DETERMINANTS OF TIME TO RECOVERY AMONG CHILDREN WITH SEVERE ACUTE MALNUTRITION ADMITTED TO GOBA REFFERAL HOSPITAL, BALE, ETHIOPIA

BY- LEMESSA TAMIRU(BSc.)

A THESIS SUBMITTED TO DEPARTMENT OF POPULATION AND FAMILY HEALTH, FACULTY OF PUBLIC HEALTH, INISTITUTE OF HEALTH, JIMMA UNIVERSITY, IN PARTIAL FULLFILMENT OF THE REQUIRMENTS FOR MASTER OF SCIENCE IN HUMAN NUTRITION.

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Abstract

Background: *Malnutrition remains to be one of the most common causes of morbidity and mortality among children in developing countries. Children with severe acute malnutrition often die because doctors unknowingly use practices that are suitable for most children, but highly dangerous for severely malnourished children. In Ethiopia management of severe acute malnutrition guide line, training material and management protocol were developed and being updated continuously to improve outcome of treatment. Despite these efforts, recent review indicated that the average time to recovery during severe acute malnutrition inpatient treatment ranged from 11-79 days compared to minimum international standards recommendation of less than 30 days.*

Objective: *To assess the determinants of time to recovery among children with severe acute malnutrition admitted to Goba Referral Hospital, Bale, Ethiopia.*

Methods: *Institution based retrospective cohort study was conducted among 306 children with severe acute malnutrition who were admitted to Goba Referral Hospital from September2014 to September2017. Data analysis was conducted using SPSS version 23 for windows. The time to recovery during SAM treatment was estimated using the Kaplan-Meier survival curve and the Cox proportional-hazard model was fitted to identify the determinant factors of time to recovery from SAM.*

Result*. From a total of 332 records assessed analysis was based on 306 (92.2%) cases with complete base line data. Children who achieved nutritional recoveries were 58.2% and the median recovery time was 15 days with Inter Quartile Range (IQR) of 10(15, 20). After adjustment for important covariates in multivariable model, the time to recovery during SAM treatment was significantly shorter for children who received vitamin A supplementation compared to those who did not receive. (AHR=1.67; 95%CI; 1.129-2.470), and children who had no comorbidity of tuberculosis at admission had shorter time to recovery compared to those who had. (AHR=0.21; 95%CI; 0.052-0.881).*

Conclusion and Recommendation: *In this study Children who achieved nutritional recoveries were 58.2% with a median recovery time of 15 days .Determinant factors for time to recovery from SAM among children admitted to nutritional rehabilitation unit in Goba Referral Hospital were vitamin A supplementation and the presence of comorbidity of tuberculosis at admission. Thus emphasis given to children with comorbidity of tuberculosis at admission and vitamin A supplementation at admission will have a positive effect on treatment duration.*

Key Words= *Severe acute malnutrition; time to recovery; inpatient.*

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List of Acronyms and Abbreviations

AHR	Adjusted Hazard Ratio
CHR	Crude Hazard Risk
AIDS	Acquired Immune Deficiency Syndrome
CI	Confidence of Interval
EDHS	Ethiopian Demographic and Health Survey
HIV	Human Immunodeficiency Virus
HR	Hazard Ratio
IU	International Unit
IV	Intravenous
MUAC	Mid-Upper Arm Circumference
NCHS	National Center for Health Statistics
NRUs	Nutritional Rehabilitation Units
PEM	Protein-Energy Malnutrition
RUTF	Ready to Use Therapeutic Food
SAM	Severe Acute Malnutrition
SNNPR	Southern Nation, Nationality and People Region
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
TFCs	Therapeutic Feeding Centers
UNICEF	United Nations Children's Fund
US	United States
USAID	United States Agency for International Development
WFH	Weight for Height
WFL	Weight for Length
WHO	World Health Organization

INTRODUCTION

1. BACKGROUND

Adequate nutrition is the means by which people thrive, maintain growth, resist and recover from diseases and perform their daily tasks. When nutrition is unhealthy, vulnerable populations' subgroups are likely to become malnourished. Worldwide more than 19 million children are affected by sever acute malnutrition and Africa pointed as a region where the problem is highly prevalent (1). Severe acute malnutrition is defined by a very low weight for height, by visible severe wasting or by the presence of nutritional edema. In children aged 6-59 months, mid upper arm circumference less than 11.5cm is also indicative of severe acute malnutrition (2)

Globally in 2016 wasting continued to threaten the lives of an estimated 7.7 percent or nearly 52 million children under five and 17 million are severely wasted. More than two thirds of all wasted children under 5 lived in Asia and more than one quarter lived in Africa. In Africa 14 million and 4.1 million children under five are wasted and severely wasted respectively and in Eastern Africa 6.5 children under 5 are severely wasted. Wasting in children is the life-threatening result of hunger and/or disease. Children suffering from wasting have weakened immunity, are susceptible to long term developmental delays, and face an increased risk of death: they require urgent treatment and care to survive (3).

It is estimated that 19 million preschool-age children, mostly from the WHO African Region and South-East Asia Region, are suffering from severe wasting. Childhood under nutrition is a major global health problem, contributing to childhood morbidity, mortality, impaired intellectual development, suboptimal adult work capacity, and increased risk of diseases in adulthood. Of the 7.6 million deaths annually among children who are under 5 years of age approximately 35% are due to nutrition-related factors and 4.4% of deaths have been shown to be specifically attributable to severe wasting. Severe acute malnutrition remains a major cause of child mortality worldwide. While pneumonia and diarrhea are often the final steps in the pathway, severe wasting is estimated to account for around 400 000 child deaths each year (4).

Severe malnutrition is one of the most common causes of morbidity and mortality among children under the age of 5 years worldwide. Many children with Severe Acute Malnutrition die at home without care, but even when hospital care is provided, mortality rates may be high. Children with severe acute malnutrition often die because doctors unknowingly use practices that are suitable for most children, but highly dangerous for severely malnourished children. With appropriate case management in hospitals and follow-up care, the lives of many children can be saved, and Therapeutic Feeding Unit or severe malnutrition wards can dramatically lower case fatality rates. In certain hospitals that have used these case management methods, the mortality rate has been reduced from over 30% to less than 5 % (5).

Despite the existence of in-patient and other nutrition programs in every corner of the country, the national survey and different studies have showed that deaths due to severe acute malnutrition is indicated to be still high. The Ethiopia Demographic and Health Survey 2016 reported that the national stunting, underweight and wasting rates among under five year old children were 38%, 24% and 10% respectively (6). In Ethiopia, the health sector has increased its efforts to enhance good nutritional practices through health education, treatment of extremely malnourished children and provision of micronutrients for mothers and children. But, the poor nutritional status of women and children continues to be a series problem still (7).

Malnutrition has a dramatic impact on childhood mortality still in Sub-Saharan African countries including Ethiopia. Ethiopia is one of the countries in the sub-Saharan Africa with the highest rates of severe acute malnutrition. Over the past fifteen years, the trend of malnutrition revealed that there is a reduction in stunting by 38% and underweight by 24%. However, there was only a small decline in the prevalence of wasting over the last 15 years (from 12% to 10%). In Ethiopia, 3% of under-five children have SAM and 3.5% are found in Oromia region (6).

The expansion in the coverage of outpatient treatment services is reducing the need for inpatient treatment of children with SAM. However, there will arguably be certain proportion of children with SAM that will be identified at a late stage requiring inpatient treatment to stabilize their condition. The treatment success in such inpatient setups is variable. It is almost impossible to stipulate with certainty the key reasons behind the successes in those institutions with low mortality or failures in others. So, this study intended to identify determinants of time to recovery among 6–59 months old children in Goba Referral Hospital.

1.2 STATEMENTS OF THE PROBLEM

Malnutrition in all its forms continues to hamper the lives and opportunities of millions of people worldwide. An estimated 805 million people worldwide are chronically undernourished; 161 million under 5 children are stunted and, while 42 million are overweight/ and obese. Improvements in nutrition will contribute significantly to reducing poverty and to achieving health, education, and employment goals (1).Acute malnutrition is a major contributor to deaths in children under five years of age Worldwide. According to current estimates, Approximately 17 million children under the age of five suffer from severe acute malnutrition. Nearly two-thirds of the burden of acute malnutrition is borne by South- East Asia and sub-Saharan Africa (2).

Severe acute malnutrition affects nearly twenty million children under 5 years, causing up to 1 million deaths each year by increasing susceptibility to death from severe infection. The most susceptible age for malnutrition is 6 to 18 months, when growth velocity and brain development are especially high; SAM is classified in to marasmus(characterized by wasting of body tissues), kwashiorkor(characterized by bi-lateral edema and weight for height of greater than or equal to -2 SD)and marasmic-kwashiorkor: (characterized by bi-lateral edema and weight for height of less than -2 SD) (10).

Over 17 million children are affected by severe acute malnutrition worldwide. Children with severe acute malnutrition are nine times more likely to die than well-nourished children. The management of severe acute malnutrition is critical for child survival and is a key cost-effective component of the scaling up nutrition framework for addressing under nutrition (11).

Under nutrition which is a cause for stunting, severe wasting and intrauterine growth restriction are estimated to be responsible for 21% of disability-adjusted life lost. In an analysis that accounted for co-exposure of these nutrition related factors, together they were found to be responsible for about 11% of the global disease burden. And also causes sub-optimal physical and cognitive development, lower resistance to infection and hinders the productivity of adults, thereby lowering the economic potential of societies and perpetuating poverty.(12).In Africa, an estimated 13.4 million children under five years of age, or 8.5%, were wasted. In 2011 these children are at substantial increased risk for SAM and death (13).

In Ethiopia 28% of all child mortality is associated with under nutrition, 81% of all cases of child under nutrition and its related pathogenesis go untreated and 44% of the health cost associated with under nutrition occur before the child turns one years old. Child mortality associated with under nutrition has reduced Ethiopia's workforce by 8% (14). Different Studies suggested that: age, sex, co-morbid conditions, types of malnutrition, base line anthropometry values, and taking amoxicillin, vitamin A and de-worming as determinant factor for time to recovery (15). In Ethiopia management of SAM guide line, training material and management protocol were developed and being updated continuously to improve outcome of treatment (2) . Despite of these efforts, Recent review indicated that time to recovery from SAM under inpatient ranges from 11-79 days (14-15).

The time to recovery of children managed at inpatients were varying and determinants of time to recovery specifically, Effect of vaccination status, was not investigated. In line with this, there was no study conducted in Bale Goba Referral Hospitals. So the purpose of this study was to identify determinants of time to recovery among in SAM children in Goba referral Hospital.

2. LITERATURE REVIEW

Over 17 million children are affected by severe acute malnutrition worldwide. Despite significant progress in recent years, approximately 2.9 million children accessed treatment in 65 countries in 2013 – only about 17 percent of the children needing treatment. Children with SAM are nine times more likely to die than well-nourished children. The management of severe acute malnutrition is critical for child survival and is a key cost-effective component of the scaling up nutrition framework for addressing under nutrition (11).Severe Acute Malnutrition (SAM) is description of malnutrition level encompassing children 6-59 months with < -3 z-scores, and/or MUAC < 11.5 cm, and/or bilateral pitting nutritional edema (2).

The preferable outcome of malnutrition is to reach normal standard weight for height / length, after the nutritional supplementation in the ward. This outcome can be achieved by prompt treatment of all infections in these children with appropriate antibiotics, correction of the electrolytes, hypothermia, hypoglycemia, micronutrients and macronutrients following WHO criteria. Unfavorable outcomes include failure to gain weight for severe marasmus children and failure of reduced weight for the edematous children, failure of treatment of infected children and death due to complications of malnutrition most commonly occur during the first 48 hours of admission (11). According to SPHERE the acceptable standards for cure rate , death rate , defaulter rate , rate of weight gain and average length of stay are >75%,<10%,<15%,>8g/kg/d and <4wks (11).

This section reviews available literatures on the topic under the study. Literature search was made using relevant key words related to treatment outcome and determinants of time to recovery. Previous research findings are reviewed from international and local literatures in order to develop an understanding on and identify Socio-demographic factors, anthropometry and type of malnutrition, underlying co-morbidity/complications and clinical conditions at admission were some of factors in relation to determinants of time to recovery. In addition, concepts considered pertinent are cited and used as reference.

2.1Treatment outcomes and time to recovery

Study conducted at Tamale Teaching Hospital; Ghana reported, 33.6% recovered, 49.1% defaulted, and 11.5% transferred. The average length of stay was 8 days {5.34 days and the maximum was 33 days (4 weeks). The children who recovered from SAM had an average weight gain of 28.3 (23.9 gm./kg/day)(18). This study revealed that recovery rate and defaulter rates were remote from the international acceptable standard ranges.

Study conducted at Debre Markos and Finote Selam Hospital reported that the recovery rate was 77.9% and the overall median recovery time was 11 days(19). Another study conducted at Yirgalem Hospital reported that among admitted children 78% were cured, 16% were dead, 3.1% transferred out and 2.6% were defaulted. The average weight gain was found 9.5 g/Kg/day with 2.6 weeks (18.16 days) mean length of stay(20). Study conducted at Gedeo zone SNNPR reported that 9.3% children had died, and 76% and 4.8% children had recovered and defaulted respectively. The survival rates at the end of the first, second and third weeks were 95.3%, 90% and 85%, respectively, and the overall mean survival time was 79.6 days of age (16).

A study conducted in Jimma specialized teaching hospital reported 77.8 % were discharged with improvement, 9.3 % died during treatment and 12.9 % absconded (left the NRU before completing treatment). Of 88 deaths27.3 % occurred in the first 48 h and 60.2 % by the end of the first week. The average length of stay in the hospital was 17.4 days (16.7 for children with non-edematous and 17.9 for children with edematous malnutrition) and the average weight gain was 10.4 g/kg/day (12.9 g/kg/day for children with non-edematous and 7.6 g/kg/day for children with edematous malnutrition (9).

2.2. Determinant factors of time to recovery in severely malnourished children.

2.2.1. Socio-demographic Factors

Study conducted in Debre Markos reported that children age from 24 to 35 months had 34% lower probability of recovery from SAM compared to 6–11 months (AHR=0.66,95% CI;0.35-0.89) (19).A study conducted in Jimma specialized teaching hospital reported that more than half (58.6 %) of the children enrolled into the study were males and 68.1 % were in the age group of 6–59 months with median age of 24 months (9).

2.2.2 Anthropometry and type of malnutrition

Study conducted in different places reported that the type of malnutrition was not the same study conducted at Gandhi Memorial Hospital; India reported that75.8% cases of children had severe visible wasting, and 27% had bilateral pitting edema (21).Another study conducted at Lusaka; Zambia Kwashiorkor was seen as the most frequently recorded type of SAM accounting for 62.0% of the children. This was followed by marasmus that accounted for 21.6% of the children while miasmic–kwashiorkor had 16.4% (22).Study conducted at University of Aden Yemen reported that 94.2% of the patients were classified under marasmus and only 5.8% were diagnosed as kwashiorkor (23).

Study conducted in Southern Ethiopia the age, type of SAM, and rate of MUAC gain (mm/day) were independently associated with the time to recovery. Children older than 3 years were 33% less likely to achieve nutritional recovery compared to the reference [adjusted hazard ratio, AHR 0.67, 95% CI (0.46, 0.97)]. Similarly, children with marasmus stayed longer on treatment compared to children with kwashiorkor [AHR0.42, 95% CI (0.32, 0.56)]. However, children who gained MUAC] 0.24 mm/day were 59% more likely to recover faster [AHR1.59, 95% CI (1.23, 2.06). Study conducted in Jimma specialized teaching hospital reported 60.8 % of the children enrolled into the study had edematous malnutrition (kwashiorkor or marasmic-kwashiorkor).More than half [58.5 % (87 % of non-edematous and 43 % of edematous)] of 6–59 months old children had MUAC less than 11.5 (9).

2.2.3 Underlying co-morbidities

Study conducted at Gandhi Memorial Hospital; India reported that 54% had diarrhea and 27.8% had acute respiratory tract infections. Tuberculosis was diagnosed in 22% of cases (60.8% cases in children 6-12 months old). Malaria and Measles were diagnosed in 3.8% each, and HIV infection was seen in 2.9% cases. Signs of vitamin B and vitamin A deficiency were seen in 14.4% and 5.8% cases,(21).Study conducted at Lusaka; Zambia reported that 29.8% had diarrhea, 25.3 % had pneumonia, 11.6% had anaemia,5.3% tuberculosis and 6.8% septicemia, while 21.2% had other co- morbidities (22).

Study conducted at Debre Markos and Finote Selam Hospitals reported that among admitted children 64.9% of them had co-infection and the most common co-infections were diarrhea (28.2%), pneumonia (23.3%), anemia (18.4%) and tuberculosis (11.7%) (19). Study conducted at

Sekota Hospital Waghemra zone; among children with severe acute malnutrition who had malaria at admission time, more than two times hazard of death as compared to children with SAM without malaria (Hazard ratio 2.13, 95% CI = 1.12, 7.35). Children with severe anemia (<4 gm/dl) had more than six and half times hazard of death when compared to those with no anemia (AHR=6.71, 95% CI = 3.22, 13.97). Moreover children with moderate anemia were more than four and half times hazard of death when compared to children with no anemia (AHR= 4.71, 95% CI = 2.38, 9.60). Furthermore the hazard of death due to TB was about three times as compared to children with no TB (HR = 2.88, 95% CI = 1.72, 4.65)..Among children with severe acute malnutrition who had malaria at admission time, more than two times hazard of death as compared to children with SAM without malaria. Children with severe anemia (<4 gm/dl) had more than six and half times hazard of death when compared to those with no anemia Moreover children with moderate anemia were more than four and half times hazard of death when compared to children with no anemia (24).

Study conducted at Gedeo zone SNNPR reported that 27.0% study participants had pneumonia at the time of admission and 12.5% were anemic. Hypoglycemia, malaria, disseminated TB, conjunctivitis and kwash-dermatosis were prevalent in 8.8%, 6.8%, 7.5%,4.5% and 10.1% children, respectively(16).A study conducted in Jimma specialized teaching hospital reported that Children with co-morbidity/complication at admission were found to be 3.7 (95% CI [1.9-7.2]; p < 0.001) times more likely to die earlier than children without co-morbidity/complication at admission (16).

2.2.4 Clinical conditions at admission

Study conducted at Kenya reported that 49% had diarrhea of which 21% died compared to 12% deaths in those without diarrhea at admission. Any diarrhea during admission resulted in a significantly higher mortality 19% than those uncomplicated by diarrhea 9% (25).Study conducted at Wolayita Zone Children with hypothermia, had 11.8 times increased risk of dying when compared to children with complicated SAM with normal temperature (AHR=11.8, 95% CI [3.77-37.02], P < 0.0001). Similarly, children having sepsis at admission had 2.9 times more at risk of death when compared to those with no sepsis (AHR=2.9, 95% CI [1.03-8.40], P = 0.045,) (26).

A study conducted in Jimma specialized teaching hospital reported that most of children were in critical condition at the time of admission. Axillary temperature ≤ 35 °C, 69.2 % had deranged respiratory rate and 21.8 % had deranged pulse rate. Pale conjunctiva, palmar pallor and hypothermic were present in 23.6, 18 and 1.8% of the children respectively. Dehydration was present in 11.8 % of the children of which 67.9 % were severely dehydrated. Shock was present in 6.4 % of the children. Children with impaired level of consciousness (lethargic or comatose) account for 12.5 % of the total. The majority (66.0 %) and more than half (51.6 %) of the children had diarrhea and vomiting respectively where 88.8 % had watery diarrhea. Ninety eight (15.7 %) patients with diarrhea were dehydrated (of which 66 (67.3 %) were severely dehydrated) .Risk of earlier death for hypothermic children was found to be 3.0 (95% CI [1.4-6.6]; p = 0.005) times higher than children without hypothermia. Children with impaired consciousness level (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. 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 (9).

Study conducted at Gedeo zone altered pulse rate (AHR =3.926, 95% CI =1.579–9.763), altered temperature (AHR =7.173, 95% CI =3.05–16.867), shock (AHR =3.805, 95% CI =1.829–7.919), anemia (AHR =2.618, 95% CI =1.148–5.97), nasogastric tube feeding (AHR =3.181, 95% CI =1.18–8.575), hypoglycemia (AHR =2.74, 95% CI =1.279–5.87) and treatment at hospital stabilization center (AHR =4.772, 95% CI =1.638–13.9) were independent predictors of mortality. The survival of children with hypoglycemia, shock, altered pulse rate and altered body temperature was significantly shorter (died earlier) (16).

2.2.5 Types of treatment given

Study conducted at Sekota Hospital Waghemra zone; result shows that there was significant difference in the hazard of death among children who had been treated with medication than those children not managed., children not supplemented folic acid during their hospitalization, more than two time hazard of death when compared to supplemented children (AHR 2.30, 95% CI=1.54, 3.40). The hazard rate of death among children not supplemented for Vitamin A were 53% times higher than supplemented children (AHR= 1.53, 5% CI = 1.05, 2.24). Children who have complication that need special antibiotics, but not managed were about 3 time likely to die as compared to the same cases managed by special antibiotics (AHR =2.72, 95% IC = 1.90, 4.00) (24).

Study conducted at Debremarkos children who didn't take folic acid supplement had 65% lower probability of recovery from SAM compared to children who took folic acid supplement (AHR = 0.35, 95% CI: 0.14–0.89) (13).Study conducted at Mekelle city blood transfusion, intravenous fluid infusion and intravenous antibiotic administration were found to be statistically significant at 5 percent. The adjusted relative risk of fatality comparing infused and not-infused groups was 2.52 (95% CI 1.25 - 5.07). Likewise, the adjusted relative risk of the fatality for intravenous antibiotic administration and blood transfusion were 5.87 (95% CI 1.73 - 19.87) and 3.05 (95% CI 1.51 - 6.17), respectively(8). Similar study conducted at Wolayita Zone; children who did not have antibiotics at admission are 3.7 times more at risk of death (AHR=3.7, 95% CI [1.55-8.64], P=0.003) compared to those had it (26).

2.3. CONCEPTUAL FRAMEWORK

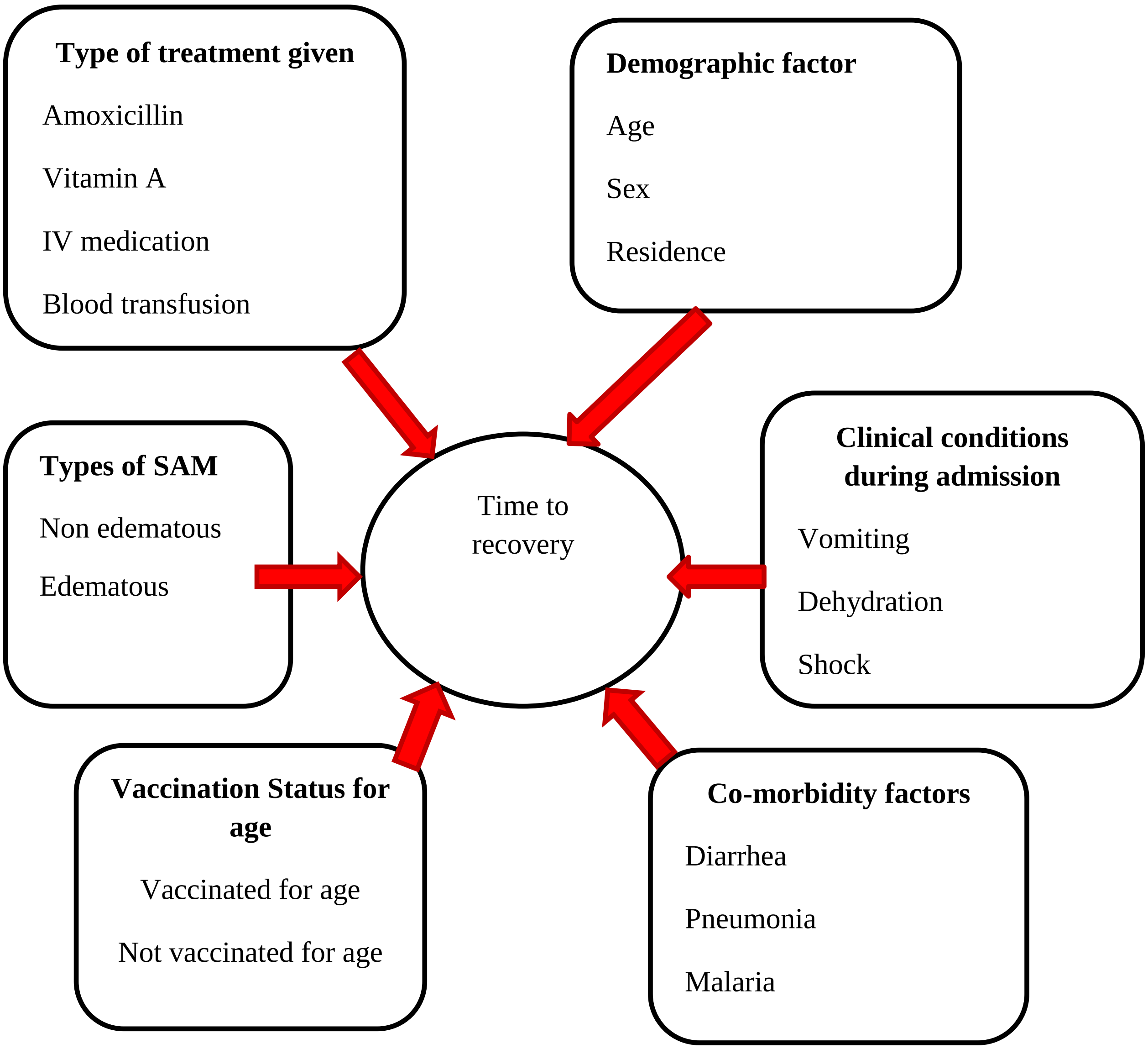


Figure 1 Conceptual framework for determinant factors affecting time-to-recovery during SAM treatment.

2.4. Significance of the study

Information on determinants of time to recovery in severely malnourished children admitted to hospitals is critical for the improvement of quality care. The times to recovery of children managed at inpatients were varying and a factor that determines time to recovery specifically, Effect of vaccination status, was not significantly investigated. In line with this, there was no study conducted in Bale Goba Referral Hospitals. So the purpose of this study was to identify determinant factors of time to recovery among severely acutely malnourished children aged 6-59 months who were admitted to Nutritional Rehabilitation Unit at Goba Referral Hospital.

The results of the study will be used by health personnel, health service managers and policymakers for best practices in the management of severely malnourished children at Nutritional Rehabilitation Units (NRUs). The findings may also be used by organizations and stakeholders who have special interest in the health of children as part of evidence for coming up with strategies that would help to improve management of severely malnourished children.

3. Objectives

3.1 General objective

- To assess the determinants of time to recovery among children with severe acute malnutrition admitted to Goba Referral Hospital, Bale, from September 2014 to September 2017 , Bale; Ethiopia.

3.2 Specific objectives

- To assess time to recovery from SAM among children who were admitted to Nutritional Rehabilitation Unit in Goba Referral Hospital from September 2014 to September 2017 , Bale; Ethiopia.
- To identify determinant factors of time to recovery among children who were admitted to Nutritional Rehabilitation Unit in Goba Referral Hospital from September 2014 to September 2017 , Bale; Ethiopia.

4. Methods and Materials

4.1 Study Setting

The study was conducted in Goba Referral hospital which is located in Bale Zone Oromia Region in south east Ethiopia; at a distance of 446km from Addis Ababa. The hospital serves as teaching hospital for Mada Walabu University and has bed capacity of 117. It provides services for a population of 1 million living under its catchment area. Pediatric ward is one of the wards in the hospital while Nutritional Rehabilitation Unit (NRU) is one of the units in the pediatric ward. Severely malnourished children are directly admitted to NRU and treated by different professionals including Interns, Nurses and General practitioners. The common health problems from ten top causes of morbidity among hospital attendants of under- five children are: acute upper respiratory infection, pneumonia, diarrhea and malnutrition. Severe acute malnutrition was the second commonest reason for hospital admission. In 2009 E.C. about 217 cases of severe acute malnutrition were admitted to the NRU in the Hospital.

4.2 Study design and period

An institution-based retrospective cohort design was employed Children with SAM who were admitted to the NRU between 2014 and 2017 were followed for this study.

4.3 Population

4.3.1 Source population

Source population was severely acutely malnourished children who receive treatment in the NRU between 2014 and 2017 at Goba Referral Hospital.

4.3.2 Study population

Study population was those children admitted to the NRU between 2014 and 2017 and fulfilled the study inclusion criteria.

4.4 Inclusion and exclusion criteria

Inclusion criteria

All SAM children aged 6-59 months who were admitted to the NRU in Goba Referral Hospital between September 11, 2014 and September 11, 2017.

Exclusion criteria

Those SAM cases who were with allergy to the components of therapeutic feeding.

4.5 Sample size determination and sampling technique

The sample size was calculated by STATA version 14 considering the following assumptions: 95% CI, power 80%, attrition rate 10%, over all probability of an event censored(PE) 80%, coefficient of determination for the correlation between predictors of interaction with other covariates in the model (R2) 20% (27) and Hazard ratio of 1.5 (the effect of vitamin A supplementation) (28) . And provide 332 individual records of children that have been managed for severe acute malnutrition was estimated for this study.

4.6 Study variables

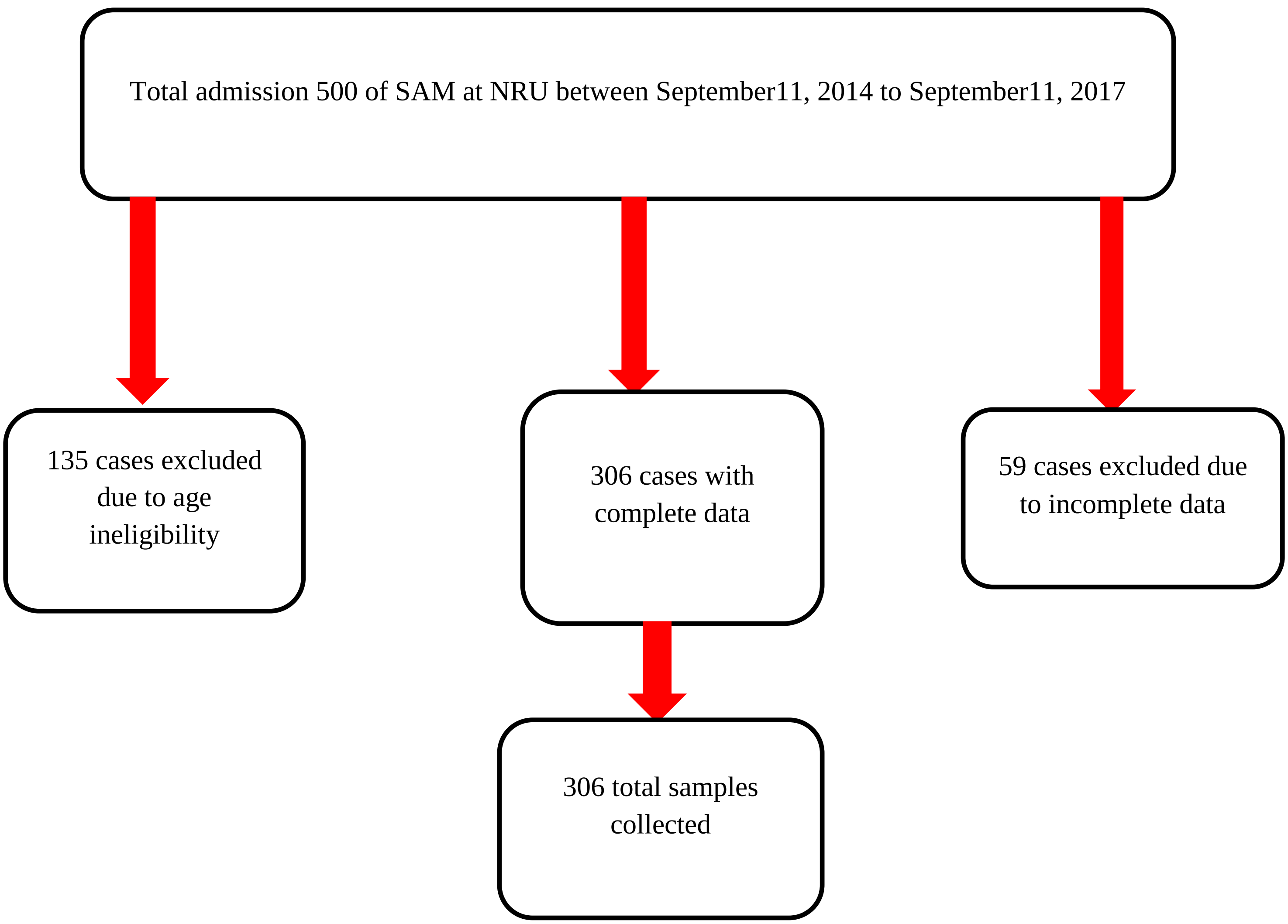
The study outcomes are the median time to recovery during treatment and the different potential outcomes for SAM treatment including cured, defaulted, death and transfer out. The independent variables are the different factors that can potentially affect treatment outcomes and can be available from the patient treatment card including the type of SAM (non- edematous and edematous), patient characteristics (child age. sex and residence), presence of co-morbidities (pneumonia, diarrhea. malaria, tuberculosis, severe anemia), clinical condition at admission , type of treatment given and vaccination status for age.

4.7. Data collection and instruments

A check list was developed from the management of severe acute malnutrition, SAM registration log book, SAM monitoring multi chart (WHO/FMOH; 2013). The checklist consists of the following data; Patient related data (age, sex, and residence), anthropometric measurements (height, weight, MUAC), and co-morbidities, types of severe acute malnutrition, medication given and status of treatment outcome.

4.8 Data quality management

Three BSc. Nurses, two data collectors and one supervisor who had training on SAM management were recruited for data collection. To keep data quality, one day training was given for data collectors and supervisor to ensure common understanding on the checklist how and what information they should be collected from the targeted data sources. Reviewed cards were boldly marked to avoid re-review. Completeness of the collected data was checked on daily bases during data collection by the supervisor and the principal investigator. Whenever there appears incompleteness and ambiguity of recording, the filled information was crosschecked with source data as soon as possible. Cases with medical records containing incomplete information were excluded from study.



4.9 Data processing and analysis

Data were cleaned, edited and coded before data entry. The template scheme for data entry was developed and entered into Epi data version 3.1and the data were exported for analysis to SPSS version 23 for Windows. Descriptive analyses was done and presented by tables and graphs.

We used the Kaplan-Meier's technique survival curve to estimate the median time to cure for the whole sample and sub-samples by different categories. The Cox proportional hazards regression model was fitted to identify the determinant factors of time to cure in the study population. First, a bivariate Cox regression analysis was performed for the association between each potential determinant factor with time to cure. Then, a multivariable Cox proportional-hazard regression model was fitted to identify the independent determinants of time to recovery. As a starting model, we included all variables that showed a marginally significant association (p-value ≤ 0.25) in the multivariable Cox regression analysis. Statistical significance was considered at p-value of less than 0.05 A priori test was performed for the assumption of proportional hazards by categories of the different covariates using the Kaplan-Meier hazard plots and testing an interaction of covariate with time.

4.10. Ethical considerations

Ethical approval for the study was obtained from Institutional Review Board (IRB) of Institute of Health, Faculty of Public Health of Jimma University. Permission to use the data was obtained from Goba Referral Hospital of Pediatrics department, and confidentiality was assured by collecting data anonymously using just card number of the records.

4.11 Plan for data dissemination

The findings of the study will be presented to the Jimma University, Scientific Community and submitted to the department of Population and Family health, Institute of Health, Faculty of Public Health Jimma University; Recommendations will be forwarded to hospital staffs and other stakeholders based on the findings of the study. Efforts will be made to publish the findings on national or International scientific journals.

4.12. Operational Definitions

- **Time to recovery** – the length of time (in days) between admission to NRU and discharge.
- **Treatment outcomes -**refers to cured, defaulter from treatment, transfer out, those who died with indirect and direct causes.
- **Co-morbidities**- children with severe acute malnutrition, who have pneumonia, diarrhea, TB, HIV, malaria and severe anemia co-infection at admission to stabilization center.
- **Recovered**- Patient that has reached the discharge criteria with improvement.
- **Dead**- Patient that has died with direct and indirect causes while he/ she was in the program at the stabilization center.
- **Defaulter-** Patients who were discharged against medical advice.
- **None recovered**- Patient that has not reached the discharge criteria after six weeks in the in- patient program.
- **Non edematous-**Severe form of acute malnutrition characterized middle upper arm circumference [MUAC] <11.5cm in children 6-59 months, or a weight-for-height/length <-3 Z scores.
- **Edematous-**Severe form of acute malnutrition characterized by bi-lateral edema and weight for height equal to -2SD to-3 SD or bi-lateral edema.

5. RESULTS

A total 500 cases of SAM were admitted to NRU in Goba Referral hospital during the study period (September 11, 2014-September 11, 2017) 135 cases were excluded due to age ineligibility and 59 cases were excluded due to incomplete data. Finally a total of 306 cases were fulfilled the inclusion criteria.

5.1 Socio-demographic characteristics

More than half of children enrolled into the study were males (57.8%) and in the age group of 12-23 months (53.5%). The mean and SD age of study the participants were 18.84$\pm$12.34 months respectively. Most (90.5%) of the children came from rural districts.

5.2 Anthropometry and type of malnutrition

Majorities (78.8%) of the children enrolled into the study had non edematous malnutrition (**Figure2)**. Larger proportion (89%) of marasmus (non- edematous malnutrition) was observed among children of age 6-11 months old children than edematous.

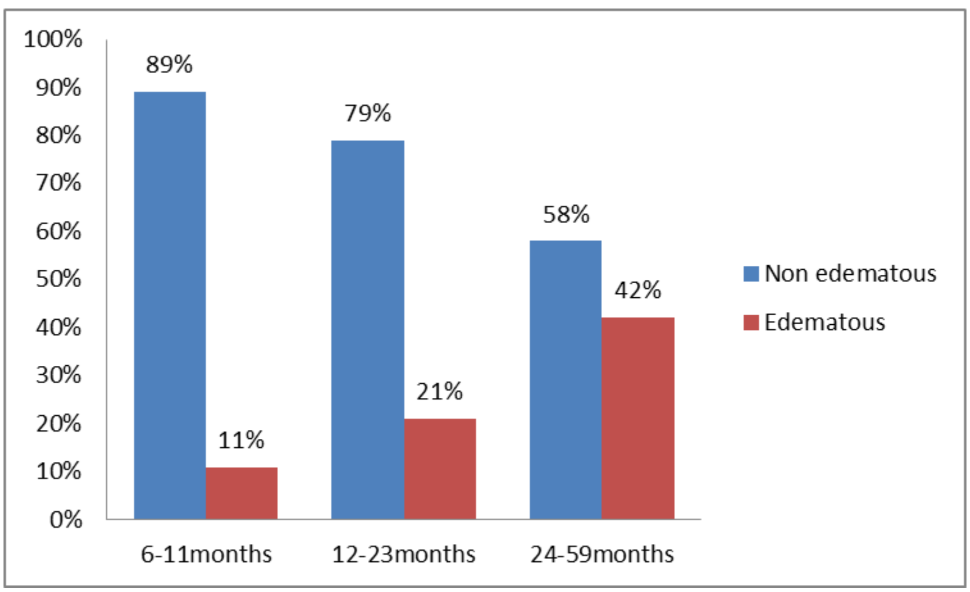


Figure 2 Type of SAM malnutrition by age category among children admitted to Goba Referral Hospital between Sept. 2014 and Sept. 2017.

5.3 Clinical conditions during admission

Regarding clinical conditions of children at admission, most of the children had 222(72.5%) diarrhea and 183(59.8%) vomiting. Out of total 306 children, 52(17%) had altered temperature (axillary temperature < 35^{0c} and >38.4^{0c}). **(Table1)**. Palmar pallor and pale conjunctiva were present in 130(41.5%), 165 (53.9%) of the children respectively .Children with impaired level of consciousness (lethargic) account for (19.9%) of total children. Regarding co-morbidity at admission, close to all of the children (96.7%) at least one comorbidity at admission. (**Table1)**. Diarrhea 222 (75), Pneumonia 151 (49.3%), anemia 23 (7.5%) and TB 17(5.6%) were the leading co-morbidities at admission **(Table 1**).

Table 1Distribution clinical condition and of co-morbidities at admission among severely malnourished children admitted to Goba Referral hospital, Sept. 2014-Sept. 2017

Variables	**Number**	**Percent**
Co-comorbidity during admission		
Diarrhea	222	52
Pneumonia	151	35.4
Anemia	23	5.3
Tuberculosis	17	3.9
Conductivities	10	2.3
Otitis media	8	1.8
Others	5	1.2
Total	426	100
Co-comorbidity developed after admission		
Pneumonia	78	62.9
Diarrhea	16	12.9
Anemia	13	10.5
Tuberculosis	8	6.45
Heart diseases	5	4.05
Others	4	3.2
Total	124	100
Clinical characteristics		
Altered Temperature	52	17
Fast respiratory rate	147	48
Fast pulse rate	71	23
Pale conjunctiva color	165	53.9
Palmar pallor	130	42.5
Dehydration	114	37.3
Shock	3	0.9
Impaired consciousness level	61	19.9
Diarrhea	222	72.5
Vomiting	183	59.8
Skin lesion	61	18.5

Regarding length stay 111 (36.3%) and 113 (36.9%) had 7-14 days and 15-22 days respectively. **(Figure3)**

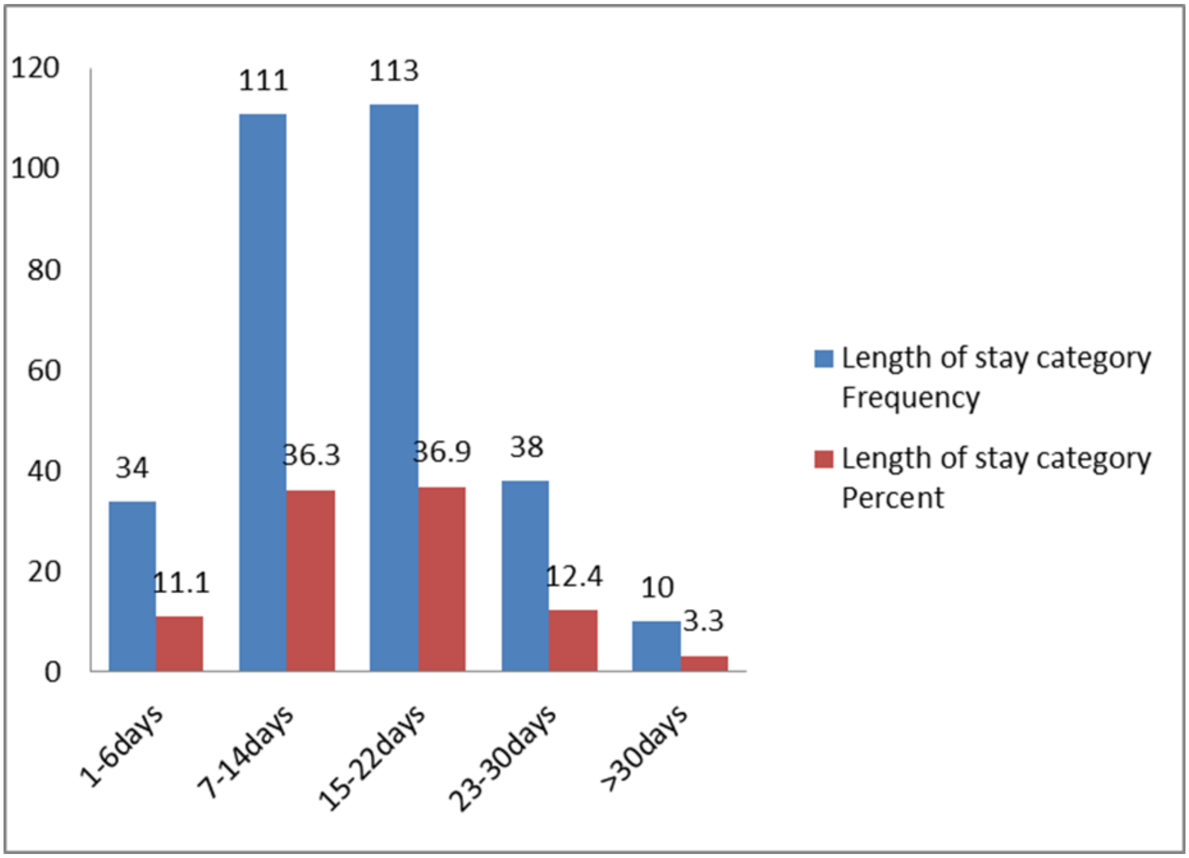


Figure 3 Length of stay category among children admitted to Goba Referral Hospital between Sept. 2014 and Sept. 2017.

5.4 Treatment outcomes

The median time to cure during treatment was 15 days with Inter Quartile Range of (IQR) 10(15, 20) and ranged from 2-38 days. With regard to treatment outcomes of the study cases, 178

(58.2%) were discharged with improvement, 37 (12.1%) died during treatment, 59 (19.3%) defaulted from treatment and 32 (10.5%) were transferred to other health facilities (**Figure3**).

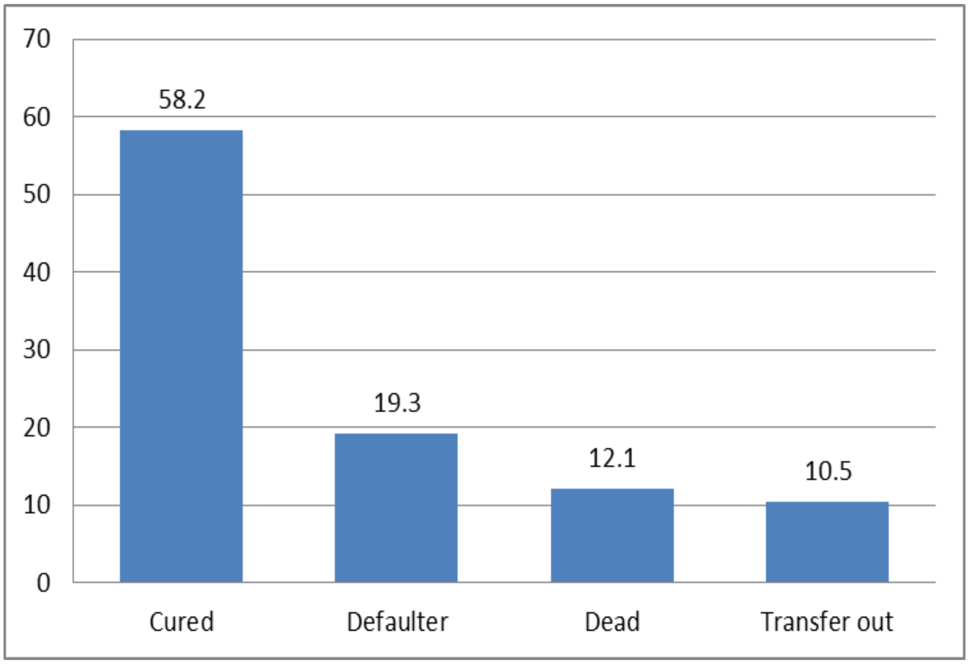


Figure 4 Treatment outcomes in severely malnourished children admitted To Goba Referral Hospital, Sept. 2014-Sept. 2017

5.5. Determinants of time to recovery in severely malnourished children

Time-to-cure during SAM treatment those candidate for final model were vitamin A supplementation (CHR=1.82, 95%CI; 1.227-2.712), folic acid supplementation (CHR=1.27; 95%CI; 0.725-2.248), malnutrition category (CHR=1.36; 95%CI; 0.849-2.093), amoxicillin (CHR=0.8395%CI; 0.466-1.483), presence of pneumonia (CHR=1.00; 95%CI; 0.690-1.458), presence of dehydration (CHR= 0.81;95%CI;0.581-1.130), transfusion (CHR=0.51;95%CI;0.186-1.433) and tuberculosis at admission (CHR=0.21, 95%CI;0.052-0.881). (**Table2**).

Table 2Biviriate analysis of Socio-demographic characteristics, Anthropometry and type of malnutrition, Clinical conditions at admissions

Factors(variables)	Category	No (%)	Median survival time(days)	CHR(95%CI)	P-value
Socio-demographic characteristics					
Sex	Male	177(57.8)	20	0.92(0.67-1.25)	0.596
	Female	129(42.2)	19	1	
Age	6-11months	92(30.1)	19	1	
	12-23months	164(53.6)	20	1.28(0.755-1.92)	0.435
	24-59months	50(16.3)	21	1.12(0.732-1.73)	0.587
Residence	Urban	29(9.5)	21	0.77(0.46-1.28)	0.326
	Rural	277(90.5)	20	1	
Type of malnutrition					
Type of malnutrition	Non edematous	241(78.8)	21	1.37(0.93-2.02)	0.106*
	Edematous	65(21.2)	19	1	
Clinical conditions at admissions					
Temperature	Normal	254(83)	20	0.91(0.62-1.33)	0.635
	Altered	52(17)	21	1	
Fast respiration rate	Yes	147(48)	20	1.03(0.76-1.39)	0.846
	No	159(52)	19	1	
Fast pulse rate	Yes	71(23.2)	20	1.22(0.86-1.73)	0.258
	No	235(76.8)	19	1	
Diarrhea	Present	222(72.5)	20	0.92(0.66-1.29)	0.661
	Absent	84(27.5)	19	1	
Vomiting	Present	183(59.8)	20	0.97(0.71-1.31)	0.848
	Absent	123(40.2)	19	1	
Consciousness level	Normal	245(80.1)	19	1.26(0.82-1.95)	0.284
	Impaired	61(19.9)	20	1	
Dehydration	Present	114(37.3	20	0.82(0.59-1.14)	0.246*
	Absent	192(62.7)	19	1	
Degree of dehydration	Some	111(97.4)	19	1.19(0.28-4.95)	0.804
	Severe	3(2.6)	20	1	
Shock	Present	2(0.7)	27	0.54(0.76-3.89)	0.543
	Absent	304(99.3)	20	1	
Vaccination status for age	Complete	211(69)	19	1.04(0.759-1.43)	0.794
	Incomplete	95(31)	20	1	

* = COTPP (conscious, oriented to time, place and person), alert, irritable, apathetic

……Bivariate analysis of Type of co-morbidity at admission, Type of co-morbidity developed after admission, Type of routine medication given, Type of treatments given

Factors(variables)	Category	No (%)	Median survival time(days)	CHR(95%CI)	P-value
Type of co-morbidity at admission					
Pneumonia	Yes	151(49.3)	20	1.26(0.92-1.71)	0.138*
	No	145(47.4)	19	1	
Tuberculosis	Yes	17(5.6)	28	0.21(0.53-0.87)	0.031*
	No	279(91.2)	19	1	
Diarrhea	Yes	222(75)	20	0.95(0.69-1.31)	0.771
	No	74(15)	19	1	
Anemia	Yes	23(7.5)	21	0.80(0.40-1.58)	0.527
	No	273(89.2)	19	1	
Type of co-morbidity developed after admission					
Pneumonia	Yes	76(24.8)	21	1.14(0.42-3.07)	0.787
	No	30(9.8)	19	1	
Diarrhea	Yes	16(5.2)	22	1.00(0.29-3.41)	0.993
	NO	90(29.4)	21	1	
Anemia	Yes	12(3.9)	27	0.53(0.12-2.28)	0.400
	No	94(30.4)	21	1	
Tuberculosis	Yes	7(2.3)	23	0.41(0.55-3.05)	0.385
	No	99(32.4)	21	1	
Types of treatment given					
Amoxicillin	Yes	211(69)	19	1.31(0.93-1.85)	0.112*
	No	95(31)	20	1	
Vitamin A	Yes	244(79.7)	19	2.24(1.38-3.63)	0.001*
	No	62(20.3)	22	1	
Deworming	Yes	3(1)	18	0.67(0.16-2.74)	0.585
	No	303(99)	20	1	
Folic acid	Yes	193(63.1)	19	0.64(0.35-1.15)	0.138*
	No	113(36.9)	20	1	
Measles vaccine	Yes	3(1)	16	3.07(0.42-22.2)	0.265
	No	303(99)	20	1	
ReSoMal	Yes	180(58.8)	19	1.03(0.76-1.39)	0.833
	No	126(41.2)	20	1	
Co-morbidity at admission	Present	296(96.7)	21	1.69(0.54-5.34)	0.364
	Absent	10(3.3)	19	1	
HIV status	Negative	244(79.7)	19	1(0.70-1.44)	0.976
	Unknown	62(20.3)	20	1	
Types of treatments given					
Infusion with special medication	Yes	303(99)	19	1.03(0.14-7.42)	0.972
	No	3(1)	20	1	
Transfusion with blood	Yes	15(4.9)	21	0.55(0.20-1.49)	0.244*
	No	291(95.1)	19	1	

5.6. Determinant factors affecting time to recovery in severely malnourished children

In a multivariable model, adjusting for important covariates, vitamin A supplementation and comorbidity of tuberculosis during admission were the variables that were found to be independent determinants of time to cure during SAM treatment.

Table 3 Multivariable analysis determinant factors associated with earlier recovery in severely and acutely malnourished children admitted to Goba Referral Hospital, Sept. 2014-Sept. 2017.

Factors(variables)	Median Survival Time (days)	CHR(95%CI)	P-value	AHR(95%CI)	P-value
Malnutrition category					
Non edematous	19	1.37(0.93-2.02)	0.106	1.36(0.849-2.093)	0.211
Edematous	21	1			
Tuberculosis at admission					
Yes	28	0.21(0.53-0.87)	0.031	0.21(0.052-0.881)	0.033*
No	19	1			
Pneumonia at admission					
Yes	19	1.26(0.92-1.71)	0.138	1.00(0.690-1.458)	0.989
No	20	1			
Dehydration					
Yes	20	1.21(0.87-1.67)	0.246	0.81(0.581-1.130)	0.216
No	19	1			
Amoxicillin					
Yes	19	1.31(0.93-1.85)	0.112	0.83(0.466-1.483)	0.531
No	20	1			
Folic acid					
Yes	19	1.34(0.952-1.88)	0.138	1.27(0.725-2.248)	0.398
No	20				
Vitamin A					
Yes	19	0.56(0.34-0.92)	0.25	1.67(1.129-2.470)	0.010*
No	22	1			
Transfusion					
Yes	21	0.55(0.20-1.49)	0.244	0.51(0.186-1.433)	0.209
No	19	1			

Children who received vitamin A supplementation had 1.6 times shorter time to recovery compared to those did not had vitamin A supplementation during admission. (AHR= 1.67 (95% CI [1.129-2.470] P=0.010).

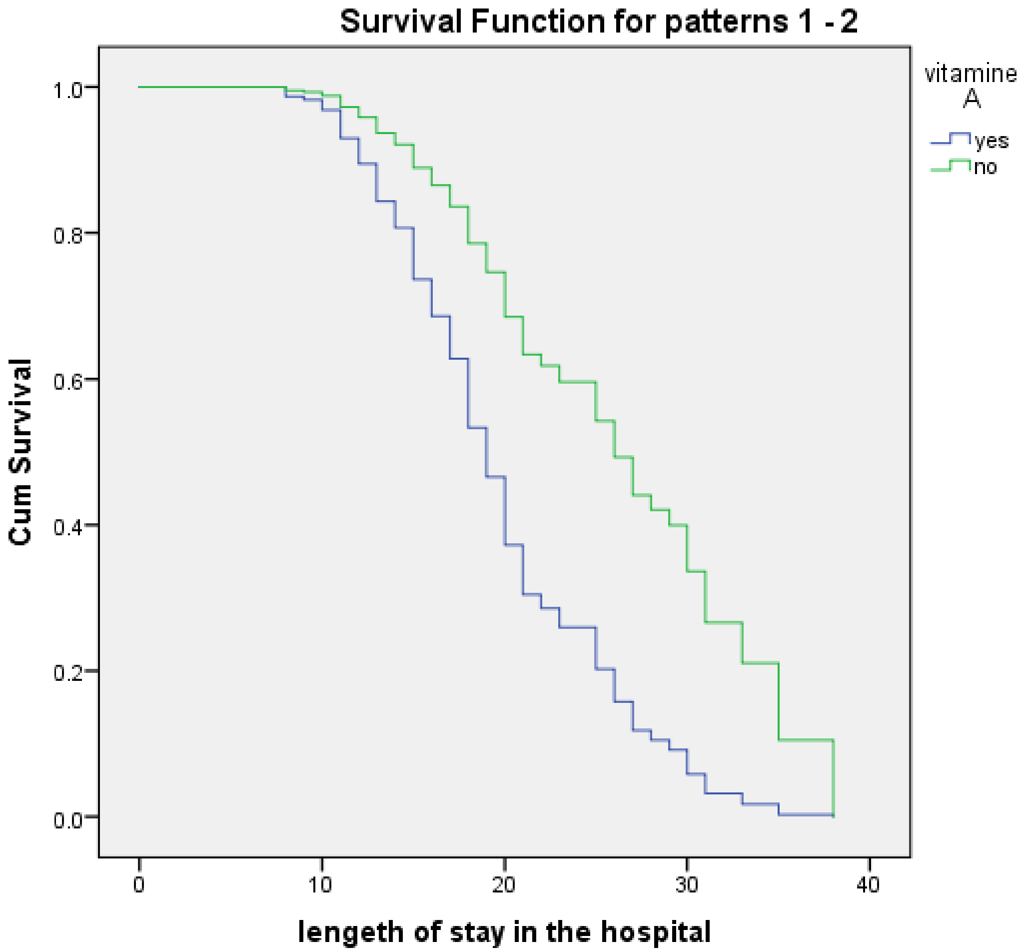


Figure 5 Figure 4 Cox regression survival curve at mean of covariates retained in the final multivariable model by vitamin A supplementation of severely malnourished children admitted to Goba Referral Hospital, Sept. 2014- Sept. 2017.

Children who had not comorbidity of tuberculosis at admission had shorter time to recovery compared to children who had tuberculosis comorbidity at admission. (AHR=0.21(95%CI [0.052-0.881]; p=0.033).

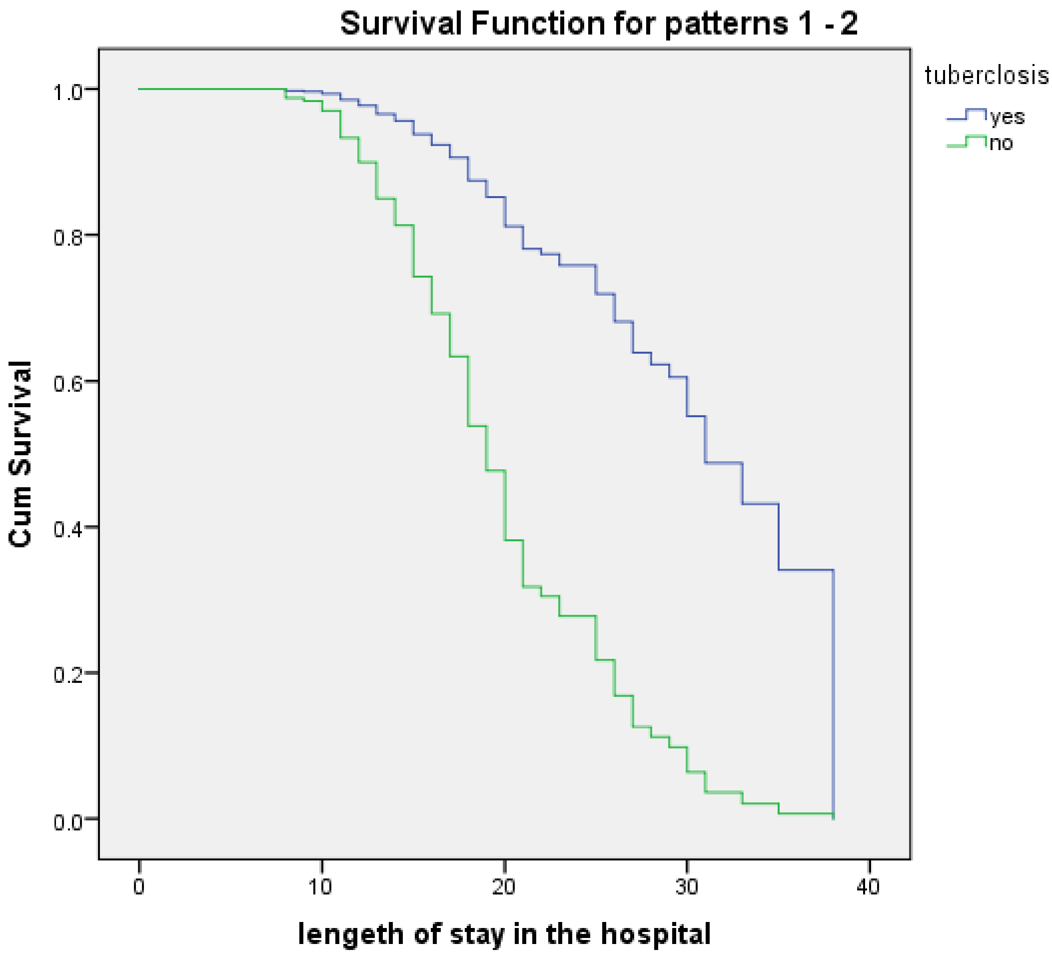


Figure 6 Figure 5 Cox regression survival curve at mean of covariates retained in the final multivariable model by comorbidity of tuberculosis at admission of severely malnourished children admitted to Goba Referral Hospital, Sept. 2014- Sept. 2017

6. DISCUSION

Study on determinants of time to recovery in severely malnourished children admitted To Goba referral hospital was conducted from September 2014 to September 2017. In this study Children who achieved nutritional recoveries were 58.2% with a median recovery time of 15 days with Inter Quartile Range (IQR) of 10(15, 20). The main determinants of time to cure include comorbidity of tuberculosis at admission and vitamin A supplementation at admission.

Table 4 Comparison of the treatment outcomes of severe acute malnutrition in children at study settings with Nutritional Rehabilitation Unit (NRU) acceptable performance range of Ethiopian SAM management guideline.

Outcome indicator	**Current outcome (%)**	**SPHERE standards**	
		Acceptable	Alarming
Recovery rate	58.2	>75%	<50%
Defaulter rate	19.3	<15%	>25%
Death rate	12.1	<10%	>15%
Average weight gain	8.38	≥8	<8
Average length of stay	2weeks	<4weeks	>6weeks

SPHERE-Social and Public Health Economics Research Group

Children who achieved nutritional recoveries noted in this study have not met the minimum SPHERE standard which recommends 75% of recovery from therapeutic care. (17). However, the recovery rate in this study was higher than a study done in Sekota Hospital (47%) (24); whereas other studies reported better recovery rates including, Jimma University Specialized Hospital (77.8%) (9), Debremarkos Finote Selam Hospital (77.9%) (19) and Yigalem Hospital(78%) (20). The difference in recovery rate in the current and previous studies could be due to differences in patient load, patient profile, management protocol and availability of medical supplies.

The overall mortality rate of the Cohort is 12.1%. This finding was not in line with minimum international standard set for management of severe acute malnutrition which is death rate of less than 10%. This finding is better than study done in north Ethiopia(28.7%) (24)and Southern Ethiopia (16%) (8). But higher than study done South Western Ethiopia(9.3%) (9). The difference in mortality rate in the current and previous studies could be due to differences in socio-economic status, quality of care provided for children, health seeking behavior, availability as well as accessibility of therapeutic foods and medications (19).

The default rate of 19.3% in this study is slightly below the minimum international standard (12). This finding is also higher than studies done in Southern Ethiopia (2.6%) (8) And South Western Ethiopia (12.9%) (9). The higher default rate in the current study hospital might be due to the hospital being far for most cases and parents discontinuing treatment due to financial problems to purchase drugs and care takers food.

The median time to recovery reported in this study was comparable with findings from South West (9) and Southern Ethiopia (20). It was also beyond the minimum SPHERE standards for the treatment duration of children with SAM at inpatient (12). The acceptable length of stay for inpatient management of SAM according to SPHERE standard was less than four weeks (12).

The average weight gain of children in the NRU of the study was also consistent with findings from South West (9) and Southern Ethiopia (20). and efficiently harmonizing with national SAM management guideline which was greater than or equal to 8gm/kg/day (12).

Regarding determinant factors of time to recovery children with vitamin A supplementation at admission had shorter time to recovery compared to those who had not. This may be due to Lack of vitamin A damages the surfaces of the skin, eyes, and mouth, the lining of the stomach, and the respiratory system. A child with vitamin A deficiency (VAD) has more infections, which become more severe because the immune system is damaged. In the case of children with severe acute malnutrition production of gastric acid and flow of saliva is reduced. The small bowel of malnourished children is often colonized with abundant bacteria, and their pattern of commensal flora is altered and also secretory IgA is reduced in saliva, tears and nasal washings and their immunity may decline (29), So vitamin A supplementation may hinder this problem. And also World Health Organization (WHO) recommends ten basic steps to manage SAM. Correct deficiencies of micronutrients is the sixth important recommendation in children with complicated SAM (4).

Children who had comorbidity of tuberculosis at admission were found to stay longer on treatment. This may be due to under nutrition compromises mucosal barrier function, allowing microbial translocation and weakening of immune system thus reducing the ability of the patient to remove the pathogens once they enter the body. infections can worsen nutritional status due to reduced appetite, lower intake and poor absorption, increased nutrient requirements as well as loss of nutrients (30). Type of malnutrition was significantly associated with time to recovery in study conducted in Southern Ethiopia(15), which supported our finding that , for all children with edematous type of malnutrition was associated with lower time to recovery compared to no edematous. However, this association in the bivariate was lost in the multivariable Cox regression.

Strength and limitation of the study

a) Strengths

The study guarantees that the measurement of determinants variables was not biased by knowledge of which subjects had the outcome of interest.

b) Limitations

Missed cards of some children and lack of control over the quality of the measurements that were made might be the threats to this study.

7. Conclusion and Recommendations

Conclusions

In this study Children who achieved nutritional recoveries were 58.2% with a median recovery time of 15 days .Determinant factors for time to recovery from SAM among children admitted nutritional rehabilitation unit in Goba Referral Hospital were vitamin A supplementation and the presence of comorbidity of tuberculosis at admission. Thus emphasis given to children with comorbidity of tuberculosis at admission and vitamin A supplementation at admission will have a positive effect on treatment duration.

Recommendations

a) To Goba Referral hospital

The presence of comorbidity of tuberculosis at admission and vitamin A supplementation at admission were important determinants of time to recovery during severe acute malnutrition treatment. Thus emphasis given to children with comorbidity of tuberculosis at admission and vitamin A supplementation at admission will have a positive effect on treatment duration.

b) To Researchers

Broad range of socio-demographic characteristics, biochemical and patient management related factors like availability of medical supplies, adherence to treatment protocol and skill of professionals were not considered in this study. Therefore, prospective studies which fill this gap should be conducted to further identify determinant factors in severely malnourished children admitted to the hospital.

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Annexes

Annex 1. Checklist

Jimma University Institute of Health, Faculty of Public Health

Department of Population and Family Health

Checklist for collecting information on determinants time to recovery in severely malnourished children admitted to Goba referral Hospital Goba, Ethiopia.

I am conducting study on determinants of time to recovery in severely malnourished children admitted to Goba referral Hospital in collaboration with School of Post Graduate Study, Institute of Health, Faculty of Public Health, Jimma University. Therefore, this checklist is prepared for collecting information on determinants of time to recovery in severely malnourished children admitted to Goba referral Hospital from September2014-September2017, Goba town. Information will be collected from children's records. Information collected will be used only for academic purpose and improvement of patient care.

A. **BASELINE DATA (DATA AT ADMISSION)**

Part I: Background information

101. Admission date ___________________

102. Card number ____________________

Part II: Socio demographic characteristics

Code	Question	**Response**	**Remark**
201	Age in (months)	______________	
202	Sex	1.Male 2.Female	
203	Place of residence	1.urbal 2.rural	

Part III: Clinical conditions at admission

Code	Question	Response	Remark
301	Diarrhea	1.present 2.Abscent	If 2 go to 303
302	Type Diarrhea	1.watery 3.dysentary 2.mucoid	
303	Vomiting	1.present 2.Absent	
304	T^{o} $_{(in\ c^{o})}$	___________________	
305	RR (in count per min)	__________________	
306	PR (in count per min)	__________________	
307	Conjunctiva color	1.pink 2.pale 3.very pale	

308	Consciousness level	1.conscious 2.lethargic 3.comma	
309	Edema	1.present 2.Abscent	If 2 go to 313
310	Grade of edema	1. + 2. ++ 3. +++	
311	Palmar pallor	1.present 2.Abscent	
312	Skin lesion	1.present 2.abscent	
313	Dehydration	1.present 2.Abscent	If 2 go to 317
314	Degree of dehydration	1.some 2.severe	
315	Patient in shock	1.yes 2.No	
316	Vaccination status for age	1.complete 2.incomplete	

Part IV: Anthropometry, type of malnutrition and underlying co-morbidities

Code	Question	Response	Response
401	Height(in cm)	_______________	
402	Weight (in kg)	_______________	
403	MUAC (in cm)	_______________	
404	Type of malnutrition	1.Non edematous(Marasmus) 2.Edema(Kwashiorkor) 3.Marasmic kwashiorkor	
405	Co-morbidity	1.present 2.Absent	If 2 go to 501
406	Type co-morbidity	1.Pneumonia 2.Tuberclosis 3.Diarrhea 4.Anemia 5.Other (specify)______________	

B. NON BASELINE DATA

Part V: Treatment and follow up

Code	Question	Response	Remark
501	HIV status	1.Reactive 2.NR 3.Unknown	
502	Co-morbidity developed after admission	1.yes 2.No	If no go to 505
503	Type of co-morbidity after admission	1.pneunomia 2.Diarrhea 3..Tuberclosis 4.Other (specify)________	
504	Co-morbidity controlled/cured	1.yes 2.No	
505	Type of treatment given	1.Amoxa 2.Vitamine A 3.Deworming 4.Folic acid 5.Measles vaccine 6.Other(Specify)________	

506	Patient infused with special iv medication (Ampill,Genta,Ceftr…)	1.yes 2.No	
507	Patient with blood transfused	1.Yes 2.No	

Part VI: Discharge conditions

Code	Question	Response	Remark
601	Outcome	1.cured 2.Dead 3.Defaulter 4.Transfer out	
602	If died possible causes death	_____________	
603	If cured, weight at discharge	______________	
604	Target weight	______________	
605	MUAC		
606	Date of discharge/died/absconded/referral /transfer	_______________	
607	Length of stay in the Hospital	_______________	

Data collector's Name________________________________
Signature_______________
Date _________________
2. Checked by supervisor: Name ________________________________
Signature_______________
Date _________________

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the college of public health in effect at the time of grant is forwarded as the result of this application

Name of the student; LemessaTamiru

Date June 14, 2018 Signature

APPROVAL OF THE FIRST ADVISOR

Name of the first advisor; Mr. AlemayehuArgaw (MSc Assistant Professor, PhD fellow)

Date june 14, 2018 Signature

APPROVAL OF THE SECOND ADVISOR

Name of the second advisor; Mr.NurezemanGali (BSc, MSc)

Date for Nurzeman Gali Signature

Annex 2. Summary of treatment protocol for severely malnourished children at Goba Referral Hospital

Admission Criteria

Children 6 months to 5 years:

• Weight –for- Length (WFL) / WFH less than 70 % or < -3Z score
OR

• Presence of pitting Edema of both feet

OR
• MUAC <11cm for child length greater than 65 cm

Discharge Criteria

The discharge criteria differ for children age 6-59 months

Children age 6-59 months and who will complete their phase 2 treatments as inpatient should be discharged from in-patient care if they fulfill the following criteria

Option 1- weight-for-length or height ≥85% for 2 consecutive days AND no edema for 10 days (In-patient) or

Option 2- Target weight gain achieved for 2 consecutive days if the child is admitted with MUAC

Normal Heart Rate by Age (beats/minute)

Reference: PALS Guidelines, 2015

Age	Normal
6-11months	90-160
1-2yrs	80-120
3-5yrs	65-100

Normal Respiratory Rate by Age (breaths/minute)

Reference: PALS Guidelines

Age	Awake
6-11months	30-50
1-2yrs	20-40
3-5yrs	20-30