

Addis Ababa University College of Health Sciences School of Public Health

**Treatment Outcomes and Its associated factors among Children with
Severe Acute Malnutrition at Therapeutic Feeding Units of Regional
Hospitals of Addis Ababa, Ethiopia**

By: Hiwot W/Kidan Ayalkibet

**A Thesis submitted to Addis Ababa University, College of Health Sciences,
School of Public Health, in Partial Fulfillment of the Requirements for
Master Degree in Public Health**

Addis Ababa Ethiopia

October 2018

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ACKNOWLEDGEMENTS

God! No one is like you. All the ups and downs in the journey of my study turned into success by your mercy and grace. Thank you Almighty God, as this is the only word you seek from me for all your priceless gifts.

I express my genuine gratitude to my advisor Prof. Fikre Enquoselassie, for his consistent guidance, encouragement and critical reviews while developing the proposal and for giving constructive and valuable comments and suggestions that shaped this thesis.

I am also deeply grateful to Yekatit 12 and Zewditu memorial hospitals staff members and data collectors for providing all necessary materials and information for my work. I am also thankful to Addis Ababa health bureau ethical clearance committee for their valuable comments.

I am very much indebted to Firehiwot Amare and Yeshialem Adafrie for their material and moral support to bridge the gaps in my study. Lastly, my special thanks go to my lovely husband Getahun Mengistu for his wholehearted encouragement and always being anxious to see my success.

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ACRONYMS AND ABBREVIATIONS

CHD	Chronic Heart Disease
DHN	Dehydration
EBF	Exclusive Breast Feeding
EDHS	Ethiopian Demographic Health Survey
FMOH	Federal Ministry of Health
GDD	Growth Development Delay
H/A	Height for Age
MUAC	Mid-Upper Arm Circumference
OTP	Outpatient Therapeutic Program
TFU	Therapeutic Feeding Unit
TB	Tuberculosis
SAM	Severe Acute Malnutrition
SD	Standard Deviation
UN	United Nations
UNICEF	United Nations Children's Fund
W/H	Weight For Height
WFP	World Food Program
WHO	World Health Organization

ABSTRACT

Background: Nearly 17 million children are affected by severe acute malnutrition worldwide. Ethiopia is one of the countries with highest under five child mortality rate, with malnutrition underlying to 28% of all children deaths. Overall, 10 percent of children in Ethiopia are wasted, and 3 percent are severely wasted (below -3 SD). This study provides an insight regarding the overall management SAM & help to improve the management of severe acute malnutrition in the hospitals.

Objective: This study aimed to assess treatment outcomes and factors associated with recovery among children with severe acute malnutrition at the therapeutic feeding unit of regional hospitals of Addis Ababa, Ethiopia.

Methods: A cross-sectional study was conducted using retrospective data at Yekatit 12 and Zewditu memorial hospital therapeutic feeding unit. About 544 children aged less than 59 months old who have been admitted since January 1, 2013 up to December 31, 2017 for management of severe acute malnutrition were used. One population proportion sample size determination formula was used. Factors associated with treatment outcome were assessed using binary logistic regression. Descriptive statistics was used to show distribution of variables.

Results: Among 544 admitted children to therapeutic feeding unit included in the study 77.4% were cured, 13.2% were dead, 4.6% transferred out and 4.8% were defaulted. The odd of recovery was decreased by 59% among orphan children with severe acute malnutrition. Longer duration of hospital stay and attachment of follow-up chart to the individual folder was also positive indicator of recovery but children with HIV, Tuberculosis, dehydration and stunting were less likely to recover. In addition, being unvaccinated and not exposed to sunlight were significant factors that influence recovery of the children admitted in TFU.

Conclusion: The recovery of SAM in the hospitals was in the acceptable range. On the other hand their death rates were beyond the international acceptable range. Tuberculosis and HIV /AIDS co morbidities were statistically significant factors that hinder recovery rate of malnourished children.

Keywords: sever acute malnutrition; treatment outcome; regional hospital; Addis Ababa

1. INTRODUCTION

1.1. Background

Malnutrition is abnormal physiological condition caused by deficiencies, excesses or imbalances in energy, protein and/or other nutrients (1). Malnutrition is also defined as a state in which the physical function of an individual is impaired to the point where he/she can no longer maintain adequate body performance processes such as growth, pregnancy, lactation, physical work, and resisting and recovering from disease. Malnutrition is categorized as acute (recent) or chronic (long term). It can be either under-nutrition or over-nutrition (obesity). There are four forms of under-nutrition: acute malnutrition, stunting, under-weight and micronutrient deficiencies. This can also be categorized as either moderate or severe malnutrition and can appear isolated or in combination, but most often overlap in one person or population (2).

Severe Acute Malnutrition (SAM) is defined as weight-for-height (W/H) ratio of less than -3 standard deviations (SD) below the median reference population or W/H of below 70% or presence of nutritional oedema or by mid-upper arm circumference (MUAC) value of less than 110 mm in children aged 6 - 59 months (3, 4).

There are nearly 800 million people who suffer from hunger worldwide, the vast majority in developing countries. It is estimated that there are nearly 232.5 million who suffer from hunger worldwide in 2015 in Africa (5).

The poor nutritional status of children and women continues to be a serious problem in Ethiopia. Overall, 10 percent of children in Ethiopia are wasted, and 3 percent are severely wasted (below -3 SD). The health sector has increased its efforts to enhance good nutritional practices through health education, treatment of extremely malnourished children, and provision of micronutrients (6).

There are two treatment modality of SAM in which Patients with failed appetite, and/or with a major medical complication are initially admitted to an in-patient facility to treat the complications and stabilize their clinical situation. Whenever patients have good appetite and

no major medical complication or do not have +++ oedema and marasmic kwashiorkor they enter to the out-patient treatment program (OTP) directly. The children that were initially admitted to in-patient are also transferred to outpatient once the complications are addressed and appetite is regained (7).

1.2. Statement of the Problem

Childhood under nutrition increases the risk of childhood morbidity and mortality, impairs cognitive development, adult productivity and may also increase the risk of certain diseases in adulthood (8).

It is clear that SAM is an important global health problem. Worldwide trends show that malnutrition and lack of sanitation contribute to over half of all under-five deaths (8). This is so obvious with a visit to almost any hospital in a developing country where it is likely that severely malnourished children comprise a significant proportion of pediatrics deaths (4).

According to UNICEF 2015, globally, approximately 2.9 million children accessed treatment in 65 countries in 2013 that is only about 17 percent of the children needing treatment. Children with SAM are 9 times more likely to die than well-nourished children (9). Scaling up access to critical nutrition interventions such as the treatment of SAM is paramount to achieve the global target of reducing and maintaining childhood wasting to less than 5 percent. This underscores the urgent need to increase actions to strengthen country-level capacities to scale-up access to the treatment of SAM alongside preventive actions to protect the nutritional status of children (9).

Ethiopia is one of the countries with highest under five child mortality rate, with malnutrition underlying to 28% of all children deaths(10). The management of SAM is critical for child survival and is a key cost-effective component of the scaling up nutrition framework for addressing malnutrition. Governments face great challenges in building capacity and providing sufficient resources to prevent and treat acute malnutrition (9).

Majorities of children with SAM are presented to hospital or health center to be treated at TFU and OTP. But, due to many factors including late presentation of cases, co-morbidities and error in managing; many children are dying any way. Moreover, the major determining factors for poor treatment outcomes are not well understood (11).

This study attempted to assess treatment outcomes and factors associated with treatment outcome among children with severe acute malnutrition at the therapeutic feeding unit of regional hospitals of Addis Ababa.

1.3. Significance of the Study

Even though there are many studies conducted about treatment outcome of SAM at OTP in some health centers, there is scarcity of studies on outcome of inpatient SAM treatment at higher hospitals in Addis Ababa. Since the hospital and the health center set up and their way of managing SAM is deferent it is difficult to generalize health centers studies with hospitals. It's also difficult to generalize studies conducted in other parts of Ethiopia with Addis Ababa since Addis Ababa has different socio economic status. The study helps to assess the treatment outcome of SAM and identify factors associated with treatment outcome among children attending the TFU of regional hospitals of Addis Ababa. Hence, the input from the study will help to provide data to health care providers on the success of treatment and factors associated with treatment outcome of SAM in the TFU program. It will also provide an insight regarding the overall management of SAM and characteristics of patients attending the TFU of the hospitals.

Therefore, the information derived from the study can be used to improve the management of SAM in the TFU of the hospitals and for policy implementation, program planning and as a base line for further study.

2. LITERATURE REVIEW

2.1. Background of SAM

Acute malnutrition leads to changes in the body related to cellular composition, tissue and organ functions and increases vulnerability to infections. A severely malnourished child is likely to have various health problems (7). SAM can directly cause death or indirectly increase the fatality rate in children suffering from diarrhea and pneumonia (4).

While a significant number of acutely malnourished children live in countries where cyclical food insecurity and protracted crises further exacerbate their vulnerability, many more are in developing countries not affected by emergencies. The result is significant barriers to sustainable development in these nations (9).

2.2. Epidemiology of SAM

Globally it was estimated that over 17 million children were affected by SAM and approximately 875,000 deaths, or 12.6% of all deaths in children under the age of five, can be attributed to acute malnutrition (8, 9).

Severe acute malnutrition is a common indication for hospital admission among pediatric patients in sub-Saharan Africa. In Ethiopia, severe acute malnutrition is the primary diagnosis in 20% of pediatric hospital admissions (4), while 41.4% of preschool-aged children are affected by malnutrition of any degree (12).

Overall, 10 % of children in Ethiopia were wasted, and 3 % are severely wasted (below -3 SD). Regional variations exist, with Somali and Afar having the highest percentages of children who are wasted, 23 % and 18 %, respectively (6).

Wasting or acute malnutrition is highest in children less than 6 months of age and children age 12-17 months (15 % and 14 %, respectively) and lowest in children age 36-47 months (5 %). Male children are slightly more likely to be wasted (10 %) than female children (7 %) (6).

2.2. Treatment Outcome of Child with SAM Admitted to Therapeutic Feeding Unit

Based on the study conducted in St. Mary's hospital Lacor, Northern Uganda TFU, from a total of 251 severely malnourished hospitalized children, 168 (66.9 %) were successfully discharged as cured, 30 (11.9 %) died, and the rest had potentially unsatisfactory outcome comprising defaulting treatment (8.0 %), transfer out (9.6 %), and non-response (3.6 %) (13).

According to the study conducted in Woldia hospital TFU, from a total of 324 children admitted with SAM, 275(85%), 21(6%), 15(5%) and 13(4%) cases were cured, died, defaulted and transferred out respectively (14).

The study conducted in Felege Hiwot referral hospital, Bahir Dar revealed that the recovery rate was 58.4%. Among the recovered 234 SAM children, 118 (50.4%) were males and 116(49.6%) were females. Recovered edematous children had the longest mean length of stay which was 19days (± 6.5 days) and the highest mean weight gain of 9.9kg (± 2.5 Kg). Mean length of stay for severely wasted children was 17days (± 6 days). More than half (63.1%) of the children enrolled into the study had severe wasting and 36.9% had edema (kwashiorkor or marasmic kwashiorkor) (15).

Based on study conducted in Gondar university tertiary hospital TFU, among 298 children admitted with severe acute malnutrition reported that 68.5% of children were cured, 19.8% were defaulters and 11.7% were died (16).

The study conducted among admitted SAM cases in Zewditu memorial hospital revealed that the predominant age group suffered from marasmus was the infants (75.4%) while kwashiorkor was prevalent during the second and third year and the difference noted was statistically significant. Death occurred in 21.3% of the cases suggesting that mortality rate was higher than the acceptable range (17).

According to study conducted in Debre Markos and Finote Selam hospitals, out of 253 children whose records were reviewed, 197 (77.9%) were recovered, 14(5.5%) died during treatment, 31(12.3%) defaulted and 11(4.3%) transferred from treatment centers (18).

Study conducted in Jimma University specialized hospital showed that improvement, death and defaulter rate were 77.8, 9.3 and 12.9 % respectively. From this 9.3% death rate, 27.3 % was in the first 48 h and 60.2 % was by the end of the first week). The median duration from admission to death was 7 days (19).

Regarding the treatment outcome of children admitted in Yirgalem hospital for severe acute malnutrition clinical management 78% were cure , 16.2% were dead, 3.1% transferred out and 2.6% were defaulted (20).

2.3. Factors associated with treatment outcome of SAM

Study conducted in St. Mary's hospital Lacor, Northern Uganda TFU showed that, SAM children who were HIV/AIDS infected (OR: 3.087, $p = 0.010$) were significantly more likely to die during treatment compared to their HIV negative counterparts who were more likely to have a successful outcome (13).

According to study conducted in Woldia Hospital, North Ethiopia, admission category of the child and HIV/AIDS status were significant predictors of recovery and death rate. Edematous children were less likely (or the probability of recovery was reduced by 73% among edematous children as compared to wasted children) to be cured than wasted children. Severely malnourished children co-morbid with HIV/AIDS were less likely to be cured as compared to not co-morbid with HIV/AIDS. HIV infection was a predominant factor that compromised recovery rate and increased mortality rate. Nevertheless, age of the child, pneumonia, anemia, heart failure and TB infection were showed association with recovery and death rate but the associations were not statistical significant. The most common sign of infection at admission was fever (16%), followed by hypothermia (1.9%). The most common

co-morbidities accompanied with SAM at admission were diarrhea (43.2%), pneumonia (29%), HIV infection (6.2%) and TB (4%). Diarrhea (73.6%) was found with a significant higher frequency in children with marasmus (14).

Based on the study conducted in Felege Hiwot referral hospital, those children who were fully (AOR= 4.12; 95% CI: 1.64, 10.35) and partially (AOR= 7.16; 95% CI: 1.97, 25.25) vaccinated for age had better recovery rate than those children who hadn't been vaccinated. Edematous children (AOR= 0.46; 95% CI: 0.22, 0.95) were less likely to be recovered than wasted children. The overall length of stay (AOR= 1.09; 95% CI: 1.05, 1.12) for the entire cohorts of children with SAM was significantly associated with recovery rate; for a one day increase in stay in the therapeutic feeding units, the recovery rate would increase by 9%. At admission, children who were presented with co-morbidity were 84% times less likely to be recovered than children without co-morbidities at admission. Severely malnourished children co-morbid with HIV/AIDS and tuberculosis were less likely to be recovered. Lastly, children who did take vitamin-A as routine medication were 2.8 times more likely to be recovered as compared to those who did not take vitamin-A (AOR = 2.84; 95% CI: 1.41, 5.72). The most commonly administered routine medications were ampicillin and gentamycin (75.6%), vitamin-A (71%), and folic acid (95%). Children who presented with diarrhea were also received Zinc (28.8%) in addition to routine medications (15).

Results from multivariate analysis in Gonder university tertiary hospital showed that children with severe acute malnutrition who had acute gastroenteritis and HIV/AIDS comorbidities were about three and ten times more likely to die (AOR = 2.79, 95% CI: 1.31, 5.96), (AOR = 9.61 95% CI: 1.48, 62.32) respectively as compared to their counterparts (16).

Zewditu memorial hospital study showed that presence of diarrhea (AOR= 3.5, 95% CI: 1.2, 10.2), edema (AOR= 0.2, 95% CI: 0.1, 0.9), stunting (AOR= 3.3, 95% CI: 1.2, 8.2) and short mean duration of hospital stay (AOR= 4.4, 95% CI: 2.0, 10.1) were predictors of death outcome (17).

Based on the study conducted in Debre Markos and Finote Selam hospitals, those children age from 24 to 35 months had 34% lower probability of recovery from SAM compared to 6–11 months old children (AHR = 0.66, 95% CI: 0.35, 0.89). Children whose ages from 36 to 59 months had 47% lower probability of recovery from SAM compared to 6–11 months old children (AHR = 0.53, 95% CI: 0.31, 0.91). HIV negative children had 2.48 times higher probability of getting recovered from SAM compared to HIV positive children (AHR = 2.48, 95% CI: 1.23, 5.01). Children who didn't take folic acid supplement had 65% lower probability of recovery from SAM compared to children who took folic acid supplement (AHR = 0.35, 95% CI: 0.14, 0.89) (18).

According to the study conducted in Jima university, the main predictors of earlier hospital deaths were age less than 24 months (AHR = 1.9, 95 % CI: 1.2, 2.9), hypothermia (AHR = 3.0, 95 % CI: 1.4, 6.6), impaired consciousness level (AHR = 2.6, 95 % CI: 1.5, 4.5), dehydration (AHR = 2.3, 95 % CI: 1.3, 4.0), palmar pallor (AHR = 2.1, 95 % CI: 1.3, 3.3) and co-morbidity/complication at admission (AHR = 3.7, 95 % CI: 1.9, 7.2) (19).

Based on the study conducted Yirgalem hospital, presence of dermatosis ($\chi^2=5.13$ & P-value=0.02), admission body temperature ($\chi^2=8.12$ & P-value=0.04), tuberculosis co-infection ($\chi^2=4.15$ & P-value=0.04) and multi-chart completeness ($\chi^2=5.42$ & p-value=0.02) were found associated with treatment outcome of SAM clinical management (20).

According to study conducted in Sekota hospital, children with severe anemia (<4 gm/dl) had more than six and half times hazard of death when compared to those with no anemia (AHR=6.71, 95% CI = 3.22, 13.97). Moreover children with moderate anemia were more than four and half times hazard of death when compared to children with no anemia (AHR=4.71, 95% CI = 2.38, 9.60). Furthermore the hazard of death due to TB was about three times as compared to children with no TB (HR = 2.88, 95% CI = 1.72, 4.65) (21).

Ricketts is often considered a rare disease in tropical regions because of the role of sunlight in synthesis of vitamin D (22). Available evidence suggests an association between vitamin D deficiency and risk of pneumonia, acute lower respiratory tract infections, and diarrhea among

children and mortality among adults (23). Rickets is common among children with complicated SAM and associated with stunting. It is associated with increased risk of death (HR =1.61, 95% CI: 1.14, 2.27) and hospital admissions with severe pneumonia (24).

In general study that were conducted in different parts of Ethiopia shows some factors that shows significant association with recovery of SAM children including, HIV/AIDS, TB, presence of edema, stunting and history of vaccination. In this study the above variables and additional variables like history of being orphan, sun exposure and attachment of follow up chart to the individual folder was assessed to identify factors that associated with recovery.

2.4. Conceptual Framework

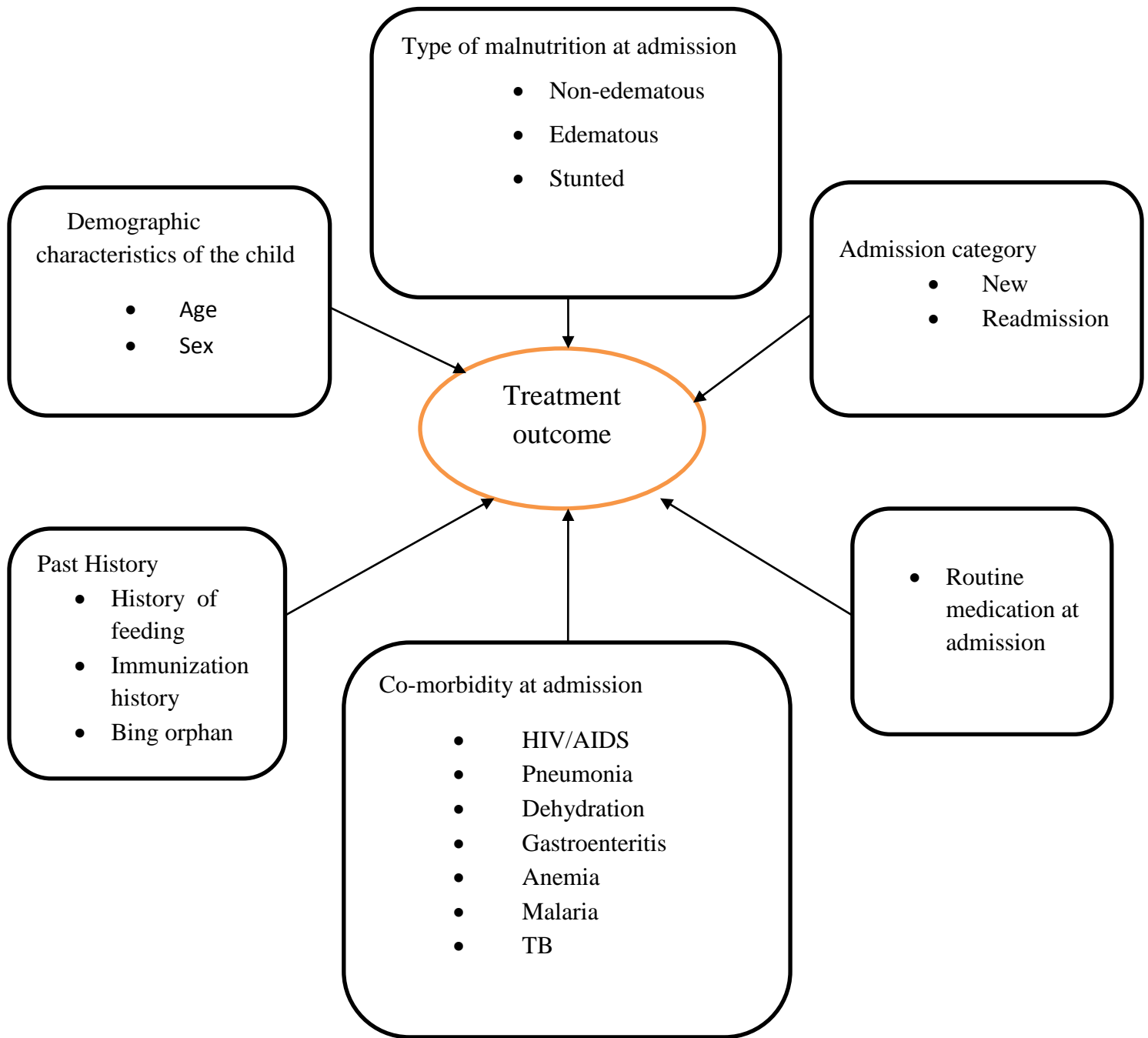


Figure 1 Schematic presentation of the conceptual framework developed by reviewing related literature (15-18).

3. OBJECTIVES

3.1. General Objective

To assess treatment outcome and associated factors among children with severe acute malnutrition at the therapeutic feeding unit of regional hospitals of Addis Ababa during the period of January 1, 2013 up to December 31, 2017.

3.2. Specific Objectives

- To assess treatment outcome among children with severe acute malnutrition at regional hospitals of Addis Ababa
- To identify factors associated with recovery among children with severe acute malnutrition

4. MATERIALS AND METHODS

4.1. Study Design

Cross-sectional study was conducted using retrospective data at Yekatit 12 and Zewditu memorial hospitals therapeutic feeding unit. The study was conducted from February 2018 up to April 2018.

4.2. Study Setting

Addis Ababa is the capital and biggest city of Ethiopia. It consists of estimated population of 6.6 million in 2017, as per the 2007 population enumeration, with yearly growth rate of 3.8%. This number has been expanded from the initially published 2,738,248. The city has 527 km² area with an altitude of 2,355 m.a.s.l (25). It has 10 sub-cities & 116 woredas and has different government health facilities including 14 hospitals and 95 public health centers. In addition to these, 36 private hospitals, 4 non-governmental hospitals, 31 NGO's clinics and about more than 700 private owned clinics were found in the city. From the above public health facilities, 6 of the hospitals are regional hospitals which are under Addis Ababa health bureau.

Yekatit 12 and Zewditu memorial hospitals are the only regional hospitals in Addis Ababa that give inpatient management service for SAM. The hospitals serve around 1.5 million and 169,272 populations respectively. The hospitals have arranged 57 and 38 beds for pediatric, of which 12 and 6 bed is isolated for severe malnutrition patient respectively. Both hospitals have well equipped and trained health care workers for the management of SAM and uses standardized management protocol of severe acute malnutrition that is update by FMOH in 2014 (7). According to this protocol, all SAM cases with co morbidities and poor appetite was admitted in the hospital for in patient management. The hospitals have isolated TFU classes, assigned trained nurses and necessary equipment for preparation of formula milk in the pediatric ward.

4.3. Study Population

4.3.1. Source population

All medication records of children with SAM who have been under therapeutic feeding unit of Yekatit 12 and Zewditu memorial hospitals.

4.3.2. Study subject

All medical records of children with SAM who have been under TFU at Yekatit 12 and Zewditu memorial hospitals inpatient since January 1, 2013 up to December 31, 2017 was the study population. Child aged less than 59 months old who have been admitted for management of SAM and have completed their registers were included. Those children with incomplete registers were excluded from the study.

4.3.3. Sample size determination

Sample size is calculated using the following formula.

$$n = \frac{Z_{\alpha}^2 P(1-P)}{d^2}$$

Where: n=Sample size

Z= is the standard normal value at the level of confidence, 95% confidence level

P=Point estimate of treatment outcome

q =1-p

d= Desired degree of error

Sample size was determined using the following assumptions:-

- From previous study, an average recovery rate in admitted under-five children with SAM to be 85%, P=85% (0.85) (14).
- The Z statistics value =95% (1.96).
- In order to maximize level of precision of my study, the possible minimum margin of error (d) was used 3% or 0.03.

$$\text{Hence, } n = \frac{(1.96)^2 * 0.85(0.15)}{(0.03)^2}$$

$$n = 544$$

4.3.4. Sampling procedure

Study population was selected by using systematic random sampling. All medical records for patients who attended in Yekatit 12 and Zewditu memorial hospitals inpatient therapeutic feeding unit from January 1, 2013 to December 31, 2017 were listed based on the sequence of their card numbers. Then study units were selected through proportional allocation to size for each hospital by calculating the interval from the sampling frame N (Yekatit, N=1437 and Zewditu N=564) and sample size n ($k=N/n$). The interval ($k=4$) is similar for each year. The first number to start with was selected randomly. The total no of sample size (544) was divided proportionally in to the hospitals. Those children who have incomplete data in their cared were substituted with other cared with the nearest cared number during data collection.

Table1. Distribution of sample size across selected hospitals with their admission period

S.No.	Period	Total no. of SAM admitted		Number of samples selected		Total no of samples selected
		Yekatit 12	Zewditu memorial	Yekatit 13	Zewditu memorial	
1	2013	217	118	59	32	91
2	2014	273	85	74	23	97
3	2015	337	117	92	31	123
4	2016	254	112	70	31	101
5	2017	356	132	96	36	132
Total		1437	564	391	153	544

4.4. Data Collection

4.4.1. Study Variables

➤ **Dependent variables**

- Treatment outcome (recovery)

➤ **Independent/explanatory variables**

1. Socio-demographic characteristics of the child

- Age

- Sex
2. Admission category
 - New
 - Readmission
 3. Type of malnutrition at admission
 - Non-edematous
 - Edematous
 - Stunted
 4. Medical complication on admission like HIV/AIDS, pneumonia, dehydration, gastroenteritis, anemia, malaria and TB.
 5. Past history the child like history of feeding ,orphan, sun exposure and Immunization
 6. Routine medications at admission
 7. Length of stay

4.4.2. Operational definitions

Co-morbidity: additional medical problem with severe acute malnutrition (26).

Death: Patient that has died while he/she was in the program in a facility (26).

Defaulter: patient left the therapeutic feeding center before completing the treatment (26).

Kwashiorkor: is severe under nutrition or malnutrition in children resulting from a diet excessively high in carbohydrates and low proteins(26).

Marasmus-Kwashiorkor: (W/H<70% with oedema or MUAC<11cm with oedema) (26).

Medical transfer: patient that is referred to a health facility /hospital for medical reasons (26).

New admission: patient that are directly admitted to therapeutic feeding center to start a nutritional treatment (26).

Recovered: weight for height of more than or equal to 85% of the median WHO growth reference, absence of bilateral pitting edema and no medical complication (26).

Readmission after defaulting: if the patient previously absconded before reaching the discharge criteria and is re admitted to be therapeutic feeding center (26).

Sever wasting or marasmus: W/H less than -3 SD (z scores) or less than 70% of the median WHO growth standard, or MUAC less than 110mm in children aged 6-59 months (26).

Stunting: individuals whose height is below the average expected height for their age (26).

Treatment Outcome: Evaluation undertaken to assess the result or consequence of management and procedure used in combating disease in order to determine the efficiency, effectiveness, safety and practicability of these interventions in individual case or series (27).

4.4.3. Data collection instrument

A data abstraction format was used to collect the necessary information from patients' medical record (annex I).

4.4.4. Data collection technique

A medical record review was performed and data collection form was developed from inpatient therapeutic feeding registration book; individual follow up chart being used in the stabilization unit and baseline previous study (15-18). Then a data abstraction format was completed for each eligible patient card. Information regarding demographic characteristics of the patients, clinical characteristics of children at admission, other medical complication at admission and other related data was gathered from the sampled individual patient's card. A total of two days training was given for all data collectors. The overall activities were controlled by the principal investigator.

4.4.5. Data Collectors

Data was collected from patient cards by data collectors who were trained on techniques of data collection. Four nurses were selected from Yekatit 12 Hospital and Zewditu Memorial hospital for data collection since they have a medical background.

4.5. Data Processing and Analysis

4.5.1. Data processing

Data were coded, entered and analyzed using Statistical Package for Social Science (SPSS) version 24.

4.5.2. Data analysis

Descriptive analysis was carried out to describe the patient's baseline characteristics and summarized as frequencies, proportions, means and SD. In the binary logistic regression analysis odds ratios (OR), 95 % confidence intervals (CI) and p-values were used to determine the factors that were associated with treatment outcome. Variables with $P < 0.25$ in the bivariate analysis were included in the model at multivariate analysis. A p-value of less than 0.05 was considered statistically significant. Results were summarized and presented in graphs and tables.

4.6. Data Quality Control

To ensure the data quality, pre-test was conducted on 27 (5%) of the total sample at Yekatit 12 hospital to ensure the agreement of the data abstraction format with the need of the study. Any error found during the process of pre-test was corrected and modification was made into the final version of the data abstraction format. Data was cleaned by using SPSS version 24 through sorting and running frequency.

4.7. Ethical Consideration

Before starting data collection and preliminary study, ethical clearance was obtained from Addis Ababa University College of health sciences school of public health and Addis Ababa health bureau ethical review committee. In addition to this, permission was obtained from Yekatit 12 and Zewditu Memorial hospitals. The study was conducted through a review of records. To ensure confidentiality, name and other identifiers of patients, physicians and other health care members who examine the patient was not recorded on the data abstraction format.

4.8. Dissemination of Research Finding

The finding of the research will be submitted to the Addis Ababa university college of health sciences school of public health; Addis Ababa health bureau and to the hospitals. Publication of the research finding will also be considered

5. RESULTS

5.1. Demographic Characteristics

From a total of 544 children who were admitted to TFU from January 1, 2013 to December 31, 2017; 54.4% of children enrolled into the study were males. About 54.2% of children were in the age group of 6–24 months with mean age of 13.4 months (SD = ± 11.87 months).

Table 2 Distribution of demographic characteristics among admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Frequency	Percent (%)
Age	< 6 month	174	32.0
	6-24 month	295	54.2
	>=24 month	75	13.8
Sex	Male	296	54.4
	Female	248	45.6

5.2. Type of Malnutrition at Admission

About 387 (71.1%) of children admitted to TFU had non-edematous, type of severe acute malnutrition at admission. In addition 289(53.1%) of the children admitted to TFU were stunted (Table 3).

Table 3. Type of malnutrition among admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Frequency	Percent (%)
Admission category	New	518	95.2
	Readmission	26	4.8
Type of Malnutrition	Non-edematous	387	71.1
	Edematous	157	28.9
Stunting	Stunted	289	53.1
	Not stunted	255	46.9

5.3. Past History of the Patient

About 294(54%) of children admitted TFU were exclusively breast feed until the age of six month. Among admitted children 75(13.8%) were orphans. Concerning vaccination history: 355(65.3%) were fully vaccinated and 55(10.1%) were not vaccinated for age as shown in Figure 2. From children admitted TFU 373(68.6%) of the child were exposed to sun light as presented in Table 4 below.

Table 4. Distribution of past history of the patient among admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Frequency	Percent (%)
Feeding	EBF	294	54.0
	Not EBF	194	35.7
	Unknown	56	10.3
Orphan	Yes	82	15.1
	No	462	84.9
Sunlight Exposure	Yes	380	69.9
	No	72	13.2
	Unknown	92	16.9

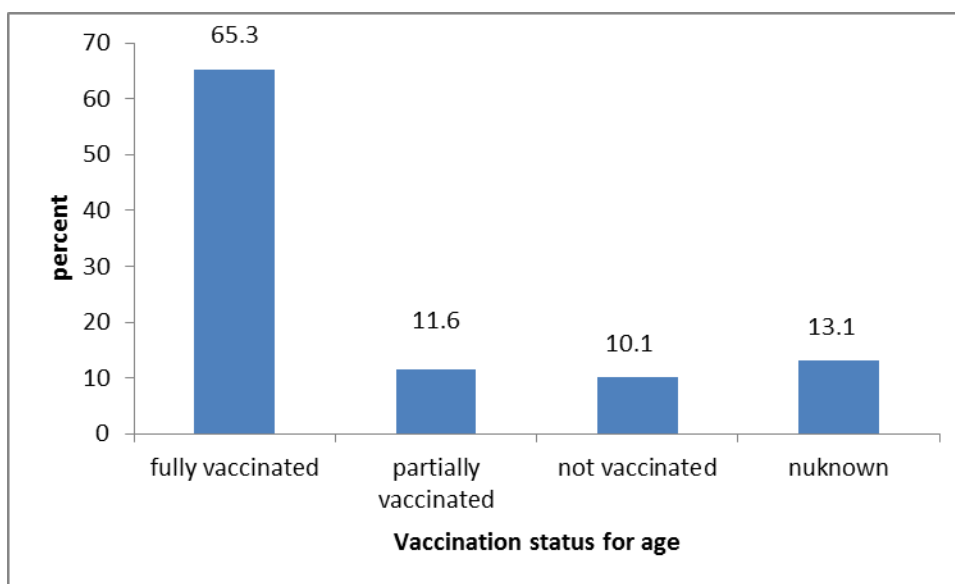


Figure 2. Vaccination for age status of SAM children admitted in the TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

5.4. Co-morbidity at Admission

Eighty six percent (86%) of children admitted to TFU had one or more co-morbidities at admission such as diarrhea (48.7), pneumonia (29.8) and anemia (54.8). In addition to these 12.5% of the children had skin lesion, 10.7% had GDD, 9.2% had rickets, 7.9% had microcephaly and 8.6% had CHD co-morbidity at admission (Table 5).

Table 5. Distribution of comorbidity among admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Frequency	Percent (%)
Diarrhea	Yes	265	48.7
	No	279	51.3
Pneumonia	Yes	162	29.8
	No	382	70.2
Anemia	Yes	298	54.8
	No	246	45.2
HIV/AIDS	Yes	35	6.4
	No	509	93.6
TB	Yes	18	3.3
	No	526	96.7
Skin lesion	Yes	68	12.5
	No	476	87.5
Rickets	Yes	50	9.2
	No	494	90.8
CHD	Yes	47	8.6
	No	497	91.4
Meningitis	Yes	17	3.1
	No	527	96.9
Sepsis	Yes	35	6.4
	No	509	93.6
Microcephaly	Yes	43	7.9
	No	501	92.1

5.5. Routine Medication at Admission

For management of children with SAM, the regional hospitals used the Ethiopian SAM inpatient management protocol. Based on that, those children admitted to TFU took different types of routine medication at admission such as folic acid (60.7%), vitamin A (51.3%), ampicillin and gentamycin (51.1%), and amoxicillin (36.0%) (Table 6).

Table 6. Distribution of routine medication provided to admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Frequency	Percent (%)
Amoxicillin	Yes	196	36.0
	No	348	64.0
Ampicillin & gentamycin	Yes	278	51.1
	No	266	48.9
Vitamin A	Yes	279	51.3
	No	265	48.7
Folic acid	Yes	330	60.7
	No	214	39.3
Deworming	Yes	56	10.3
	No	19	3.5
	Not applicable (children age <2 years)	469	86.2

5.6. Treatment Outcome

From a total of 544 children who were admitted to TFU from January 1, 2013 to December 31, 2017, about 421 (77.4%) were recovered and 72 (13.2%) were dead. The remaining 26 (4.8%) and 25(4.6%) were defaulter and medical transfer respectively as shown in Figure 3. Hence the final fate of defaulters and transferred cases were unknown; children who have cure and death outcome (n=493) were used to determine factors that affect the recovery rate of children with SAM.

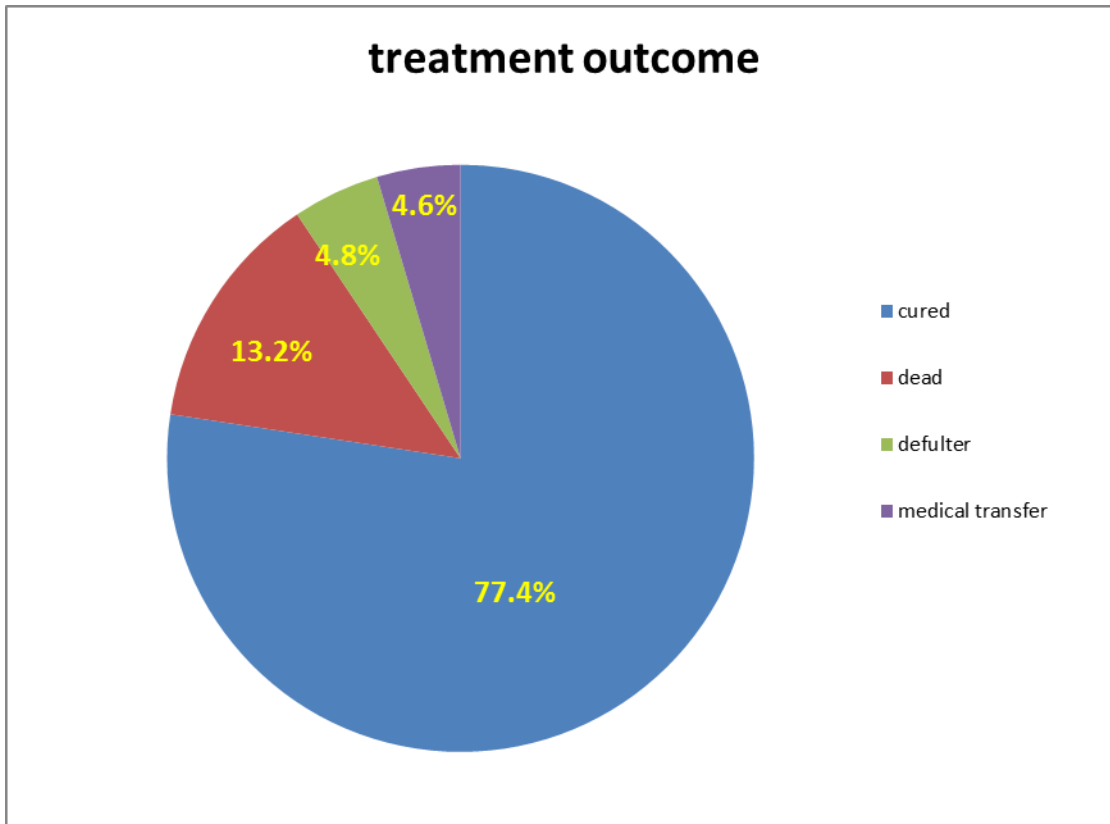


Figure 3. Treatment outcome of SAM cases admitted in the TFU of Regional Hospital, Addis Ababa from Ethiopia January 1, 2013 to December 31, 2017.

5.7. Factors Associated with Recovery Rate

The association of independent variables with the dependent variable was investigated using both bivariate and multivariate logistic regression technique. In bivariate logistic regression analysis; age, presence of stunting, diarrhea, dehydration, TB, HIV/AIDS, level of consciousness at admission, length of stay, history of breast feeding, sunlight exposure, vaccination, being orphan, follow up chart and routine medication like vitamin A, amoxicillin showed association with recovery rate (P - value less than 0.25) and hence were used in multivariate analysis.

The result of the multivariate analysis showed stunting to be significantly associated with recovery rate in that not stunted children were 4 times more likely (AOR= 3.90, 95% CI: 1.90, 8.37, P=0.00) to have recovery than those stunted. Children with DHN were 87% (AOR= 0.13, 95% CI: 0.05, 0.32, P=0.00) less likely to recover than those with no DHN. HIV/AIDS and TB comorbidity were found to have association with recovery, in those children with HIV/AIDS and TB were 86% (AOR= 0.14, 95% CI: 0.04, 0.50, P=0.00) and 93% (AOR =0.07, 95% CI: 0.02, 0.33, P=0.00) less likely to recover than their counter part respectively.

Vaccination and sunlight exposure also found to be significantly associated with recovery in which unvaccinated children were 72% (AOR= 0.28, 95% CI: 0.10, 0.78, P=0.01) and children who were not exposed to sunlight were 82% (AOR=0.18, 95% CI: 0.07, 0.47, P= 0.00) less likely to recover than those children with fully vaccinated for age and sunlight exposer respectively. Orphan children were 59% (AOR= 0.41, 95% CI: 0.17, 0.97, P= 0.04) less likely to recover than those children who were non orphan. Children with attachment of follow-up chart in their individual folder were 5 times more likely to recover than children without follow-up chart (AOR= 4.54, 95% CI: 1.42, 14.49, P= 0.01). Length of stay was also associated with recovery in that children who stayed longer than 21 days in the TFU were 7 times more likely to recover than children who stayed less than 21 days (AOR= 6.94, 95% CI: 2.56, 18.78, P= 0.00).

Table 7. Factors associated with recovery rate among admitted SAM cases in TFU at regional hospitals of Addis Ababa Ethiopia from January 1, 2013 to December 31, 2017

Characteristics	Category	Outcome (n=493)		COR (95%CI)	AOR(95%CI)
		Recovered n (%)	Dead n (%)		
Age	6-24 month	240(88.9)	30(11.1)		1
	< 6 month	127(80.9)	30(19.1)	0.53(0.31-0.92)	0.60(0.29-1.28)
	>=24 month	54(81.8)	12(18.2)	0.56(0.27-1.17)	0.48(0.19-1.23)
Stunting	not stunted	218 (92.8)	17 (7.2)	3.47 (1.95-6.18)	3.90(1.90-8.37)*
	stunted	203 (78.7)	55 (21.3)		1
Diarrhea	yes	193(82.1)	42(17.9)	0.61(0.36-1.00)	1.04(0.47-2.30)
	no	228(88.4)	30(11.6)		1
Dehydration	yes	72(69.9)	31(30.1)	0.27(0.16-0.46)	0.13(0.05-0.32)*
	no	349(89.5)	41(10.5)		1
HIV/AIDS	yes	19(67.9)	9(32.1)	0.33(0.14-0.76)	0.14(0.04-0.50)*
	no	402(86.5)	63(13.5)		1
TB	yes	11(61.1)	7(38.9)	0.25(0.09-0.67)	0.07(0.02-0.33)*
	no	410(86.3)	65(13.7)		1
Level of consciousness	conscious	363(87.3)	53(12.7)		1
	Lethargic	58(75.3)	19(24.7)	0.45(0.25-0.81)	1.45(0.58-3.62)
History of feeding	EBF	232(88.9)	29(11.1)		1
	Not EBF	141(79.7)	36(20.3)	0.53(0.31-0.89)	0.62(0.29-1.35)
	unknown	48(87.3)	7(12.7)	1.35(0.50-3.64)	3.04(0.50-18.56)
Vaccination	Fully vaccinated	282(86.8)	43(13.2)		1
	Partially vaccinated	45(84.9)	8(15.1)	0.86(0.38-1.94)	1.39(0.49-3.91)
	Not vaccinated	36(72.0)	14(28.0)	0.39(0.20-0.79)	0.28(0.10-0.78)*
	unknown	58(89.2)	7(10.8)	1.26(0.54-2.95)	4.07(0.95-17.48)
Sunlight exposure	yes	304(88.4)	40(11.6)		1
	no	43(68.3)	20(31.7)	0.31(0.17-0.57)	0.18(0.07-0.47)*
	unknown	74(86.1)	12(13.9)	1.22(0.57-2.62)	0.31(0.09-1.08)

Table 7. Factors associated with recovery rate among admitted SAM cases in TFU at regional hospitals of Addis Ababa (*cont...*)

Characteristics	Category	Outcome (n=493)		COR (95%CI)	AOR(95%CI)
		Recovered n (%)	Dead n (%)		
Orphan	yes	55(68.7)	25(31.5)	0.28(0.16-0.50)	0.41(0.17-0.97)*
	no	366(88.6)	47(11.4)		
Vitamin A	no	198(80.8)	47(19.2)	0.47(0.28-0.80)	0.60(0.31-1.16)
	yes	223(89.9)	25(10.1)		
Amoxicillin	yes	156(91.8)	14(8.2)	2.44(1.32-4.52)	0.99(0.45-2.16)
	no	265(82)	58(18)		
Follow up	yes	102(95.3)	5(4.7)	4.29(1.68-10.92)	4.54(1.42-14.49)*
	no	319(82.6)	67(17.4)		
Length of stay	> 21 days	113(89.7)	13(10.3)	1.67(0.88-3.15)	6.94(2.56-18.78)*
	<21 days	308(83.9)	59(16.1)		

6. DISCUSSION

This study aimed at identifying treatment outcome and factors associated with recovery among children aged 0-59 months with severe acute malnutrition admitted to regional hospitals of Addis Ababa.

The recovery rate of SAM in this study was found to be 77.4%, 13.2% death, 4.8% defaulter and 4.6% medical transfer. While, the acceptable reference value which has been developed by Sphere project (28) has: > 75% recovery, < 15% defaulter and < 10% death rates. This showed that except the death rate, the other outcome indicators in this study were within the recommended standard set of sphere project values/international standards.

In this study, the recovery rate (77.4%) is greater than the minimum acceptable range as compared to the international standard. Higher achievement in recovery rate was observed in this study as compared to similar studies in Felege Hiwot referral hospital (58.4%) (15) and Gondar university tertiary hospital (68.5%) (16). This difference may be due to the differences in health seeking behavior, availability as well as accessibility of therapeutic foods and medications and also use of updated SAM treatment guideline.

However, the recovery rate in this study is lower than the study conducted in Woldia hospital, which showed 85% recovery rate (14). The present study also found that higher mortality rate than reports from Debre Markos and Finote Selam hospitals (5.5%) (18), Woldia hospital (6%) (14) and Uganda (11.9%) (13). Since the study setup was at the referral hospital and high health seeking behavior of mothers in Addis, patient overload might account for the higher mortality rate in the current study. However, it is lower than report from previous study conducted in Zewditu memorial hospital (21.3%) (17).

Non-edematous was the most common type of severe acute malnutrition and identified in 71.1% followed by edematous 28.9%. Similar findings were also observed in Zewditu (17), Felege Hiwot (15), Gondar university tertiary hospitals (16). This (15) causes of malnutrition in most of Ethiopian town. The results from Zewditu (17), Felege Hiwot (15) and Gondar hospitals(16) showed that, recovery rate was lower for edematous malnutrition where as in

this study there was no relationship between type of malnutrition and treatment outcome which is in line with the finding of Jimma university specialized hospital (19), Debre Markos and Finote Selam hospitals (18).

Not-stunted children were 4 times likely to recover than children who were stunted (AOR= 3.99; 95% CI: 1.90, 8.37). The previous study conducted in Zewditu hospital (15) also support this finding as stunting (AOR= 3.3, 97% CI: 1.2, 8.2) was predictor of death. This due to the fact that nutrition is a critical determination of immune responses and malnutrition the most common cause of immune deficiency worldwide. Protein-energy malnutrition is associated with a significant impairment of cell-mediated immunity, phagocyte function, complement system, secretory immunoglobulin A antibody concentration and cytokine production. Deficiency of single nutrients also results in altered immune response: this is observed even when the deficiency state is relatively mild (29). Stunting is a chronic malnutrition that makes the recovery difficult (26).

Child vaccination status had showed statistically significant association with recovery rate. In this study finding, the odds of recovery was decreased by 72% among un-vaccinated children (AOR= 0.28; 95% CI: 0.10, 0.78). Study conducted in Felege Hiwot hospital (15) also support this finding as fully vaccinated (AOR= 4.12; 95% CI: 1.64, 10.35) children are likely to recover.

Exposure to sun light was significant association with recovery. The odd of recovery was decreased by 82% among SAM children who were not exposed to sun light (AOR= 0.18; 95% CI: 0.07, 0.47). Children unexposed to sunlight had got rickets that would frequently expose to series infection like severe pneumonia, diarrhea, which may hinder recovery of children from SAM (22-24).

The odd of recovery was decreased by 59% among orphan children with severe acute malnutrition (AOR= 0.41; 95% CI: 0.17, 0.97). This might be due to the fact that orphaned children will not get special attention and care as non-orphan. The child will not get breast feeding and appropriate follow up during illness and immunization.

Dehydration has significant association with recovery hence the odd of recovery was decreased by 87% among children who have dehydration (AOR= 0.13; 95% CI: 0.05, 0.32). The study conducted in Jimma university specialized hospital also support this finding in which dehydrated children were found to be 2.3 (AHR=2.3; 95% CI: 1.3, 3.9) (19) times more likely to die than children without dehydration. This might be due to the difficulty in differentiating the signs of dehydration in SAM patients. Misdiagnosis and mistreatment for dehydration is the commonest cause of death in child with SAM under treatment (7).

Severely malnourished children who had co-morbidity with HIV/AIDS were less likely to recover in which the odd of recovery was decreased by 86% (AOR= 0.14; 95% CI: 0.04, 0.50). This result is in line with the study done in Weldia hospital (AOR= 0.1; 95% CI: 0.03, 0.423) (14). Other studies in different hospitals also support this finding in which SAM children with HIV/AIDS comorbidity were likely to die; Gondar university tertiary hospitals (AOR = 9.61 95% CI: 1.48, 62.32) (16), Debre Markos and Finote Selam hospitals (AHR = 2.48, 95% CI: 1.23, 5.01) (18) and St. Mary's hospital Northern Uganda (OR: 3.087, p = 0.010) (13). This is due to the fact that HIV/AIDS co-morbidity by itself decreases immunity of the child and facilitates to death with malnutrition.

SAM Children with TB co-infection were less likely to recover than their counterparts in which the odd of recovery was decreased by 93% (AOR= 0.07; 95% CI: 0.02, 0.33). The study conducted in Sekota hospital reported that the risk of death due to TB co-morbidity among SAM was about three times as compared to children with no TB (HR= 2.88, 95% CI: 1.72, 4.65) (21) and Yergalem hospital ($\chi^2=4.15$ & P-value=0.04) (20). The similarity of the study finding may be due to similar pattern of TB distribution in Ethiopia.

In this study, children admitted in SAM TFU with an attached follow-up chart were 5 times more likely to recover than those children without follow up chart (AOR: 4.54; 95% CI: 1.42, 14.49). Study conducted in Yergalem hospital also support this finding ($\chi^2= 5.42$ & p-value=0.02) (20). This might be due to the fact that children with an attached follow up chart will have strict follow up status as directed by the discretion on the chart.

There was positive association between longer duration of hospital stay with recovery. SAM children who stay more than 21 days were 7 times more likely to recover than those children with shorter duration of hospital stay (AOR: 6.94, 95% CI: 2.56, 18.78). Study conducted in Felege Hiwot (AOR= 1.09; 95% CI: 1.05, 1.12) (15) and Zewditu hospital also support this finding in which short mean duration of hospital stay (AOR=4.4 95% CI: 2.0, 10.1) (17) was a predictor of death. This might be due to the late presentation of SAM children with comorbidity for TFU service.

7. LIMITATION OF THE STUDY

Due to incomplete nature of secondary data and inappropriate keeping of old registration books variables like percent of formula milk intake/day, frequency of fluid loss by diarrhea and vomiting per day, family educational status, maternal nutritional status , which might contribute on treatment outcomes were not addressed in this study. Since the study was analyzed using logistic regression model rather than cox-regression model it doesn't show the time effect of factors on the outcome of the study.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion

Even though recovery rates in the study area are above the cut of points of the minimum standard sets in humanitarian and disaster prevention (or the sphere standards), it is low as compared to similar studies conducted in different parts of Ethiopia and death rate is also higher than the international standard. TB and HIV co morbidities were statistically significant factors that hinder recovery rate of malnourished children. On the other hand, vaccination and exposure to sunlight were positive indicators for recovery. Attachment of follow-up chart to the individual folder and monitoring of the child progress with the chart also has greater contribution in improving recovery of children with severe acute malnutrition in the TFU.

8.2. Recommendations

Based on the above finding the following recommendations are forwarded for the concerned bodies:

- ❖ For Yekatit and Zewditu hospitals health care providers

The health care providers should give emphasis for those SAM cases with co morbidity like TB HIV and dehydration which need strict follow up according to the protocol and increase use of SAM management follow up chart for all SAM patients.

- ❖ For Yekatit and Zewditu hospital administrator

The hospitals shall adjust on time training and refresher programs for the health care provider regarding management of SAM. There is a need for continuous TFU program supportive supervision and evaluation.

❖ For Addis Ababa health bureau and federal ministry of Health

By working in deferent media, community mobilization must be done to combat TB, HIV, SAM and aware the community about the use of immunization. Special attention should be given for orphanage since they are non-breast feeder they are likely to be malnourished.

❖ For Researchers

As this is a hospital-based secondary data analysis, further prospective studies are needed to identify risk factors for treatment outcome of severe acute malnutrition at TFU.

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10. ANNEX I

Data Abstraction Format

This Data Abstraction Format is prepared for collecting information on Treatment Outcome and associated factors among Children with Severe Acute Malnutrition at the Therapeutic Feeding Units of Regional Hospitals of Addis Ababa, Ethiopia.

1. Interviewer name _____
2. Interviewer phone no _____
3. Hospital name _____
4. Date of data collection _____
5. Questionnaire identification number /_____/_____/

• Socio-demographic characteristics

1. Child's age _____ Months
2. Child's sex A. Male B. Female

• Vital signs at admission

- A. RR _____ breath/min C. T° _____ °C
B. PR _____ bet /min D. Not register

• Anthropometrical measurement at admission

- A. Child weight in kilogram _____ D. W/H at admission _____
B. Child height in centimeters _____ E. H/A at admission _____
C. MUAC in centimeters _____

• Medical complication at admission

1. Type of malnutrition at admission
A. Marasmic C. Kwashiorkor
B. Marasmic kwash D. Stunted
2. Child admission status A. New B. Readmission
3. Presence of edema A. Yes B. No
4. Presence of fever A. Yes B. No
5. Presence of sweating A. Yes B. No
6. Presence of cough A. Yes B. No C. If yes describe duration _____
7. Presence of diarrhea A. Yes B. No C. If yes describe duration _____

8. Presence of vomiting A. Yes B. No C. If yes describe duration _____
9. Presence of gastroenteritis. A. Yes B. No
10. Presence of oral ulcer A. Yes B. No
11. Presence of hypoglycemia A. Yes B. No
12. Presence of dehydration A. Yes B. No
13. Presence of pneumonia A. Yes B. No
14. Presence of Anemia A. Yes B. No C. if yes describe _____
15. Presence of measles A. Yes B. No
16. . Presence of malaria A. Yes B. No
17. Presence of HIV/AIDS A. Yes B. No
18. Presence of TB A. Yes B. No
19. Presence of sepsis A. Yes B. No
20. Presence of ricketts A. Yes B. No
21. CNS condition at admission A. Alert B. Lethargic C. unconscious/coma
22. Presence of other medical complication at admission (list) _____
-

• Past history of the patient

1. History of breast feeding before six month
- A. Exclusively breast feed until six month
 - B. Formula milk only until six month
 - C. Caw milk only until six month
 - D. Mixed feeding until six month
 - E. Unknown history
2. Being orphan A. Yes B. No
3. History of vaccination
- A. Vaccinated for age B. Not vaccinated
 - C. Partially vaccinated for age D. unknown

4. History of sun light exposure

- a. Yes
- b. No
- c. Unknown

5. **Routine medications during admission**

- 1. Presence of Ng tube A. Yes B. No
- 2. Does the child take Vit A A. Yes B. No
- 3. Does the child take Folic acid A. Yes B. No
- 4. Presence of IV antibiotic/s A. Yes B. No
- 5. If the answer for question number 4 is yes list _____
- 6. Does the child take Antibiotic/s (PO) A. Yes B. No
- 7. If the answer for question number 6 is yes list _____
- 8. Was the child dewormed with Albendazole or Mebendazole A. Yes B. No

6. Does follow up attached to the individual folder?

- A. Yes
- B. No

7. **Vital signs at discharge**

- A. RR _____ breath/min C. T° _____ °C
- B. PR _____ bet/min D. Not register

8. **Anthropometrical measurement at discharge**

- A. Child weight in kilogram _____
- B. Child height in centimeters _____
- C. MUAC measurement in centimeters ____
- D. W/H at discharge _____
- E. Not registered

9. **Treatment outcome at discharge**

- 1. Cured 3. Defaulter
- 2. Dead 4. Medical transfer

5. Other

10. Length of stay

1. Date of admission _____

2. Date of discharge _____

3. Length of stay at admission _____

Checked by supervisor; Name _____, Signature _____