**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCES**

**SCHOOL OF NURSING AND MIDWIFERY**

**DEPARTMENT OF NURSING AND MIDWIFERY**

# RECOVERY TIME FROM SEVERE ACUTE MALNUTRITION AND ASSOCIATED FACTORS AMONG UNDER-5 CHILDREN IN YEKATIT 12 HOSPITAL, ADDIS ABABA, ETHIOPIA.

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**A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCEs, DEPARTMENT OF NURSING AND MIDWIFERY FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER’S OF SCIENCE IN PEDIATRICS AND CHILD HEALTH NURSING.**

**JUNE 2019**

**ADDIS ABABA ETHIOPIA**

**ADDIS ABABA UNIVERSITY**

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| Full Title of the research project | Recovery time from severe acute malnutrition and associated factors among under-5 children in Yekatit 12 hospital, Addis Ababa, Ethiopia. |
| Duration of the study | **Two months** |
| Study area | Yekatit 12 hospital, Addis Ababa , Ethiopia |
| Budget proposed | *Birr* **36,291.15** |

# APPROVAL SHEET

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I, the undersigned MSc student, declare that I have submitted my original work on a title Recovery time from severe acute malnutrition and associated factors among under-5 children in Yekatit 12 hospital, Addis Ababa, Ethiopia for the examination.

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**APPROVAL BY THE BOARD OF EXAMINATION**

This thesis by **Mekonen Adimasu** is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in Pediatrics &child health nursing

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# ACKNOWLEDGEMENT

First of all, I would like to present my profound thanks to Almighty GOD for all the blessings in my life.

My thanks goes to Addis Ababa University College of Health Sciences, school of Nursing and Midwifery for giving and sponsoring me to attend this postgraduate program.

Secondly, I express my genuine gratitude to my advisors Mr. Girum Sebsbie (Asst. professor) and sir Fkirtemariam Abebe for their consistent guidance, encouragement and critical reviews while writing my thesis.

In addition, I am also deeply grateful to Yekatit 12 hospitals staff members for providing some necessary information for writing my thesis. I would like to extend my thanks for my colleagues and data collectors especially Mr. Wuletaw and Sr. Nigstie in advising and supporting to write my thesis.

# ACCRONYUM AND ABBREVIATIONS

**AGE-** acute gastroenteritis

**AHR**- Adjusted Hazard Ratio

**CD -** Comorbid Diseases

**CHD-** Congenital heart diseases

**CHR**- Crude Hazard Ratio

**DHN-**Dehydration

**EDHS-** Ethiopian Demographic and Health Survey

**FA-** Folic Acid

**FMOH-** Federal Ministry of Health

**IV- Intravenous**

**KM-**Kaplan-Meier

**MUAC-** Mid Upper Arm Circumference

**NGO-** Non-Governmental Organization

**OTP-** Out Patient Program

**ReSoMal-** Rehydration Solution for Malnutrition

**RCT-** Randomized Control Trial

**RUTF-** Ready to Use Therapeutic Food

**SAM**- Severe Acute Malnutrition

**SD-** Standard Deviation

**TB-** tuberculosis

**TFC**- Therapeutic Feeding Center

**TFU-** Therapeutic Feeding Unit

**UNICEF-** United Nations International Children's Emergency Fund

**WFA**- Weight -for -Age

**WFH**- Weight- for -Height

**WHO** - World Health Organization

**WHZ -** Weight-for -Height Z score

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# ABSTRACT

**Background:** Nearly 20 million under-five children are affected by severe acute malnutrition worldwide. In Africa, more than 14.0 million under-5 children are wasted, of which 4.1 million children are severely wasted. Ethiopia is one of the countries with highest under-five child mortality rate, with malnutrition underlying to 28% of all children deaths.

According to world health organization and the SPHERE project, at least 75% of children admitted due to SAM should be recovered and they should be recovered in less than or equal to 28 days.

O**bjective:** The main objective of this study was to assess recovery time from severe acute malnutrition and associated factors among under-5 children admitted and treated in Yekatit 12 Hospital.

**Method:** A retrospective cohort study was conducted in Yekatit 12 hospital. The study population was under-5 children with severe acute malnutrition who have been managed at Yekatit 12 hospital therapeutic feeding unit. The total sample size was 423 and quantitative pretested data abstraction format was used. Kaplan Meier analysis was used to estimate time to nutritional recovery; Log rank was used to test whether the observed difference of recovery time between different groups of predictor variables is significant or not; and Cox proportional-hazard regression analysis was carried out to determine independent predictors.

**Result:** The nutritional recovery rate was 81.3% and the median recovery time was 15 days (95% CI: 13.608-16.392). By controlling other factors, age, daily weight gain per Kg, vaccination status, comorbidities like pneumonia, stunting, shock, and deworming were significant predictors of nutritional recovery time.

**Conclusion:**

In conclusion, the overall death rate in this study is poor compared to sphere project reference value. However, recovery rate, default rate and nutritional recovery time were in the acceptable range of SHHERE project reference value. Daily Wt gain of ≥8g/Kg, full vaccination, and deworming with albendazole/mebendazole were proven to reduce nutritional recovery time. Conversely, older age, the presence of pneumonia, the presence of stunting, and the presence of shock as comorbidities were proven to increase nutritional recovery time.

**Key words:** Recovery time, severe acute malnutrition, under-5 children, Yekatit 12 Hospital.

# CHAPTER-1. INTRODUCTION

## 1.1. Back ground

The term malnutrition is multi-faceted. It incorporates both over nutrition, manifested as overweight or obesity, and under nutrition including acute and chronic malnutrition, and micronutrient deficiencies. However, malnutrition is perceived by our society, including scientific community, as undernutrition. Undernutrition is associated with > 50% of mortality in developing countries because of an underlying infectious disease(1, 2).

Globally, malnutrition is linked directly or indirectly to death or disability in a significant number of children. There are around 60 million children with moderate acute malnutrition and 20 million with severe acute malnutrition (SAM). In 2016, wasting related to malnutrition threatened the lives of about 7.7 percent or 52 million children under-5 years of age, of which 17 million were severely wasted. The joint estimates by UNICEF, WHO and World Bank cover indicators of stunting, wasting, severe wasting and overweight among children under-5, and reveal insufficient progress to reach the World Health Assembly targets set for 2025 and the Sustainable Development Goals set for 2030 (3, 4).

Acute malnutrition has been defined in various ways and has been referred to by various names with partially overlapping definitions, including protein-energy malnutrition and wasting, that may be manifested as kwashiorkor, or marasmus. Marasmus refers to children who are very thin for their height that is, they meet the WHZ or MUAC cutoff but do not have bilateral pitting edema; and kwashiorkor refers to edematous malnutrition (5).

Acute malnutrition is usually the result of a combination of inadequate dietary intake and infection (6). It may result from multiple causes. Of these, sudden reduction in food intake and reduced quality of diet in combination with a pathological cause is more pronounced. Acute malnutrition, or wasting, is defined and categorized using anthropometric cutoffs and clinical signs adopted by world health organization in 2013, and can be classified as moderate acute malnutrition and severe acute malnutrition (SAM) (5).

SAM is defined as a WFH measurement of bellow 70% or a WHZ score below 3 SD from the mean or the presence of bilateral pitting edema of nutritional origin, or a MUAC of less than 11cm in children age 1–5 years (7).

When we come to the treatment approach, WHO endorses a community-based treatment as a treatment model for uncomplicated SAM (2). However, in complicated cases of SAM, children should be managed in inpatient facilities in accordance with WHO 10-step model. WHO and the Sphere Association have also recommended admission and discharge criteria of SAM. According to their recommendation, the anthropometric indicator that is used to confirm admission should also be used to discharge from SAM treatment (2, 8).

Children and infants ≥ 6 months old who a have a MUAC <11.5cm, or a WFH of <70%, or who have bilateral edema should be immediately admitted for SAM treatment. Again, children and infants ≥ 6 months should be discharged when their MUAC is ≥12.5cm , WHZ is ≥–2 or edema is absent for at least 2 weeks (2).

Effective treatment of SAM not only depends on the percentage of recovered children but also recovery time. Children admitted for treatment of SAM should be recovered as fast as possible. According to the Sphere Handbook for Humanitarian Charter and Minimum Standards children should be recovered from SAM with in ≤28 days of hospital admission (2, 8).

## 1.2. Problem statement

The number of children with SAM is still devastatingly growing globally. It is the third most contributing factor for the death of under-5 children over the entire globe. However, the prevalence of SAM is highly variable in developed and developing countries (9).

According to WHO report, SAM affects nearly 20 million under-5 children, causing 1 million deaths annually by increasing susceptibility to death from severe infection (10). Globally, children suffering from SAM have a 5–20 times greater risk of death than well-nourished children. SAM can directly cause death or indirectly increase the fatality rate in children suffering from diarrhea and pneumonia(11). Even though SAM is considered as a minor problem in developed countries, it poses a major problem in Asia and Africa. In Asia, 35.9 million under-5 children are wasted, of which 12.6 million are severely wasted with a significant number of death figure. For instance, in Bangladesh, a research report showed that a total death of around 9% from a total of 400 children admitted due to SAM(12).

In Africa, more than 14.0 million under-5 children are wasted, of which 4.1 million children are severely wasted. A cohort study done in Malawi showed a substantial mortality rate (23%) of children especially on marasmic children, with a hospital stay ranging from 13 to 33 days (13).

In Ethiopia, the prevalence of SAM changed little over a long period with a rate of 10% at the time of the EDHS 2016, which was the same level as in 2011. Based on the report, Ethiopia has the region's highest rate of acute malnutrition with 10% identified as too thin for their height, including 3% who are severely wasted. The prevalence of SAM in our country differs from region to region, with the heaviest burden in Somali, Affar, Oromia and Gambela, with rates of 6.1%, 5.3%, 3.5% and 3.4% respectively (14, 15). Ethiopia is one of the countries with highest under-five child mortality rate, with malnutrition underlying to 28% of all children deaths (16).

Despite efforts made in treating SAM based on standard protocol, in some treatment centers, it continues to cause unacceptably low level of recovery rate and prolonged hospitalization (17-19).

Longer duration of hospitalization is a high risk of local and systemic infection. A cohort research in Malawi examined the correlation between markers of infection and length of hospitalization (p<,0.001) (13). Another longitudinal study stated that hospital acquired infection was associated with prolonged hospital stay and increased hospital mortality (20).

Inpatient treatment program of SAM has huge economic disadvantages for treating children. For instance, a cost analysis study comparing costs of outpatient and inpatient treatment reported the mean cost per child treated to be $284.56 in impatient center and $134.88 in an outpatient center. The same study in West Africa reported that outpatient and inpatient treatment costs per child were €75.50 and €134.57 respectively. These huge cost differences become more visible as the child stays more and more in hospital (21, 22).

Moreover, when mothers/caregivers stay with children for a longer duration, the whole family lost labor and economic productivity, and pose challenges for other children at home. This negative impact of impatient management of SAM become more pronounced if the length of stay in hospital is prolonged (5).

Another devastating outcome of longer duration of SAM is the long-term impact of SAM on the development of nervous system. Studies done on humans as well as animals revealed prolonged starvation in infants and children result in essential clinical neurological signs including learning deficits and behavioral problems (23, 24).

The impact of long-term hospitalization of under-5 children goes beyond the children themselves. Two cohort studies in Italy highlighted that hospitalization of children prolonged over 16 days produced a significant increase in stress among mothers/caregivers compared to shorter hospitalizations (25, 26).

In our country, researchers deeply investigated the prevalence and treatment outcomes of SAM (6, 27-31). However, recovery time from SAM is ignored despite all mentioned impact of prolonged hospitalization. Even though there are a few studies on nutritional recovery time in our country, length of hospitalization is highly variable even in these studies (18, 32-35).

To the best of my search, there is no such study particularly in the study area, Addis Ababa.

Therefore, the intention of this research is to determine recovery time from SAM and identify predictors of length of hospitalization among under-5 children using the inpatient program at Yekatit 12 hospital, Addis Ababa city administration, Ethiopia.

## 1.3. Significance of the study

The study was done to assess the recovery time from SAM and identify predictors of recovery time among under-5 children attending the therapeutic feeding unit (TFU) of Yekatit 12 hospital, Addis Ababa.

Hence, the input from the study will provide a base line data:

- ✓ For health care providers, on the success of treatment in relation to recovery time and associated factors in accordance with the international standard time of recovery from SAM.
- ✓ For policy makers, to develop strategies and guidelines or standards for scaling up the management guidelines for sever acute malnutrition in order to hasten recovery time from SAM.
- ✓ For hospital managers, to design an interventional project towards improving SAM management to shorten recovery time of children with SAM in Yekatit 12 hospital.

Additionally, findings of this study will be important to increase existing knowledge and skill of health professional, especially child health nurses, about appropriate management of SAM to shorten recovery time of children with SAM in selected hospital.

Lastly, findings from this study will serve as a base line for further study.

# CHAPTER-2. LITERATURE REVIEW

The term malnutrition encompasses both ends of the nutritional spectrum, from under-nutrition to over-weight(36). Different dictionaries and organizations have defined malnutrition. The free encyclopedia defined malnutrition as a general term for the medical condition caused by an improper or insufficient diet.

According to WHO, malnutrition is an imbalances in a person’s intake of energy or nutrients which encompasses two broad groups of malnutrition. One is "under nutrition" which includes stunting, wasting, and micronutrient deficiencies. The other is overweight, obesity and diet-related non-communicable diseases(2, 36).

Acute malnutrition has been defined in various ways and has been referred to by various names with partially overlapping definitions, including protein-energy malnutrition, wasting, kwashiorkor, and marasmus(37). It can be categorized using anthropometric cutoffs and clinical signs as moderate and severe acute malnutrition**.** If the child's weight-for-height Z score (WHZ) is between −2 and −3 or mid-upper arm circumference (MUAC) is between 11.5cm and <12.5cm, the child has moderate acute malnutrition. If the child's WHZ is < −3 or MUAC is < 11.5cm, or the presence of bilateral pitting edema, or both, the child has SAM(2, 5).

SAM again may occur in the form of marasmus or kwashiorkor. Marasmus is a form of SAM characterized by significant loss of muscle and subcutaneous fat, resulting children in skeletal appearance. Whereas, kwashiorkor is a form of SAM described by bilateral edema of the lower limbs, often associated with cutaneous signs like shiny or cracked skin, burn-like appearance; discolored and brittle hair. Moreover, the two forms may co-occur together as marasmic-kwashiorkor(38)

SAM can be diagnosed with anthropometric data (MUAC, WHZ and WFH) and clinical data. A MUAC of <11.5cm or a WFH of <70% or a WHZ of<-3 with reference to the new WHO child growth standard indicates SAM and it shows a significant risk of mortality and eligibility for admission. SAM can also be diagnosed in the presence of edema of lower limbs bilaterally regardless of MUAC or WFH if other causes of edema are excluded (1, 38). Like that of admission, discharge from inpatient treatment of SAM has its own criteria. Therefore a MUAC of ≥12.5cm, WFZ of ≥–2 Z-score or absence of edema at least 2 weeks are pertinent discharge Criteria for children with SAM (2, 5).

## 2.1. Treatment outcome and recovery time from SAM

The treatment outcome of children with SAM can be recovery, death or default. According to WHO and the sphere standard book, these indicators can be calculated statistically as follows(8).

1) Percentage of recovered = number of individuals recovered/total number of patients x 100
2) Percentage of died = number of deaths/total number of patients x 100
3) Percentage of defaulted = number of defaulters/total number of patients x 100

Researchers agreed on treatment outcomes of children with SAM and acceptable length of stay of hospital as noted in 2018 sphere standard handbook. Therefore, recovery rate of ≤75%, death rate of ≥10%, default of ≥15% and length of stay of ≥28 days in hospital is un acceptable (2, 8).

Different researchers in different parts of the world straggle to determine the treatment outcomes of children admitted due to SAM. For instance, a cross-sectional study was published in Indonesia among 195 children to identify the outcome of children hospitalized with SAM. According to the report, more than three-forth (77.9%) of children had recovered, and the rest were not recovered. The recovery rate is acceptable according to the sphere hand book for Humanitarian charter and minimum standards in humanitarian response, but he did not specifically determine whether unrecovered children were died or discharged by any means (39).

In addition, a cross-sectional study in India among under-5 children with SAM revealed a recovery rate of 84.1%, a default rate of 13% and a death rate of 5.3% with a length of stay of 11.71±7.59 days (40).

Furthermore, a retrospective study in rural Gambia reported a very low recovery rate (45.6%) compared to the international standard and an acceptable median length of stay (18 days) in treatment (41). In the same way, a retrospective health facility-based study has been done among 969 children with SAM in Ghana. According to the study, most children (82.3%) were recovered; about 13% of children were died, and the rest were default their treatment. Besides, treatment outcomes, almost half of all the children (45.7%) were discharged after 7 days of hospitalization; about one-third of children (31.2%) stayed 8 to 14 days; and 11.4% of children stayed 15 to 21 days. However, discharges for 4.3% and 4.6% of children were done within 22 to 28 days and beyond 29 days respectively (42). Besides this, a cohort study in Zambia reported a recovery rate of 53.7%, a death rate of 40.5% and a default rate of 5.8% with a median length of stay of 5 days (43). Additionally, another comparative study in Zambian children with SAM reported a median length of stay of 22±11.8 days in 2012 and 15.9±9.6days in 2015 (44).

Different research projects done in different parts of Ethiopia to assess the recovery rate and recovery time of children admitted in hospital because of SAM. For instance, a three year retrospective cohort study was conducted among 450 under five children with SAM admitted to stabilization centers in Dilla university referral hospital to assess the incidence and predictors of mortality. According to the study, the recovery time ranges from a minimum of 1 day to a maximum of 54 days with a median period of 15 days (45).

Another facility based retrospective cohort research was done in Bahir Dar City among 401 under five children treated for SAM. Of all children, more than half children were recovered (51.9%); and the rest were censored. According to the study, the mean length of stay of children in Felege Hiwot hospital was 16 days (18).

Desyibelew HD, Fekadu A, and Woldie H had done another cross-sectional project in Bahir Dar among 401 severely malnourished children. Out of the total reviewed records the majority of children were recovered (58.8%). From all admitted children at therapeutic feeding unit (TFU), 78.4% of children were recovered from phase I, whereas 89.3%, and 81.5% were recovered at transition phase and phase II, respectively (19).

Furthermore, an institutional based cross-sectional study in Ayder referral hospital, among 195 children with SAM reported that, less than half of children with SAM were recovered (43.6%) whereas 56.4% of the patients' treatment was censored. According to the report of the study, only 43.6% of children were recovered from SAM and the mean time of recovery was 21.56 ±1.27 days (32). Another cohort study was done in Gedeo zone, among 545 under-5 children admitted due to SAM. This study highlighted that over three-fourth of children (76%) were recovered; and the rest were censored. From the survival analysis table using cox-regression, the survival rate was 95.3%, 90% and 85% at the end of the 1st, 2nd and 3rd week respectively and the overall mean survival time was 79.6 days (34).

Moreover, Alemneh K. and Gezahegn B. published another hospital based retrospective study among 196 under-five children with SAM to determine the treatment outcome and length of stay in hospital. The finding of the study showed that 78% of children treated for SAM were cured; 16.2% were dead; and the rest were transferred out and defaulted. In addition, the study showed that less than 1/5th of children (18.3%) recovered within one week; more than half of children (53.9%) recovered within 2-3 weeks; around 21% of children recovered within 4-5 weeks, and about 6.8% of children stayed over 5 weeks with a median length of stay of 18 days (46). Therefore, according to the international standard, the findings of this study have an acceptable cure and default rate but an alarming rate of death. Similarly, another retrospective cohort study in Hospitals of Wolaita Zone among under-5 children with SAM reported a recovery rate, death rate, absconded rate and non-respondent rate of 75.6%, 8.8%, 10.% and 1.8% respectively (47).

Additionally, a retrospective cohort study in Dilchora Referral Hospital, Dire Dawa reported 69.9%, 7.6%, and 20.9% of recovery, death and default rates, and a hospital length of stay ranging from 1 to 81 days, with an average of 10 days (48). There was also another retrospective cohort study conducted on 500 under-5 children in Hadia zone. According to the report of the study, the median length of stay was 11 days, with an inter-quartile range of 7 to 16 days (49).

Another retrospective study in three hospitals in North Shoa Zone, reported a recovery rate of 55.9%, a death rate of 5.8% and a default rate of 16.3%. Based on the report of this study the overall median recovery time of children admitted with SAM was 12 days (95% CI, 11.22, 12.78) (50). Lastly, another retrospective cohort study in Wolisso St. Luke catholic hospital, southwest Ethiopia, among children admitted with SAM reported a recovery rate of 83% with recovery time ranging from7 to 63 days and a median recovery time of 14 days (51)

## 2.2. Associated factors for variable length of stay in hospital

Some scholars in different countries of the world including Ethiopia strive to examine predictors of recovery time among SAM diagnosed under-5 children. Even though, they have found different associations; socio-demographic variables, immunization status, base line anthropometric measurement, the type of malnutrition, comorbid diseases and treatments and supplements are considered as associated factors for a variable length of stay in hospital among children admitted due to SAM (19, 32, 33, 46, 52).

### 2.2.1. Socio-demographic characteristics

Some evidences showed us the association between socio-demographic variables and the time to recover from SAM. For instance, a randomized, double-blind, placebo-controlled trial, in Malawi among under-5 children with SAM was done to determine the association between socio-demographic variables and time to recover. According to the report, age was the only socio-demographic factors for prolonged hospitalization, increased risk of treatment failure and increased risk of death. More clearly, a one-month increase in children's age with SAM is 0.7% (AHR=1.007; 95% CI: 1.001–1.017; P=0.02) more likely to recover faster and they are 1.1% less likely to die (AHR=0.989; 95% CI: 0.981–0.998; P=0.01) (52). However, a cross-sectional research in Indonesia reveal no association between the recovery time of children with SAM and all the socio-demographic variables (39).

Another retrospective study in Debre Markos and Finote Selam also revealed the association between socio-demographic variables and the length of stay in hospital among children with SAM. Again, age group was the only significant factor for the length of stay in hospital. More clearly, those children aged 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). In addition, those children aged 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) (33). Besides to the above, another cross-sectional, longitudinal study in Northern India showed a significant recovery time difference in different age groups (11.72±7.93days in children 0–6 months, and 12.68±6.39days in children25–59 months) (40). Age group was also a significant factor for time to recover in a retrospective cohort study done in Wolisso St. Luke catholic hospital, southwest Ethiopia, among children admitted with SAM (51)

Additionally, an institution based retrospective longitudinal study in Gamo-Gofa Zone among SAM children in OTP reveal the association between age group and recovery rate. Based on the study finding, children aged greater than two years old have a 1.25 times higher recovery rate than those children aged less than or equal to two years old (AHR = 1.255, 95% CI = 1.012, 1.556) (53).

In addition to age, sex was a significant determinant factor as reported by a cohort study in Enderta woreda, Tigray region. According to this study, males were 1.3 times more likely to recover faster than females (AHR = 1.30, 95% CI: 1.01, 1.68, P=0.043). However, sex was not a significant factor for time to recover in a retrospective cohort study done in Wolisso St. Luke catholic hospital, southwest Ethiopia, among children admitted with SAM and in OTP center found in Shebedido woreda (51, 54, 55). Additionally, a retrospective cohort study in Shebedido woreda OTP center reveals a significant association between time to recover from SAM and age group of children. According to the study, Children older than 3 years were 33% less likely to achieve nutritional recovery (AHR=0.67, 95% CI: 0.46, 0.97) (55).

However, a facility-based retrospective cohort study done in Felege Hiot referral hospital did not show any association between recovery time and any of socio-demographic variables (18). There was also another retrospective study in three hospitals in North Shoa Zone that didn't show any association between recovery time and socio-demographic variables (50).

### 2.2.2. Immunization status of children and recovery time

Limited studies have been done to predict the association between the immunization status of children with SAM and the time of recovery from SAM. Many investigators determined the association of treatment outcome of children with SAM and immunization status and found significant associations between the two variables. However, most investigators of recovery time ignore studying immunization status as an independent variable (39).

A hospital based cross-sectional study in Bahir Dar among 401 under-5 children with SAM showed a significant association between these variables. According to the report, 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 (19)

However, another retrospective study in North Shoa did not show any association between time to recover in children with SAM and their immunization status (50).

Besides to the above, an institutional based cohort study in OTP in Enderta Woreda Tigray did not show any association between the immunization status of children and recovery time from SAM (54).

### 2.2.3. The type of SAM and recovery time

Some evidences show the association between type of SAM and outcome of treatment and recovery rate. A randomized, double-blind, placebo-controlled trial in Malawi by Trehan reveal that Children with marasmic kwashiorkor recovered less frequently and had higher mortality rates than children with either kwashiorkor or marasmus. More precisely, children with marasmic-kwashiorkor needed more length of stay in hospital (41±19 days) than those with either marasmus (37±22 days) or kwashiorkor (27±17 days) independently. Children with kwashiorkor were around 6 times more likely (AHR = 5.88; 95% CI: 4.15–8.33; P<0.001) to recover faster than children with marasmic-kwashiorkor and those with marasmus were around 74% more likely (AHR = 1.74; 95% CI: 1.22–2.47; P<0.002) to recover faster than that of children with marasmic-kwashiorkor (52, 56).

Another institutional based cross-sectional study done in Felege Hiot referral hospital tried to uncover the association between time to recover from SAM and having edematous (kwashiorkor or marasmic kwashiorkor) or non-edematous (marasmus or severe wasting) SAM. Depending on the report of this research, children with kwashiorkor or marasmic kwashiorkor had longer hospital stay (19 ±6.5 days) than that with pure marasmus (17 ±6days) (19).

Furthermore, a retrospective cohort study conducted in Southern Ethiopia reported a significant difference in recovery time among marasmic children (29 days) and children with kwashiorkor or marasmic kwashiorkor (22 days) (57)

Besides to the above, a retrospective chart review in three hospitals of North Shoa showed a significant difference in recovery time between marasmic(11days) and kwashi or marasmic-kwashi children (16days) according to the study, children with kwashiorkor or marasmic kwashiorkor was 41% less likely to recover faster than children with marasmus (AHR=0.59; 95% CI: 0.39, 0.90; P=0.000) (50).

Type of SAM is also a determinant factor in a retrospective study done in south west Ethiopia among children with SAM admitted in outpatient therapeutic feeding centers. According to the study, marasmic children, significantly, stay longer (8.1weeks) than children with kwashiorkor or marasmic kwashiorkor (6.4weeks). Moreover, the likelihood of recovery was around 2.3 times high for children with kwashiorkor or marasmic kwashiorkor than marasmic ones (AHR = 2.25 at 95% CI 1.79, 2.82) (58).

However, a retrospective cohort follows up in Dilla university referral hospital did not show any independent prediction between type of mal-nutrition and recovery time and mortality (AHR = 0.74; 95%; CI: .22-1.3; P=.251) (45). In addition to a study in Dilla University, a retrospective study in Yirgalem hospital also did not show any association between the type of SAM and the treatment outcome as well as the length of stay in hospital (46). Another retrospective cohort study in Wolisso St. Luke catholic hospital, southwest Ethiopia, among children admitted with SAM, did not show any association between the type of SAM and the time to recover from SAM(51). Moreover, a retrospective study done in Gamo-Gofa Zone among children treated in OTP did not show a significant association between recovery time and type of SAM (53). Another retrospective cohort study in Shebedido woreda OTP center also reveals a significant association between time to recover from SAM and the type of malnutrition children has. According to the study, the median time of recovery was 35 days for children with kwashiorkor and 49 days for children with marasmus (55).

**2.2.4. Base line anthropometric measurement at admission and gains/kg/day**

Some studies have been done to determine the association between the base line anthropometric measurements and recovery time from SAM. For instance, a study in Malawi examined this relationship as well as the outcome of treatment. Children with the lowest WAZ score at enrollment were most likely to have treatment failure or to die. According to this study, a 1point increase in WAZ-score decreased the length of stay of children by 22% (52).

In Ethiopia, some researchers strive to examine the association between the base line anthropometric measurement and the treatment outcome and time to recover from SAM. For instance, a retrospective research done in Bahir Dar concluded that children who gained an average weight of more than 8g/Kg/day were 1.2 times more likely to recover earlier than children who gained an average weight of less than 8g/Kg/day (AHR =1.200; 95% CI: 1.014–1.422) (18).

There are also studies in other parts of Ethiopia concerning on base line anthropometric measurement, and their length of stay during inpatient treatment of children with SAM. For instance, an institutional based prospective cohort study conducted in OTP sites in Enderta woreda, Tigray, reported that children with a WHZ score of ≥ -3 at admission were 1.87 times more likely to recover faster than those children with admission WFZ score of <-3 (AHR: 1.87; 95% CI: 1.31, 2.66; P=0.001) (54). Another retrospective cohort study in Shebedido woreda OTP center also reveals the association between time to recover from SAM and weight and MUAC gains per day. According to the study, the median weight and MUAC gain among recovered children was 4.45g/Kg/day and 0.24mm/day respectively. On this study, children’s weight gain/Kg/day was not significantly associated with recovery time. However, children who gained MUAC of 0.24 mm/day or more were 59% more likely to recover faster [AHR=1.59, 95% CI 1.23, 2.06] (55).

### 2.2.5. Comorbid medical conditions before or after admission

Children with SAM may have many comorbid diseases (CD) either before admission or after 48 hours of admission.

A cohort study was done in Zambia University Teaching Hospital stabilization centre among 430 children with SAM to assess the relationship between different CD and, time of recovery from SAM. On the cohort, more than one-third of children (67.1%) had diarrhea; almost half of the children had a febrile illness; and around 40% of children were HIV positive. According to the report, the mean length of stay of children with diarrhea (9.6 days) was shorter than children without diarrhea (11.8days). Additionally, HIV-positive children stayed (11.9 days) longer than HIV-negative children did (9.4 days). However, admission fever had no effect on length of stay in hospital (43). Another retrospective study in Zambia Reported pneumonia as a significant predictor of nutritional recovery time with a p-value of 0.008(59).

In Ethiopia, different research articles report the association between CD in children with SAM and time to recover from SAM. A retrospective cohort study was conducted in Southern Ethiopia to predict nutritional recovery time depending on if children with SAM have comorbidities or not. Based on the finding, children who had diarrhea stayed longer (26 days) than their counterparts (25days). Similarly, nutritional recovery time was significantly different for children who had dehydration (29 days) and their counterparts (26 days). Additionally, nutritional recovery time was significantly different between children with anemia (27days) and without anemia (26 days). However, nutritional recovery time was not significantly associated with complications such as fever, vomiting, malaria, pneumonia, hypothermia, and lethargy (57).

Furthermore, another facility based retrospective cohort study in Bahir Dar City among 401 under five children was done to determine the association between CD and time of recovery. There was a significant difference in the median recovery time between children who had cough at admission and who did not have (17 days; 95% CI: 14.8–19.2 and 15 days; 95% CI: 13.3–16.7) respectively. In the same fashion, HIV negative children were recovered much faster than HIV-positive children and the median recovery time was 17 days (95% CI: 14.1–19.9) and 27 days (95% CI: 12.8–41.2) respectively (18). HIV sero-status is a significant predictor of recovery time in a study done in Debre Markos and Finote Selam hospital. According to the study, HIV negative children had 2.48 times higher probability fast recovery from SAM compared to HIV-positive children (AHR = 2.48, 95% CI: 1.23–5.01) (33).

However HIV sero-status(P=0.63) was not a significant factor in another study in Mekelie city (60). Moreover, the report of the above article reveals the association between the presence of anemia at admission and time to recover from SAM. According to the report, children who had no anemia at admission were approximately 1.6 times more likely to recover faster than children who had (AHR = 1.552; 95% CI: 1.134, 2.124) (18)

Moreover, a retrospective chart review in North Shoa strives to determine the association between some CD and recovery time of children from SAM. According to the study, SAM children comorbid with rickets are approximately 1.4 times more likely to stay longer than children who didn't have (AHR = 1.41; 95%CI: 0.98, 2.04; P: 0.02). Additionally, there was another retrospective study done in Debre Berhan referral hospital, Enat general hospital and Mehal Meda primary hospital. According to this study children developing pneumonia were 29% less likely to recover faster compared to children without pneumonia (AHR= 0.71, 95% CI: 0.51- 0.98)(50).

Another retrospective cohort study in Wolisso St. Luke catholic hospital, southwest Ethiopia, among children admitted with SAM reveal a significant association between time to recover from SAM and co-infection (51)

#### 2.2.6. The use of broad-spectrum antibiotics, supplements and different therapeutic feedings

The international literature response to the use of broad-spectrum antibiotic was mixed. Some supported the view that the use of broad-spectrum antibiotics has unintended consequences which outweigh the benefits of routine administration. Others noted that a lack of clinical improvement in children receiving amoxicillin should not be extrapolated to mean that antibiotics are not beneficial in children with SAM as it may simply be that amoxicillin is no longer the most appropriate antibiotic.

However, the current WHO guideline recommends giving routine antibiotics for all children with SAM, even if they have uncomplicated diseases with no clinically obvious infections. WHO also gave recommendations about the use of supplements and therapeutic feedings.

More specifically, WHO recommends giving supplements like ‘’Iron, vit A, Folic acid and Zink’’; and transition from F75 to RUTF or F100 to RUTF (61).

A systematic review has been done in 2013 by Gabriel Alcoba, etal to generate evidences about the use of broad-spectrum antibiotics for the management of severe acute malnutrition. This systematic review used three randomized control trials (RCT), 5 Cochrane reviews, and 37 observational studies. One of the RCTs showed no difference in nutritional recovery time and mortality in uncomplicated SAM where no antibiotics is used.

That means, there was no significant association between usage of antibiotic for uncomplicated SAM and nutritional recovery time and mortality due to SAM ($p>0.05$). However, another unpublished RCT on that setting showed there was a significant negative relationship between the use of antibiotic and mortality due to SAM. Another RCT in this review try to examine the effect of using ceftriaxone or amoxicillin. This study revealed that there was no superiority in using ceftriaxone or amoxicillin to predict outcomes of SAM, and recovery time, with either complicated or uncomplicated SAM (62).

Another experimental research done in Malawi in 2016 among under-5 children on the use of placebo or antibiotic in the management of SAM had compared different broad-spectrum antibiotics and placebo treatment. On this experimental study a total 924 children were randomly assigned to the amoxicillin group, 923 to the cefdinir group, and 920 to the placebo group and were showed us a significant variability among cefdinir, amoxicillin, and placebo treatment of SAM. Children who were treated with cefdinir, amoxicillin, and placebo showed a higher recovery rate difference of 90.9%, 88.7%, and 85.1% respectively. This study also revealed that among children who recovered, a greater weight gain and fast recovery time is observed among broad-spectrum antibiotic users than placebo treatment users (52, 56).

In contrast, a RCT among 2399 children aged 6–59 months with uncomplicated SAM in four rural treatment centers in Niger found no significant difference in the likelihood of recovery between those treated with amoxicillin and those who received placebo. Therefore, this trial challenged the view that antibiotic therapy is always necessary or beneficial in the management of SAM and concluded that, by eliminating the routine prescription of antibiotics in children with uncomplicated SAM, treatment could be simplified with associated cost savings, and limiting the spread of antibiotic resistance (63).

Limited studies in different parts of Ethiopia have been done to determine the effect of using routine and special medications; and different supplements and therapeutic feedings on recovery time. For instance, a retrospective cohort study was published in Bahir Daring among 401 children having SAM. According to the study, all routine and special medications as well as supplements were not associated significantly. However, the highest difference in median recovery time was observed between children who received plumy nut and those who didn't, which was 14 days (95% CI: 13.033–14.967) and 28 days (95% CI: 23.301–32.699) respectively (18).

There was also another retrospective cohort study in Debre Markos and Finote Selam hospital among 253 undre-5 children with SAM. On this study, investigators strive to determine associated factors for the length of stay of children including the use of routine medications, special medications, different supplements and therapeutic feedings. However, there was no significant association except folic acid supplementation(AHR = 0.35, 95% CI: 0.14–0.89) (33).

In summary, different researchers found a recovery rate ranging from 43.6% in Ayder referral hospital to 84.1% in India, with a variable median recovery time ranging from 5days in Zambia to 21.56 days in Ayder referral hospital. Additionally, recovery time is associated with multiple predictor variables including socio-demographic variables like age and sex, the base line anthropometric measurement, immunization status, the type of SAM, comorbid diseases and treatments, supplements and therapeutic feedings.

### 2.3. Conceptual framework

Here bellow is the conceptual framework for my study. It is developed from the literature review (18, 19, 33, 52).

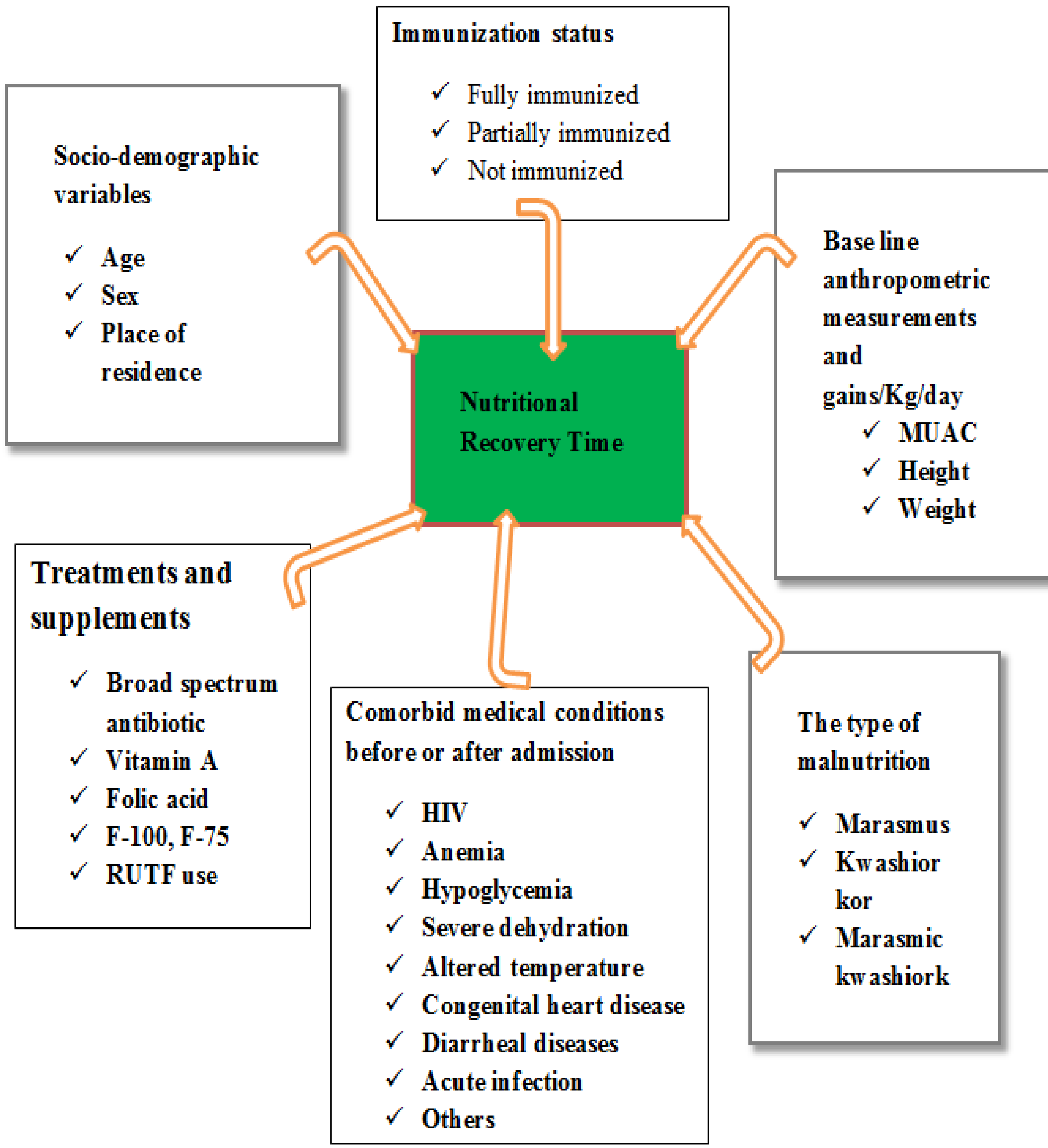


**Figure-1: Conceptual framework for determinants of recovery time from SAM**

# CHAPTER-3. OBJECTIVES

## 3.1. General objective

The general objective of this study is to determine the mean time to recover from severe acute malnutrition and associated factors among children in Yekatit 12 hospital, Addis Ababa, Ethiopia, 2019.

## 3.2. Specific objectives

To assess the treatment out comes of children with severe acute malnutrition.

To determine the median recovery time of children from sever acute malnutrition.

To identify factors affecting recovery time from sever acute malnutrition

# CHAPTER-4. METHODS AND MATERIALS

## 4.1. Study Area and Period

The study was conducted in Yekatit 12 hospital, which provides inpatient services for the management of SAM in Addis Ababa city administration. Addis Ababa is the capital city of Ethiopia and seat of African Union & Economic Commission for Africa. It consists of an estimated population of over 7 million (7,170,000) at the end of 2019(64).

The city has 10 sub-cities & 116 woredas and different government health facilities including 14 hospitals and 95 public health centers. From the above public health facilities, six of the hospitals including Yekatit 12 are regional hospitals, which are found under Addis Ababa health bureau.

Currently, Yekatit 12 hospital is an organized health facility, which provides inpatient services for the management of SAM in Addis Ababa city administration. The hospital has 12 isolated beds for SAM patients and well equipped and trained health care workers for the management of SAM and uses standardized management protocol of SAM that is updated by FMOH in 2014(65). The hospital also has isolated TFU classes, assigned trained nurses and necessary equipment for preparation of formula milk in the pediatric ward.

The study was conducted from February to March 2019.

## 4.2. Study design

A hospital based retrospective record review was conducted in Yekatit 12 hospital from February to March 2019.

## 4.3. Source Population

The source population comprises all under-5 children with SAM, who were admitted for SAM management and treated in Yekatit 12 Hospital.

## 4.4. Study population

The study population comprises all selected under-5 children with SAM, who were admitted for SAM management and treated in Yekatit 12 Hospital from January 1, 2016 to December 30, 2018.

## 4.5. Inclusion and Exclusion criteria

### 4.5.1. Inclusion criteria

Children under the age of five who received treatment for SAM in Yekatit 12 hospital between January 1, 2016, and December 30, 2018 were included in the study.

### 4.5.2. Exclusion Criteria

The study excluded children with SAM who did not have proper records (incomplete records) or missing charts in the logbook. A patient who had diagnosed and started treatment at other hospital and referred to Yekatit 12 hospital for further treatment was also excluded.

## 4.6. Sample size determination

The sample size in this in retrospective chart review was determined using a single proportion formula.

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

The sample size of charts reviewed in this study was 384 patient cards using the above formula. In the formula n is the sample size; Z is the standard normal deviate set at 1.96 (for 95% confidence level); d is the desired degree of accuracy (taken as 0.05). Lastly, p is the estimate of the recovery rate (assumed to be 52% as obtained from a retrospective study in Bahir Dar city on recovery time and associated factors of SAM among children)(18).

$$n = 1.96^2 \times 0.52(0.48)/0.05^2 = 384$$

After addition of 10% sample for missing and incomplete data, the final sample size was **423** under-5 children cards with SAM.

## 4.7. Sampling procedures

Three consecutive years; 2018, 2017, and 2016 were purposively selected for record reviews because they provide latest information about problem under investigation in the selected institution for the study.

All cases of SAM were obtained from therapeutic feeding unit register book. Systematic sampling was employed to select enough amount of samples (patient charts) starting from the latest month backwards, based on the sequence of their card number, until the required sample size is reached. The total number of under-5 SAM admissions during the three-year period was one thousand fifty (1050). The total sample size for each year was allocated proportionally by calculating the interval from the sampling frame N (2016, N=254; 2017, N=356 and 2018 N=440) and sample size n (k=N/n). The interval (k=2) is similar for each year. The first number to start with was selected randomly. Four hundred twenty-three (**423)** patient charts during these three consecutive years were reviewed. Those children who have incomplete data in their chart were substituted with other chart with the nearest card number during data collection.

**Table-1: Distribution of sample size across admission period in Yekatit 12 hospital.**

| S. no | Period | Total number of SAM admitted | Number of samples was selected |
|---|---|---|---|
| 1 | 2016 | 254 | 103 |
| 2 | 2017 | 356 | 143 |
| 3 | 2018 | 440 | 177 |
| Total | | 1050 | 423 |

## 4.8. Methods of Data Collection

A structured data abstraction form was used for data collection. The data abstraction form is adopted from Ethiopian protocol for the management of severe acute malnutrition (66), the sphere standard for management of severe acute malnutrition (8) and base line previous studies(18, 19, 33, 67). Data were gathered for baseline characteristics like socio-demographic data, immunization status, and base line anthropometric data; type of malnutrition; comorbidities; routine medications, supplements and therapeutic feedings; treatment outcome status and recovery time. Moreover, the data abstraction form was pre-tested in 5% of the sample size in Zewditu memorial hospital.

## 4.9. Data collection procedure

Data collectors were two masters' students and two BSC nurses. One supervisor was needed to supervise and organize the whole process during data collection.

Training was given for supervisors and card reviewers for two days. Orientation was given for the supervisor separately on how to supervise the data collectors and how to check for the completed data abstraction form. The supervisor were responsible for supervising the data collectors, check for completed data abstraction format; and correct any mistake or problem encountered.

## 4.10. Variables

### 4.10.1 Dependent variable

Recovery time of children from SAM.

### 4.10.2. Independent variables

Independent variables that was studied include-

- Socio-demographic variables like age, sex, place of residence, occupational status of parent, and educational status of parent
- Type of malnutrition like marasmus, kwashiorkor, marasmic kwashiorkor
- Base line anthropometric measurements like MUAC, weight, and height
- Immunization status like fully immunized, partially immunized and not immunized
- Treatments, supplements and therapeutic feeding such as broad spectrum antibiotic, vitamin a, folic acid, F-100, F-75, RUTF,
- Comorbid medical conditions before or after admission like HIV, anemia, hypoglycemia, severe dehydration, altered temperature, congenital heart disease, diarrhea diseases, acute infection, and others

## 4.11. Operational definitions

**Recovery time** – number of days it takes from admission until a child is recovered from SAM.

**Recovered**- are those children who have become free from medical complications, edema and have achieved and maintained sufficient MUAC (≥12.5cm) and weight for height (when WFH≥ 85%)(8).

**Censored-** are those children whose death report is recorded, or against medical advice (caregivers sign on behalf of their child to leave the treatment before recovery), or SAM cases that are lost during treatment with unknown status.

**Died**--are those children who passed away and whose death report is recorded on the patient's chart.

**Default-** SAM cases that are against medical advice (caregivers sign on behalf of their child to leave the treatment before recovery) or SAM cases that are lost during treatment with unknown status.

**Co-morbidity**- additional medical problem with severe acute malnutrition

**Base line anthropometric measurement**- is an anthropometric measurement recorded first at admission such as admission MUAC, admission weight, and height.

**Marasmus=** non-edematous SAM

**Kwashiorkor =**edematous SAM

**Marasmic kwashiorkor =** SAM cases with both edema and severe wasting.

## 4.12. Data Quality Control

To ensure the data quality, pre-test was conducted on 5% (22 charts) of the sample to ensure the agreement of the data abstraction format with the need of the study. Any error found in the data abstraction format during the process of pre-test was corrected and modified. Training was provided using a standard tool.

Then, the actual data was collected with close supervision. After proper collection, the supervisor checked information for completeness and consistency regularly until data collection is completed. Subsequent to fitting collection, data was carefully entered, cleaned, coded, and analyzed in SPSS version 25. The investigator carried out systematic data cleaning procedures to assure the data quality of both categorical and continuous variables. Then after, the investigator cleaned the data orderly by firstly sorting each variable in ascending order to check for unexpected cases. After that, the investigator verified variables with respective checklist if they are identified as unexpected and extreme. Lastly, the investigator did further cleaning by selecting randomly 10% (43 cards) from the total number of participants.

## 4.13. Methods of Data Analysis

The data was checked, coded and entered into EpiData version 4.2 and exported to SPSS Version 25 software for analysis. The data were checked for missingness, fulfillment of assumptions was checked by using frequencies, and cross tabulations. Graphs and frequency tables were used to report the descriptive data.

Recovery time from SAM was estimated using Kaplan-Meier and Log rank test was used to test whether the observed difference of recovery time between different groups of predictor variables is significant or not.

Then after, bivariate Cox regression analysis was computed for each predictor variable with time to recovery. A P-value of <0.25 was used as a cutoff point to enter variables to multivariate cox regression. Then, an adjusted hazard ratio (AHR) with 95%CI was used to identify predictor variables. Variables, which had p-value < 0.05, were considered as significant. Lastly, results were summarized and presented in graphs and tables.

## 4.14. Ethical Considerations

Ethical clearance was obtained from the Institutional Review Board of Addis Ababa University, College of health sciences, school of nursing and midwifery. Permission was obtained from Yekatit 12 Hospital board. Additionally, at selected study department, the matron/ medical officer in-charge was contacted for consent and necessary information before the commencement of the study. Privacy and confidentiality of study participants were maintained by making the data abstraction form anonymous, protecting our personal computers by strong password, and giving training for data collectors on how to keep the data confidential.

## 4.15. Dissemination of the Study

This study upon completion will serve as resource material for researchers, managers, and policy makers. To reach these targets, the result of the study:

- ✓ Will be submitted and presented to Addis Ababa University, School of Nursing and Midwifery as a partial fulfillment of masters in pediatric and child health nursing.
- ✓ Will also be submitted to Yekatit 12 hospital.
- ✓ Will be given to Addis Ababa city administration health bureau, FMOH and NGOs working around malnutrition in the city.
- ✓ Will also be presented in locally or internationally held seminars, workshops, conferences and meetings including in Ethiopian nursing association.

Finally, it will be published in nationally or internationally recognized journals.

# CHAPTER-5: RESULTS

## 5.1. Socio-demographic characteristics of the study participants

The study included records of 423(100%) under-5 children with the diagnosis of severe acute malnutrition admitted in three consecutive years (2016, 2017, and 2018) at TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia.

Out of the total 423 children in the cohort, 241(57%) were males and more than two-third or 289(68.3%) of children were urban residents. The age of children ranges from 1 month to 59 months with a median age of 11 months and majority of children 341(80.6%) were younger than 24 months.

Greater than two-third of children at admission, 291(68.8%), had a WFH Z score of ≤ -3 and the rest (31.2%) had a WFH Z score of above -3. Of all children at admission, 126(29.8%) were under-age (<6 months) to measure their MUAC; and of children whose MUAC was measured at admission, 186(62.6 %,) had a MUAC of less than 11cm, 39(13.1%) had a MUAC of 11 to 12 cm and the rest 72(24.2%) had a MUAC of > 12cm (Table-2)

**Table-2: Distribution of socio-demographic characteristics of under-5 children with SAM admitted and treated in TFU of Yekatit 12 hospital from January 1, 2016 to December 30, 2018.(N=423)**

| Characteristics | Categories | Frequency (N=423) | % |
|---|---|---|---|
| Age of the child | <24 months | 341 | 80.6 |
| | ≥ 24months | 82 | 19.4 |
| Sex of the child | Male | 241 | 57 |
| | Female | 182 | 43 |
| Residence | Urban | 289 | 68.3 |
| | Rural | 134 | 31.7 |
| WFA Z score at admission | <-3 Z score | 277 | 65.5 |
| | -3 to -2 Z score | 102 | 24.1 |
| | >-2 Z score | 44 | 10.4 |
| **WFH Z score at admission** | ≤-3 Z score | 291 | 68.8 |
| | > -3 Z score | 132 | 31.2 |
| **Admission MUAC in cm** | <11cm | 186 | 44 |
| | 11-12cm | 39 | 9.2 |
| | >12cm | 72 | 17 |
| | Under age(<6 months) to measure | 126 | 29.8 |

## 5.2. Type of malnutrition and immunization status

About 313(74.0%) under-5 children admitted to TFU had marasmus, 69(16.3%) of them had kwashiorkor and the rest 41(9.7%) had marasmic-kwashiorkor. Similarly, about 269(63.6%) of under-5 children had fully vaccinated for their age, 66(15.6%) of them vaccinated partially, and the rest 88(20.8%) of children had not vaccinated at all (Fig-2&3)

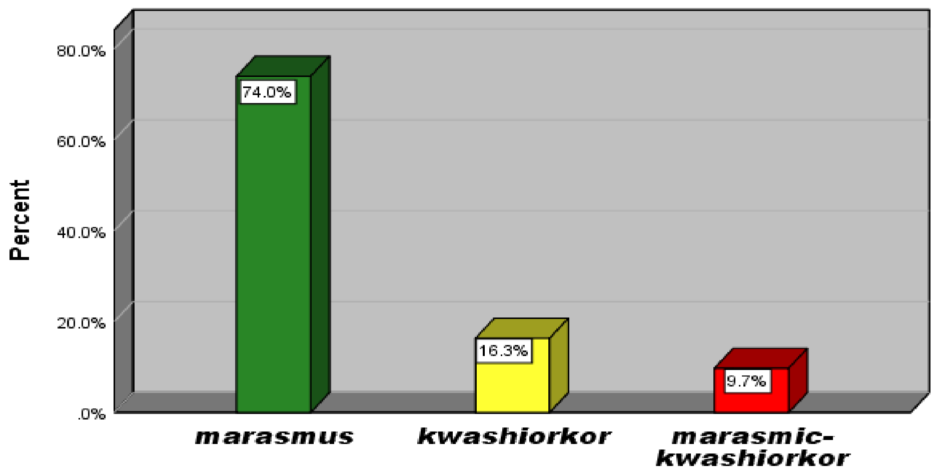


**Figure-2: shows the distribution of type of malnutrition among admitted under-5 with SAM children in TFU of Yekatit 12 hospital from January 1, 2016 to December 30, 2018.**

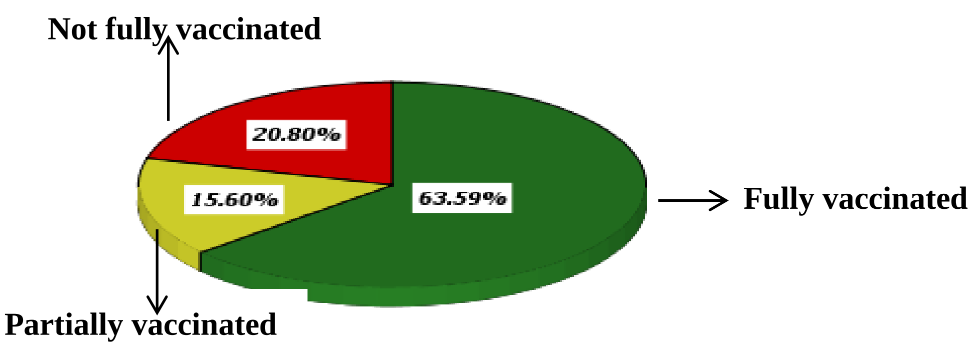


**Figure-3: Vaccination for age status of under-5 children with SAM admitted in the TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018.**

## 5.3. Comorbid medical diseases before or after admission

Among all under-5 children selected for the study, 405(95.7%) of them had at least one form of comorbid disease. The most common medical comorbidities of under-5 children accompanied with SAM were diarrheal diseases (53.0%), anemia (42.8%), pneumonia (42.3%), and fever (33.1%) (Table-3).

**Table-3: Distribution of comorbid diseases among admitted SAM cases in TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018.(N=423)**

| Variables | Category | Frequency | % |
|---|---|---|---|
| **HIV/AIDS** | Yes | 39 | 9.2 |
| | No | 384 | 90.8 |
| **Anemia** | Yes | 181 | **42.8** |
| | No | 242 | 57.2 |
| **Dehydration** | Yes | 83 | 19.6 |
| | No | 340 | 80.4 |
| **Fever** | Yes | 140 | **33.1** |
| | No | 283 | 66.9 |
| **Axillary $T^0$** | < 38 | 62 | 14.7 |
| | ≥38 | 79 | 18.7 |
| **Congenital heart disease** | Yes | 40 | 9.5 |
| | No | 383 | 90.5 |
| **Diarrheal disease(s)** | Yes | 224 | **53.0** |
| | No | 199 | 47.0 |
| **Tuberculosis** | Yes | 24 | 5.7 |
| | No | 399 | 94.3 |
| **Pneumonia** | Yes | 179 | **42.3** |
| | No | 244 | 57.7 |
| **Gastroenteritis** | Yes | 202 | 47.8 |
| | No | 221 | 52.2 |
| **Sepsis** | Yes | 85 | 20.1 |
| | No | 338 | 79.9 |
| **Rickets** | Yes | 70 | 16.5 |
| | No | 353 | 83.5 |
| **Stunting** | Yes | 106 | 25.1 |
| | No | 317 | 74.9 |
| **Global developmental delay** | Yes | 42 | 9.9 |
| | No | 381 | 90.1 |
| **Shock** | Yes | 37 | 8.7 |
| | No | 386 | 91.3 |
| **Microcephaly** | Yes | 31 | 7.3 |
| | No | 392 | 92.7 |

## 5.4. Managements and care given for under-5 children

Admitted cases with SAM in TFU of Yekatit 12 hospital were managed according to WHO and Ethiopian federal ministry of health treatment guideline for the management of SAM. Out of 423 children, whose medication records were selected for review, the most prescribed routine medication were IV antibiotics (ampicillin, gentamycin, ceftriaxone, vancomycin) 378(89.4%), and PO antibiotics (amoxicillin, cotrimoxazole, azithromycin) 205(48.5%). Regarding deworming of children, only 85 (20.1%) children were eligible (≥2 years) to take Albendazole/Mebendazole. Of those eligible children 22(25.9%) had been dewormed with Albendazole/ Mebendazole.

**Table-4: Distribution of routine medication, special medication, supplements and therapeutic feeding provision for admitted SAM cases in TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018.(N=423)**

| Variables | Category | Frequency | % |
|---|---|---|---|
| **Routine treatments** | | | |
| **IV antibiotic/s** | Yes | 378 | 89.4 |
| | No | 45 | 10.6 |
| **PO antibiotic/s** | Yes | 205 | 48.5 |
| | No | 218 | 51.5 |
| **Albendazole/Mebendazole** | Yes | 22 | 5.2 |
| | No | 63 | 14.9 |
| | Not applicable | 338 | 79.9 |
| **Special medication** | | | |
| **IV fluid** | Yes | 67 | 15.8 |
| | No | 356 | 84.2 |
| **ReSoMal** | Yes | 180 | 42.6 |
| | No | 243 | 57.4 |
| **Supplements given** | | | |
| **Vitamin A** | Yes | 69 | 16.3 |
| | No | 354 | 83.7 |
| **Iron** | Yes | 92 | 21.7 |
| | No | 331 | 78.3 |
| **Folic Acid** | Yes | 160 | 37.8 |
| | No | 263 | 62.2 |
| **Zink** | Yes | 61 | 14.4 |
| | No | 362 | 85.6 |
| **Therapeutic foods given** | | | |
| $F_{75}$ | Yes | 310 | 73.3 |
| | No | 113 | 26.7 |
| $F_{100}$ | Yes | 390 | 92.2 |
| | No | 33 | 7.8 |
| RUTF | Yes | 145 | 34.3 |
| | No | 278 | 65.7 |

## 5.5. Treatment outcome compared to sphere project value by time series

Regarding the overall treatment outcomes of children with SAM, 344 (81.3%) of children were recovered from their diseases compared to 79 (18.7%) of them whose treatment was censored. Among seventy-nine children, 47 (11.1%) died and the rest 32 (7.6%) defaulted their treatment. When we see treatment outcome by time series, the recovery rate increased from 77.7% in 2016 to 81.8% in 2017 to 82.5% in 2018. In contrary, the death rate was decreased from 14.6% in 2016 to 11.2% in 2017, but had shown a slight increase (11.3%) in 2018. Similarly, the default rate was consecutively decreasing and it was 7.8%, 7.0% and 6.2% from 2016 to 2018 respectively as shown in **table-5**.

The cumulative chance of recovery at the end of the 1st week, 2nd week, 3rd week and 4th week was 12%, 45%, 73% and 87% respectively. Additionally, 13% of children stayed longer than 28 days, and about 3% of children stayed beyond 42 days **(See fig-4).**

**Table-5: Treatment outcomes of children with severe acute malnutrition admitted in the TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018 compared to sphere project value/international standard by time series.(N=423)**

| Variables | | | Frequency (N=423) | % | Sphere Standard Acceptable | Sphere Standard Alarming |
|---|---|---|---|---|---|---|
| Outcomes of treatment | 2016 | Recovery | 80 | 77.7 | >75% | <50% |
| | | Death | 15 | 14.6 | <10% | >15% |
| | | Default | 8 | 7.8 | <15% | >25% |
| | 2017 | Recovery | 117 | 81.8 | >75% | <50% |
| | | Death | 16 | 11.2 | <10% | >15% |
| | | Default | 10 | 7.0 | <15% | >25% |
| | 2018 | Recovery | 146 | 82.5 | >75% | <50% |
| | | Death | 20 | 11.3 | <10% | >15% |
| | | Default | 11 | 6.2 | <15% | >25% |
| Overall | | Recovery | 344 | 81.3 | >75% | <50% |
| | | Death | 47 | 11.1 | <10% | >15% |
| | | Default | 32 | 7.6 | <15% | >25% |

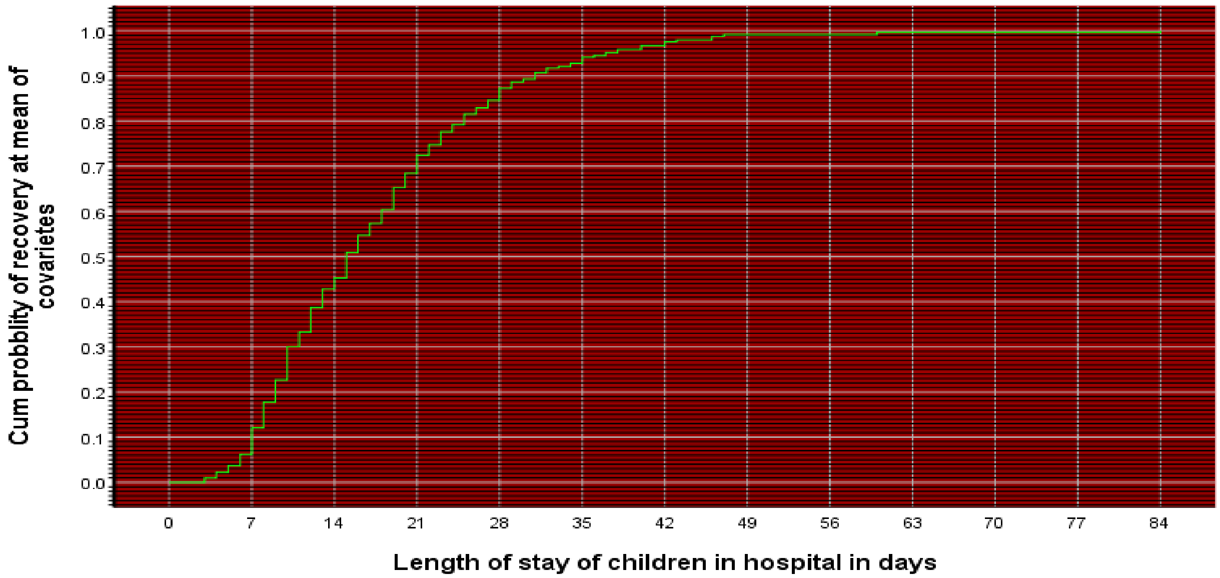


**Figure-4: Shows the cumulative chance of recovery among under-5 children with SAM managed at Yekatit 12 hospital from January 1, 2016 to December 30, 2018.**

## 5.6. Kaplan-Meir survival estimates for sever acute malnutrition recovery time by time series.

The nutritional recovery rate was 5.29(95% CI: 0.0476378 - 0.058849) per 100-person day observations among entire subjects in the cohort. The median nutritional recovery time of the entire cohort was 15 days (95%CI:13.608-16.392). Median recovery time decreased from 16 days (95% CI: 13.879-18.121) in 2016 to 15 days (95%$CI_S$: 12.904-17.096, 13.075-16.925) in both 2017 and 2018. Further analysis comparing the median survival time according to age group showed that there was significant difference($P<0.05$) in median nutritional recovery time between children aged <24 months 15days, (95% CI: 13.729-16.271) and children aged ≥24 months 19 days, (95% CI: 16.192-21.808). Similarly, significant median recovery time difference has been observed between children who came from urban areas, 14 days, (95% CI: 12.662-15.338) and rural areas 20 days, (95% CI: 17.702-22.298).

Regarding type of malnutrition and vaccination status, there were significant differences in median recovery time between marasmic children, 14days (95% CI: 12.682-15.318) and kwashi/marasmic-kwashi children 21days, (95% CI: 18.447-23.553); and children who were fully vaccinated for their age 13 days, (95% CI: 11.679-14.321) and those who were not vaccinated at all 23days, (95% CI: 19.415-26.585).

In relation to comorbid diseases, nutritional recovery time was significantly different for SAM children who had HIV 21 days, (95% CI: 18.512-23.488) and those who had not, 15days, (95% CI: 13.765-16.235). Similarly, median nutritional recovery time was significantly different for children with anemia 17 days, (95% CI: 14.786-19.214) and their counterparts 14 days, (95% CI: 12.273-15.727). In addition, nutritional recovery time was significantly different for children with TB 21days, (95% CI: 14.094-27.906) and children without TB 15days, (95% CI: 13.758-16.242).

Median nutritional recovery time was also significantly different for children who had pneumonia 19 days, (95% CI: 17.096-20.904) and their counterparts 13days, (95% CI: 11.621-14.379). In the same way, there was a significant nutritional recovery time difference between stunted children 20days, (95% CI: 17.533-22.467) and their counterparts 14days, (95% CI: 12.867-15.133). Moreover, there was a significant recovery time difference between children who were complicated with shock 26 days, (95% CI: 20.548-31.452) and who were not 15 days, (95% CI: 13.761-16.239).

Regarding treatments, supplements and therapeutic feedings, a significant recovery time difference has been observed in children receiving deworming medication, IV fluid and ReSoMal and their counter parts. However, there was no significant recovery time difference in children taking IV and PO antibiotics, different supplements & therapeutic feedings and their counterparts. Lastly, there was also a significant recovery time difference between children who gained a daily Wt of ≥8g/Kg 11 days, (95% CI: 10.011-11.989) and those who gained a daily Wt of < 8g/Kg 20 days, (95% CI: 18.827-21.173) **(Table-6).**

**Table-6: Kaplan-Meir survival estimates for sever acute malnutrition recovery time with different covariates at the TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018.(N=423)**

| Characteristics | Category | Median recovery time in days | | | |
|---|---|---|---|---|---|
| | | **Estimate** | **95%CI** | **Log rank X2-value** | **P-Val** |
| **Age group** | <24 | 15.00 | 13.729-16.271 | 6.739 | .009 |
| | ≥24 | 19.00 | 16.192-21.808 | | |
| **Residence** | Urban | 14.00 | 12.662-15.338 | 17.401 | .000 |
| | Rural | 20.00 | 17.702-22.298 | | |
| **Type of malnutrition** | Marasmus | 14.00 | 12.682-15.318 | | |
| | Kwashiorkor | 21.00 | 18.447-23.553 | 14.769 | .001 |
| | Marasmic-kwashiorkor | 21.00 | 17.841-24.159 | | |
| **Vaccination status** | Fully vaccinated | 13.00 | 11.679-14.321 | | |
| | partially vaccinated | 19.00 | 17.095-20.905 | 34.031 | .000 |
| | Not vaccinated | 23.00 | 19.415-26.585 | | |
| **HIV/AIDS** | Yes | 21.00 | 18.512-23.488 | 6.194 | .013 |
| | No | 15.00 | 13.765-16.235 | | |
| **Anemia** | Yes | 17.00 | 14.786-19.214 | 5.860 | .015 |
| | No | 14.00 | 12.273-15.727 | | |
| **TB** | Yes | 21.00 | 14.094-27.906 | 5.678 | .017 |
| | No | 15.00 | 13.758-16.242 | | |
| **Pneumonia** | Yes | 19.00 | 17.096-20.904 | 18.202 | .000 |
| | No | 13.00 | 11.621-14.379 | | |
| **Stunting** | Yes | 20.00 | 17.533-22.467 | 17.775 | .000 |
| | No | 14.00 | 12.867-15.133 | | |
| **Shock** | Yes | 26.00 | 20.548-31.452 | 13.094 | .000 |
| | No | 15.00 | 13.761-16.239 | | |
| **Deworming** | Yes | 9.00 | 7.161-10.839 | 23.228 | .000 |
| | No | 23.00 | 19.955-26.045 | | |
| **IV fluid** | Yes | 25.00 | 19.819-30.181 | 15.351 | .000 |
| | No | 15.00 | 13.734-16.266 | | |
| **ReSoMal** | Yes | 14.00 | 12.709-15.291 | 5.281 | .022 |
| | No | 17.00 | 15.168-18.832 | | |
| **Daily wt gain** | <8g/Kg/d | 20.00 | 18.827-21.173 | 79.509 | .000 |
| | ≥8g/Kg/d | 11.00 | 10.011-11.989 | | |
| **Overall** | | 15.00 | 13.608-16.392 | | |

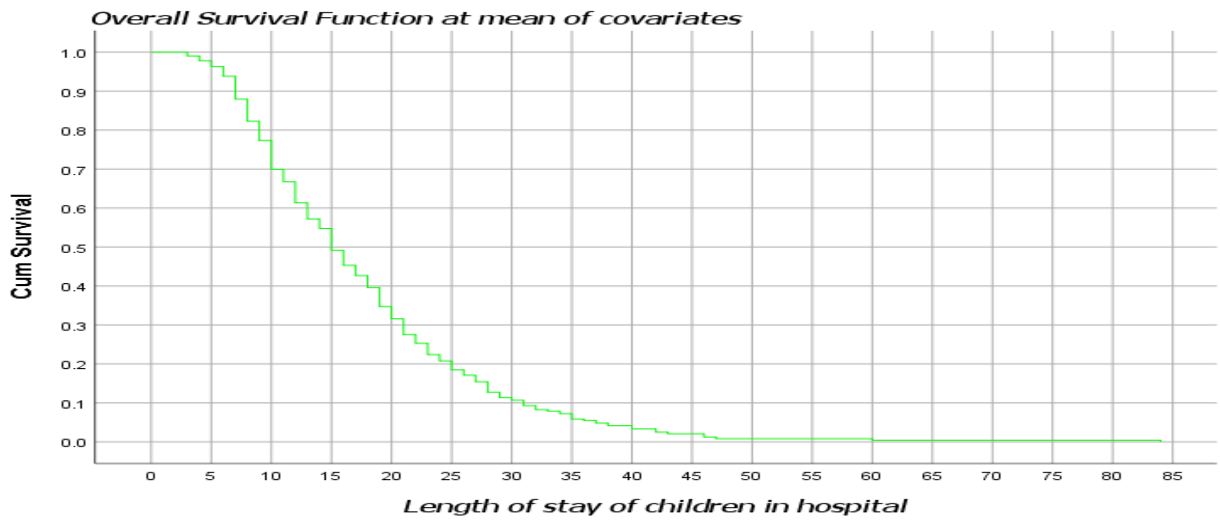


**Figure-5:** **Shows overall Kaplan-Meier estimation of survival time to recover from SAM among under-5 children managed at Yekatit 12 hospital from January 1, 2016 to December 30, 2018**

### 5.6.1. Survival functions among different groups of under-5 children with SAM managed at Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018

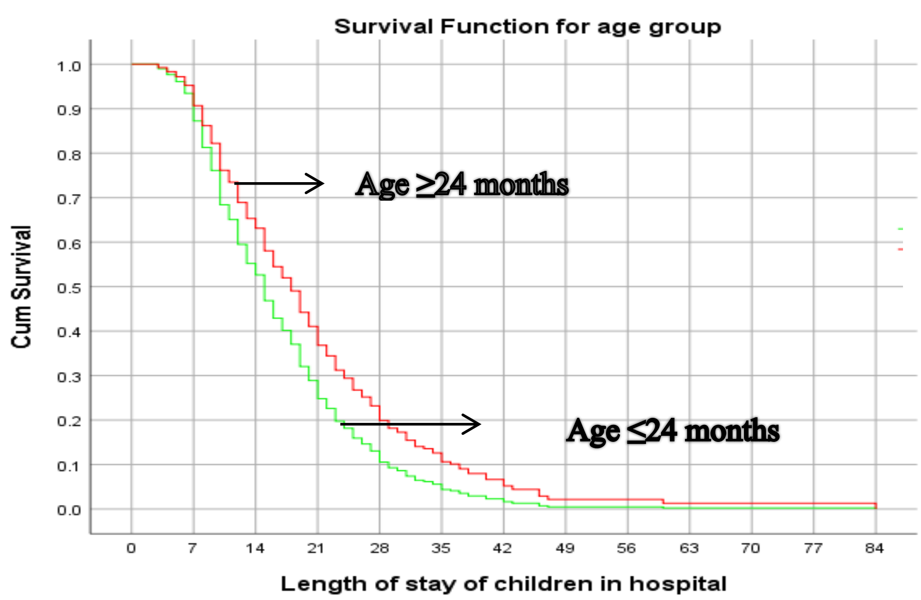


**Figure-6:** **Kaplan-Meier survival curves comparing recovery time between under-5 children managed at Yekatit 12 hospital from January 1, 2016 to December 30, 2018 based on age group.**

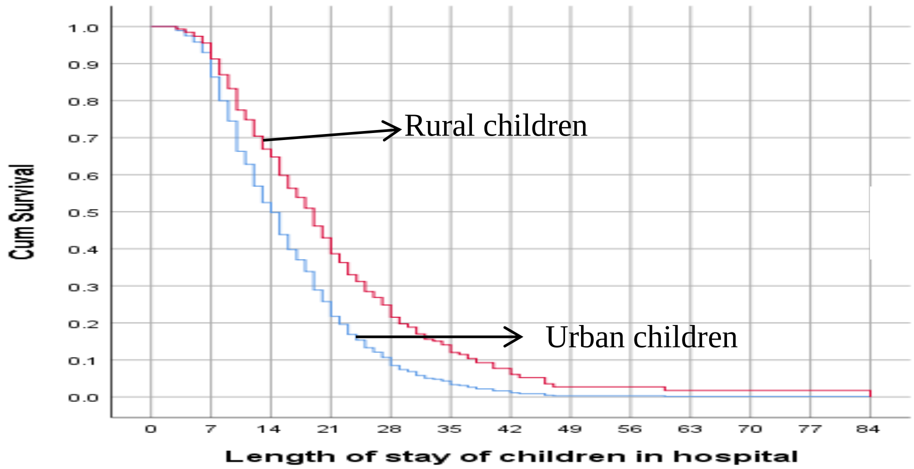


**Figure-7: Kaplan-Meier survival curves comparing recovery time of under-5 children with SAM managed at Yekatit 12 hospital from January 1, 2016 to December 30, 2018 based on residence.**

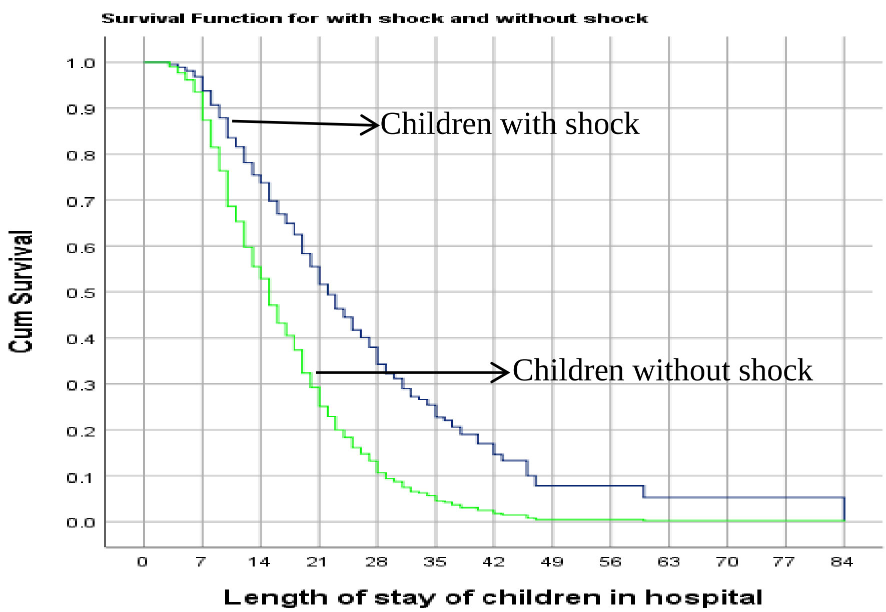


**Figure-8: Kaplan-Meier survival curves comparing recovery time of under-5 children with SAM managed at Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018 based on the presence/absence of shock.**

## 5.7. Test of proportional hazard assumption by Schoenfeld's residuals

Testing the proportional hazard assumption is vital for interpretation and use of fitted proportional hazard models. Therefore, in this study goodness-of-fit (GOF) particularly the Schoenfeld residuals proportional hazard assumption test for the individual covariates and global tests was used. If P-Value < 0.05, then the proportional hazard assumption is not fulfilled. From Table below, each covariate (P-Value > 0.05) and all of covariates simultaneously (Global test for Cox proportional hazard P-Value=0.2197> 0.05) met the proportional hazard assumption.

**Table-7: test of proportional hazard by Schoenfeld residuals for each predictor as well as global test.**

| **Predictors** | **rho** | **chi2** | **Df** | **Prob>chi2** |
|---|---|---|---|---|
| Age group | 0.02074 | 0.02074 | 1 | 0.7058 |
| Gender | 0.03268 | 0.39 | 1 | 0.5333 |
| Residence | 0.09418 | 3.17 | 1 | 0.0751 |
| Type of malnutrition | 0.06373 | 1.39 | 1 | 0.2382 |
| Vaccination status | 0.10243 | 3.46 | 1 | 0.0627 |
| HIV/AIDS | -0.09879 | 3.73 | 1 | 0.0536 |
| Anemia | -0.08966 | 3.02 | 1 | 0.0821 |
| DHN | 0.02126 | 0.17 | 1 | 0.6777 |
| Fever | -0.00545 | 0.01 | 1 | 0.9153 |
| Diarrhea | 0.03594 | 0.48 | 1 | 0.4895 |
| TB | -0.01373 | 0.07 | 1 | 0.7928 |
| Pneumonia | -0.14688 | 3.49 | 1 | 0.0618 |
| AGE | -0.04923 | 0.92 | 1 | 0.3376 |
| Rickets | -0.06977 | 1.71 | 1 | 0.1905 |
| Stunting | 0.04778 | 0.86 | 1 | 0.3551 |
| Shock | -0.05870 | 1.20 | 1 | 0.2740 |
| Microcephaly | 0.01325 | -0.06 | 1 | 0.8048 |
| IV Antibiotics | 0.02308 | 0.19 | 1 | 0.6643 |
| Deworming | -0.01396 | 0.07 | 1 | 0.7905 |
| IV Fluid | -0.10037 | 3.44 | 1 | 0.0635 |
| ReSoMal | 0.04279 | 0.62 | 1 | 0.4307 |
| Vit A | 0.03076 | 0.35 | 1 | 0.5517 |
| Daily Wt gain/Kg | -0.10119 | 2.93 | 1 | 0.0868 |
| **Global test** | | 18.79 | 23 | 0.2197 |

## 5.8. Factors associated with recovery time from SAM

Thirty-nine independent variables were analyzed in the cox-proportional hazard analysis with the dependent variable. Twenty-four variables, which have a P value of < 0.25 in the bivariate cox, were entered in to a multivariate cox proportional hazard regression analysis. However, only seven variables such as age, vaccination status, pneumonia, and stunting, shock, deworming and daily Wt gain/Kg were independent predictors (Table-7).

Nutritional recovery rate was decreased by 1.9% for every 1-month increase in child's age (AHR=0.981, 95% CI: 0.966-0.997). Regarding to vaccination status of children, those under-5 children who were fully vaccinated for their age were about 1.64 time more likely to recover faster than children who were not vaccinated fully (AHR=1.639, 95% CI: 1.197-2.243).

Depending on children's exposure for different comorbid diseases, children who developed pneumonia were 23.4% less likely to recover faster than those children who didn't develop (AHR =0.835, 95 % CI: 0.599-0.975). Likewise, compared to children who were not stunted, stunted children were 33.4% less likely to recover faster (AHR =0.666, 95 % CI: 0.502-0.882). Additionally, children who experienced shock during hospital stay were 46.9% less likely to recover earlier than those who did not experience it (AHR =0.531, 95 % CI: 0.324-0.870).

Regarding treatments, supplements and therapeutic feedings, children who were not dewormed during hospital stay were 74.2% less likely to recover earlier compared to children who were dewormed (AHR =0.258, 95 % CI: 0.109-0.612). Lastly, under -5 children who gained an average daily Wt of ≥8g/Kg were 2.2 times more likely to recover faster compared to children whose average daily Wt gain were <8g/Kg (AHR =2.158, 95 % CI:1.637-2.845) (Table-8).

**Table-8: Factors associated with recovery time from SAM among under-5 children at the TFU of Yekatit 12 hospital, Addis Ababa, Ethiopia (N=423)**

| Covariates | Category | p-value | CHR(95%CI) | AHR(95%CI) |
|---|---|---|---|---|
| **Age** | | .001 | 0.98(.978-0.995) | **0.981(0.966-0.997)*** |
| Sex | Male | .062 | 1.23(.990-1.529) | 0.845(0.672-1.061) |
| | Female | | 1 | 1 |
| Residence | Urban | .000 | 1.60(1.271-2.028) | 1.203 (0.930-1.556) |
| | Rural | | 1 | 1 |
| Type of malnutrition | Marasmus | | 1 | 1 |
| | Kwashiorkor | .002 | .63(.479-.847) | 0.864(0.406-1.837) |
| | Marasmic-kwashiorkor | .014 | .64(.449-.915) | 0.785(0.363-1.697) |
| **Vaccination status** | Fully vaccinated | .000 | 2.144 (1.610-2.857) | **1.639 (1.197-2.243)**** |
| | Partially vaccinated | .083 | 1.397 (.958-2.037) | 1.255 (0 .843-1.868) |
| | Not vaccinated | | 1 | 1 |
| HIV/AIDS | Yes | .018 | .654(.460-.929) | 0.862(0.588-1.264) |
| | No | | 1 | 1 |
| Anemia | Yes | .020 | .776(.626-.961) | 1.076 (0.848-1.364) |
| | No | | 1 | 1 |
| DHN | Yes | .178 | .831(.634-1.088) | 1.085(0.763-1.542) |
| | No | | 1 | 1 |
| Fever | Yes | .210 | 1.156(.921-1.451) | 1.073 (0.825-1.397) |
| | No | | 1 | 1 |
| Diarrhea | Yes | .110 | .841(.679-1.040) | 0.724(0.464-1.130) |
| | No | | 1 | 1 |
| TB | Yes | .024 | .584(.366-.932) | 0.984(0.587-1.650) |
| | No | | 1 | 1 |
| **Pneumonia** | Yes | .000 | .637(.513-.791) | **0.764(0.599-0.975)*** |
| | No | | 1 | **1** |
| AGE | Yes | .174 | .862(.696-1.068) | 1.081(0.685-1.708) |
| | No | | 1 | 1 |
| Rickets | Yes | .071 | 0.775(.588-1.022) | 0.979(0.725-1.323) |
| | No | | 1 | 1 |
| **Stunting** | Yes | .000 | 0.604(.472-.772) | **0.666(0.502-0.882)**** |
| | No | | 1 | **1** |
| **Shock** | Yes | .001 | 0.478(.312-.732) | **0.531(0.324-0.870)*** |
| | No | | 1 | **1** |
| Microcephaly | Yes | .196 | 0.756(0.495-1.155) | 0.839(0.538-1.307) |
| | No | | 1 | 1 |
| IV antibiotics | Yes | .130 | .759(.531-1.084) | 0.960(0.651-1.414) |
| | No | | 1 | 1 |
| **Deworming** | Yes | | 1 | **1** |
| | No | .000 | .329(.197-.549) | **0.258(0.109-0.612)**** |
| IV fluid | Yes | .000 | 0.552(.403-.755) | 0.792(0.519-1.211) |
| | No | | 1 | 1 |
| ReSoMal | Yes | .027 | 1.272(1.027-1.575) | 1.199(0.903-1.590) |
| | No | | 1 | 1 |
| Vit A | Yes | .173 | 1.225(.915-1.642) | 1.346(0.971-1.865) |
| | No | | 1 | 1 |
| **Daily wt gain** | <8g/Kg/d | | 1 | 1 |
| | ≥8g/Kg | .000 | 2.272(1.759-2.935) | **2.158(1.637-2.845)**** |

***=P-value<0.05**

****=P-value<0.01**

**5.10. Overall hazard function for under-5 children with SAM managed at Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1, 2016 to December 30, 2018**

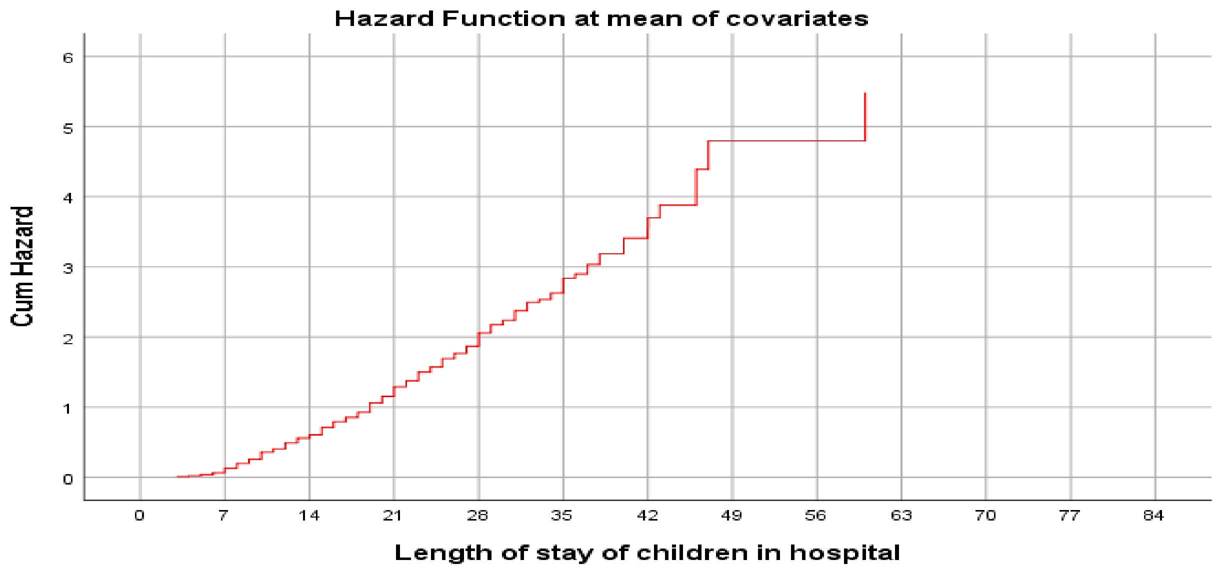


**Figure 9:** **shows cumulative estimation of chance of recovery among under-5 children with SAM in Yekatit 12 hospital, Addis Ababa, Ethiopia from January 1 2016 to December 30 2018.**

**5.10.1. Hazard functions among different groups of under-5 children with SAM managed at Yekatit 12 hospital from January 1, 2016 to December 30, 2018**

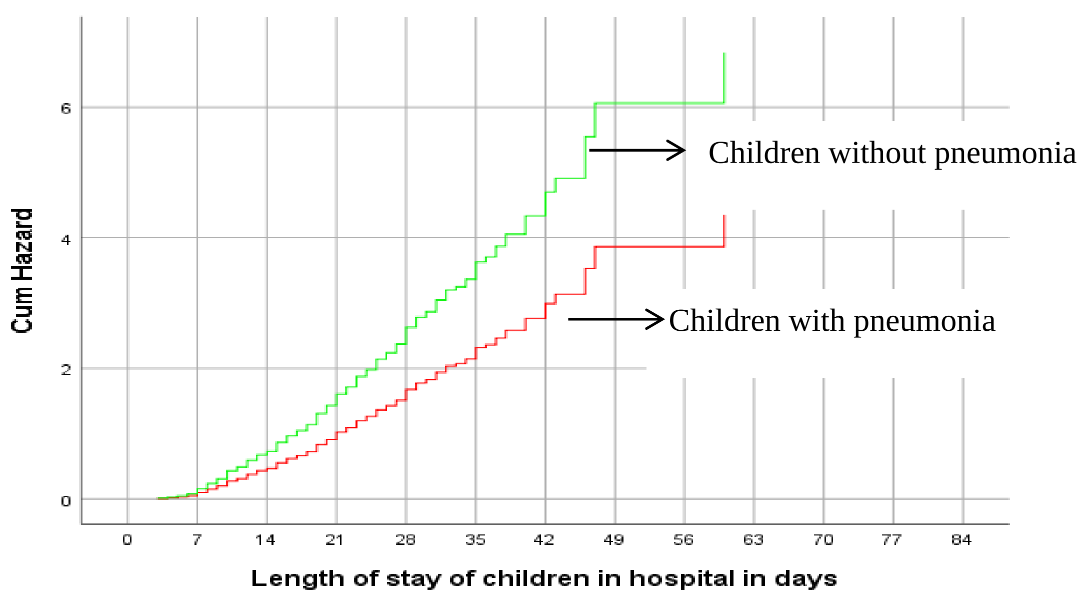


**Figure-10:** **shows cumulative estimation of chance of recovery among under-5 children with SAM by the presence or absence of pneumonia in Yekatit 12 hospital.**

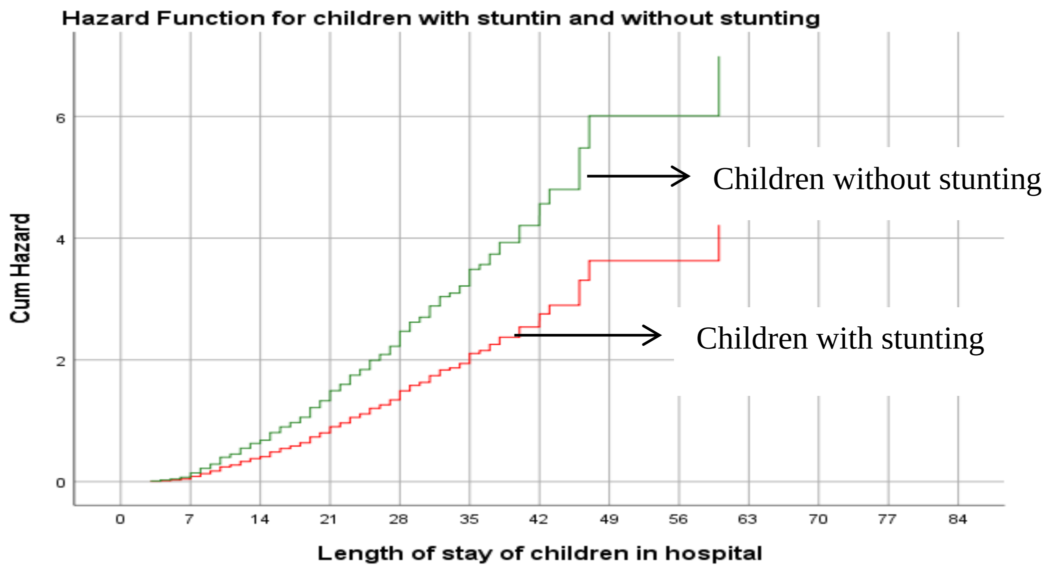


**Figure 11: shows cumulative estimation of chance of recovery among under-5 children with SAM by the presence or absence of stunting in Yekatit 12 hospital.**

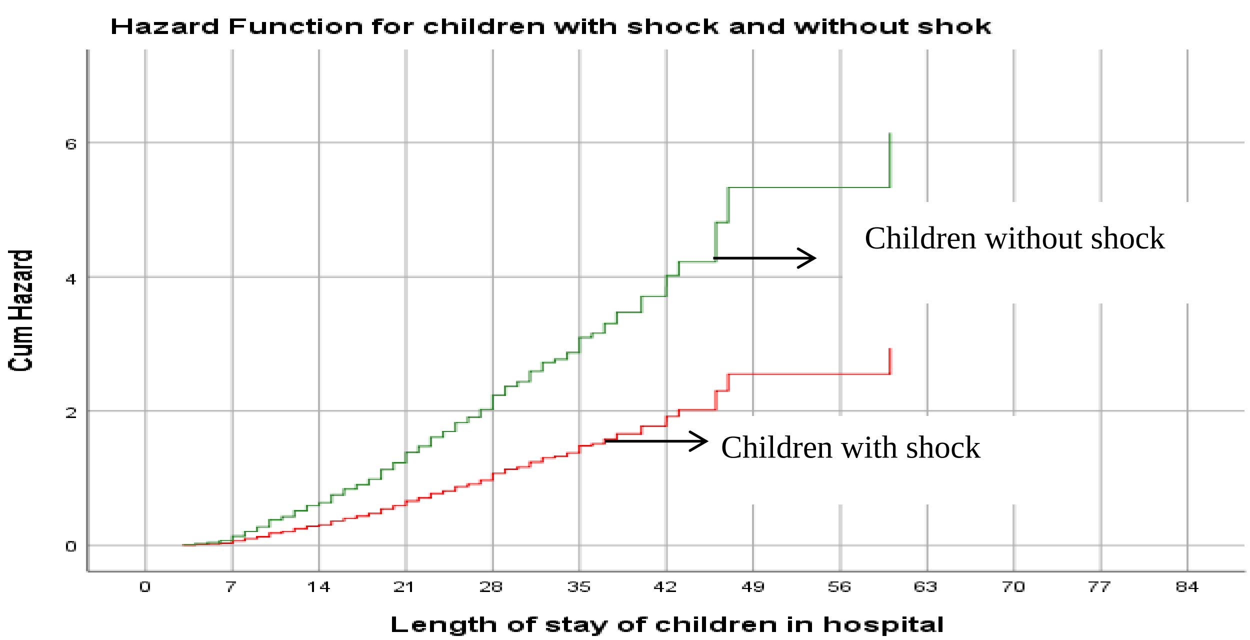


**Figure-12: Shows cumulative estimation of chance of recovery among under-5 children with SAM by in the presence or absence of shock in Yekatit 12 hospital.**

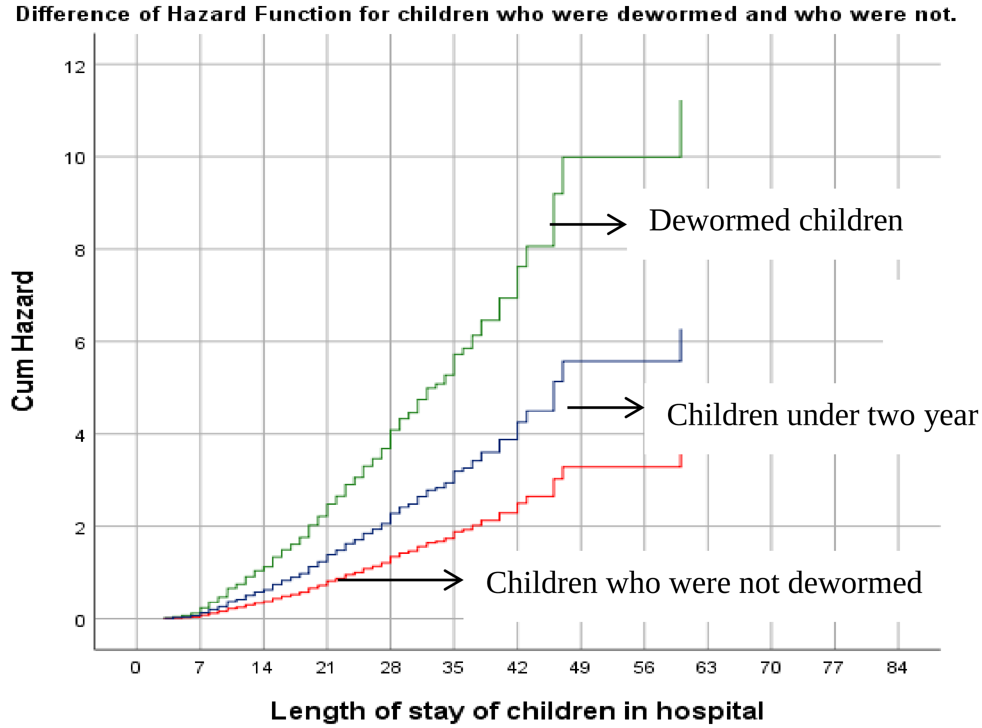


**Figure-13: Shows difference of cumulative chance of recovery for under-5 children with SAM who were dewormed and who were not in Yekatit 12 hospital.**

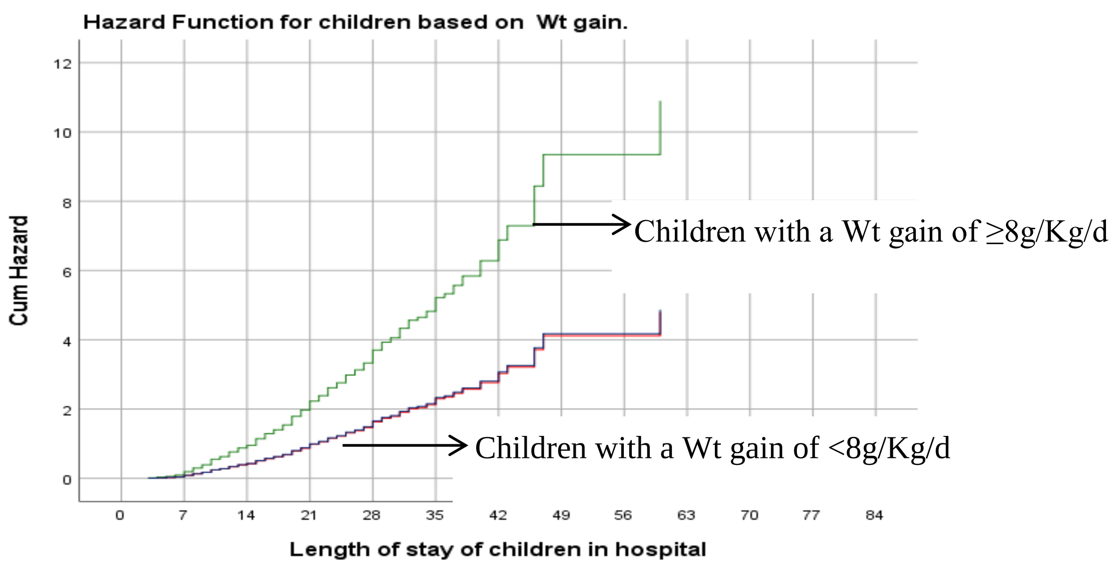


**Figure-14: Shows difference of cumulative chance of recovery for under-5 children with SAM based on daily Wt gain/Kg in Yekatit 12 hospital.**

# CHAPTER-6: DISCUSSION

The aim of the study was to determine recovery time from SAM and to identify predictors of nutritional recovery time. From the total of 423 under-5 children included in the study, 81.3% of children recovered, 11.1% died and 7.6% of children defaulted their treatment. Compared to the sphere project value, the overall recovery and default rate were in acceptable ranges (>75% and <15% respectively). However, the death rate was somewhat higher than acceptable death figure (<10%) in the sphere project value even though it was not alarming(>15%) (8). Compared to other studies in different countries, the recovery rate in this study was higher than studies done in Indonesia, Zambia, Bahir Dar city, Ayder hospital, Gedeo Zone-health, Wolaita Zone, Debre Markos and Finote Selam hospitals Dilchora Dawa and North Shoa Zone (18, 32-34, 39, 43, 47, 48, 50).

Differences in sample size, socio-demography and health care setup might be possible reasons for difference of recovery rate in Indonesia, Zambia and Ayder referral hospital. However, the low recovery rate observed in Felege-Hiot referral hospital Gedeo Zone, Wolaita Zone, Debre Markos and Finote Selam hospital, Dilchora hospital and North Shoa Zone might be due to the health care setup(these studies include HC, primary hospitals and general hospitals with no TFU).

However, the recovery rate for the present study was lower than studies done India, Wolisso St. Luke catholic hospital and Ghana(40, 42, 51). The higher recovery rate in St. Luke catholic hospital might be due to greater sample size (855). However, differences in socio-economic status, quality of care provided in each hospital, the health seeking behavior and accessibility of different medications and therapeutic foods to treat SAM might be reasons for higher recovery rates in India and Ghana.

The present study also reported a death rate higher than reported from the study done in India, Gambia, Bahir Dar City, North Shoa, Debre Markos and Finote Selam hospitals, and Wolaita zone(18, 33, 39, 41, 50, 68). The possible reason for lower recovery rate in India and Gambia might be only case specific mortality will be recorded and there might be differences in socio-economic status, treatment and caring practice. The possible variations for other Ethiopian studies might be in the present study setting, debilitated children referred from different parts of the country and the case becomes complicated in this way. As a result, the death rate might be higher.

Besides, to the treatment out comes of children, in this study, the overall recovery time from SAM and differences of recovery time between different groups of children were assessed. Accordingly, the overall median recovery time from SAM was estimated to be 15 days. This nutritional recovery time is within acceptable maximum standard (<28 days). However, about 13% of children with SAM stay in hospital beyond 28 days and about 3% of children stayed beyond 42 days, which is an alarming length of hospitalization according to the SPHERE standard.

The median nutritional recovery time is consistent with median recovery time reported from a study done in Dilla university referral hospital, Zambia, Bahir Dar city, and Wolisso (18, 35, 44, 51). However, it was higher than a report of nutritional recovery time from studies done in India, Zambia, Dilchora Referral Hospital, Hadia zone, and North Shoa zone(40, 43, 48-50). The low nutritional recovery time in India and Zambia may be due to socio-economic status as well as treatment and caring practice and the higher recovery time compared to other settings in Ethiopia might be in this study setting, complicated cases may be referred and this might prolong recovery time.

On the other hand, nutritional recovery time was better than some studies done in Gambia, Gedeo zone, and Ayder referral hospital (32, 41, 46). On this study, very high nutritional recovery time differences has been observed in under-5 children with shock, and without shock which were 26 days and 15 days respectively and; between under-5 children who were dewormed and who were not which were 9 days and 23 days respectively.

Regarding predictors of nutritional recovery time, from all socio-demographic characteristics, age was the only significant factor for nutritional recovery time. For every one-month increase in child's age, the child is 1.9% less likely to recover faster. The scientific explanation for this might be due to discontinuation of breastfeeding and inappropriate complementary feeding practices as children’s age increases. The present study was consistent with the study done in Debre Markos and Finote Selam hospitals, and Northern India (33, 40). However, this study is contrary to studies done in Malawi, Wolisso, Gamo-Gofa Zone and Shebedido woreda OTP center (51, 53-55). This difference may be due to differences in research design, and health care setting.

Related to immunization status, under-5 children who were fully vaccinated for their age were about 64% more likely to recover faster than children who were not fully vaccinated. The body of un-vaccinated children could not fight major childhood diseases like malaria, pneumonia, diarrhea, and measles. The condition of immune- suppression becomes worse when the child is under starvation. As result, the child takes longer duration of time to recover from those childhood diseases(69, 70). The present study is consistent with a study finding in Bahir Dar (19). Nevertheless, studies done in North Shoa as well as Enderta Woreda, Tigray, did not show any association between vaccination status and nutritional recovery time(50, 54). The reason for variation could be deference in health care setup and sample size.

Among all comorbidities, comorbid diseases like pneumonia, stunting, and shock were the only significant predictors of recovery time from SAM. Relative to children who did not have pneumonia, children with pneumonia were 23.6% less likely to recover earlier. This could be explained in terms of the synergistic relationship between pneumonia and malnutrition. Children with respiratory infections like pneumonia may present with tachypnea, retractions, and other signs of respiratory distress, but these are undetectable signs in children with SAM. Therefore, health care providers cannot early detect and treat early and stay hospitalized.

The present study is in line with a retrospective cohort study done in Zambia and Debre Berhan referral hospital, Enat general hospital and Mehal Meda primary hospital(43, 44, 50). However, pneumonia was not a significant predictor of nutritional recovery time in a retrospective cohort study done in Southern Ethiopia, Wolaita Zone and Bahir Dar city(18, 47, 58). The reason for difference might be in those hospitals pneumonia might be detected and treated early compared to the present study setting since it is referral for malnutrition.

Similarly, children who were stunted were less likely to recover faster compared to children who were stunted. The explanation for this association might be, management of acute malnutrition is similar regardless of whether there is stunting, although obviously the most stunted children will have the highest risk of failing to respond to therapy and stay longer in hospital. Around 10% of under-5 children in the present study were stunted, however none of studies done in Bahir Dar city, Debre Markos and Finote Selam, Debre Berhan referral, Enat general and Mehal Meda primary hospitals(18, 33, 50) included stunting as co-factor for nutritional recovery time.

Likewise, children who were in shock during treatment were 74.2% less likely to recover faster than children who were not. Unless it is prevented and detected early shock could compromise many vital organs including brain, heart and kidney especially when children were under starvation of cellular energy(1). However, shock was not a significant associated factor for recovery time from SAM in a study done in two hospitals of Wolaita (47). The reason for difference might be in those hospitals health care providers could prevent and early treat the underlying causes of shock to decrease the impact of it on length of stay of children in hospital. However, since the present study setting is referral, shock might not be early identified and treated and result in prolonged hospitalization.

Regarding treatments, supplements and therapeutic feedings, deworming of children was the only significant factor for nutritional recovery time of under-5 children. Under-5 children who were not dewormed by Albendazole/ Mebendazole were 74.2% less likely to recover faster than those who were dewormed. The scientific explanation of this report could be intestinal worms scramble the nutrients given for children and prolong recovery time. However, deworming was not associated with nutritional recovery time in studies done in Bahir Dar city, Shebedido woreda, and South West Ethiopia (18, 55, 58).

The possible reason for difference might be smaller number of sample sizes and small proportions of children were dewormed in these studies, as a result, association with nutritional recovery time could not be met.

Lastly, daily Wt gain/Kg was calculated for 313(74% of the total) marasmic children. One-hundred-forty-five (46.3%) children gained <8g/Kg/day and the rest 166(53%) children gained an average Wt of ≥8g/Kg/day. Children with an average daily Wt gain of ≥8g/Kg were around 2.2 times more likely to recover faster than children whose average daily Wt gain was ≤8g/Kg. The scientific explanation for association is clear, for marasmic children amount of daily wt gain is necessary to recover as fast as possible since one of the criteria to discharge is Wt gain. The present study is in line with a study done in Bahir Dar city(18), but other studies do not incorporate Wt gain as a co-factor(33, 50)

## 6.1. Strength and limitation of the study

### 6.1.1 Strength of the study

The strengths of this study include:

- ✓ Using a 3-year record to increase representativeness,
- ✓ Incorporating more covariates like stunting and shock that were not included in other retrospective studies.

### 6.1.2. Limitation of the study

The study was merely based on secondary data, so analysis of associated factors for nutritional recovery time was limited by the information that could be obtained from the patients' charts. Other limitations of this study include:

- ✓ Lack of comparison group from other healthcare facilities in the city,
- ✓ Classifying the child to different form of SAM based on the diagnosis obtained from the card, which may be misdiagnosed/ misreported.

# CHAPTER-7: CONCLUSION AND RECOMMENDATION

## 7.1. Conclusion

Except the overall death rate, performance indicators like recovery rate, default rate and nutritional recovery time were within the acceptable range value. From the multivariate Cox proportional hazard regression model, daily Wt gain of ≥8g/Kg, full vaccination, and deworming with albendazole/mebendazole were proven to reduce nutritional recovery time. Conversely, older age, the presence of pneumonia, the presence of stunting, and the presence of shock as comorbidities were proven to increase nutritional recovery time. Therefore, to prevent complications; to reduce death rate; and to reduce length of hospitalization, emphasis should be given for improving early detection and treatment of SAM to prevent stunting; and comorbidities like pneumonia and shock.

## 7.2. Recommendation

Based on the findings of this study, the following recommendations have been forwarded with each respective body:-

**To Federal Ministry of Health (FMOH):**

**T**he FMOH had better to strengthen primary prevention strategies especially on immunization programs, IMNCI programs especially on deworming of children greater than 2 years old, and on early identification and management of SAM on children to prevent stunting.

**To Yekatit 12 hospital medical director and staffs:**

Since the death rate is high, the hospital administrators shall adjust on job training and refresher programs for the health care provider regarding management of SAM according to the national protocol to decrease it. Additionally staffs in TFU of Yekatit 12 hospital are strongly advised to do daily Wt gain monitoring, and comply with national impatient SAM treatment and management guidelines in early diagnosis and treatment of pneumonia, and shock.

**To Future researchers**

As this is, a hospital based retrospective secondary data analysis; future researchers should use a prospective cohort study design for better information including other factors not included under this study such as parental socio-demographic and socio-economic characteristics, educational status of health worker and perception of caregivers to words SAM.

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# CAPERER-9: ANNEXES

## Annex-I: Information sheet

**Title of the Research proposal**: Time to recover from severe acute malnutrition and associated factors among under -5 children in Yekatit 12 hospital, Addis Ababa, Ethiopia, 2019.

**Name of Investigator**: Mekonen Adimasu (BSC)

**Name of the Organization**: Addis Ababa University, College of Health science, school of Nursing and midwifery.

**Name of the Sponsor**: Addis Ababa University

**Introduction**: this information sheet is prepared for Yekatit 12 hospital malnutrition unit. The aim of the form is to make the concerned office clear about the purpose of research, data collection procedures and get permission to conduct the research.

**Purpose of the Research thesis**: To assess recovery time and associated factors among under -5 children with severe acute malnutrition in Yekatit 12 hospital, Addis Ababa, Ethiopia, 2019.

**Procedure**: In order to achieve the above objective, information, which is necessary for the study, will be taken from patient charts. In order to come up with the objective of the study, selected charts of patients enrolled from January 1, 2016 to December 30, 2018 will be reviewed to access the required information from the records using a pre-prepared data abstraction format.

**Risk and /or Discomfort**: Since the study will be conducted by taking appropriate information from medical chart, it will not inflict any harm on the patients. The name or any other identifying information will not be recorded on the data abstraction form and all information taken from the chart will be kept strictly confidential and in a safe place. The information extracted will be kept secured by locked in to locker by key. After the data will be entered in to the computer, it will be protected by a computer password. The information retrieved will only be used for the study purpose.

**Benefits**: the research has no direct benefit for those whose document/ record is included in this research. However, the indirect benefit of the research for the participant and other clients in the program is clear. This is because if program planners are preparing predicted plan there is a benefit for clients in the program of getting appropriate care and treatment services for children with severe acute malnutrition.

Of all, the research work has a paramount direct benefit for health care planners and managers, especially for those on malnutrition program planning and management.

**Confidentiality**: To ensure confidentiality the data on the chart will be collected without the name and medical record number of the clients. The information collected for this research project will be kept confidential and will be stored in a file. In addition, it will not be revealed to anyone except the investigator and it will be kept in key and locked system with computer password.

**Person to contact:** This research project will be reviewed and approved by the institutional review board of college of health sciences, school of nursing and midwifery, Addis Ababa University.

If in case you want to know more information about the research and its undertakings, you can contact my advisors through the address below.

1. Mr. Girum Sebsbie (BSCN, MSCN), Assistance Professor: Addis Ababa University, college of health sciences, school of nursing and midwifery. Tel: 0920856732; email: girumseb@gmail.com

2. Sr. Fkirtemariam Abebe (BSC.N, MSC.N): Addis Ababa University, college of health sciences, school of nursing and midwifery. Tel: 0911487604; email: haymiabe@gmail.com

**Permissio**n: Lastly, you are kindly requested to permit and forward your permission to concerned body in your organization so that the researchers can get cooperation from the data clerks and other responsible bodies in place.

## Annex-II: Data Abstraction Format

This data abstraction format is prepared for collecting information on recovery time and associated factors among children with severe acute malnutrition at the therapeutic feeding unit of Yekatit 12 hospital.

1. Data collector name _____________

2. Date of data collection _____________

3. Data abstraction format identification number /__________/____________/

**Part I: Socio-demographic questions**

1. Age of the child in months------------------------------------

2. Sex of the child

Male ☐

Female ☐

3. Residence:

Urban ☐

Rural ☐

**Part II: Anthropometric measurements at admission**

1. Admission MUAC in cm _______________.

2. Admission weight in Kg________________

3. WFA Z score at admission

4. WFH Z score at admission_______________

**Part III: Type of malnutrition and Immunization status**

1. What type of severe acute malnutrition children have had?

Marasmus ☐ Kwashiorkor ☐ Marasmic-kwashiorkor ☐

2. Immunization status

Fully immunized ☐

Partially immunized ☐

Not immunized ☐

**Part IV: Comorbid medical diseases before or after admission**

1. Presence of HIV/AIDS A. NO B. Yes

2. Presence of anemia A. NO B. Yes

3. Presence of severe dehydration A. NO B. Yes

4. Presence of fever A. NO B. Yes

5. If the answer for question number 4 is yes, recorded axillary $T^0$ ________________________

6. Presence of congenital heart disease A. NO B. Yes

7. Presence of diarrhea diseases A. NO B. Yes

8. Presence of tuberculosis A. NO B. Yes

9. Presence of pneumonia A. NO B. Yes

10. Presence of gastroenteritis A. NO B. Yes

11. Presence of stunting A. NO B. Yes

12. Presence of rickets A. NO B. Yes

13. Presence of shock A. NO B. Yes

14. Other medical comorbidities (list) __________________________________________

_________________________________________________________________________________

**Part V: Treatments, supplements and therapeutic feedings**

**Routine treatments**

1. Did the child receive IV antibiotic/s? A. NO B. Yes

2. If the answer for question number 1 is yes list ________________________

3. Does the child take PO antibiotic/s? A. NO B. Yes

4. If the answer for question number 6 is yes list ________________________

5. Was the child dewormed with Albendazole or Mebendazole? A. NO B. Yes

6. Others (list) ________________________________________________________

**Special medication**

7. Did the child take IV fluid? A. NO B. Yes

8. If the answer for question number 7 is yes list type of fluid ____________________________

9. Did the child take ReSoMal? A. NO B. Yes

**Supplements given**

12. Did the child receive Vitamin A? A. NO B. Yes

13. Did the child receive Iron? A. NO B. Yes

14. Did the child receive Folic Acid? A. NO B. Yes

15. Other supplements (list) ________________________________________________

**Therapeutic foods given**

16. Did the child receive $\mathbf{F_{75}}$**?** A. NO B. Yes

17. Did the child receive $\mathbf{F_{100}}$**?** A. NO B. Yes

18. Did the child receive RUTF? A. NO B. Yes

**Part VI: Anthropometrical measurement at discharge and weight and MUAC gains per Kg**

1. Child weight in kilogram____________

2. Weight gain/kg/d_________________

**Part VII: Outcomes of inpatient management and length of hospitalization**

1. Final outcomes of treatment

Recovered ☐ censored ☐

2. Date of admission ______________________

3. Date of discharge ______________________

4. Length of stay _________________________

Checked by supervisor; Name___________________________, Signature____________