well as folic acid and ReSoMal had a greater survival rate.

9. Recommendations

- Aside from malnutrition therapy, health facilities should focus on detecting and treating associated co morbidities.
- Since a considerable number of SAM patients in this study were case relapses, long term monitoring and evaluation, set up procedures for keeping tracking and assessing the effectiveness of initiatives to lower SAM mortality
- More qualitative studies involving both health professionals and caregivers should be undertaken in order to gather more detailed information.

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Annex I: Informed consent

I. Study Information

Study title: Assessment of Treatment Outcome and Determinants of Mortality among Pediatric with Severe Acute Malnutrition at Yekatit 12 Hospital Medical College.

Institution: Addis Ababa University, Department of pharmacology and clinical pharmacy, School of Pharmacy

Greeting:

Hello, my name is Adugnaw Mulu. I am here today to collect data to for my study entitled on treatment outcome of SAM and its determinants among pediatric ward of Yekatit 12 Hospital.

Objective of the study

- To assess the treatment outcomes of severe acute malnutrition patients admitted at Yekatit 12 HMC during the study period
- To evaluate the determinants of severe acute malnutrition (SAM) patients admitted at Yekatit 12 HMC during the study period.

This is prospective cross-sectional study so I request you to take part in this study. Your cooperation and willingness are greatly helpful in assessing treatment outcomes of SAM patients at Yekatit 12 HMC.

The study will be conducted through recording medical findings from medical chart and interviewing (if needed). No information we gather from the chart and information you provide will ever include your identity or be linked to it in any way. Except for the time needed to deliver information to us, there are no potential risks to taking part in this study. Your medical record and any information you provide will be treated with the utmost confidentiality. You can choose not to take part in the study; it is entirely voluntary. You have the right to stop the study at any time if you find it uncomfortable. Please don't hesitate to get in touch with the principal investigator if you have any inquiries.

Contact Person:

Adugnaw Mulu

Phone number: 0910162583

E-mail address: adumar830@gmail.com

Do you agree to take part in this research?

1. Yes …...

2. No…….

Annex II: Questionnaire

I. Patient Information

Patient Code----------

Name of hospital----------

Date of data collection----------

A. Section 1: Socio-demographic and Admission Information of SAM patients

No.	Patients background information	Response
1	Patient's sex	☐ Male ☐Female
2	Age	☐1month to 1 year ☐>1 year to 5 years ☐>5 years to 10 years ☐>10 years to 14 Years
3	Place of residence	☐Urban☐Rural
4	Vital signs at admission	PR------b/minute. RR--------breaths/ minute. T^{o}C------
5	Vital signs at discharge	PR------b/minute. RR--------breaths/ minute. T^{o}C------
6	Duration of Breast feeding	☐Not at all ☐<6 mnths☐6-12months ☐> 12 months
7	Mother alive	☐ Yes ☐ No
8	Father alive	☐ Yes ☐ No
9	Mothers occupation	☐House wife ☐Farmer ☐Trading ☐Government employee ☐Daily laboror☐Others----------
10	Fathers occupation	☐Farmer ☐Trading ☐Government employee ☐Daily laboror☐Others----------
11	Family size	☐1to 3 ☐ 4 to 5 ☐>6
12	Average monthly income	
13	Weight for height or weight for length	☐<70% ☐70-85% ☐>85% ☐NA
14	MUAC at admission	☐<11cm ☐11-12cm ☐>12cm ☐NA----------
15	MUAC at discharge	☐<11cm ☐11-12cm ☐>12cm ☐NA----------
16	Admission type	☐New admission ☐Readmission ☐Returned after dafaulter----------
17	Type of SAM for admission	☐Only edema or kwashiorkor☐Only wasting or marasmus ☐Both edema and wasting ☐ MUAC ☐ Others----------
18	Mode of admission	☐Direct from community☐From OPD ☐ From HC☐From Hospital☐Others----------
19	Date of admission	----------
20	Date of discharge	----------

B. Section 2: Environmental characteristics of SAM patients admitted to Pediatric Ward of Yekatit 12 HMC, Addis Ababa Ethiopia

No.	Environmental status	Response
1	Kitchen status:	☐Separated ☐Attached
2	Water storage	☐Pot ☐Jerica☐ Others----------
3	Has latrine	☐ Yes ☐ No
4	Hand washing with the latrine	☐ Yes ☐ No

C. Section 3: Distribution of medical comorbidities information on treatment outcome of children with SAM admitted to Pediatric Ward of Yekatit 12 HMC, Addis Ababa Ethiopia

No.	Type of Medical comorbidity	Response
1	Presence of fever:	☐Yes ☐No ☐ NA
2	Presence of hypothermia	☐Yes ☐No ☐ NA
3	Presence hypoglycemia	☐Yes ☐No ☐ NA
4	Presence of vomiting	☐Yes ☐No
5	Appetite at admission	☐Good ☐Poor
6	Presence of diarrhea	☐Yes ☐No
7	If yes to type of diarrhea	☐Watery☐Dysentery
8	Duration of diarrhea	☐Acute ☐Persistent
9	HIV +ve	☐Yes ☐No ☐ NA
10	TB +ve	☐Yes ☐No ☐ NA
11	Presence of malaria	☐Yes ☐No ☐ NA
12	Presence of dehydration	☐Yes ☐No ☐ NA
13	Presence of anemia	☐Yes ☐No ☐ NA
14	Presence of pneumonia	☐Yes ☐No ☐ NA
15	Presence of measles	☐Yes ☐No ☐ NA
16	Presence of sepsis	☐Yes ☐No ☐ NA
17	Presence of rickets	☐Yes ☐No ☐ NA
18	Other medical complication at admission (please specify)	----------
19	CNS condition at admission	☐Alert ☐ Lethargic ☐Unconscious/coma

D. Section 4: Distribution of treatment given information on treatment outcome of children with SAM admitted to Pediatric Ward of Yekatit 12 HMC, Addis Ababa Ethiopia

1. Antibiotic given: ☐Yes ☐No ☐Not indicated--------
2. Type of antibiotics: ☐ PO☐IV☐Others(specify)----------

3. Please specify the antibiotics----------
4. Duration of antibiotics: ☐<7 days ☐7-10 days ☐10-14 days ☐>14 days
5. Vitamin A: ☐Yes ☐No
6. Immunization status: ☐ Fully immunized☐Not Completed☐Not vaccinated
7. Folic acid: ☐Yes ☐No
8. Deworming agent given☐Yes ☐No
9. Paracetamol: ☐Yes ☐No
10. ReSoMal: ☐Yes ☐No
11. Iv fluid: ☐Yes ☐No
12. If yes type of fluid: ☐RL ☐NS ☐DNS
13. Furosemide: ☐Yes☐No
14. Feeding formulas: ☐Yes☐No
15. Type of formula: ☐F-75 ☐F-100
16. CAF/ TTC eye drops: ☐Yes ☐No
17. Iron: ☐Yes ☐No
18. Discharge RUTF: ☐Yes ☐No
19. Appetite taste done ☐ Yes ☐ No

Duration of transition in phases:

A. **Phase I to transition**:☐<3 days ☐3-7 days☐7-10 days ☐10-14 days☐>14 days
B. **Transition from transition to phase II:** :☐<3 days ☐3-7 days☐7-10 days ☐10-14 days ☐>14 days

E. Section 5: Distribution of treatment outcome for SAM children who were admitted to Pediatric Ward of Yekatit 12 HMC, Addis Ababa Ethiopia.

- **Treatment response of the child:**

A. Overall outcomes observed ☐Died **B**. ☐ Cured **C**. ☐Defaulter **D**. ☐ Transferred out☐ Fail to improve

E. Weight gain for cured in three consecutive weeks: ☐Yes ☐No

F. Length of hospital stay:☐<7days☐8-14 days☐15-22 days ☐>22 days

G. MUAC at discharge: ☐>12.5cm☐ 11.5cm-12.5cm ☐<11.5cm☐NA

Annex III: Ethical Clearances

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Addis Ababa University

School of Pharmacy
Ethical Review Board

ቀን Date: September 25, 2019

ማጣቀሻ Ref. No.: ERB/SOP/124/09/2019

To: **Adugnaw Mulu**

School of Pharmacy

Re: Ethical Clearance

It is to be recalled that you submitted a study proposal entitled ***"Assessment of treatment outcome and determinants of pediatric severe acute malnutrition patient at Yekatit 12 Hospitals, Addis Ababa Ethiopia"*** for ethical approval by the School's Ethical Review Board (ERB). The Board thoroughly reviewed the proposal based on its operational guidelines and found it to fulfill all ethical requirements stipulated in the guidelines. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Arebu Issa

Chairperson, ERB

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City Government of Addis Ababa Health Bureau

Ref.No [illegible]/2/266/222
Date 10/02/[illegible]

TO:

- **Yekatit 12 Medical College Hospital**

Addis Ababa

Subject: Request to access Facilities to conduct approved research

The letter is to support **Adugnaw Mulu** of **"Assessment of Treatment Outcome and Determinants of Pediatric Severe Acute Malnutrition Patient at Yekatit 12 Hospitals, Addis Ababa Ethiopia** " The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

With Regards

Dr. Yohannes W/Kidan

Ethical Clearance Committee

Cc

- Adugnaw Mulu
- **To Ethical Clearance Committee**

Addis Ababa

CamScanner

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Yekatit 12 Hospital Medical College

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Research and Publication office

Ref. No: Y12HMC/RPO/013/2019

Date: December 03, 2019

To: School of Pharmacy
College of Health Sciences, Addis Ababa University
Addis Ababa, Ethiopia

Protocol title: Assessment of treatment outcome and determinants of pediatric sever acute malnutrition patients at Yekatit 12 Hospital, Addis Ababa, Ethiopia

The Institutional Review Board (IRB) of Yekatit 12 Hospital Medical College has thoroughly reviewed the research protocol stated above and granted ***full approval*** for a period of one year (**December 03, 2019 to December 02, 2020**). The study should comply with standard international and national scientific ethical guidelines. Any change to the approved protocol or consent form must be approved through the amendment process prior to its implementation. Any adverse or unanticipated events should be reported within three days to the IRB of the college. Please ensure that you submit biannual report once in six months and renewal application 30 days prior to the expiry date.

We, therefore, request you to ensure the commencement and conduct of the study accordingly and wish for the successful completion of the project.

Regards,

ዶ/ር አለም አብርሃ
Dr. Alem Abrha Kalayu (PhD)
Assistant Professor of M/Microbiology
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Research and Publication Coordinator