ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

DEPARTMENT OF NURSING

SURVIVAL STATUS AND PREDICTORS OF MORTALITY AMONG SEVERLY ACUTE MALNOURISHED UNDER FIVE CHILDREN ADMITTED TO STABILIZATION CENTERS IN SELECTED GOVERNMENT HOSPITALS IN ADDIS ABABA, ETHIOPIA, 2022.

BY: AMANUEL NUREDIN (BSc)

A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF NURSING AND MIDWIFERY, COLLEGE OF HEALTH SCIENCES IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTERS IN CHILD HEALTH NURSING.

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May, 2023

APPROVAL SHEET

I, the undersigned MSc student, affirm that I have submitted my original thesis, entitled as "Survival status and predictors of mortality among under five children with severe acute malnutrition admitted to stabilization centers in selected government hospitals in Addis Ababa, Ethiopia,2022" to School of Nursing and Midwifery of Addis Ababa University for examination.

Submitted by: Amanuel Nuredin _____ _____

(Student's name) (Signature) (Date)

This thesis work has been submitted for examination with my approval as an advisor.

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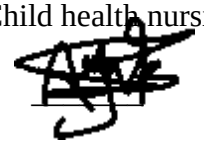
(Co-Advisor) (Signature) (Date)

I, the undersigned below, had examined and accepted the thesis work entitled as in the above as a satisfying thesis in its present form, and recommended to School of Nursing and Midwifery of Addis Ababa University, for its acceptance as a partial fulfillment for the award of Master of Science (MSc) in Pediatrics and Child health nursing:

Examiners: Name: Abdissa Boka  15/6/2023

(Examiner) Sign Date

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ACRONYMS (ABBREVIATIONS)

AACAHB : Addis Ababa City Administration Health Bureau

AAU : Addis Ababa University

EDHS : Ethiopian Demographic Health Survey

FDRE : Federal Democratic Republic of Ethiopia

GAM: Global Acute Malnutrition

LMICs : low-income and middle-income countries

MAM :Moderate Acute Malnutrition

MOH : Ministry Of Health

MUAC : Mid-Upper Arm Circumference

ODK : Open Data Kit

RUTF : Ready-to-Use Therapeutic Foods

SAM :Severe Acute Malnutrition

SDGs : United Nations' Sustainable Development Goals

SPHERE : Social and Public Health Economics Research Groups

TB : Tuberculosis

WFH: Weight For Height

WFA: Weight For Age

ABSTRACT

Background: Malnutrition is a medical disorder that causes the body's physical functioning to deteriorate due to an imbalance, shortage, or excess of energy and/or nutrients. Nearly a quarter of the world's malnutrition was found in Sub-Saharan Africa, and undernutrition was responsible for roughly half of all under five children mortality. Among different types of malnutrition, severe acute malnutrition is a major killer and a serious public health issue that requires attention, especially when complicated, because it causes morbidity and shortens the survival of children under the age of five.

Objective: The aim of this study was to assess the survival status and predictors of mortality among children under the age of five admitted with severe acute malnutrition in selected government hospitals in Addis Ababa, Ethiopia, 2022.

Method: A hospital-based retrospective cohort study was carried out on 422 severely malnourished children who had been admitted to four selected hospitals in the last three years. The study unit was selected using a systematic sampling technique, and a structured questionnaire was gathered using an open data kit collect app. Using STATA version 17, the analysis was carried out. The Kaplan-Meier survival curve and the log-rank test were used to describe the survival function and each predictor. To find the independent factors affecting mortality, a bivariate and multivariate cox proportional hazard regression model was used.

Result: In this study 44(10.4%) died with an incidence rate of 10.3%/1000 person days. The median hospital stay was 8 days and vaccination status (AHR=0.227,95%CI,0.088-0.583), Feeding 75(AHR=0.20195%CI,0.062-0.651), supplement, Intra venous fluid administration (AHR=3.65295%CI,1.525-8.743), presence of Human Immune deficiency virus (AHR=2.159,95%CI,1.001-4.65),pneumonia(2.15995%CI,1.001-4.65), and shock (AHR=3.47595%CI,1.451-8.321) were identified as significant predictors of mortality.

Conclusion: The recovery rate was found to be within the social and public health economics study group's acceptable range, although the mortality rate was only slightly beyond it. A number of factors, including vaccination, the human immunodeficiency virus, pneumonia, shock, intravenous fluid administration, and not taking supplements like Feeding 75, were independent predictors of mortality.

Key Word

Under five children; severe acute malnutrition; Survival status, treatment outcome; Addis Ababa

1. INTRODUCTION

1.1. Background Information

Malnutrition is defined as an imbalance, lack, or excess of a person's energy and/or nutrient intake. It is also a medical condition that causes the body's physical functioning to deteriorate, making it difficult for it to function properly. Malnutrition encompasses undernutrition and over nutrition. Undernutrition is further divided also as acute, chronic, and micronutrient deficiencies(1–3). Acute malnutrition in children can occur when food intake is suddenly reduced for a variety of causes, such as a medical condition or poor diet composition. It is also known as Protein-energy malnutrition ,wasting, kwashiorkor, and marasmus(3). Based on anthropometric limit values and clinical signs, acute malnutrition is further divided into three categories by the World Health Organization (WHO): moderate acute malnutrition (MAM), severe acute malnutrition (SAM), and global acute malnutrition (GAM). Severe acute malnutrition was distinguished from other classifications of acute malnutrition using the WHZ <3 or MUAC <115 millimeters, or the presence of bilateral pitting edema, or both(3,4).

Children with severe acute malnutrition (SAM) can manifest in at least three different ways in low- and middle-income countries (LMIC). The first form is called marasmus and characterized with severe wasting. The second type is characterized with edema and called kwashiorkor. The third type is called marasmic-kwashiorkor which constitute both characteristics. These children typically have the worst health and the greatest risk of dying (5).

By depending on the presence or absence of medical complications, SAM children are again classified as ‘complicated’ and uncomplicated. Children who are classified as complicated for the presence of medical complications needs inpatient treatment. While those with uncomplicated SAM children, who are clinically healthy with no symptoms of infection and a retained appetite, are treated as outpatient’s according to the World Health Organization guideline, with ready-to-use therapeutic meals (RUTF) (6,7). The objectives of effective management of SAM children are to limit susceptibility to life-

threatening infections, ensure sustained nutritional recovery with shorter hospital stays, and support neurocognitive development(8). FDRE MOH on its turn modified management protocol for SAM in 2016 with aim of decreasing the mortality from complicated SAM to less than 5%(9).

Even though the prevalence of severe acute malnutrition has decreased since the 2011 Ethiopian Demographic Health Survey (EDHS) report, Ethiopia continues to have the highest rate of acute malnutrition in the region, with 3% of children under the age of five being classified as severely malnourished(10). Furthermore, malnutrition accounts for 28% of all child deaths in Ethiopia, which makes the country have the highest rates of under-5 child mortality in the region(11). According to the mini-EDHS, in Ethiopia, the prevalence of wasting and underweight was 21% and 7%, respectively(12).

Malnutrition puts children at risk for various serious diseases and has a long-term negative impact on their physical and cognitive capacities. In addition, malnutrition is the cause of 3.1 million child deaths each year(13). Sub-Saharan Africa continues to have the highest mortality rate in the world, with one child in every 13 dying before reaching their fifth birthday, despite numerous attempts to lower the number of deaths among children under the age of five(14).

In 2019, children under the age of five made up 70% of all global deaths among children and young people under the age of 25. Children under the age of five died in more than 2.4 million worldwide. Infectious diseases such as pneumonia, preterm birth, and intrapartum complications are the leading causes of death for these children. Furthermore, malnourished children are more likely to die from these common childhood illnesses, particularly those suffering from severe acute malnutrition(15).

Therefore, combating this severe problem in children necessitates an integrated and systemic approach based on current evidences. Despite Severe acute malnutrition has a substantial impact on the survival of SAM children, to the best of our knowledge, no specific research in the study area has ever been

found. As a result, the objective of this study is to evaluate the survival status and risk factors of SAM in children under the age of five in order to improve their chances of surviving.

1.2. Statement of the problem

Around 200 million young children under five are malnourished worldwide, with one-third of children under the age of six months and nearly two-thirds of children aged six months to two years having inadequate nutrition(16,17). Worldwide, there are approximately 45.4 million wasted children under the age of five, With SAM affecting an estimated 13.6 million of them. Malnutrition remains a public health issue, despite the United Nations' Sustainable Development Goals (SDGs) of ending all kinds of malnutrition by 2030(8,18).

The leading global cause of death in children under five is severe acute malnutrition. Around half of the 7.6 million children under five who are malnourished worldwide died each year(19,20) and around 1 million of them are specifically due to severe acute malnutrition(9). Following South Asia, Sub-Saharan Africa was responsible for nearly a quarter of worldwide malnutrition, with About half of all deaths among children under five in these areas are attributed to undernutrition.(20). Severe acute malnutrition is responsible for about 400,000 child mortality each year worldwide (21). Despite having only 52 percent of the world's under-five children, Sub-Saharan Africa and Asia account for more than 80% of all under-five deaths(14).

Ethiopia is the second most malnourished country in Sub-Saharan Africa and one of the twenty nations with the highest prevalence of malnutrition, accounting for 80% of global malnutrition(22). Over 25,000 children are admitted each month with severe acute malnutrition to hospital stabilization centers. (23).Despite Ethiopia's efforts to reduce SAM mortality to less than 5% by applying a new management strategy, many Ethiopian health institutions still have a SAM mortality rate of more than 20%(24). This shows how widespread severe acute malnutrition is, despite the nation's efforts to carry out national and international pledges to eradicate all kinds of malnutrition by the year 2030.Faulty management is

raised as one of the reason for the continued existence of the problem and put the country as one of the slow progress in addressing sustainable development goal(22).

Severe acute malnutrition is the most common cause of pediatric hospital admission in many developing nations, especially in Sub-Saharan Africa, where the number of hospitalized children with severe malnutrition keeps rising despite the availability of outpatient therapy(25).Malnutrition renders children more vulnerable to illnesses and increases the severity and magnitude of those infections(20). This, in turn, prolongs the duration of recovery and increases the chance of mortality, despite the fact that the Sphere Handbook for Humanitarian Charter and Minimum Standards recommends a recovery time of less than 28 days after admission and a recovery rate of more than 75% for children with SAM(26–28). Furthermore the longer hospital stays by itself can increase the risk of several illnesses, including hospital-acquired infections and hasten the mortality of the child(29).

Furthermore, more than a quarter of SAM deaths occur while in admission and this number is progressively rising on our continent, especially when SAM is accompanied by other serious complications. In Ethiopia, nearly half of all deaths are due to malnutrition, with SAM mortality rates ranging from 6.67% to 28.67%, and most of them also die while in stabilization centers(30,31).

Among the types of SAM kwashiorkor and marasmus responsible for around 10% of all under five children mortality worldwide and almost all of them are from the low- and middle-income countries. Food security, environmental enteropathy, poor complementary feeding practices, and chronic and acute infections, contribute the development of severe acute malnutrition as a risk factors(32)

Therefore, severe acute malnutrition are serious public health issues that require attention. Especially when complicated, they are the causes of morbidity and shorten survival in children under the age of five, thus greater attention is required. Nevertheless, despite the enormous scope of the issue in our community, despite our best efforts, we were unable to locate a study that explicitly examined the survival status of under five children admitted with SAM and its predictors in the study area. This research, for its part, tries to identify the survival status of SAM among under five children, to give

more emphasis to their treatment, in order to minimize the death rate. In addition, this research will try to identify some of the possible factors that responsible for the death of under five children from SAM, as well as provide information to those in charge of the area so that they can improve the implementation and management of these children in order to prolong their survival.

1.3. SIGNIFICANCE

This study aims to promote the survival of SAM-affected under five children so that they can receive greater attention by uncovering the factors that affect survival. The study will provide updated and fresh information to government and non-governmental organizations working to minimize child malnutrition. Furthermore, the study's findings will aid health practitioners and stakeholders in highlighting and integrating care for severe acute malnourished under five children. It can be used as empirical evidence by decision and policy makers, assisting them in maintaining best practices or reviewing current practices to increase survival. The study will also serve as a springboard for further investigation in the area.

2. LITERATURE REVIEW

2.1. Survival status of under five children admitted with SAM

Improving the survival of children including recovery from acute malnutrition maintaining physical and cognitive development is the main programmatic outcome of SAM management. However, the survival status and treatment outcome will not be limited to recovery for different diseases. Historically speaking the consequences of treating SAM were based on clinical results such as curing or fatality percentages. The first iteration of the Social and public health economics research groups (SPHERE) Project stressed on this by presenting a series of indicators to evaluate Programme quality. Our aim is to improve intervention quality as well as case management in order to maintain high levels of performance such as a recovery rate greater than %75 while having less than 10% mortality rate and less than 15% defaulter rate(27).

According to a study conducted at Minia University hospital 9.6% of children under the age of five were died during their stay. The study also reveals that 6.7% of 104 living discharged children experienced post-discharge deaths within 8 weeks of discharge(33).Another study conducted at southwestern Uganda showed a 10.7% mortality rate of which 5.7% of death was recorded within the first 48hrs of hospital admission(34). Likewise, a study conducted at Zambia among under five children with complicated SAM found 40.5% mortality rate and 30.6% of this deaths occurred within 48hrs(43).

A research conducted in under-five children admitted at Felege-Hiwot comprehensive specialized hospital, northwest, Ethiopia was found a 11.34% incidence rate of mortality (35).which is greater than the maximum acceptable range of mortality rate recommended by SPHERE. Similarly a research done in North West Ethiopia found a mortality rate of above the maximum acceptable rate,12.52%(36).

A meta-analysis done in Ethiopia found a 10.3% mortality rate among SAM under five children (37).Another study conducted in Eastern Ethiopia's Dilchora Referral Hospital found a death rate of 7.3%, with the majority of them dying during the first week of their hospital admission. (38).Similar to

this finding a four year retrospective review done in Hadiya Zone, south Ethiopia found mortality rate of 7%(39).

According to a study conducted in South Wollo Zone, Amhara Region, Ethiopia, the death rate was 3.4%.This result was consistent with the results of a retrospective cohort research conducted in Tigray, which indicated that 3.8% of under-five children admitted with SAM died(31) and it is within the acceptable range of both SPHERE and Ethiopian ministry of health target of minimizing the death of under-five children to less than 5%(40).

Similar prevalence of death among children under five with SAM was identified in studies conducted in JUSH and Gedeo Zone. Their data showed that the death rate was 9.3%(25,41). This result was in line with the minimal international criteria of less than 10% set for the management of SAM(27). However, it is on highest limit and an alarming for the better intervention and management compared to studies done in three Ethiopian hospitals that were chosen at random, the death rate was greater, which found a mortality rate of 5.8% out of a three-year review of 413 records under five children admitted(42). The Ethiopian Federal Ministry of Health established a target of fewer than 5%, although this figure is slightly above that(9). Similarly, a 7% death rate among children under the age of five was discovered in another study carried out in the Hadiya Zone to determine the patterns of morbidity and mortality of severe acute malnutrition(39).

Different studies conducted in different parts of Ethiopia and other nations also showed a considerable increase in mortality when SAM is complicated. The study done at Sekota Hospital, Ethiopia found similarly a 28.7% among children under the age of five with complicated SAM(30). A similar study reported an 8.8% mortality rate among children under the age of five admitted with complicated SAM in Wolaita Zone, South Ethiopia(44).

2.2. Predictors of mortality

2.2.1. Socio-demographic characteristics

According to a research done at Minia University hospital, Egypt being age <12 month was found to be an independent predictor for death from severe acute malnutrition. This study found that children under the age of 12 months were a 1.5-times more likely to die compared to their counterpart (33). Similarly, a retrospective research conducted in the Gedeo Zone found that children under 24 months of age had a threefold higher mortality rate than those over 24 months(25).Another research done at general hospitals of Tigray; found as being an urban residence was significant predictors of child mortality from SAM. This study, revealed that a 2.73 more likely death of under five children with SAM from urban areas compared to their counterparts(31).

2.2.2. Anthropometric measurement and types of malnutrition

According to study conducted in Zambia Kwashiorkor was found to be the most often observed kind of SAM, making up 62.0% of the children, being followed by marasmus, which had 21.6% of the children, and Marasmic-kwashiorkor, which had 16.4% of the children(43). In addition according to a study in Dilchora Referral Hospital a one centimeter increase in WFH% index was found to decrease the risk of mortality in under five children(45).

Research conducted at Dilchora Referral Hospital, found as edematous malnutrition significantly associated with mortality from severe acute malnutrition. The study found that an increase of one centimeter in the WFH% index was associated with a 5% meaningful reduction in the risk. (45).Another study conducted at Felege-Hiwot Hospital children who had edema at the time of admission had a 2.9-times higher chance of dying than children who did not have edema(35).

2.2.3. Comorbidities

A retrospective research conducted in the Gedeo Zone found that presence of anemia had a 2.62 times increased risk of dying compared to their counterpart(25). Similarly, a meta-analysis conducted in Ethiopia found a significant association between anemia and likelihood of mortality from severe acute malnutrition which revealed that a two times more likely death among children with anemia compared with those children without anemia(37).In addition a research done in Sekota hospital Waghemra Zone revealed that under five children who had severe anemia had a six and half times higher risk of mortality, which is much more than a research conducted in Gedeo(30).

As evidenced by a study done in University of Gondar hospital, under five children who developed shock were has approximately eight times higher risk of mortality compared to their counterparts(46) .Likewise another retrospective study done in Gedeo Zone found nearly four times higher hazard of dying among under-five children with the presence of shock compared to their counterparts who were without shock (25).Another meta-analysis done in Ethiopia showed a 1.5 times higher risk of mortality among SAM under five children presented with diarrhea compared to their counterparts (37).Moreover a study conducted at Felege-Hiwot Referral Hospital found nearly seven times higher hazard of mortality among SAM children with congenital heart disease(CHD) than those without CHD(47).

Furthermore, according to a meta-analysis conducted in Ethiopia dehydration was found to be a significant predictor of childhood mortality in under five children admitted with severe acute malnutrition with a three times increased risk among dehydrated children compared to their counterpart. As evidenced by the meta-analysis the risk of mortality among dehydrated under five children is three times more than those not dehydrated(37). Similarly different studies found a higher probability of risk of death among under five children with altered body temperature. A retrospective study conducted in Gedeo and Wolaita Zone showed a seven and nearly twelve risk of mortality among children with hypothermia compared to under five children with normal temperature respectively(25,44).Furthermore the same study conducted in Wolaita also showed nearly three times high probability of death among children having sepsis compared with those who have no sepsis(44).According to a study conducted in

Wolaita zone, children having sepsis were nearly three times more at risk of death when compared with those who had no sepsis(44).

Furthermore, children with Tuberculosis(TB) were nearly three times more at risk of mortality from severe acute malnutrition than their counterparts who did not have the disease, according to a study conducted in Sekota Hospital in Waghemra zone(30).A study conducted in Eastern Ethiopia's Dilchora Referral Hospital found HIV Sero-positivity significantly raised the hazard of death from SAM by 11 times compared to HIV non-reactive status(45). While a research conducted at Felege-Hiwot hospital indicated that HIV-positive children had a 2.8-fold higher risk of dying than their counterparts, a finding lower than that of a research done in Dilchora. (35). Besides that, a study done in Tigray's general hospitals revealed that developing comorbidity after admission increased the likelihood of death by about 13 times compared to those who did not (31).

2.2.4. Treatment

A study done in South-Western Uganda found a strong link between IV fluid delivery and mortality. According to this study, under five children who got intravenous fluid had a seven times higher adjusted risk of dying than children who did not.(34).According to research conducted at Dilchora Referral Hospital, Eastern Ethiopia Intravenous(IV) intake of antibiotic medication had an increased hazard of mortality(45).Similarly a research conducted in Sekota hospital Waghemra Zone Children with a complicated SAM and not managed with special antibiotics had a three times higher risk of mortality compared to their counterparts(30).Likewise a finding from a retrospective Cohort Study conducted in Wolaita Zone, South Ethiopia also found 3.7 times more likely death of under five children with SAM not having antibiotics at admission than those had had it(44).

As evidenced by a research conducted at Dilchora Referral Hospital, Eastern Ethiopia those who did not get F75 and F-100 had 2.56 and 3.26 times higher risk of mortality from severe acute malnutrition than their counterparts(45). A retrospective cohort study conducted at Felege-Hiwot hospital, similarly found

that those who did not received F-100 at higher risk of mortality. According to the finding of the study children those did not take F-100 were 2.63 time more prone to die than those who have taken(35).

A research conducted in Sekota hospital Waghemra Zone shows children who have received pharmacological treatment had a much lower risk of dying compared to untreated children. This finding showed that children who did not receive vitamin A supplements had a 53% higher risk of dying than those who did(30). Furthermore a study done at Sekota Hospital showed that an increased risk of death by 2.3 and 1.5 times among children not provided with folic acid and Vitamin A respectively compared to those who were treated with(30).

2.2.5. Admission type

According to a study done at Hadiya, newly admitted children had an 86% lower mortality rate than those admitted repeatedly, and the researchers also identified the progression of medical disorders with repeated admission, as a as a main reason for the increment of the chance of mortality among under five children with repeated admission`(39).Meanwhile Additional research did not support the findings of this study (31,44,47).

2.2.6. Immunization status

The other associated factors of mortality is a child's immunization status. As a study done at Bahirdar Felege Hiwot Referral Hospital children who are fully vaccinated had a 84% lower hazard of mortality compared to those non vaccinated or partially vaccinated under five children(47).However other studies conducted in different places of Ethiopia did not found the immunization status as a significant predictors of mortality(25,39,42).

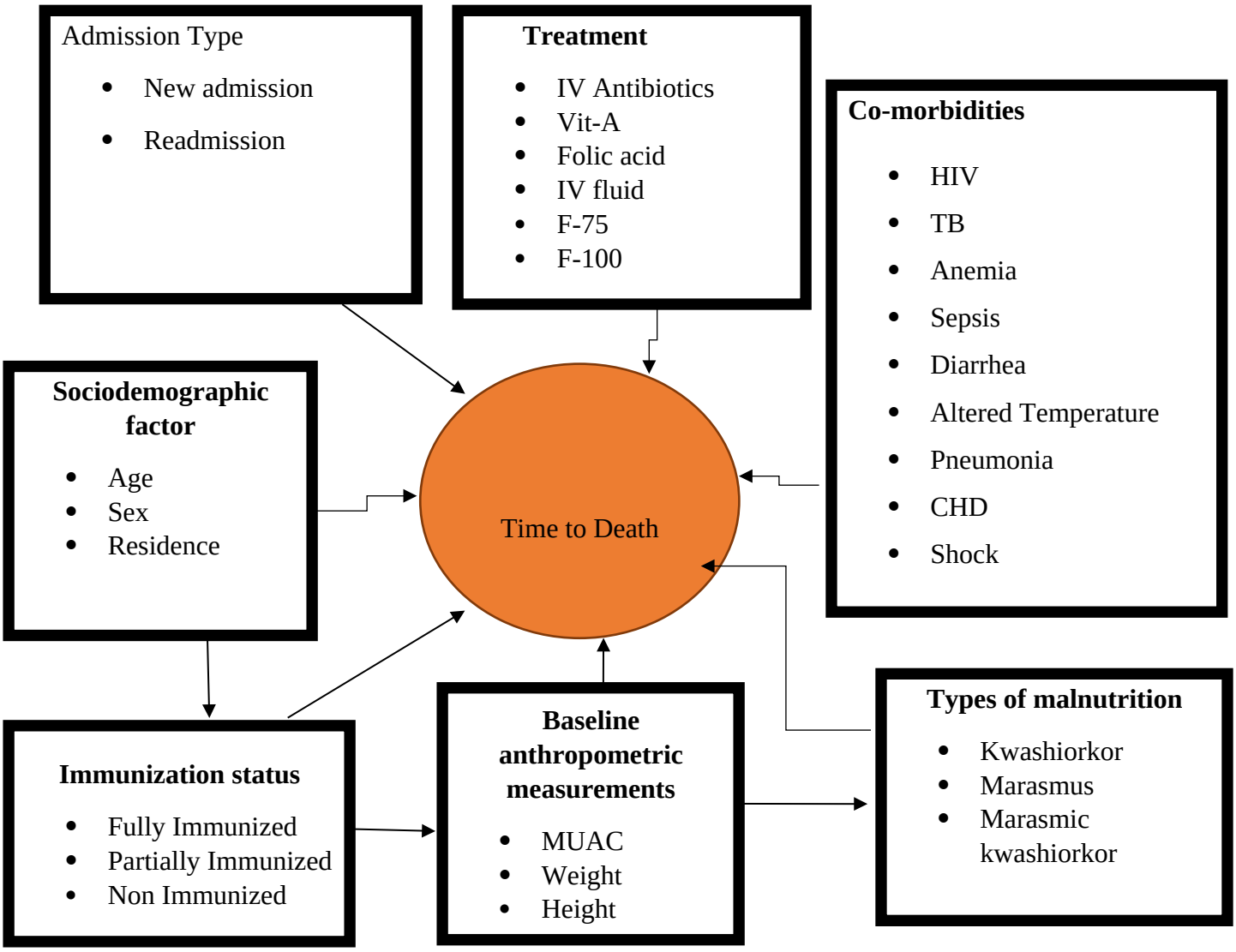
Admission Type
New admission
Readmission
Treatment
IV Antibiotics
Vit-A
Folic acid
IV fluid
F-75
F-100
Co-morbidities
HIV
TB
Anemia
Sepsis
Diarrhea
Altered Temperature
Pneumonia
CHD
Shock
Sociodemographic factor
Age
Sex
Residence
Time to Death
Immunization status
Fully Immunized
Partially Immunized
Non Immunized
Baseline anthropometric measurements
MUAC
Weight
Height
Types of malnutrition
Kwashiorkor
Marasmus
Marasmic kwashiorkor

Figure 1: conceptual framework of survival status and predictors mortality among under five children with SAM. Adopted from different studies(25,44).

3. OBJECTIVE

3.1. General Objectives

To assess the survival status and predictors of mortality among under five children admitted with severe acute malnutrition to SCs in selected government hospitals at Addis Ababa, Ethiopia, 2022.

3.2. Specific objectives

- To Assess the incidence of mortality in under five children admitted severe acute malnutrition to stabilization centers in Addis Ababa
- To identify risk factors of mortality in among under five children admitted with severe acute malnutrition to stabilization centers in Addis Ababa.

4. METHODOLOGY

4.1. Study area and period

Addis Ababa is established in 1886 GC and serves as both the African Union's headquarters and the capital city of Ethiopia, due to its historical, diplomatic, and political importance on the continent. It is located 2,355 meters (7,726 feet) above sea level in the foothills of the Entoto Mountain in the country's geographic center. It is the largest city in Ethiopia and the third-highest capital in the world(48).The population count as of 2017 was growing closer to 4 million and is currently estimated to be around 5005524 million. The city has 11 sub-cities and different government health facilities including 13 hospitals and 98 public health centers(49). From the 13 Hospitals, Addis Ababa Health Bureau owned six of them, four of them are under Federal Ministry Health, one under Addis Ababa University and the rest two are governed by Ministry of defense. Among the six hospitals under Addis Ababa city administration, four of them provide inpatient service for SAM; these include Tirunesh Beijing Hospital, Minilik II General Hospital, Zewiditu Memorial Hospital, and Yekatit 12 Medical College. Four hospitals were included in this study: Yekatit 12 Medical College, Zewiditu Memorial Hospital, Tirunesh Beijing Hospital, and Tikur Anbessa Hospital (under AAU), with three participating from AACAHB and one from AAU. The study was conducted in selected Addis Ababa government hospitals from January 1, 2020 to December 31, 2022 (for three consecutive years).

4.2. Study design:

Health facility based retrospective cohort study design was conducted.

4.3. Source population:

All records of children under the age of five with SAM admitted at the malnutrition ward in Addis Ababa public hospitals from January 1, 2020 to December 31, 2022

4.4. Study subject:

All records of SAM children under the age of five who were admitted to the malnutrition unit at selected Government hospitals of Addis Ababa during the period from January 1, 2020 to December 31, 2022(for three consecutive years) and met the eligibility criteria.

4.5. Inclusion criteria and Exclusion criteria

Inclusion criteria

All records of children under the age of five treated for SAM in Addis Ababa selected government hospitals' stabilization centers

Exclusion criteria

• Children having incomplete records with regard to the interest variables.

4.6. Sample size determination:

By utilizing a single population proportion formula and the 95% confidence interval, 5% degree of precision, and proportion of Mortality rate (12.52%) from a study conducted in Northwest Ethiopia, the sample size was determined(36).

$$n = \frac{\left(z_{\frac{\alpha}{2}}\right)^2 p(1-p)}{d^2}$$

Where,

z α/2 = normal standard distribution value at 95% confidence level of = 1.96

d= Margin of error between the sample and population=5%=0.05

p= Population Proportion

n= Sample size,

The study's calculated sample size was n = 168. The final sample size was 185 under-5 children's cards with qualifying requirements after 10% of the sample was added to account for missing and insufficient data.

Sample size for second objective (predictors of mortality in SAM)

The sample size needed to identify predictors of mortality in SAM was calculated based on double Population proportion formula by using Kelsey formula in version 7 of Epi info computer program by considering 95% CI, power 80%, ratio of unexposed to exposed 1:2.

$$n1=\frac{\left[z_{\frac{a}{2}}\sqrt{\left(1+\frac{1}{r}\right)p(1-p)}+z_b\sqrt{p_1(1-p_1)+\frac{p_2(1-p_2)}{r}}\right]^2}{(p_1-p_2)^2}$$

- P1(14.2%) - expected case mortality rate (incidence)of SAM among exposed children
- P2(5.8%) - expected case mortality rate(incidence) of SAM among unexposed children

Table 1: sample size determination for predictors of mortality in SAM

S.N	Factors	CI	AHR	Power	P1	P2	Sample size	Lost follow-up	Final sample	Ref.
1	Folic acid given	95%	1.2	80	20.83	9.4	316	10% (32)	348	(36)
2	Diarrhea	95	6.69	80	18.8	34.48	300	10% (30)	330	(30)

		%			3					
3	Altered temperature	95 %	7.17	80	42.4	2.6	30	10% (3)	33	(25)
4	Pneumonia	95 %	2.43	80	14.2	5.8	395	10% (40)	435	(38)

The sample size for this study was determined by comparing all computations and choosing the one with the largest sample size. The study enrolled 435 children under the age of five admitted with SAM.

4.7. Sampling procedure:

Four hospitals with SAM stabilization centers were chosen deliberately regarding having stabilization center and their length of providing the service for the under five children from among the 13 public hospitals in Addis Ababa. All records of under five children who were admitted to malnutrition ward with SAM at the selected government hospitals in Addis Ababa from January 1, 2020, and December 31, 2022 (three consecutive years) and who met the eligibility requirements were included in the study. The sample needed was 435 children which was proportionally allocated to the four stabilization centers for each year. When the sampling frame was obtained from the institutional list, the study units were then identified using a systematic random sampling procedure. Separate k interval was calculated to select sampling unit from each selected hospital as follows.

k=N/n

K=1589/435=3.65≈K=4

Therefore, we used an interval of four (k = 4) for each hospital since the proportion of the available cards were almost approximately the same in each hospital. And the first chart was selected randomly. Then every fourth medical record was reviewed within the three consecutive years. In the event that the

fourth record was missed, the subsequent fourth chart was reviewed until the required sample size was attained.

Table 2: Distribution of sample size over the selected hospitals' admission periods.

Year	Tikur Ambessa	Yekatit 12	Zewditu	Tirunesh
2020	125	180	119	43
2021	145	205	115	43
2022	103	225	127	43
Total	373	610	361	245
Sample allocated	102	167	99	67
Total Sample needed	**435**			

Proportional sample size allocation (n)= $\frac{Nf \times Nj}{N}$

Nf=final sample size of the study, which is **435**

Nj= number of SAM under five children from each hospital

N= Total number of SAM children admitted in selected hospital

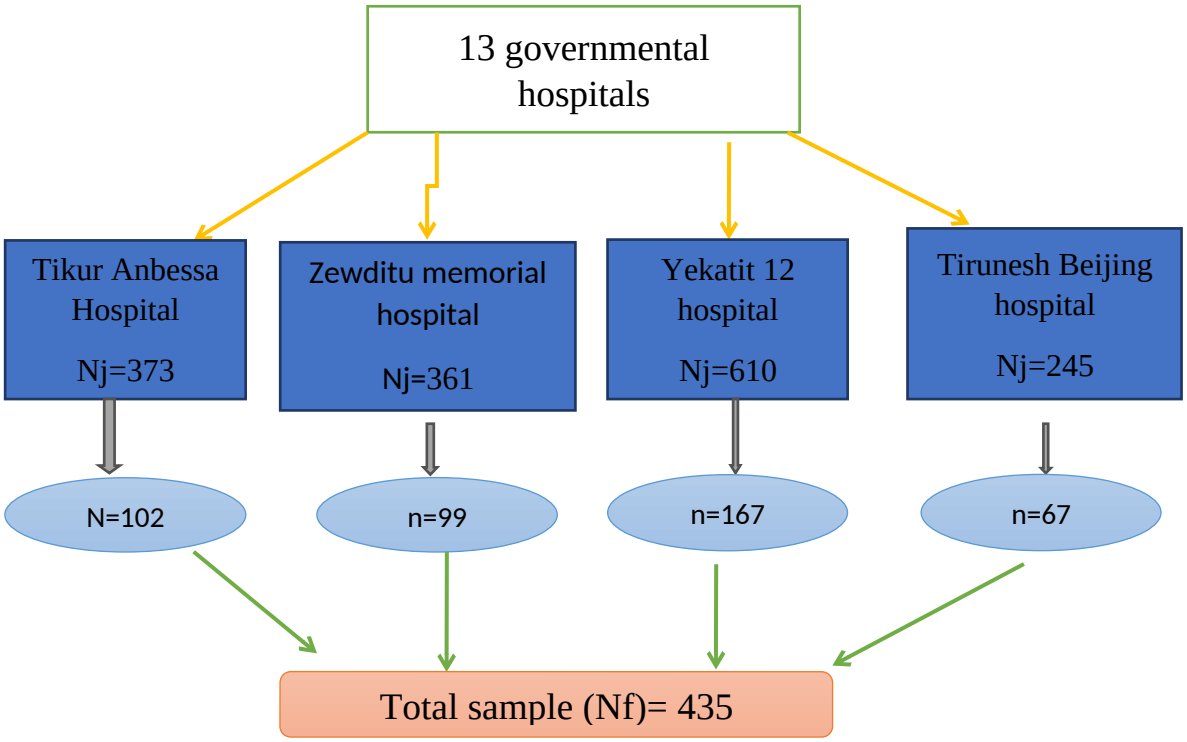

Figure 2: Sample frame work of the study participant in the selected Addis Ababa government hospitals

4.8. Data collection tool

The data collection was made using a structured data abstraction checklist. A review of the medical records was done, and a data collecting form was made from the inpatient therapeutic feeding registration book; the stabilization unit is using individual follow-up charts., SAM management standard of the SPHERE ,the Ethiopian management protocol of SAM(27,50) and baseline previous studies on severe acute malnutrition(25,44). The information was gathered through structured checklist using the Open data kit (ODK) collect app on the data collector's smart phone or tablet. First, the admissions book and the inpatient therapeutic feeding registration book were used to compile a list of the SAM-affected children, and the checklist was used to extract their card numbers from the chart. The next step was to receive each child's particular patient card from the card unit and use the ODK collect app to gather the essential data.

4.9. Data collection procedure

Data extraction was conducted by two BSC nurses working at the SAM stabilization unit of the selected hospitals and one supervisor. A one day training was prepared for all data collectors on how to use the ODK collect app to complete the structured data collection form, and we made an effort to introduce them to the Collect app. Separate training was provided to the supervisor in order to monitor the data collection and ensure that the data abstraction form is fully filled out before submitting it to the server, and even after submission, they were checked for the completeness of the data before approving it.

4.10. Study variables

4.10.1: Dependent variable

Time to death

4.10.2: Independent variables

Sociodemographic variables: Age, Gender, Residence

Comorbidities: Anemia, Pneumonia, HIV, TB, Sepsis, AGE (acute gastroenteritis), CHD

Type of severe acute malnutrition: Kwashiorkor, Marasmus, Marasmic kwashiorkor.

Anthropometric baseline measurements: Weight, Height, MUAC

Treatment: Treatments, Supplements and Therapeutic feeding.

Admission type: New-admission, Readmission

Immunization status: Fully Immunized, Partially Immunized, Non-Immunized

4.11. Operational definitions and term definitions

Event(Death): Are under five children who died while receiving treatment in the health facility(51).

Recovered: are under five children who have overcome medical problems and satisfied the requirements for discharge.

Censored: Those who are defaulted, recovered, transfer out, non-responded and medically transferred.

Defaulters: Are those who stop receiving treatment before the child is recovered or lost and whose condition is unknown.

Base line anthropometric measurement: It is the baseline measurement (anthropometric) taken during the child's admission.

Co-morbidity: Those children under the age of five who were admitted with/developed medical diseases in addition to SAM.

4.12. Data quality control

Two BSC nurses stationed at the SAM stabilization unit of the chosen hospitals, along with one supervisor, extracted the data. All data collectors received a one-day training session on how to complete the structured data collecting check list. We performed a pretest on 5% of the sample at the Minilik-II hospital to check the accuracy of our data. We tested against the registration book to compare the questioner with the current registration book to collect all relevant data.

4.13. Methods of Data analysis

Data was collected using the ODK collect app and was checked for completeness and consistence

every night of the data collection date by the principal investigator and supervisors. The data was checked for completeness, consistency, and missing values on the last day of collection. For analysis, all confirmed data will be transported to STATA version 17. The levels of missing values, the presence of significant outliers, multi-collinearity, normality, and proportionality of hazards across time were examined by exploratory data analysis. To verify the data's normality, graphic and statistical techniques like the Kolmogorov-Smirnov test were used.

To find associations between dependent and independent variables, bivariate analysis was used. The degree of association and statistical significance was determined using the hazard ratio, 95% confidence interval, and P-value. A life table was created to calculate the likelihood of mortality for both exposed and unexposed groups at certain time points. The Kaplan-Meier survival curve and the log rank test were fitted to see if there was a difference in the rate of mortality between the groups. For exposed and unexposed groups, the incidence of death in relation to person time at risk was estimated and compared. In order to find independent predictors of mortality the final Cox regression analysis included factors significant at $p<0.25$ level in the bivariate analysis and variables with medical/public health significance. A list of the significant predictors and any statistical tests that were considered significant at a P level less than 0.05 were obtained using the forward stepwise regression approach. Covariates' interaction effects were examined. Finally, residual plots like the Cox-Snell residual were graphed to test the Cox regression model's fitness to the data and suitability. The results were then presented and summarized using tables and graphs.

4.14. Ethical Considerations

The AAU College of Health Sciences, School of Nursing and Midwifery, Department of Nursing Ethical review committee, and Addis Ababa city administration health bureau (AACAHB) was granted ethical clearance. The hospital board approved the study, and before it was began, the matron or medical officer in charge at a selected study department was contacted for permission and the relevant details. By using strong passwords to secure our own electronic devices and maintaining the anonymity

of the data abstraction form, and providing training for data collectors on how to keep the information confidential, we were able to maintain the privacy and confidentiality of study participants.

4.15. Dissemination of the Study

The finding of this study will be submitted and presented to the Department of Pediatrics and Child Health Nursing, the School of Nursing and Midwifery, the College of Health Science, the AAU, and AACAHB. The finding will also, disseminated through publication in peer-reviewed, reputable journals and will be presented at local or international conferences. The results will also be submitted to AACHB, respective health institutions (Addis Ababa selected government hospitals), regional and federal health bureaus, and other concerned bodies working around malnutrition and HIV in the city.

5. RESULT

5.1. Socio-demographic characteristics and Anthropometric measurement

Records of under five children who were admitted with SAM over a three-year period, in a selected government hospitals, were observed in this study. 422 of the 435 selected medical records were confirmed to be complete, with a response rate of 97%.Out of the 422 children under-the age of five with SAM enrolled in the study, 218(51.66%) of them were females and 344(81.52%) of them were urban residents and 374(88.63%) of the enrolled under five children were with the age less than 24 months as indicated in the table 3 below.

Table 3**:** Sociodemographic characteristics of SAM children admitted to SC from January 1st, 2020 to December 31st, 2022 (n = 422)

Characteristics	Category	Frequency(422)	Percent
Sex	Male	204	51.66

	Female	218	48.34
Age in month	<24	374	88.63
	>24	48	11.37
Residence	Urban	344	81.52
	Rural	78	18.48

Out of 422 reviewed records, 248(58.8%) of them are admitted with a MUAC of less than 11.5 cm, 69(16.4%) are greater than 11.5 cm, and the rest, 105(24.9%) of admitted children are not eligible for MUAC measurement due to their age. Their weight ranged from 1.7 to 15, with a mean of 5.58 (SD+2.25(5.2)) kilograms. Regarding their height, the mean height/length was 66.6 (SD+11.68 (65.5)) centimeters. In addition most children were admitted with WFH (86.49%) and WFA (79.15%) Z score less than <-3 as illustrated in the table 4 below.

Table 4**:** Anthropometric measurements of children under the age of five with SAM from January 1, 2020 to December 31, 2022.

Characteristics	**Category**	**Frequency(n=422)**	**Percent**
MUAC	<115cm	248	58.77
	>115cm	69	16.35
	NA	105	24.88
WFA Z score at admission	<-3	334	79.15
	-3 & -2	50	11.85

WFH Z score at admission	>-2	38	9.00
	<-3	365	86.49
	>-3	57	13.51

5.2. Type of malnutrition

Among the 422 under-five children admitted most of them were admitted with marasmus 352(83.3%), as indicated in figure 4.

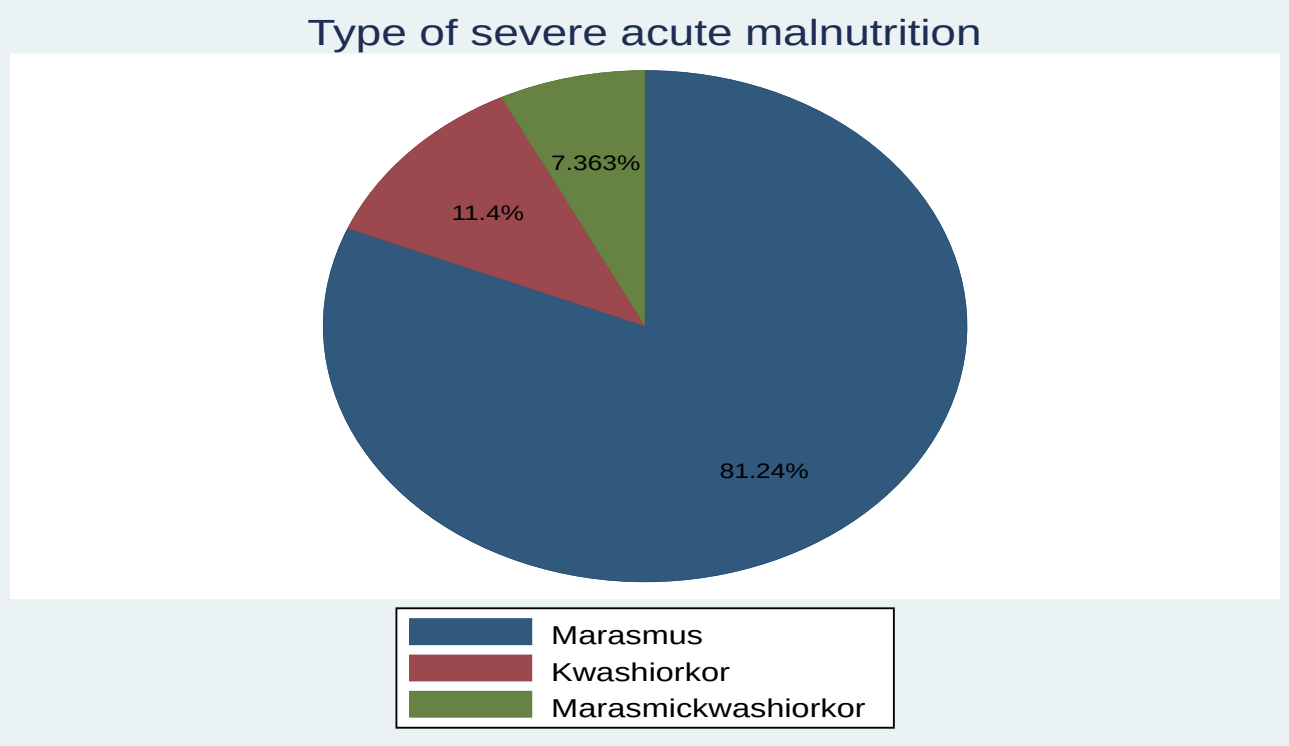

Figure 3: shows the distribution of types of malnutrition among under five SAM children admitted to governmental hospitals, 2020-2022, Addis Ababa, Ethiopia.

5.3. Treatment

Among the 422 children whose cards were reviewed, IV antibiotics were the most prescribed drug, 363 (86.02%), followed by F 75, which accounted for 297 (70.38%), and F 100, which was 286(67.8%). However, deworming and Vitamin A medications were the least prescribed and only 24(5.7%) and 42(10%) of the under five children had received, even though some of the children were not eligible for the treatment due to their age.

Table 5: Distribution of medications and therapeutic feeding provision from January 1st, 2020 to December 31st, 2022.

Variables	Category	Frequency(n=422)	%
IV antibiotics	Yes	363	**86.02**
	No	59	13.98
IV fluid	Yes	25	5.92
	No	397	94.08
Amoxicillin	Yes	74	17.54
	No	348	82.46
Albendazole/Mebendazole	Yes	24	5.7
	No	65	15.4
	NA	333	78.9
Folic Acid	Yes	130	30.8
	No	292	69.2
Vitamin A	Yes	42	9.95
	No	380	90.05
RUTF	Yes	204	**48.34**
	No	218	51.66
F75	Yes	297	**70.38**
	No	125	29.62
F100	Yes	286	**67.8**
	No	136	32.2

5.4. Comorbidities

The most frequently observed disease among under-five children whose cards were reviewed was diarrheal disease (174, 41.2), followed by pneumonia (160, 37.9%), and fever (121, 28.7%).

Table 6: Distributions of comorbidities among under five children with SAM admitted in selected governmental hospital of Addis Ababa, Ethiopia from January 1st , 2020 to December 31st , 2022.

Variables	Category	Frequency(422)	%
Anemia	Yes	87	20.6
	No	335	79.4
HIV/AIDS	Yes	37	8.77
	No	385	91.23
Congenital heart disease	Yes	45	10.66
	No	377	89.34
Dehydration	Yes	70	16.6
	No	352	83.4
Fever	Yes	121	**28.7**
	No	301	71.3
Pneumonia	Yes	160	**37.9**
	No	262	62.1
Tuberculosis	Yes	24	5.7

	No	398	94.3
Gastroenteritis	Yes	165	**39.1**
	No	257	60.9
Shock	Yes	31	7.35
	No	393	92.65
Down syndrome	Yes	15	3.55
	No	407	96.45
Global developmental delay	Yes	23	5.45
	No	399	94.55
Comorbidity after admission	Yes	42	9.95
	No	380	90.05

5.5. Admission type

Among the under-five children admitted to the four hospitals in Addis Ababa, most of them were newly admitted (346, or 82%), while the rest (76, or 18%) were re-admitted.

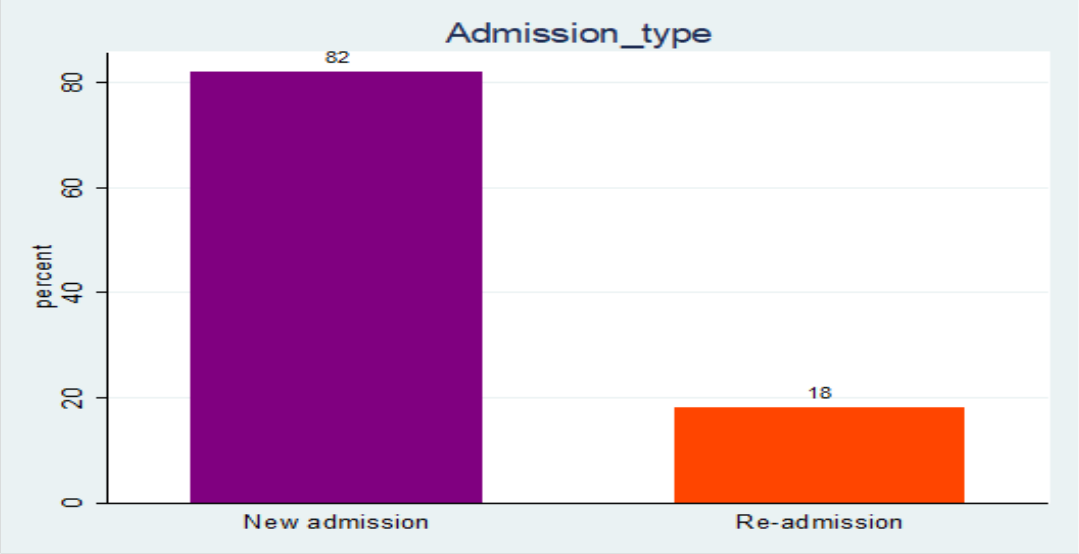

Figure 4: shows the distribution of Admission type among under five SAM children admitted to governmental hospitals, 2020-2022, Addis Ababa, Ethiopia.

5.6. Immunization Status

Regarding the immunization status of 422 under five children admitted to the selected Hospitals about 297(70.40%) are fully vaccinated, while 39(9.20%) of under-five children are not totally immunized and the rest were vaccinated partially as shown in the figure below.

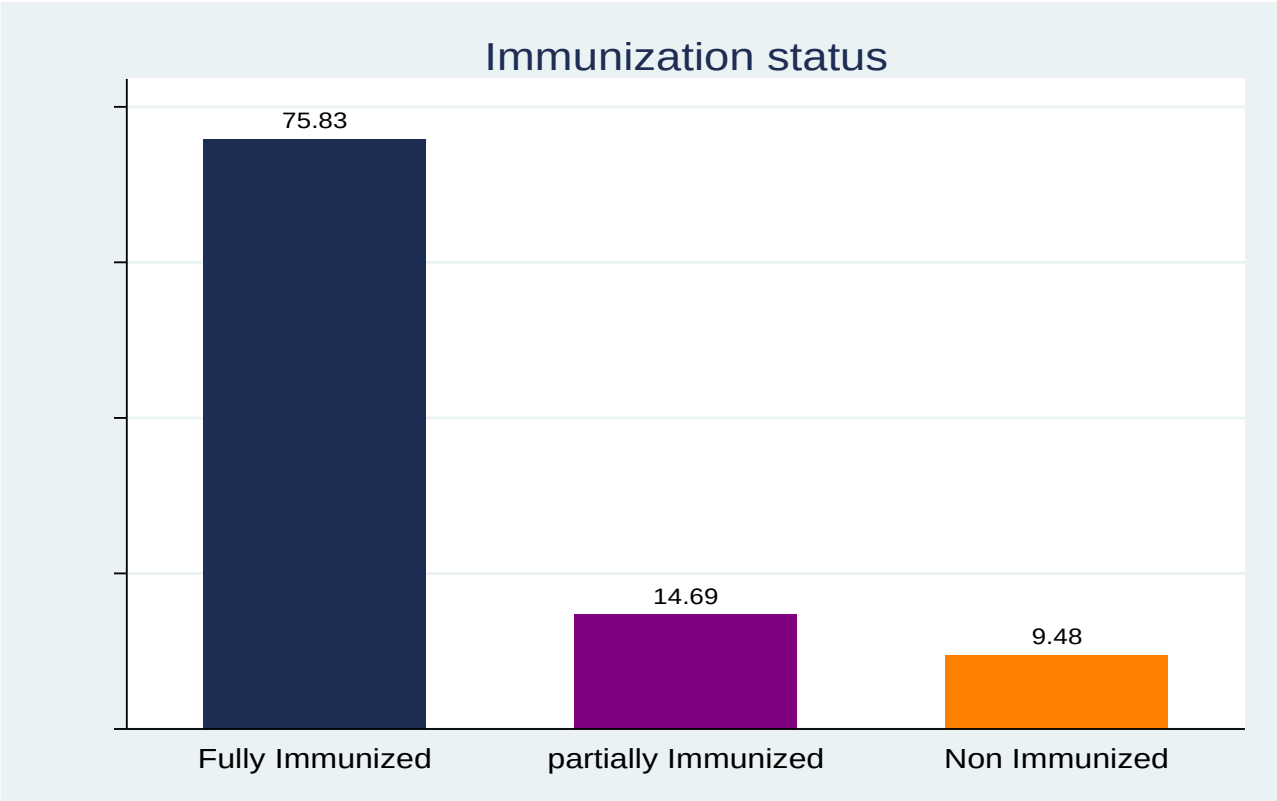

Figure 5: shows the distribution of Immunization status among under five SAM children admitted to governmental hospitals, 2020-2022, Addis Ababa, Ethiopia.

5.7. Survival status

About 422 children under-the age of five children were being observed between January 1, 2020 and December 31, 2021, for a maximum of 60 days and a minimum of one (01) day time periods. The overall time at risk was 4250 days with a Incidence rate of 10.35% (95% CI: 7.71 -13.9) with 8 (95% CI: 8.00 -9.00) days of median length of stay in the hospital, the cumulative survival probability on the first, seventh, fourteenth, and twenty-first days was 99.03%, 92.56%,85.99%, and 80.22%, respectively. The overall survival probability by the end of 59 days was 73.23%, with a standard error of 0.07 (95% CI: 55.38-84.85).In this study the maximum recorded analysis time was censored and the survival

function did not reach zero, so that the median time was not able to be determined. Yet the quartile survival time was 27 (95% CI: 16-36) days.

Among the 422 study subjects, 44(10.43%) died, and the rest (378, or 89.57%) were censored. From those censored, 351(83.28%) were recovered, 6(1.42%) were transferred to other health institutions, and the rest, 21(4.97%) were defaulters.

5.8. Estimation of the Kaplan-Meir median survival time

With the Kaplan-Meier survival estimate of time to death with various covariates, a significant mean survival time difference was observed among under five children with HIV, 19 days (95%CI = 12.210–26.318) and non-reactive were 53 days (95%CI: 49.875–55.420) and Children with pneumonia had a 41-days mean survival time (95%CI: 34.623–47.804) whereas those without pneumonia had 53 days (95%CI: 49.883-56.756). Furthermore, other predictors such as presence of shock, Down syndrome and GDD were shown to have a mean survival time of 17 days, 25 days, and 22 days among children with the disease respectively as shown in the table below.

Table 7: The Kaplan-Meier survival estimate of time to death with various covariates among children under the age of five admitted with SAM to selected governmental hospitals from Jan. 1st, 2020 to Dec. 31st, 2022 (n = 422).

Characteristics	**Category**				
		Estimate	95%CI	Log rank X2 - value	P-Value
HIV/AIDS	Reactive	19.264	12.210-26.318	14.820	.00
	Non-reactive	52.647	49.875-55.420		
Anemia	Yes	29.012	27.914-30.109	5.497	.019
	No	46.811	41.731-51.891		
Congenital heart disease	Yes	44.341	33.784-54.898	5.351	.021
	No	49.132	44.065-54.198		

Type of SAM	Marasmus	49.906	44.288-55.523	15.104	.001
	Kwashiorkor	27.583	23.496-31.670		
	Miasmic-kwashiorkor	35.884	24.230-47.539		
Immunization status	Fully	51.255	45.943-56.568	10.169	.006
	partially	37.726	27.609-47.843		
	Not	18.282	14.620-21.944		
place of residence	Urban	50.721	45.744-55.698	5.867	.015
	Rural	24.098	20.223-27.973		
Pneumonia	Yes	41.214	34.623-47.804	7.069	.008
	No	53.319	49.883-56.756		
Vitamin A	Yes	20.060	17.911-22.208	8.902	.012
	No	52.117	48.494-55.740		
	NA	38.762	28.378-49.146		
IV-fluid	Yes	11.098	7.269-14.927	64.335	.000
	No	50.914	46.155-55.673		
RUTF	Yes	49.028	45.290 52.767	4.900	.027
	No	52.831	38.069-52.791		
F75	Yes	32.459	42.041 52.440	6.222	.013
	No	47.241	29.882-35.036		
F100	Yes	22.328	19.238-25.419	21.738	.000
	No	52.058	47.145-56.972		
Shock	Yes	16.691	12.620-20.761	37.469	.000
	No	50.066	45.228 -4.903		
Global developmental delay	Yes	22.078	16.771-27.385	6.102	.014
	No	49.255	44.434-54.076		

Down syndrome	Yes	25.013	16.641-33.386	4.301	.038
	No	49.130	43.996-53.980		

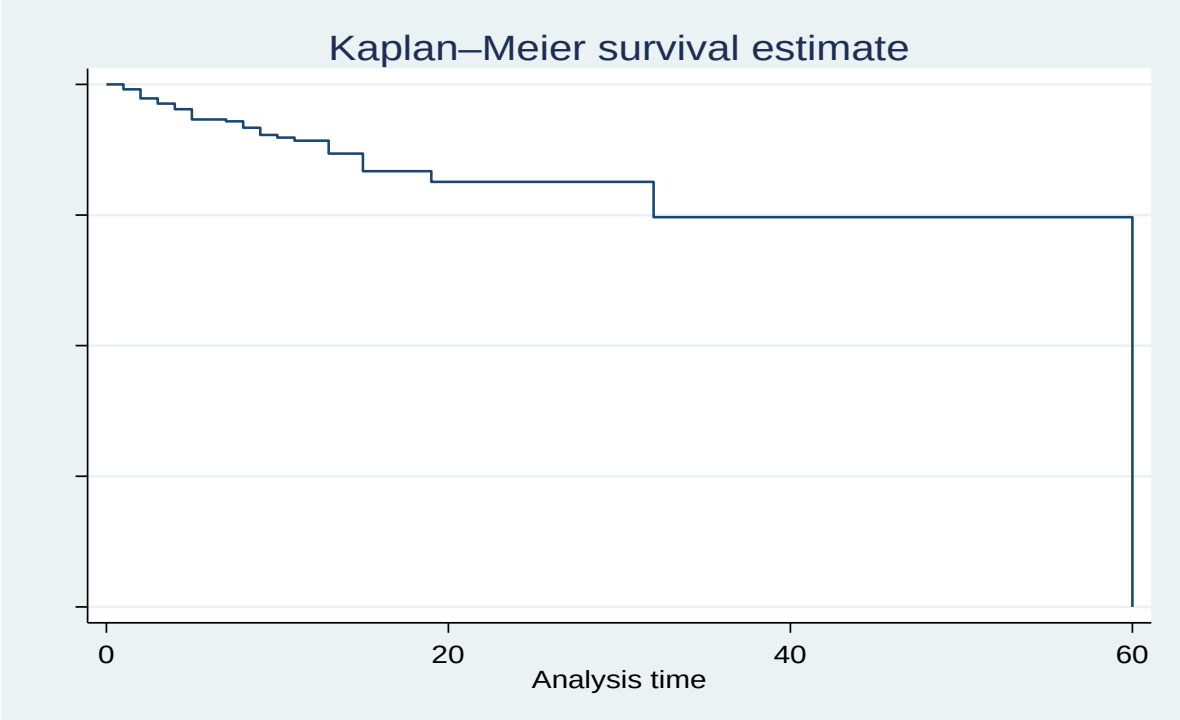

Figure 6: Overall Kaplan-Meier survival estimate of severely malnutrition children under the age of five.

5.9. Testing Cox proportional hazards assumptions using Schoenfield residuals

The proportional hazard assumptions must be tested in order to apply the fitted proportional model and for the interpretation of the results. This study found that both the individual covariates and the global test were adequately tested using the Schoenfield residuals proportional hazard assumption test. For the acceptance of the model the p-value for each covariate and the global test must be more than

0.05(p>0, 05) and our test of the cox proportional hazard model of fitness also fulfills this by giving us p>0.05 for all covariates and a global test of .9996, which is far greater than 0.05.

Table 8: Testing Cox proportional hazards assumptions using Schoenfield residuals for the interpretation and apply the fitted proportional hazard model.

predictors	Rho	Chi2	Df	Prob>chi2
Age	0.03734	0.09	1	0.7679
Gender	0.12205	0.66	1	0.4173
Residence	0.06995	0.29	1	0.5878
Admission type	0.11930	0.62	1	0.4301
Type of SAM	-0.03936	0.09	1	0.7610
pneumonia	-0.00108	0.00	1	0.9936
anemia	0.13104	1.15	1	0.2826
Folic acid	0.05915	0.21	1	0.6436
RUTF	-0.08576	0.35	1	0.5539
F_100	0.00935	0.00	1	0.9478
Amoxicillin	0.06586	0.21	1	0.6483
IV antibiotics	0.01005	0.00	1	0.9459
Gastroenteritis	-0.11429	0.54	1	0.4606
Fever	-0.02389	0.02	1	0.8860
temp	0.04759	0.08	1	0.7812
Congenital heart disease	-0.09310	0.37	1	0.5421
Shock	0.06252	0.17	1	0.6758
GDD	-0.06988	0.27	1	0.6034
down syndrome	-0.01629	0.01	1	0.9153

Global test		5.76	21	0.9996

5.10. Predictors of mortality among severely malnourished children

To identify the significant predictors of mortality of severe acute malnutrition in this investigation, we performed the variate Cox proportional hazard regression for every predictor and transferred those with a $p<0.025$ to the multivariate Cox proportional hazard regression. Accordingly variables with $p<0.05$ at 95% CI were presented as they have significant association with our dependent variable (death).

Accordingly from the comorbidities we found Children with HIV had a 2.16 times higher mortality rate than HIV-negative under five children (AHR; 2.159,95%CI:1.001-4.65).Similarly Children with pneumonia had a 2.15 times higher mortality rate than their peers (AHR;2.154,95%CI:1.085- 4.275).

Regarding the treatment and the supplements provided during the hospital stay, In comparison to their counterpart, children who received IV fluid (AHR; 3.65, 95%CI: 1.525-8.743) had a 3.65-fold increased risk of dying. Likewise, Children that got F75 had an 80% lower mortality rate than those who did not (AHR: 0.20, 95%CI: 0.062-0.651).

Table 9: Predictors of survival status of children under age of five with SAM.

Predictors	**Category**	**p-value**	**CHR (95%)**	**AHR (95%)**
Residence	Urban		1	1
	Rural	. 226	2.151(1.135-4.074)	1.563(0.758-3.224)
Immunization status	Fully	.002	0.37(0.159-0.857)	**0.227(0.088-0.583)***
	partially	.202	0.921(0.356-2.383)	0.510(0 .181-1.434)
	Non		1	1
Type of SAM	Marasmus		1	1
	kwashiorkor	.136	1.990(.899- 4.403)	1.976(0 .807-4.836)
	Miasmic kwashiorkor	.455	3.913(1.83- 8.362)	1.485(0.526- 4.199)
IV fluid	Yes	.004	9.142(4.723- 17.698)	**3.652(1.525-8.743)****
	No		1	1
F-75	Yes	.007	0.293(0.105-0 .822)	**0.201(0.062-0 .651)****
	No		1	1
F-100	Yes	.168	3.893(2.096-7.231)	1.683(0 .802-3.530)
	No		1	1
HIV	Yes	.050	3.508(1.767- 6.965)	**2.159(1.001-4.65)***
	No		1	1
Pneumonia	Yes	.028	2.220(1.210- 4.075)	2.154(1.085- 4.275)
	No		1	1
Shock	Yes	.005	6.280(3.190- 12.364	**3.475(1.451-8.321)****
	No		1	1
GDD	Yes	.158	2.818(1.187- 6.691)	2.037(0 .758-5.474)
	No		1	1

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

***** =P-value<0.05**

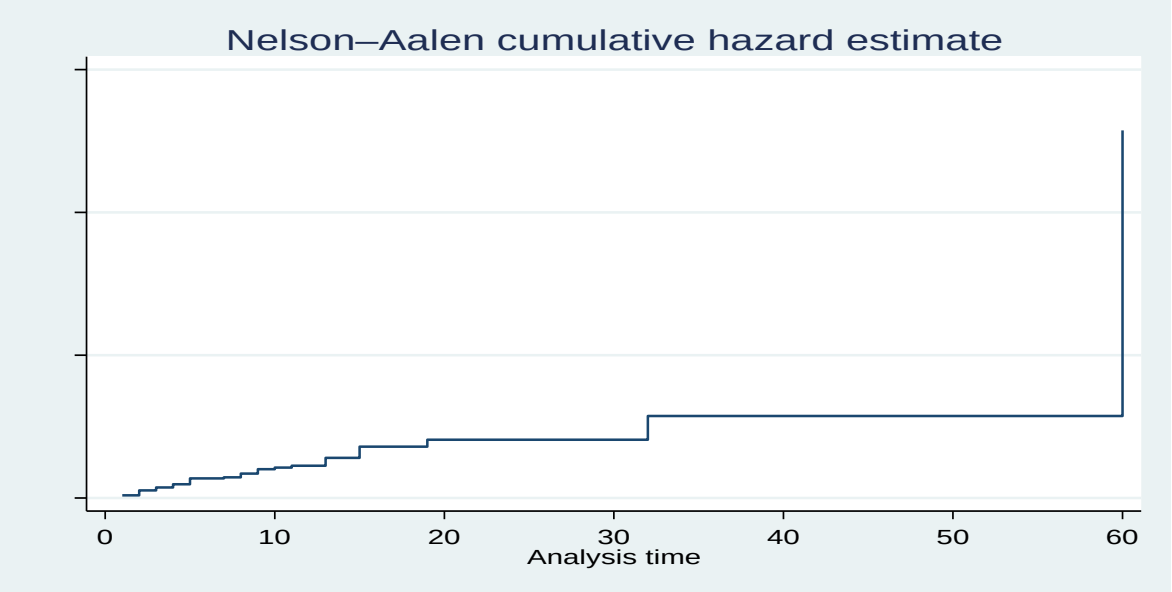

Figure 7: Overall Nelson Aalen estimate of hazard function among under five SAM children admitted to governmental hospitals, 2020-2022, Addis Ababa, Ethiopia.

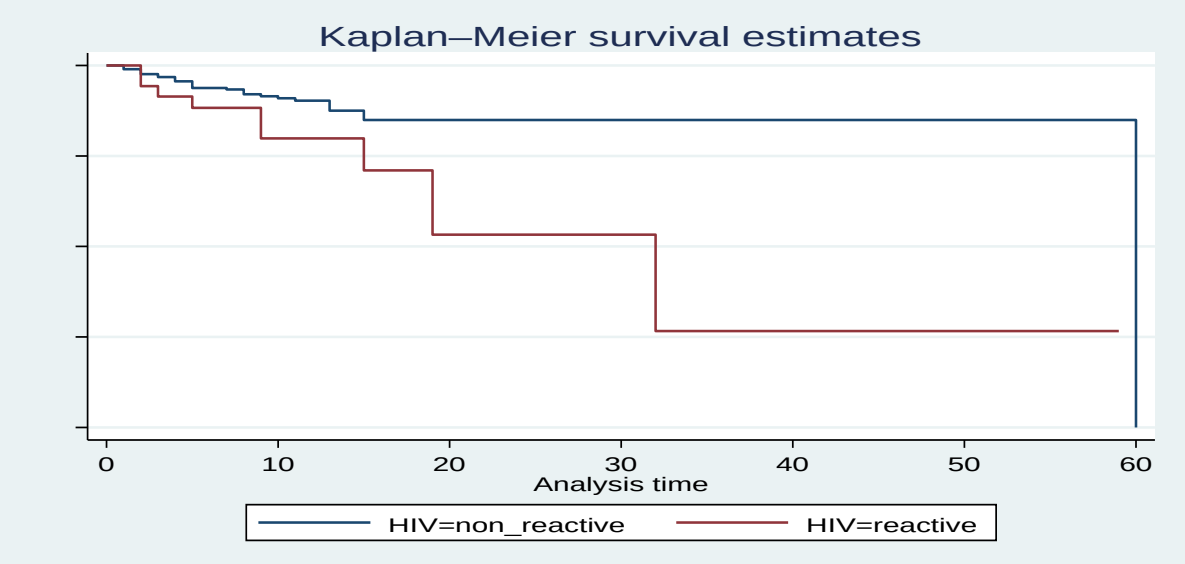

Figure 8: Kaplan-Meier estimation of the hazard function with regard to HIV status among SAM children under the age of five admitted to governmental hospitals in Addis Ababa, Ethiopia.

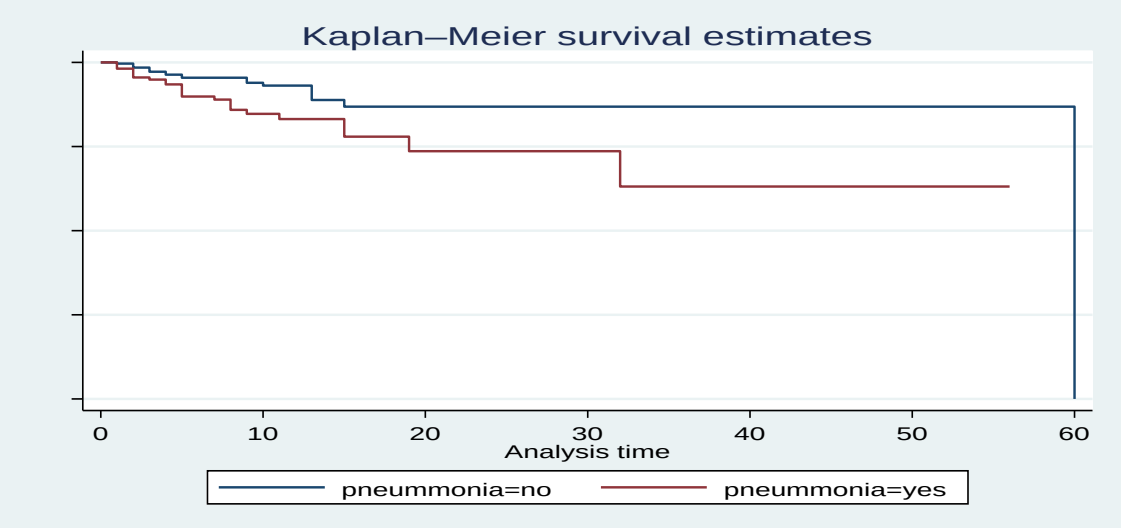

Figure 9: Kaplan-Meier estimation of the hazard function with regard to presence of pneumonia among SAM children under the age of five admitted to governmental hospitals in Addis Ababa, Ethiopia.

6. DISCUSSION

About 422 under five children were being followed for a median of ten (10) days. The maximum follow-up period was two months, with a minimum of one day. According to our finding most of the under five children admitted were recovered 351(83.18%) while almost 44(10%) of them were died. Their recovery rate is in the acceptable range (>75%) when we compared it with the SPHERE project value. In addition other studies also supports this finding(31). and it is more than the recovery rate reported from researches conducted in different countries of Ethiopia(25,46).The observed discrepancy may be since the hospitals are a referral, medical supplies and the profile of the staff, the difference in sociodemographic and sample size may contribute for the difference.

Even though the death rate was not in the alarm figure (>15%), it was slightly above the acceptable value, and was marginally greater than the SPHERE project's acceptable figure (<10%)(27).Studies conducted at southwestern Uganda, Felege-Hiwot hospital, and another meta-analysis done in Ethiopia also showed that a slight higher than the acceptable range of mortality(34,35,37).However other studies done at Minia University, Eastern Ethiopia's Dilchora Referral Hospital and Hospital in Hadiya Zone found a minimum mortality rate less than 10%,which is in the acceptable range(33,39,45).

Regarding Immunization status, Children who had received all recommended vaccinations for their age had an about 77% lower mortality rate than those who had not. It is most likely because unvaccinated children are more susceptible to contracting serious childhood diseases that can be readily prevented with immunization. In particular, having severe acute malnutrition increased the chance of mortality from different infections like sepsis, measles, meningitis, and tuberculosis.(52). Similarly A research conducted at Bahirdar Felege Hiwot Referral Hospital is in line with our finding by reporting 84% lower hazard among fully vaccinated children compared to those non vaccinated or partially vaccinated under five children(47). However other studies did not identified immunization status as significant predictors of mortality((25,35,42). The discrepancy may be due to the difference in length of time, sociodemographic differences, and healthcare setup.

Our finding indicated that the risk of mortality is more than 3.6 times higher in under five children who had received IV fluid as compared to under five children who did not on an IV fluid. This may be due to fluid overload and sodium retention which can lead to heart failure and other complications which lately results into death(53).A study conducted in Uganda found almost double of the mortality risk that we had found(34).Similarly different studies done in different places of Ethiopia also found a significant association between administration IV fluid and the risk of mortality(42,46,54).

The other predictor that we look for was presence of shock. According to our finding the presence of shock increases the risk of death by 3.5 times than those who did not entered into shock. This is may be due the reason that shock from dehydration and sepsis can coexist in severely malnutrition and over hydration during the management shock increases the risk of mortality(55).The finding of this research is in line with study done at stabilization units in Gedeo Zone and Dilla University Referral Hospital which reported a 3.8 and 3.1 times more hazard of mortality among children who developed shock compared to their counterpart(25,42).

According to our finding Compared to children who did not receive F-75 treatment, F-75 recipients had an 80% lower mortality rate. This is due to F-75 is given for SAM children to provide the body requirement of nutrients without overwhelming the bodies system. Since they can not tolerate too much protein and sodium increase the risk of death by preventing fluid overload(8,56).The other probable reason may be not following of the WHO and national SAM management protocol which can effectively reduce the mortality rate if rightly implemented. Similarly other studies conducted in several parts of Ethiopia also reports an increase in the chance of death in under five children who had not had F-75 treatment(45,46).

Among the comorbidities and clinical manifestations pneumonia, HIV and shock were found to be significant. According to our study being HIV infected increase the mortality rate by more than two times than those who were not infected. This may be due to malnutrition and HIV/AIDS are inextricably linked, with one fueling the other and raises the risk of opportunistic diseases such as diarrhea, TB pneumonia, kala-azar, meningitis, and malaria(57).

A research conducted at Felege-Hiwot hospital, Ethiopia supports our finding by revealing that children with HIV had a 2.8-fold higher risk of dying than children without the virus(35).However our finding our was much lower than the findings of A research done at Dilchora Referral Hospital, Eastern Ethiopia which revealed a 11 fold increased risk among the HIV positive under five children than non-reactive their counterpart(45).

The other predictor that we look for was presence of shock. According to our finding the presence of shock increases the risk of death by 3.5 times than those who did not entered into shock. This is may be since severe diarrhea, septicemia and hypovolemia can result into shock and the managements are still controversial and the fluid administration can result precipitated heart failure and increase the mortality of the child(55,58).The finding of this research is in line with a study done at stabilization units in Gedeo Zone and Dilla University Referral Hospital which reported a 3.8 and 3.1 times more hazard of mortality among children who developed shock compared to their counterpart(25,42).

Moreover, the risk of death was more than two times higher when pneumonia was present, making it one of the most important significant predictors of mortality among under five children with pneumonia than who did not develop the disease. This is likely due to the synergetic effect of pneumonia and the inflammatory effect of pneumonia may aggravate the malnutrition condition by further putting the children in disease related malnutrition. On top of that the disease related malnutrition can result the breakdown of tissues and anorexia led to decreased free of fat muscle mass, a loss in function, and an increased risk of death(59).The other possible reason can be the late diagnosis and treatment which can increases the chance of mortality since malnutrition children are unable to produce clinical manifestation because of the blunted inflammatory response(60).

6.1. Strengths and limitations of the study

6.1.1 Strengths of the study

- The results are more generalizable because the study was carried out at a multicenter.
- The inclusion of a 3-year record improves representativeness.

6.1.2 Limitations of the study

- Due to the fact that we were only using secondary data from recorded cards and that our information was thus restricted to what was recorded on the chart, the study did not fully account for all sociodemographic and socioeconomic status of the family which can be essential predictors of mortality.

- Health care providers may misdiagnose and underreport the type of SAM that the child has, which has an impact on our mortality predictions.

- The survival status may have been overestimated or underestimated as a result of the selection bias since incomplete records were removed from the study.

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

In general, the survival status and predictors of mortality from SAM were assessed in the study. This study found a 10.4% survival rate, which was slightly higher than the acceptable range of mortality rates (10%). From a multivariate cox proportional hazard regression model, we found immunization status, administration of therapeutic milk (F75), and IV infusion as significant predictors of mortality. Along with comorbidities and clinical manifestations, the presence of shock, pneumonia, and being reactive to HIV were found to raises the hazard risk of mortality in under five children.

7.2. Recommendation

To Federal Ministry of Health (FMOH)

- The FMOH needs to place more emphasis on the primary prevention of child immunization, and health workers at the SC of SAM need ongoing support and training to comply with the management protocol.

To the community

- To prevent children from dying due to SAM complications, parents must develop a health-seeking habit before the disease worsens and regular diet follow-up is needed.

To Health care providers

- Proper attention must be paid to the identified predictors, and all children admitted with SAM must be treated in accordance with the SAM management protocol, with special consideration given to children with comorbidities.
- Health education have to be given for the parents on how to feed their children and care for them.

To Future researchers

- Future researchers would be recommended to conduct a prospective study to gather more data and identify additional mortality predictors, particularly those connected to sociodemographic characteristics, the family's socioeconomic condition, as well as the educational status of health professionals working at the SC.

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8. ANNEX

Annex 1: Data Abstraction Format

This data abstraction format is prepared for collecting information on Survival status and predictors of mortality among under five children admitted with SAM at selected hospitals in Addis Ababa. All relevant information to the study will be retrieved from the client's chart without stating their name. Health care professionals (BSc Nurses) working in the therapeutic unit of selected hospitals will collect this data and will be kept confidential.

Unit of selected hospitals.

Contact information- Amanuel Nuredin

Cell phone+251912141115,

Email- amannure77@gmail.com

1. Data collector name _____

2. Date of data collection _____

3. Data abstraction format identification number /_____/_____/

4. Name of Hospital_____

Part I Socio-demographic factor			
No.	Questions	Options	Remark
101	Sex	1. Male 2. Female	
102	Age of child (month)?	_____ months	
103	Place of residence	1. Urban 2. Rural	

Part II: Anthropometric measurements at admission

No.	Questions	Options	Remark
201	MUAC at admission(mm)	_____mm.	
202	MUAC at discharge(mm)	_____mm.	
203	weight at admission (Kg)	_____ Kg	
204	Weight at discharge (Kg)	_____ Kg	
205	Height/length (cm) at admission	_____ cm	
206	Height/length (cm) at discharge	_____ cm	
207	WFA Z score at admission	_____Z-score	
208	WFA Z score at discharge	_____Z-score	
209	WFH Z score at admission	_____Z-score	
208	Date of admission	_____E.C	
209	Date of discharge	_____E.C	
21	Admission type	1.New admission 2.Re-admission	

0			
21 1	Admission criteria	1.only edema(kwashiorkor) 2. only wasting (W/H) (marasmus) 3. both edema and wasting 4. MUAC	

Part III Type of severe acute malnutrition			
No.	Questions	Options	Remark
30 1	What type of severe acute malnutrition children have had?	1. Marasmus 2. Kwashiorkor 3. Marasmic-kwashiorkor 4.Not specified	
Part IV-Immunization status			
40 1	Immunization status	1.Fully immunized 2. Partially immunized 3.Not immunized	

Part V: Comorbidity(after/before admission)			
No.	Questions	Options	Remark
50 1	HIV status	1.Reactive 2.non-reactive	
50 2	Presence of tuberculosis	1.No 2.Yes	
50 3	Presence of pneumonia	1.No 2.Yes	
50	Presence of anemia	1.NO	

4		2.Yes	
505	Presence of severe dehydration	1.NO 2. Yes	
506	Presence of fever	1.NO 2.Yes	
507	If the answer for question number 506 is yes, recorded axillary T0	_____To	
508	Presence of congenital heart disease	1.NO 2.Yes	
509	Presence of diarrhea diseases	1.NO 2. Yes	
510	Presence of Sepsis	1.NO 2. Yes	
511	Presence of Oropharyngealcandidiasis	1.NO 2. Yes	
512	Presence of Persistent Diarrheal Disease	1.NO 2. Yes	
513	Presence of stunting	1. NO 2. Yes	
514	Presence of rickets	1. NO 2.Yes	
515	Presence of shock	1. NO 2.Yes	

516	Other medical comorbidities (list)	_____ _____	
517	co-morbid condition after Admission?	1.No 2.Yes	
518	If yes for Q-417, specify?	1._____ Date_____ 2._____Date_____ 3._____ Date_____	

Part VI. Treatment given			
No.	Questions	Options	Remark
601	I.V Fluid given	1. No 2. Yes	
602	I.V Anti-biotic given	1. No 2. Yes	
603	RUTF given	1. No 2. Yes	
604	F-75 given	1. No 2. Yes	
605	F-100 given	1. No 2. Yes	
606	Amoxicillin	1. No 2. Yes	
607	Vitamin A	1. NO 2.Yes	
608	Folic acid	1. NO	

		2.Yes	
609	Albendazole/ Mebendazole	1. NO 2.Yes 3.Not applicable	
610	Paracetamol Tab/syrup	1. No 2. Yes	

Part VII Treatment outcome (SAM)			
No.	Questions	Options	Remark
701	Treatment response of the child?	1.Cure/Recovered 2.Defaulter 3.non-responder 4. Died	If 1, for Q-701 go to 702
702	Treatment response for those who had been cured	1.Weight gain(g/kg/week) _____ 2.Length of stay (days)_____ 3.MUAC gain (mm /week) _____ _____	
703	If 4, for Q-701, when was death occurred?	_____hrs./days after admission	