



MEKELLE UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF NURSING

TREATMENT OUTCOME AND ASSOCIATED FACTORS AMONG
UNDER-FIVE CHILDREN WITH SEVERE ACUTE
MALNUTRITION WHO ARE ADMITTED IN STABILIZATION
CENTER OF PUBLIC HOSPITALS, IN EASTERN ZONE OF
TIGRAY, ETHIOPIA, 2024.

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ABBREVIATIONS/ ACRONYMS

| | |
|---------|---|
| AHR | Adjusted Hazard Ratio |
| AOR | Adjusted Odd Ratio |
| AWG | Average Weight Gain |
| CHR | Crude Hazard Ratio |
| CI | Confidence Interval |
| EMDHS | Ethiopia Mini Demographic and Health Survey |
| EPHI | Ethiopian Public Health Institute |
| ETB | Ethiopian Birr |
| HIV | Human Immune Virus |
| IQR | Inter Quartile Range |
| IRB | Institutional Review Board |
| IV | Intra venus |
| JME | Joint Malnutrition Estimâtes |
| LAMA | Left Against Medical Advice |
| LOS | Length Of Stay |
| MUAC | Mid Upper Arm Circumference |
| NGT | Naso Gastric Tube |
| OTP | Outpatient Therapeutic Program |
| RUTF | Ready Use Therapeutic Food |
| ReSoMal | Rehydration Solution for Malnutrition |
| SAM | Severe Acute Malnutrition |
| SD | Standard Deviation |
| SDG | Sustainable Development Goal |
| SPSS | Statistical package for social science |
| TB | Tuberculosis Bacilli |
| TFC | Therapeutic Feeding Center |
| WFH | Weight For Height |
| WHA | World Health Assembly |
| WHO | World Health Organization |
| WHZ | Weight for Height Z Score |

ABSTRACT

Background: Globally, it is estimated that there are nearly 20 million children who are severely acutely malnourished. Undernutrition accounts for 45% of child mortality under the age of five, stunting still affects more than 5.4 million Ethiopian children. Researches are limited on treatment outcomes among severe acute malnutrition children in Tigray, Therefore, this study has the potential to fill this gap by providing evidences on treatment outcomes and associated factors among under-five children admitted in a stabilization center.

Objective: The aim of the study is to assess treatment outcome and associated factors among children under-five with severe acute malnutrition who are admitted in a stabilization center, in public hospital in eastern zone of Tigray region 2024.

Methods: A health facility-based cross-sectional study was done in 6 public hospitals of eastern zone of Tigray. The total sample size was 347 which were proportionally allocated for each hospital based on the estimated monthly case admission and participants were selected from each hospital using simple random sampling method. A pretest was done on 5% of the sample size in Kuiha hospital. In the Bivariate analysis variables with p-value < 0.25 were a candidate for the multivariable logistic regression analysis and statistical significance was declared at a p-value of < 0.05 .

Result: Among 347 children, 70.3%, 19%, 6.3% and 4.6% of the cases were cured, died, transferred out and defaulters respectively. Children with better appetite upon admission (AOR = 3.849, 95% CI: 1.183–12.523), higher admission weight (AOR = 3.998, 95% CI: 2.022, 7.908), greater weight gain during treatment (AOR = 1.601, 95% CI: 1.096–2.339) and longer hospital stays (AOR = 1.222, 95% CI: 1.021–1.463) were associated with good treatment outcome. Conversely, the presence of fever at admission (AOR = 0.343, 95% CI: 0.152–0.772) was negatively associated with treatment success.

Conclusions and Recommendations: Appetite upon admission, admission weight, fever, weight gain, and length of stay were significantly associated with treatment outcome. Based on these findings, it is recommended that healthcare facilities enhance nutritional support programs, manage fever and infections promptly, and monitor weight gain during hospitalization.

Key words: Treatment outcome, Severe acute malnutrition, Tigray, Ethiopia

1. INTRODUCTION

1.1 Background

Every child has the right to have well nutrition. Well-nourished children grow and develop to their full potential. They are better equipped to lead healthy lives, to be free from poverty, to learn and participate, and to continue thriving across the life course, with benefits that continue over generations. The triple burden of malnutrition – stunting, wasting and overweight – continues to jeopardize children’s ability to survive and thrive. Stunting refers to a child who is too short for his or her age is the devastating result of poor nutrition in-utero and early childhood. Child wasting is when a child who is too thin for his or her height is the life-threatening result of poor nutrient intake and/or recurrent illnesses. Childhood overweight is when a child who is too heavy for his or her height occurs when children’s caloric intake from food and beverages exceeds their energy requirements. [1] Some of the factors that cause poor malnutrition are maternal and child nutrition condition, immediate determinants(diet and care of the child),under lying determinants (food, practice and availability of services) and enabling determinants(resource, norms and governance). [2] Poor malnutrition can lead to starting school later in life, spend less time in school and are more likely to repeat grades. In adulthood, their overall work productivity and earning capacity may be impaired, constraining household incomes and hindering national economic development. [3]

Severe acute malnutrition is defined by very low weight-for-height/length (Z- score below -3 standard deviation of the median WHO child growth standards), or a mid-upper arm circumference < 115 mm, or by the presence of nutritional edema. Children with severe acute malnutrition can be categorized into ‘complicated and uncomplicated’ cases based on clinical criteria. Children with SAM should be treated in as ‘inpatients’, preferably in specialized units like the Nutrition Rehabilitation Centers with skilled manpower and adequate resources for nutrition rehabilitation. Median case fatality rate in children with SAM is approximately 23.5%, which may reach 50% in edematous malnutrition. [4]

Globally, it is estimated that there are nearly 20 million children who are severely acutely malnourished. Most of them live in south Asia and in sub-Saharan Africa. Hunger and under nutrition reduce gross domestic product by US\$1.4–2.1 trillion a year. The World Bank estimates

that undernourished children are at risk of losing more than 10% of their lifetime earning potential, thus affecting national productivity, and recently, a panel of expert economists at a Copenhagen Consensus Conference concluded that fighting malnutrition should be the top priority for policymakers and philanthropists. [5]

The nutrition situation in the horn of Africa region is becoming catastrophic as malnutrition rates rise, notably in Ethiopia and the Arid & Semi-Arid Lands of Kenya & Somalia, with more than 1.8 Million expected to be wasted in 2022 alone. A 24.7% increase in mortalities in Somalia to be delivered & Ethiopia (Afar & Somali regions) compared to the same period last year. Sixty six children have been reported dead due to malnutrition in Somalia alone. The rapidly deteriorating malnutrition situation in Ethiopia, Kenya, and Somalia, has resulted in an increase in admissions of children with Severe Acute Malnutrition over the past six months compared to previous years. In Somalia, the number of children receiving treatment for SAM increased by 86 percent in the first two quarters of 2022 compared to the same period in 2021. Kenya and Ethiopia has recorded steeper increases in SAM admissions this year with first quarter admissions 68% & 37% higher in 2022 compared to last year. Undernutrition accounts for 45% of child mortality under the age of five, stunting still affects more than 5.4 million Ethiopian children. [6]

Eliminating undernutrition in Ethiopia would prevent losses of 8–11% per year from the gross national product. The effects of child undernutrition on human capacity and workforce productivity were also quantified. Based on the report's findings, the total annual cost of undernutrition in Ethiopia was estimated at ETB 55.5 billion, equivalent to 16.5% of GDP in 2009. According to the study, Ethiopia could reduce losses by ETB 148 billion by 2025 if underweight rates were reduced to 5% and stunting to 10% in children under five. Reducing child undernutrition rates to half the current levels by 2025 could reduce losses by ETB 70.9 billion, the study suggests. [5]

1.2. Statement of the problem

Stunting has been declining steadily over the last decade, with 148.1 million, or 22.3 percent of children under age 5 worldwide affected in 2022. Nearly all children affected lived in Asia (52 per cent of the global share) and Africa (43 per cent of the global share). [1] Nearly 4 out of 5 SAM children affected by stunting live in South Asia and Sub-Saharan Africa. [7]

Children suffering from wasting have weakened immunity, are susceptible to long-term developmental delays and face an increased risk of death, particularly when wasting is severe. Children suffering from severe wasting require early detection and timely treatment and care to survive. In 2022, an estimated 45 million children under five (6.8 per cent) were affected by wasting, of which 13.6 million (2.1 per cent) were suffering from severe wasting. More than three quarters of all children with severe wasting live in Asia and another 22 per cent live in Africa. [1]

Study conducted in southern Malawi states that compared to children that are transferred out,. Children whose hypoglycemia status unknown in ward have 96% reduced risk of death as compare to children without hypoglycemia in ward. Children with edema have 13 times increased risk of default as compared to children without edema. The increase in default could be due to lack of severe infections, and guardians prioritizing taking care of other siblings which might be younger than the admitted SAM children. SAM children with dehydration have 12 times increased risk of default than children that have no Dehydration. Inadequate knowledge about the benefits of dehydration treatment and general perception on dehydration treatment due to lack of education might have led to increased numbers of default among dehydrated SAM children. [8]

Results from the 2019 EMDHS show that 37% of children under 5 are short for their age or stunted (below -2 SD), and 12% are severely stunted (below -3 SD). There are some regional variations in stunting, which ranges from a high of 49% in Tigray to a low of 14% in Addis Ababa. Overall, 7% of children in Ethiopia are wasted, and 1% are severely wasted (below -3 SD) and 21% of all children are underweight (below-2 SD), and 6% are severely underweight (below -3 SD). [9]

The prevalence of acute malnutrition in Tigray region, based on Weight for Height Z-score, indicates a very high/critical situation according to WHO and UNICEF thresholds, with 15.9

percent of children aged 6-59 months malnourished. Within this group, 3.1 percent had severe acute malnutrition (SAM), and 12.8 percent had moderate acute malnutrition (MAM). [2]

The incidence of death among children with SAM treatment is 14.03%.Socio-demographic characteristics (age, sex, and residence), medical complication (heart failure, diarrhea, tuberculosis, HIV, malaria, anemia, and pneumonia), Medical care (Antibiotics, folic acid, and vitamin A provision), and nutritional factors (type of SAM) are that lead to death. [10] in addition to those mentioned above, like urban residence, presence of dehydration and shock, altered body temperature, failure to take F100 milk and oral antibiotics are determinants of mortality among severely malnourished children admitted to Stabilization center. [11] In another study factors such as longer hospital stays, line of antibiotics received, types of tuberculosis, presence of TB, presence of complications, admission diagnosis(non-edematous Vs edematous SAM),duration of breastfeeding, age, vaccination status, gender and source of income are the cause for mortality in patients with SAM admitted in SC. [12]

Length of stay in hospital for patients with complicated SAM is one of the variables that measures outcome. So, some of the predictors that make patients admitted with SAM stay longer are Anemia, Pneumonia, kwash dermatosis, hospital acquired infection. [13] diarrhea, HIV sero-status, palmar pallor (anemia), other comorbidities (pneumonia, TB and Malaria), and provision of plumpy nuts. [14]

A lot of factors may cause poor recovery for children who admitted in SC but some of them are not being dewormed, being female, HIV positive, edematous children [15] and age, vaccination status, pneumonia, stunting, shock and daily weight gain per kilogram. [16]

In general, children with vaccination history, presence of nasogastric tubes, admission, weight for height, and presence of comorbidities such as diarrhea, pneumonia, measles, HIV, malaria, sepsis are factors that cause poor treatment outcome. [17]

Therefore, this study is aimed to identify magnitude and associated factors of poor treatment outcome in the stabilization center.

1.3 Significance of the study

Severe acute malnutrition (SAM) remains a significant global burden, particularly in Sub-Saharan Africa, including Ethiopia, where it ranks among the top five causes of under-five mortality. Studying malnutrition in Tigray becomes even more crucial given to the challenges of the COVID-19 pandemic and the deadly war, which have resulted in a scarcity of data on malnutrition over the past 2-3 years.

This research aims to tackle the issue of poor treatment outcomes for severe acute malnutrition (SAM) in eastern zone Tigray's stabilization centers. It will investigate factors contributing to these outcomes, uncover hidden factors hindering successful recovery, and provide a deeper understanding of the issue's overall magnitude. The findings will be instrumental for various stakeholders: program designers and policymakers can utilize the data to develop effective interventions, practitioners and healthcare professionals can improve treatment strategies for patients in the stabilization center, researchers can use it to guide future studies, and hospitals can refine their approaches to managing complicated cases. Ultimately, this baseline data will contribute to reduced mortality and improved treatment outcomes for SAM-affected children in the stabilization center Tigray.

2. LITERATURE REVIEW

2.1 Magnitude of treatment outcome for severe acute malnutrition

A cross-sectional study in Ghana states that treatment outcome of children's admitted in SC is 77.5% of the children were discharged to continue community-based nutrition rehabilitation (17.7%) died, (3.8%) absconded (refused complete treatment and left malnutrition ward before official discharge) and (1.0%) were referred to other tertiary hospitals for further treatment. The average LOS was 11.4 ± 1.9 days. Length of stay between the two age groups 12.1 days; for children <6 months and 11.3 days; 12.3 for those aged 6–59 months and the MUAC categories 11.4 days; 13.3 for children with MUAC <11.5 cm and 10.7 days; 14.2 for those with MUAC ≥ 11.5 cm. Children with edematous SAM recorded longer LOS 14.1 days compared to those without edema 10.9 days. The average weight gain is 5.8 g/kg/day (7.0 g/kg/day for those without edema and 1.0 g/kg/day for those with edema). Children aged <6 months recorded a higher average weight gain of 11.2 g/kg/day compared to 5.4 g/kg/day in the 6–59 month age group. Average weight gain in children with WHZ <-3SD is 4.4 g/kg/day and WHZ $\geq -5SD$ is 6.2 g/kg/day. [18]

A retrospective hospital based cross-sectional study in Nekemte Referral Hospital suggest that the treatment outcome of SAM cases treated in that hospital is (66.8%) cases are cured from SAM,(4.4%) cases died because of SAM, and (16.6%) cases are defaulter from SAM management, and (12.2%)cases are transferred out from pediatric ward of Nekemte Referral Hospital. [19] Hospital Based retrospective follow up study in Gondar university showed that treatment outcome of children admitted with complicated SAM;(85.8%) was discharged improved and (14.2%) are censored (defaulted, died or transferred out). The median time to Discharge is 13 days (IQR: 9-18). Incidence of discharge is 6.4 per 100 person- day observations. Majority (45.9%) of children were discharged in the 2nd week of admission followed by 1st week, 4th week and 5th week of discharge in 21.5%, 8.6% and 2.9%) of children, respectively. [13]

A retrospective cohort study at Yekatit 12 Hospital Medical College, Addis Ababa, Ethiopia states (70.4%) of SAM children were cured, which was below the minimum recovery rate of 75% recommended in the SPHERE standard and linked to outpatient therapy. On the other hand, (12.2%) had died during treatment which was also higher than the SPHERE standard

recommendation of 10% mortality rate. Moreover 64.9% of the deaths occurred in the first 7 days of admission. The average (\pm SD) length of stay in the hospital was 16 days (\pm 10.7), and the average weight gain during the inpatient treatment phase was 8.13g/kg/day for non-edematous malnutrition. The main predictors of undesirable treatment outcomes among inpatient children treated for SAM were HIV and sepsis. [20]

An institutional-based cross-sectional study in Ayder Referral Hospital, Mekelle states that regarding the overall status of treatment outcome of children with SAM, 43.6% of the patients recovered from their disease compared to 56.4% of the patients whose treatment was censored. In addition to this, 22.1%, 3.6%, 43.6%, 9.2% and 21.5% of the patients were cured, died, defaulting their treatment, non-respondent to their treatment and transferred out to a nearby health centers for continuation of their management respectively and The mean length of stay of a 'recovered' child in the hospital was 21.56 ± 1.27 days. The cure rate in this study was found to be below-optimal according to the sphere standard which is above 75%. This low cure rate occurs in children with WFH of $\leq 70\%$ ($p < 0.038$) and MUAC of ≤ 12 cm ($p < 0.090$). [21]

A retrospective cohort study in Harar, Eastern Ethiopia suggests that (70.99%) cases recovered from SAM, whereas (6.8%) cases died because of SAM. Having diarrhea (AOR = 22, 95% CI: 2.86–169.46), presence of comorbidities such as malaria (AOR = 103.29, 95% CI: 7.42–1437.74) and human immunodeficiency virus (HIV) (AOR = 42.72, 95% CI: 4.47–408.23) were a cause for poor recovery from severe malnutrition. [17]

A cohort study in Indonesia suggested that Weight gain for all age groups during the observation period was 1.9 (0-38.7) g/kg BW/day, while in the rehabilitation phase, weight gain was 2.10 (0–71.4) g/kg BW/day. If we look at the weight gain based on age classification, the average weight gains of SAM children aged < 6 months, the median value was 3.06 g/kg BW/day, aged 6- <12 months, the mean value was 7.62 g/kg BW/day, age 12- <24 months, the median value was 0 gr/kg BW/day, and age 24-60 months the median value was 0.39 gr/kg BW/day. This shows that SAM children under 12 months of age have a better weight gain than SAM children aged over 12 months. [22]

2.2 Associated factors of poor treatment outcome

2.2.1 child factor for death

A retrospective cohort study in East Ethiopia stated that those of SAM children who were diagnosed with dehydration (CHR=2.0; 95% CI: 1.18–3.38) and pneumonia (CHR=2.68; 95% CI: 1.58–4.56) had a significantly increased risk of death from SAM. In addition, children with TB in the course of SAM treatment (CHR=2.85; 95% CI: 1.14–7.14) and those on IV fluid treatment (CHR=3.23; 95% CI: 1.94–5.36) had a significantly three-fold increased hazard of death. Children who were unable to swallow food and those who had the NGT implanted had a 13-fold increased risk of death (CHR=13.02; 95% CI: 7.54–22.48). Meanwhile, children who got vitamin supplements, deworming, and IV antibiotics had a lower hazard of death. [23]

A retrospective longitudinal study in Jimma described that children with age less than 24 months were 1.9 (95 % CI [1.2 -- 2.9]; p=0.006) times more likely to die earlier than children with age 24 and above months. Risk of earlier death for hypothermic children was 3.0 (95 % CI [1.4–6.6]; p=0.005) times higher than for children without hypothermia and Children with impaired consciousness (lethargy or coma) were 2.6(95 % CI [1.5–4.5]; p<.001) times more likely to die earlier than conscious children. Risk of earlier death for children with palmar pallor was 2.1 (95 % CI [1.3–3.3]; p=0.003) times higher than children without palmar pallor and Dehydrated children were found to be 2.3 (95 % CI [1.3–3.9]; p=0.004) times more likely to die earlier than children who were not dehydrated. Children with comorbidity/complication at admission were 3.7 (95 % CI [1.9–7.2]; p<0.001) times more likely to die earlier than children without comorbidity/complication at admission. [24]

A retrospective cohort study conducted in northwest Ethiopia stated that oxygen saturation below 90%, impaired consciousness at admission, intake of F-100, HIV/AIDS, edema and failed appetite test were predictors mortality among severe acute malnourished children and children who failed appetite test at admission were 2.44 hazard of death as compared to who have passed appetite test (AHR: 2.45; 95%CI: 1.28, 4.69).The risk of mortality of children who impaired consciousness level at admission were 2.25 times as compared to those conscious at admission (AHR:2.25; 95%CI: 1.08,4.68). [25]

2.2.2 Factors associated with poor recovery after treatment of SAM in SC

A cross-sectional study in Uganda children who were dewormed at some point during treatment were 48% more likely to recover on that day compared to their counterparts who were not dewormed (CHR =1.49 95%: 1.15-1.92). Females were 7% less likely to recover faster compared to males (CHR= 0.93 95% C.I: 0.74-1.22). Children who were HIV positive were 42% less likely to recover faster compared to children who were HIV negative (CHR = 0.93 95% C.I: 0.73-1.20, CHR= 0.42 95% C.I: 0.15-1.13). Also, edematous children were 24% less likely to recover faster compared to those with wasted children whereas those who were both edematous and wasted were 9% less likely to recover faster compared to the children with marasmus (CHR= 0.76 95% C.I 0.56-1.02, CHR= 0.91, 95% C.I: 0.52- 1.62). [15] A facility-based retrospective cohort study was conducted at Yekatit 12 Hospital in Addis Ababa stated that nutritional recovery decreased by 1.9% for every 1-month increase in child age (AHR, 0.98; 95% CI, 0.97 to 0.99), under-5 children who were fully vaccinated for their age were 1.64 times more likely to recover than children who were not fully vaccinated for their age (AHR, 1.64; 95% CI, 1.20 to 2.24) and children who had pneumonia were 24.0% less likely to recover than those who did not (AHR, 0.76; 95% CI, 0.60 to 0.97). [15]

An Institutional-Based Cross-Sectional Study in Addis Ababa revealed that Re-admitted children were 66% less likely to recover than newly admitted children by (AOR 0.34 with a 95% CI: 0.14, 0.83). Children who spent 2 weeks at the hospital had more than 3 times likely to recover compared to those that stayed for 1 week (AOR 3.38 with a 95% CI: 1.40, 8.16), While children with a length of hospital stay of at least 3 weeks were more than 6 times likely to recover as compared to children having 1-week hospital stay (AOR 6.48 with a 95% CI: 2.60, 16.16). Children who have TB had a 79% less chance of recovering as contrasting to children without TB (AOR 0.21, 95% CI: 0.06, 0.70). Moreover, children not supplied with RUTF have 96% less chance of recovery as compared to children supplied with RUTF (AOR 0.04, 95% CI: 0.02, 0.08). Related to diuretics, children who were not treated with diuretics were more than 3 times more likely to recover than who were treated with diuretics (AOR 3.33, 95% CI: 1.38, 8.01). [26]

2.2.3 Factors associated with longer length of stay in SC

Study conducted in North West Ethiopia showing that Kwashiorkor, anemia, pneumonia and Hospital acquired infection were predictors of time to discharge. Children without kwashi-

dermatosis at admission were 2.4(95% CI: 1.17-4.8) times to be discharged earlier compared with those who had kwashi-dermatosis. Not having anemia at admission had 1.7(95% CI: 1.1-2.6) times higher probability of earlier discharge than those children who had anemia at admission. Children without pneumonia at admission had 1.6(95% CI: 1.01-2.63) times chance of being discharged than those who had pneumonia at admission. Those children who had no Hospital acquired infection were 4.4(95% CI: 2.4-8.2) times to be discharged earlier than those who didn't have hospital acquired infection. [13]

Patients with diarrhea at admission were 42.7% (AHR = 0.573; 95% CI: 0.415–0.793) less likely to recover quickly from SAM as compared to those without diarrhea while those HIV positive found to be 60.9% (AHR = 0.391; 95% CI: 0.194–0.788) less likely to get cured fast in comparison with those whose sero-status is unknown. Children with palmar pallor (anemia) and other co-morbidity at admission were 42.5% (AHR = 0.575; 95% CI: 0.416–0.794) and 58.5% (AHR = 0.415; 95% CI: 0.302–0.570) less likely to recover earlier as compared to those who did not have such conditions. Patients who were not treated with plumpy nuts were 63.2% (AHR = 0.368; 95% CI: 0.262 -- 0.518) less likely to recover in comparison with those who received plumpy nuts. [14]

2.3 Conceptual framework

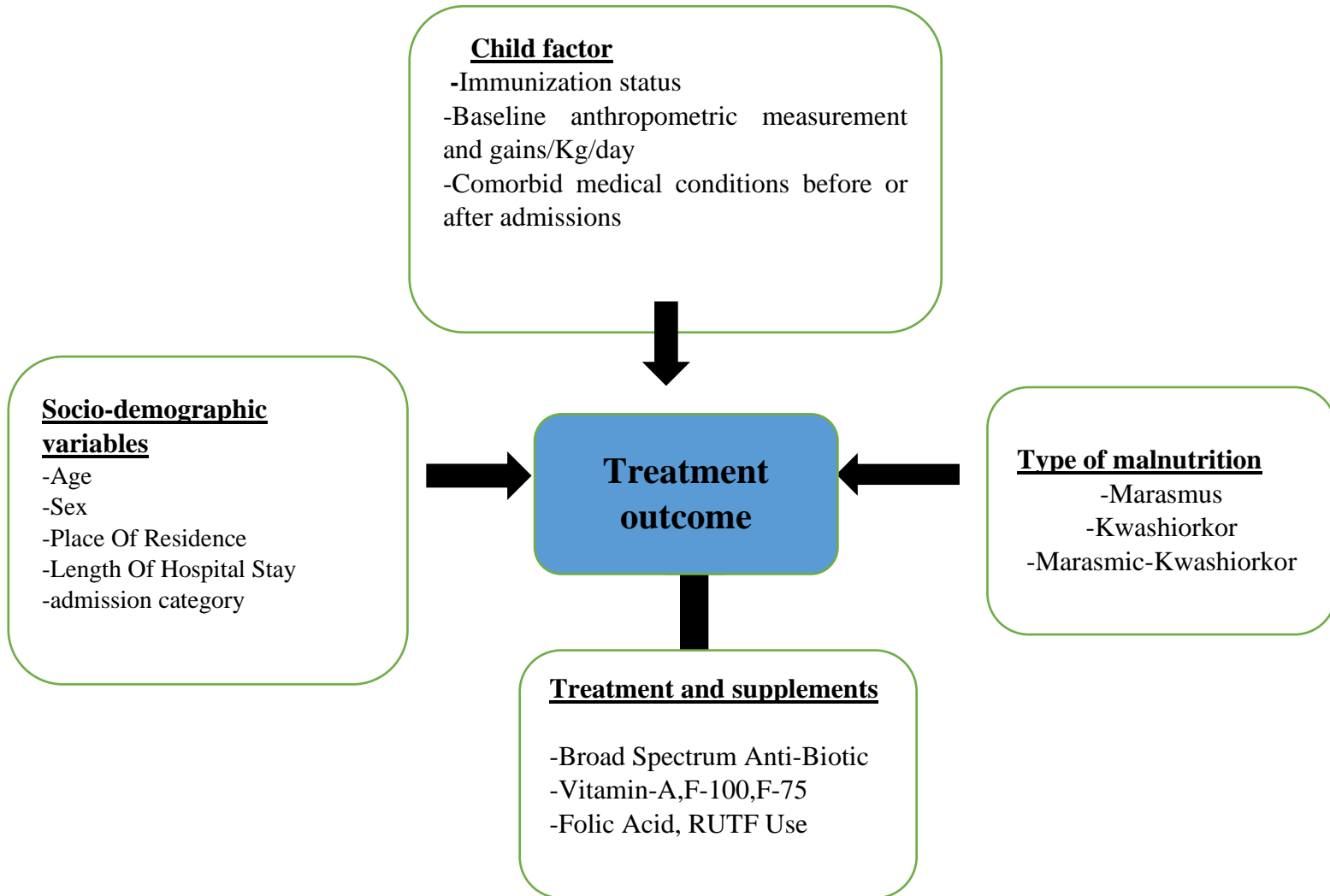


Figure 1: Conceptual framework for Poor treatment outcome for pts with SAM admitted in SC adapted from different literatures (7,8,10,17,18,19,20).

3. OBJECTIVES

3.1. General objective

- To assess poor treatment outcome and associated factors among children under-five with severe acute malnutrition who are admitted in a stabilization center, in public health facility eastern zone of Tigray, Ethiopia, 2024.

3.2. Specific objectives

- To determine the magnitude of treatment outcomes in the stabilization center.
- To identify associated factors for treatment outcomes in the stabilization center.

4. METHODS AND MATERIALS

4.1. Study Area and Period

The study was conducted in public health facility eastern zone of Tigray region. Tigray is the fifth most populous region of Ethiopia. Tigray's official language is Tigrinya. The health facility in Eastern zone Tigray includes two general hospitals, five primary hospitals and thirty-nine health centers. According to the previous census total population of eastern zone of Tigray was 1,959,279 out of this 1,188,581 are females and 770,698 are males and the total number of under five children in this zone was 254,706 of which 52% are girls. The average total number of under five children who are admitted with SAM in this zone in a year is 5400. The study was conducted from July to September 2024.

4.2. Study design

Health facility based cross-sectional study by document review from March to June 2024.

4.3. Source Population

The source population comprised all under-5 children with SAM, who were completed for SAM management and treated in a stabilization center in eastern zone public hospitals from March to June 2024.

4.4. Study population

The study population will comprise under-5 children with SAM, who were completed for SAM management and treated in stabilization center which fulfill the inclusion criteria from the selected eastern zone public hospitals.

4.5. Inclusion and Exclusion criteria

4.5.1. Inclusion criteria

All under-five children with severe malnourished who are finished their management in stabilization center and not fulfilled sphere criteria in those selected health facilities according the secondary completed data will include in the study from march up to June 2024.

4.5.2. Exclusion Criteria

- Children who were diagnosed with SAM and started treatment but referred from or to that study area in the study time period.
- Secondary under-nutrition due to other pathological disorders and with other causes of edema.
- participants with incomplete data was excluded

4.6. Sample size determination

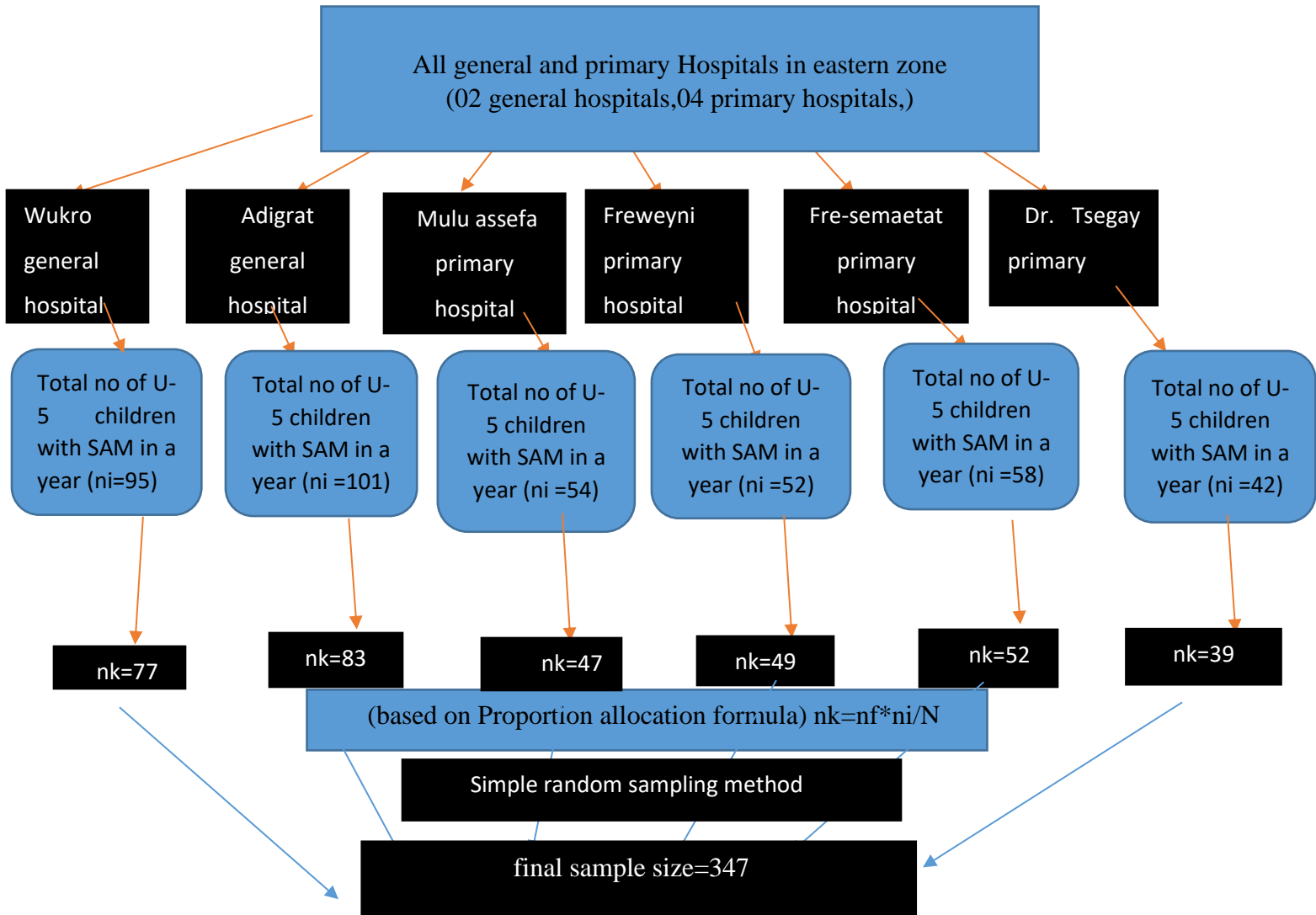
The sample size in this descriptive cross-sectional chart review was determined using a single proportion formula.

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

The sample size of charts reviewed in this study was 316 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 72.2 % as obtained from Institutional-Based Cross-Sectional Study in Addis Ababa on Treatment Outcome and Associated Factors of Acute Malnutrition Among Children.) $n = 1.962 \times 0.72(0.28)/0.025 = 316$. After addition of 10% sample for missing and incomplete data, the final sample size was 347 under-5 children's cards with SAM.

4.7. Sampling procedures

All cases of SAM were obtained from the therapeutic feeding unit register book. Simple random sampling was used by using a patient registration number to select enough samples (patient charts) starting from the latest month backwards, based on the case load, until the required sample size is reached.



nf=final sample of the study nk=sample size for each hospital

ni=number of SAM patients in each public hospital

N=total number of under 5 children with SAM admitted in a year

Figure 2: Sampling procedure

4.8. Methods of Data Collection

The data was collected through medical record reviews of pediatric patients, by using a prepared checklist. A checklist addresses all needed information as a data collection tool. Before starting the data collection, data collecting format was cross-matched with available information on records; then the study checklist and weight-for-height chart was rearranging as necessary. Incomplete chart was discarded. Data collection was conducted with appropriate training of the data collectors and continuous advices to keep the quality of the data. Close supervision was made by the investigators and the collected data was checked for completeness every day.

4.9. Data collection procedure

Data collectors were a trained 4 nurses working in TFC from the available standardized history sheet, medical log book, and individual follow-up chart. Two supervisors organized 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 was 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

Poor Treatment outcome of children from SAM admitted in SC.

4.10.2. Independent variables

Independent variables in the study includes-

- Socio-demographic variables like age, sex, place of residence, type of admission, length of hospital stay
- Type of malnutrition like marasmus, kwashiorkor, marasmus kwashiorkor
- Treatments, supplements and therapeutic feeding such as broad-spectrum antibiotic, vitamin a, folic acid, F-100, F-75, RUTF,
- Child factor

4.11. Operational definitions

Outcome comprises good outcome (recovered) and bad outcome (death, defaulter, and non-respondent)[23].

Recovered/cured: - is when a patient cure rate is above 75% according the sphere standard.

Censored: those children who have not developed an event or those children who were not recovered from SAM (Death, defaulter, non-responder, transferred-out) at the end of the follow-up period[11].

Death: -is when the child dies while on treatment for SAM, and the documented death was confirmed by the physician[4].

Defaulter: - is when the child is absent for two consecutive weighing's[4].

Non-respondent: - A patient who could not meet the discharge criteria after six weeks of inpatient management is considered[4].

Transferred out: - is when the child moved to another health facility for further medical care[4].

Comorbidity: -Any disease condition (acute or chronic) present at admission in addition to SAM which includes pneumonia, tuberculosis, diarrhea, anemia, vomiting, and retroviral infection [27].

4.12. Data Quality Control

To ensure the data quality, pre-test was conduct on 10 % 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 was completed. Subsequent to fitting collection, data was carefully entered, cleaned, coded, and analyzed in SPSS version 27. 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 a respective checklist if they are identified as unexpected and extreme. Lastly, the investigator did further cleaning by selecting randomly 10% from the total number of participants.

4.13. Methods of Data Analysis

Data was checked, coded, and entered into Epi Data version 7, then exported to SPSS version 27 for analysis. Both bivariate and multivariable analyses were performed using binary logistic regression. Variables found to be associated in the binary logistic regression were further analyzed using multivariable logistic regression to control for potential confounders. A bivariate analysis was conducted to examine the relationship between dependent and independent variables. Variables with a p-value less than 0.25 were included in the multivariable model to account for all possible confounders. Odds ratios with 95% confidence intervals were estimated to identify factors associated with the outcome variable in the multivariable logistic regression analysis. Statistical significance was set at a p-value of < 0.05 .

4.14. Ethical Considerations

Ethical clearance was obtained from the Institutional Review Board (IRB) of Mekelle University, College of Health Science (Approval No. MU-IRB 2280/2024). Support letters were obtained from the department of nursing and official letter of permission was requested from Tigray regional health bureau, zonal and woreda director office of the health facilities. 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

The results will be presented to the School of Nursing, Mekelle University College of Health Sciences, as part of the partial fulfillment of the requirements for the MSc in Pediatrics and Child Health Nursing. The findings will also be submitted to the Mekelle University School of Nursing Department, the Regional Health Bureau, and the Tigray Eastern Zone Health Office, and shared at various workshops to serve as a valuable resource for planning and implementing nutrition interventions. Additionally, efforts will be made to publish the study's findings and disseminate them through different journals and scientific publications.

5. RESULTS

5.1. Characteristics of the study participants

This study included a total of 347 children under five years old who were diagnosed with severe acute malnutrition (SAM). The response rate was 100%, indicating that all participants were successfully included in the analysis. The age distribution of the participants revealed that 49 (14.1%) were younger than six months, 185 (53.3%) were between 6 and 23 months, with 102 (29.4%) in the 12-23 months range, and 11 (3.2%) were between 24 and 59 months. The median age of the children was 9 months, with an interquartile range (IQR) of 1 to 17 months.

In terms of gender, the study found that 121 (34.9%) of the children were males, while 226 (65.1%) were females. Geographically, the majority of the children, 237 (68.3%), were from the rural part of the Eastern zone of Tigray. Most of the children, 332 (95.7%), were newly admitted, whereas 15 (4.3%) were readmissions.

Among the children admitted with SAM, 305 (87.9%) had non-edematous SAM, and 42 (12.1%) had edematous SAM. The median weight at admission was 9.1 kilograms, with an IQR of 8.7 to 10.4 kilograms. By discharge, the median weight had increased to 11.1 kilograms, with an IQR of 9.3 to 12.8 kilograms.

The outcomes for the children admitted with SAM were as follows: 244 (70.3%) were cured, 66 (19%) died, 21 (6.1%) were transferred out, and 16 (4.6%) defaulted. The median length of stay for these children was 6 days, with an IQR of 4 to 9 days.

Table 1: Sociodemographic Characteristics of participants

| Variable | | Frequency | Percentage |
|-----------|--------------|-----------|------------|
| Age | <6 months | 49 | 14.1 |
| | 6-23 months | 185 | 53.3 |
| | 12-23 months | 102 | 29.4 |
| | 24-59 months | 11 | 3.2 |
| Sex | Male | 121 | 34.9 |
| | Female | 226 | 65.1 |
| Residence | Rural | 237 | 68.3 |
| | Urban | 110 | 31.7 |

| | | | |
|--------------------|-------------------|-----|------|
| Admission status | New admission | 332 | 95.7 |
| | Readmission | 15 | 4.3 |
| Edema at admission | Non-edematous SAM | 305 | 87.9 |
| | Edematous SAM | 42 | 12.1 |
| Treatment outcome | Cured | 244 | 70.3 |
| | Died | 66 | 19 |
| | Transferred out | 21 | 6.1 |
| | Defaulted | 16 | 4.6 |

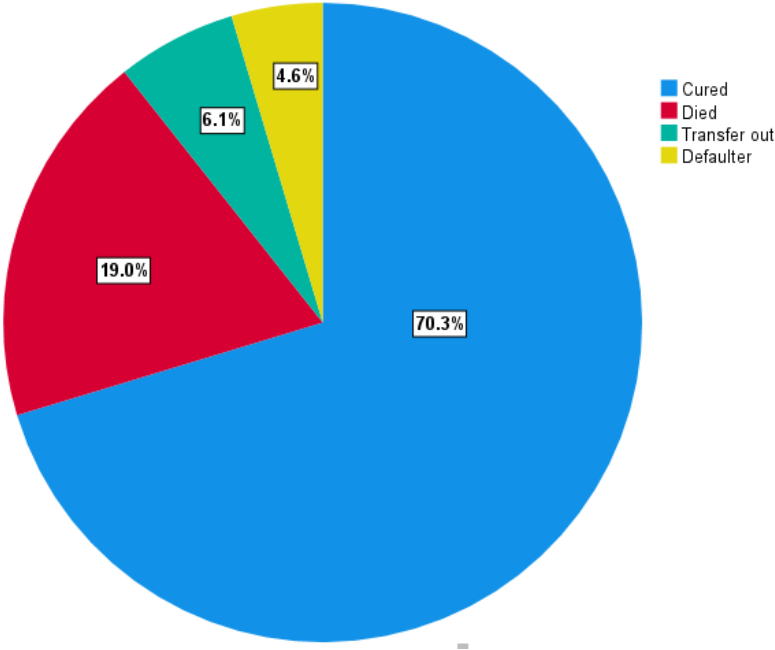


Figure 3: Percentage of treatment outcome among under-five children with severe acute malnutrition who are admitted in stabilization center in selected health facilities of eastern zone of Tigray, Ethiopia, 2024(n=347)

5.2. Complications

This study identified the prevalence of various complications among children admitted with Severe Acute Malnutrition (SAM). The findings revealed that fever was the most common complication, affecting 205 (59.1%) of the children. Diarrheal disease was the second most prevalent complication, reported in 101 (29.1%) of the cases. Similarly, hypoglycemia was

observed in 95 (27.4%) of the children, making it the third most frequent complication. Pneumonia was another common complication, affecting 72 (20.7%) of the children. Additionally, eye signs of Vitamin A deficiency were documented in 32 (9.2%) of the children. The majority of the children, 332 (95.7%), were lethargic at the time of admission. Anemia was reported in 13 (3.7%) of the children, while congenital heart disease and tuberculosis were relatively rare complications, affecting 10 (2.9%) and 12 (3.5%) of the children, respectively.

Table 2: Frequency table of complications

| Variable | | Frequency | Percentage (%) |
|-----------------------------------|-----|-----------|----------------|
| Fever | Yes | 205 | 59.1 |
| | No | 142 | 40.9 |
| Diarrheal disease | Yes | 101 | 29.1 |
| | No | 246 | 70.9 |
| Hypoglycemia | Yes | 95 | 27.4 |
| | No | 252 | 72.6 |
| Pneumonia | Yes | 72 | 20.7 |
| | No | 275 | 79.3 |
| Eye signs of Vitamin A deficiency | Yes | 32 | 9.2 |
| | No | 314 | 90.8 |
| Lethargy | Yes | 332 | 95.7 |
| | No | 15 | 4.3 |
| Anemia | Yes | 13 | 3.7 |
| | No | 334 | 96.3 |
| Congenital heart disease | Yes | 10 | 2.9 |
| | No | 337 | 97.1 |
| Tuberculosis | Yes | 12 | 3.5 |
| | No | 335 | 96.5 |
| Congenital Heart Disease | Yes | 10 | 10 |
| | No | 247 | 90 |

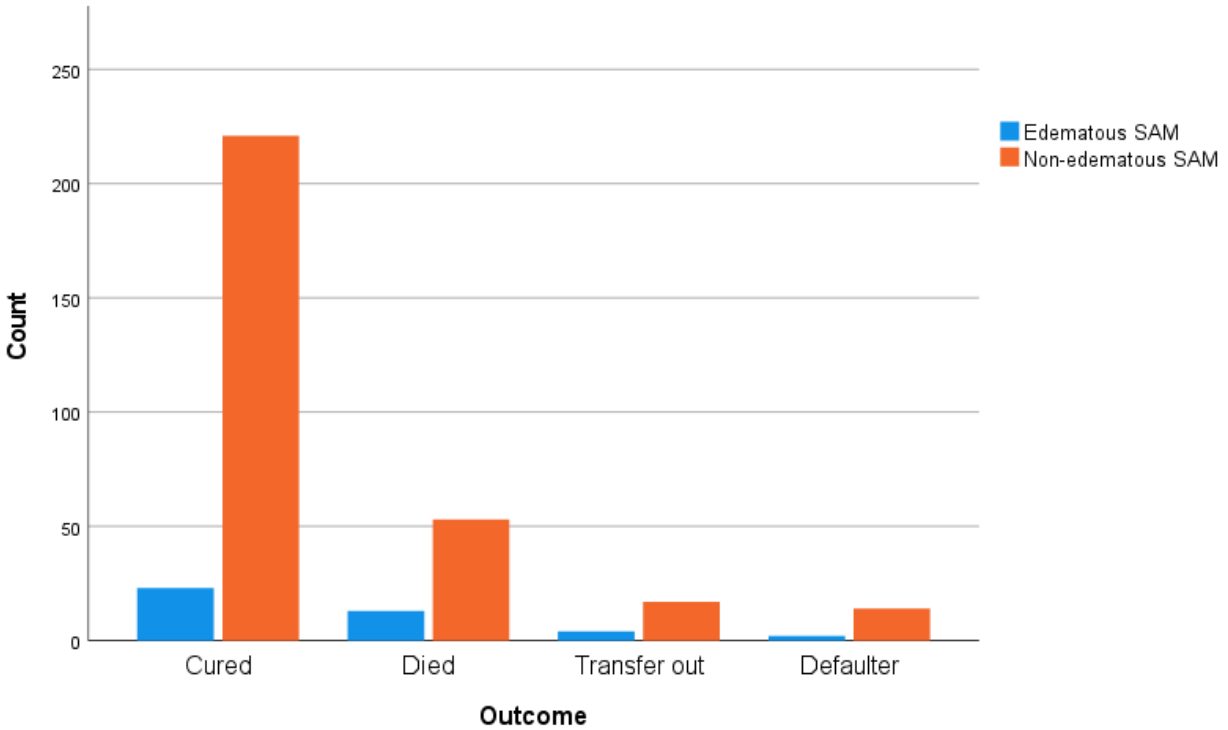


Figure 4: Bar chart depicting the treatment outcomes of under-five children with severe acute malnutrition categorized by edematous and non-edematous conditions, illustrating the differences in recovery rates between the two groups.

5.3. Treatments and Therapeutic Feeding

Among the treatments administered, IV antibiotics were the most commonly used, with 333 (96.0%) of the children receiving Gentamicin and Ampicillin. In contrast, oral antibiotics were less commonly used, with only 14 (4.0%) of the children receiving Amoxicillin.

Deworming was performed in 158 (45.5%) of the children. IV fluids were provided to 51 (14.7%) of the children, specifically using Ringer's Lactate. ReSoMal, was administered to 58 (16.7%) of the children. Vitamin A supplementation was given to 32 (9.2%) of the children.

Therapeutic feeding was a key component of the management of SAM. F-75, provided to 303 (87.3%) of the children, while F-100 was provided to 44 (12.7%) of the children.

Table 3: Treatments and Therapeutic Feeding Provided to Children with Severe Acute Malnutrition who are admitted in stabilization center in selected health facilities of eastern zone of Tigray, Ethiopia, 2024(n=347)

| Variables | | Frequency | Percent |
|-----------------------|------------|-----------|---------|
| IV Antibiotics | Yes | 333 | 96.0 |
| | No | 14 | 4.0 |
| PO Antibiotics | Yes | 14 | 4.0 |
| | No | 333 | 96.0 |
| Dewormed | Yes | 158 | 45.5 |
| | No | 189 | 54.5 |
| IV fluid | Yes | 51 | 14.7 |
| | No | 56 | 16.1 |
| ReSoMal | Yes | 58 | 16.7 |
| | No | 51 | 14.7 |
| Vitamin A | Yes | 32 | 9.2 |
| | No | 315 | 90.8 |
| F-75 | Yes | 303 | 87.3 |
| | No | 44 | 12.7 |
| F-100 | Yes | 44 | 12.7 |
| | No | 303 | 87.3 |

5.4. Factors associated with treatment outcome

In the bivariate analysis, variables with a significance level of $p < 0.25$ were identified as candidates for multivariable logistic regression. These included age (COR = 1.023, 95% CI: 0.991–1.057), appetite status at admission (COR = 1.174, 95% CI: 0.819–3.590), and weight at admission (COR = 1.195, 95% CI: 0.998–1.431). Type of malnutrition was significant, with edematous malnutrition showing higher odds of recovery compared to non-edematous (COR = 2.357, 95% CI: 1.121–4.956). Immunization status, fever presence, congenital heart disease, hypoglycemia, consciousness level, antibiotic use (IV and PO), F-75 feeding, weight at discharge (COR = 0.613, 95% CI: 0.517–0.727), average weight gain (COR = 1.337, 95% CI: 1.033–1.729), and length of stay (COR = 1.6, 95% CI: 1.427–1.793) also met the inclusion threshold. Multicollinearity among the independent variables was assessed using Variance Inflation Factor (VIF) with a threshold of 10, where values greater than 10 indicate potential multicollinearity issues. In the final regression model, all variables had VIF values below 10, with the highest

being for Admission Weight in Kg (VIF = 7.235), followed by Hypoglycemia (VIF = 6.588) and Child Weight at Discharge (VIF = 5.952), indicating the absence of severe multicollinearity. Variables such as Immunization Status and PO Antibiotics were removed during model refinement due to their higher multicollinearity in earlier iterations.

From multivariable logistic regression, results revealed that several variables were significantly associated with the likelihood of recovery. Appetite status upon admission was found to be a strong predictor, with patients exhibiting a positive appetite having almost four times higher odds of recovery 3.849(AOR = 3.849, 95% CI: 1.183-12.523) than who failed appetite test. Similarly, higher admission weight was associated with increased odds of recovery, with an odds ratio of (AOR = 3.998, 95% CI: 2.022, 7.908). On the other hand, the presence of fever was significantly associated with decreased odds of recovery (AOR = 0.343, 95% CI: 0.152, 0.772), indicating that patients with fever had lower chances of recovery than with no fever.

Furthermore, average weight gain during the hospital stay were also significant predictors, with each unit increase in average weight gain increased recovery odds by 60% (AOR = 1.601, 95% CI: 1.096,2.339). Length of stay in the hospital was positively associated with recovery, with a 22% increase in the likelihood of recovery for each additional day of hospitalization (AOR = 1.222, 95% CI: 1.021,1.463). Conversely, variables such as age, congenital heart disease, and hypoglycemia did not demonstrate statistically significant associations with recovery.

Table 4: Bivariate and Multivariable analysis of treatment outcome and associated factors among children under-five with severe acute malnutrition who are admitted in stabilization center in selected health facilities of eastern zone of Tigray region, 2024 (n=310)

| Variables | Categories | Outcome | | COR (95% CI) | AOR (95% CI) | Sig. |
|--------------------------|------------------|---------------|-----------|---------------------|---------------------|----------|
| | | Recovered (%) | Died (%) | | | |
| Age | Median \pm IQR | | | 1.023(0.991-1.057) | 0.958(0.880-1.042) | 0.320 |
| Appetite at admission | Passed | 12(30) | 28(70) | 1.714(0.819-3.590) | 3.849(1.183-12.523) | 0.025* |
| | Failed | 54(20) | 216(80) | | 1 | |
| Weight at admission | Median \pm IQR | | | 1.195(0.998-1.431) | 3.998(2.022-7.908) | 0.0001** |
| Fever | Yes | 32(17.7) | 149(82.3) | 0.6(0.347-1.037) | 0.343(0.152-0.772) | 0.10* |
| | No | 34(26.4) | 95(73.6) | | 1 | |
| Congenital Heart disease | Yes | 4(40) | 6(60) | 2.559(0.7-9.3) | 1.059(0.190-5.905) | 0.948 |
| | No | 62(20.7) | 238(79.3) | | 1 | |
| Hypoglycemia | Yes | 53(55.8) | 42(17.2) | 19.608(9.818-39.16) | 2.537(0.845-7.62) | 0.97 |
| | No | 13(6) | 202(94) | | 1 | |
| Average weight gain | Median \pm IQR | | | 1.337(1.033-1.729) | 1.601(1.096-2.339) | 0.015* |
| Length of stay | Median \pm IQR | | | 1.6(1.427-1.793) | 1.222(1.021-1.463) | 0.029* |

I = indicates reference group

** Statistically significant at $P < 0.01$

* Statistically significant at $P < 0.05$

This logistic regression model explains 61% of the variance in the dependent variable according to Nagelkerke R².

| Model Summary | | | |
|----------------------|-------------------|----------------------|---------------------|
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 163.486 | .399 | .610 |

Since the p-value is 0.462 (which is greater than 0.05), we fail to reject the null hypothesis of the Hosmer and Lemeshow Test which says there is no significant difference between the predicted and observed values. This indicates that the model's predictions align well with the actual data, supporting the model's adequacy.

| Hosmer and Lemeshow Test | | | |
|---------------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | 7.717 | 8 | .462 |

6. DISCUSSION

This study aimed to assess the magnitude of treatment outcomes and associated factors among children under five years of age diagnosed with severe acute malnutrition (SAM) in the Eastern zone of Tigray, Ethiopia.

The study results revealed a cure rate of 70.3%, which is below the minimum Sphere standard of 75% and is comparable to the findings from the study in Yekatit 12 Hospital Medical College (70.4%)[15] but higher than the recovery rates reported in Ayder Referral Hospital (43.6%)[21] and These differences may stem from variations in adherence to treatment protocols, patient management practices, and the burden of comorbidities at admission.

The death rate in this study was 19%, falling above the Sphere standard of $\leq 10\%$. This result is lower than the mortality rates reported in Ayder Referral Hospital (22.1%)[21] and higher than the study done in Yekatit 12 Hospital (12.2%).[15] The observed differences in mortality rates could be attributed to variations in study settings, patient profiles, treatment protocols, and geographic or socioeconomic factors influencing healthcare access and outcomes.

The defaulter rate in our findings was 4.6%, which is lower to rates in Nekemte Referral Hospital (16.6%)[19] and Ayder Referral Hospital (43.6%)[21]. This lower defaulter rate may reflect stronger collaboration with community health workers to track and support patients.

The average length of stay (LOS) in our study was 6 days, which is shorter than the 16 days reported in Yekatit 12 Hospital and the 11.4 days observed in Ghana. This variation may relate to the severity of malnutrition and the presence of complications.

The results from the multivariable logistic regression analysis revealed several significant predictors of recovery, including appetite status upon admission, admission weight, presence of fever, child weight at discharge, average weight gain during hospitalization, and the length of stay in the hospital. These findings are consistent with several previous studies conducted in different settings, although they also highlight unique differences in specific predictive variables.

One of the strongest predictors identified in this study was the appetite status upon admission, where children with a positive appetite exhibited almost four times higher odds of recovery (AOR = 3.849, 95% CI: 1.183–12.523) compared to those who failed the appetite test. This finding is supported by previous study done in Eastern Ethiopia where children who were unable to swallow food and those who had the NGT implanted had a 13-fold increased risk of death[23]. Similarly, the significant association between higher admission weight and increased odds of

recovery aligns with findings from studies conducted in Uganda, where nutritional factors such as weight were found to impact recovery. The importance of weight gain as a predictor of recovery has also been demonstrated in studies from Yekatit 12 Hospital in Addis Ababa[15], which showed that underweight children had lower chances of recovery.

The presence of fever was identified as a negative predictor in this study, with a significant decrease in recovery odds (AOR = 0.343, 95% CI: 0.152–0.772). Similar findings were observed in the study conducted in Yekatit 12 Hospital, where the presence of pneumonia reduced recovery odds by 24.0.

In terms of discharge and weight gain, this study found that each unit increase in weight at discharge decreased the likelihood of recovery by 65% (AOR = 0.354, 95% CI: 0.198–0.632). This contrasts with the results of the Uganda study, where children who gained weight during hospitalization had better recovery outcomes. The average weight gain during hospitalization was positively associated with recovery odds (AOR = 1.601, 95% CI: 1.096–2.339), aligning with research that indicates weight gain as a key factor for successful recovery in malnourished children.

The length of stay in the hospital was another positive predictor of recovery in this study. Each additional day of hospitalization increased the likelihood of recovery by 22% (AOR = 1.222, 95% CI: 1.021–1.463). This is consistent with findings from studies conducted at Yekatit 12 Hospital [15] and in Addis Ababa, where a length of hospital stay of at least 3 weeks were more than 6 times likely to recover as compared to children having 1-week hospital stay (AOR 6.48 with a 95% CI: 2.60, 16.16)[26].

Notably, factors such as congenital heart disease and hypoglycemia did not show significant associations with recovery in this study, potentially due to the small number of children identified with these conditions, which may have resulted in an unbalanced distribution and limited statistical power to detect associations.

7. STRENGTH AND LIMITATIONS OF THE STUDY

7.1. Strength of the study

- This study employed a multivariable logistic regression model, allowing for the identification of multiple factors simultaneously that influence recovery outcomes.
- The key strengths of this study is its multicenter design, which enhances the generalizability and external validity of the findings.
- Conducting the study in eastern zone of Tigray provides important context-specific insights.

7.2. Limitation of the study

- This study's cross-sectional nature limits the ability to establish causal relationships.

8. CONCLUSION

The study identified key factors affecting recovery. Positive appetite status upon admission, adequate weight gain during hospitalization, and longer hospital stays were associated with better outcomes. Conversely, the presence of fever negatively impacted recovery. These findings underscore the importance of targeted interventions to address these critical factors.

The results emphasize the need to strengthen nutritional support programs, improve early screening for appetite and fever, and prioritize comprehensive care during hospitalization. Addressing these areas can improve recovery outcomes and help reduce mortality and default rates among children with SAM.

9. RECOMMENDATIONS

For woreda and zone Health offices: Given the importance of nutritional recovery in this study and the potential gap between the current cure rate and the SPHERE standard, healthcare facilities should invest in comprehensive nutritional support programs.

For healthcare workers:

- Children exhibiting poor appetite should be closely monitored and provided with appropriate nutritional support to improve their chances of recovery.
- Health workers focus on strategies that promote weight gain during hospitalization,
- Health professionals should take prompt action to diagnose and manage underlying infections or conditions that may cause fever.
- Health facilities should consider adopting flexible discharge protocols that prioritize patient recovery over arbitrary discharge timelines.

For Researchers: Future research should investigate other potential factors that may influence recovery, such as psychological factors, family support, and socioeconomic status, which were not explored in this study.

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11. ANNEX

11.1. Annex-II: Checklist

This data abstraction format is prepared for assessing treatment outcome and associated factors among children under-five with severe acute malnutrition who are admitted in stabilization center, in selected health facility eastern zone of Tigray region, 2024

1. Data collector name _____

2. Date of data collection _____

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

| Part I | | | |
|---|-----------------------------|--|----------------------|
| demographic and socio economic characteristics | | | |
| Code | Question | Response | Skip to.ques. |
| 101 | Age of the child in months | 1.less than 6 month 2.6-11 month 3.12-23 month 4.24-59 month | |
| 102 | Sex of the child | 1.Male 2.Female | |
| 103 | Residence | 1.Urban 2.Rural | |
| Part II | | | |
| Anthropometric measurements at admission | | | |
| 201 | Admission status | 1.New 2.Readmission | |
| 202 | Appetite test in admission | 1.pass 2.fail | |
| 203 | Breast feeding on admission | 1.yes 2.No | |
| 204 | MUAC in cm at Admission | 1.< 11.5cm 2.11.5 cm-12.5 cm 3.> 12.5 cm | |
| 205 | Admission weight in Kg | _____ in kg | |
| 206 | WFH/L Z score at admission | 1. < -3 z score 2. ≥ -3 to < -2 Z scores 3. ≥ -2 z-score | |
| 207 | Edema at admission | 1.No edema 2.edema (+) 3.edema (++) 4. edema(+++) | |

| | | | |
|-----------------|--|---|--|
| 208 | Referral source | 1.health facility 2.self-referred | |
| Part III | Type of malnutrition and Immunization status | | |
| 301 | What type of severe acute malnutrition children have had? | 1. Marasmus 2. Kwashiorkor 3. Marasmic-kwashiorkor | |
| 302 | Immunization status | 1. Fully immunized 2. Partially immunized 3. Not immunized 4. Not documented | |
| Part IV | Comorbid medical diseases before or after admission | | |
| 401 | Presence of HIV/AIDS | 1. Reactive 2. Non-reactive 3. Unknown | |
| 402 | Presence of anemia (HGB <11 mg/dl) | 1.Yes 2. NO | |
| 403 | Level of dehydration | 1.No dehydration 2.Some dehydration 3.Severe dehydration | |
| 404 | Fever(body temperature \geq 37.5 degree Celsius) | 1.YES 2.NO | |
| 406 | Presence of congenital heart disease | 1.present 2.absent | |
| 407 | Presence of diarrhea diseases | 1.present 2.absent | |
| 408 | Presence of tuberculosis | 1.present 2.absent | |
| 409 | Presence of pneumonia | 1.present 2.absent | |
| 410 | Presence of gastroenteritis | 1.present 2.absent | |
| 411 | Presence of Hypoglycemia | 1.present 2.absent | |
| 413 | Presence of Intractable vomiting | 1.present 2.absent | |
| 414 | Consciousness level | 1. Conscious 2. Lethargic 3. Comatose | |
| 415 | Presence of Severe skin lesions | 1.present 2.absent | |
| 416 | Presence of Eye signs of vitamin A deficiency | 1.present 2.absent | |
| 417 | Other medical comorbidities (list) _____ | | |

| | | | |
|---------------|---|-----------------------------------|--|
| | | | |
| Part V | Treatments, supplements and therapeutic feedings | | |
| | Routine treatments | | |
| 501 | Did the child receive IV antibiotic/s? | 1.YES 2.NO | |
| 502 | If the answer for question number 501 is yes list | | |
| 503 | Does the child take PO antibiotic/s? | 1.YES 2.NO | |
| 504 | If the answer for question number 3 is yes list _____ | | |
| 505 | Was the child dewormed with Albendazole or Mebendazole? | 1.YES 2.NO 3.Not applicable | |
| 506 | If the child took Others type of treatments (list) | | |
| | Special medication | | |
| 507 | Did the child take IV fluid? | 1.YES 2.NO | |
| 508 | If the answer for question number 7 is yes list type of fluid | | |
| 509 | Did the child take ReSoMal? | 1.YES 2.NO | |
| | Supplements given | | |
| 510 | Did the child receive Vitamin A? | 1.YES 2.NO | |
| 511 | Did the child receive Iron? | 1.YES 2.NO | |
| 512 | Did the child receive Folic Acid? | 1.YES 2.NO | |
| 513 | Other supplements (list) | | |
| | Therapeutic foods given | | |
| 514 | Did the child receive F75? | 1.YES 2.NO | |

| | | | | |
|-----------------|--|--|------------|------------------|
| 515 | Did the child receive F100? | 1.YES | 2.NO | |
| 516 | Did the child receive RUTF? | 1.YES | 2.NO | |
| Part VI | Anthropometric measurement at discharge and weight gains per Kg | | | |
| 601 | Child weight in kilogram | | | |
| 602 | Weight gain/kg/d | 1.1kg | 2. 2-3 kg. | 3.more than 3kg. |
| Part VII | Outcomes of inpatient management and length of hospitalization | | | |
| 801 | Final outcomes of treatment | 1. Recovered 2. censored. | | |
| 802 | Date of admission | | | |
| 803 | Date of discharge | | | |
| 804 | Length of stay | 1. ≤7 days 2. 8-14 days 3. 15-22 days 4. ≥23 days | | |

Checked by supervisor; Name _____, Signature _____