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Survival Status and Predictors of Mortality among Children Aged 0-59 Months with Severe Acute Malnutrition Admitted to Stabilization Center at Sekota Hospital Waghemra Zone

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Abstract

Background: The mortality rate of children with complicated severe acute malnutrition that receive treatment in inpatient set ups has remained unacceptably high. Such high mortality in inpatient units has been attributed to either co-morbidity such as Human Immune Virus, Tuberculosis, diarrhea and malaria or due to poor adherence to the World Health Organization therapeutic guidelines for the management of severe acute malnutrition.

Objective: To assess survival status and identify the predictors of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization center in Sekota hospital, Waghemra zone of Amhara region.

Method: A retrospective cohort was conducted on 415 children aged 0-59 months who were admitted for complicated severe acute malnutrition at Sekota hospital from January1/2011 to December 30/2013. The data collection was undertaken from March 15-25, 2014 using standardized checklist. Data were cleaned, edited and entered by Epi data version 3.1. and analysed by SPSS version 16.0. Descriptive summary of child characteristics and outcome of interests were computed by using tables, graphs and Kaplan Meier curves. After checking for assumptions Cox- proportional regression model was used to identify the potential predictors of survival status. Finally variables that had P-value < 0.25 in bivariate analysis were candidates for multivariate analysis to determine independent predictors of mortality.

Results: From 441 expected samples, the data were collected on 415 children with baseline records. The most frequently 185(44.6%) associated co-morbid was diarrhoea. Independent predictors of mortality were Malaria (AHR= 2.13, 95% CI = 1.12.7.15), severe anemia (AHR = 6.71, 95% CI: 3.22, 13.97). And TB (AHR= 2.88, 95%CI = 1.72, 4.65). Other predictors of mortality of the children were: children not supplemented folic acid (AHR=2.30, 95% CI=1.54, 3.4), not supplemented for vitamin A (ARH= 1.53, 95% CI= 1.05, 2.24) and children not managed by intravenous antibiotic (AHR= 2.73, 95%CI = 1.9, 4.0).

Conclusion: The overall mortality among children aged 0-59 months with complicated SAM admitted to Sekota hospital was higher than the minimum SPHERE standard for stabilization centers. The majority of death was attributed to malaria, severe anemia, TB and mismanagement of complicated severe acute malnutrition. So improving this gap may have paramount effect on child survival.

Keywords: Co-morbid, Complicated SAM, Survival status

Abbreviations and Acronyms

ARTI: Acute Respiratory Tract Infection, AIDS: Acquired Immune Deficiency Syndrome, CMAM: Community Based Management of Acute Malnutrition, FMOH: Federal Ministry of Health, GOE: Government of Ethiopia, HCs: Health Centres, HIV: Human Immune Virus, HSDP: Health Sector Development Plan MDG: Millennium Development Goal, MOH: Ministry Of Health, MUAC: Mid -Upper Arm Circumference, NAIDS: Nutritional Acquired Immune Deficiency Syndrome, SAM: Sever Acute Malnutrition, SC: Stabilization Centre, TB: Tuberculosis, TFP: Therapeutic Feeding Program, TFU: Therapeutic Feeding Unit, UNICEF: United Nations Children's Fund, WHO: World Health Organization

Introduction

Background

Severe Acute Malnutrition (SAM) is defined globally as a very low weight for height (below - 3z scores of the median World Health Organization (WHO) growth standards, or below 70% of the median of National Centre for Health Statistics standard) or by the presence of nutritional oedema. In children 6–59 months of age, a middle upper arm circumference (MUAC) less than 11cm is also indicative of SAM [1].

It is estimated that nearly 20 million children worldwide are severely acutely malnourished. Most of them live in South Asia and Sub-Saharan Africa [2]. According to WHO, children suffering from SAM have a 5–20 times greater risk of death than well-nourished children. SAM can directly cause death or indirectly increase the fatality rate in children suffering from diarrhea and pneumonia.

Current estimates suggest that about 1 million children die every year from severe acute malnutrition [3]. It is clear that SAM is an important health problem worldwide. This is so obvious with a visit to almost any hospital in a developing country where it is likely that severely malnourished children comprise a significant proportion of pediatrics deaths [1].

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Research estimates that the risks related to stunting, severe wasting and intrauterine growth retardation are linked to 2.2 million deaths and 21% of disability-adjusted life worldwide are under five years children [4,5]. In hospitals, severe malnutrition remains poorly managed, yet effective treatment has been known for 50 years [6].

Because of the prevalence of severe malnutrition is high in most developing countries, capacity for treating children with SAM is required at all times whether in the emergency, recovery or development contexts. The Community Management Of Acute Malnutrition (CMAM) has gained widespread acceptance in the humanitarian sector following the joint UNICEF WHO statement in June 2007 [1] and is now the preferred model for SAM treatment in emergency and non-emergency contexts [7,8]. The community-based approach involves timely detection and treatment of severe acute malnutrition through case finding in the community and, for those without medical complications, ready-to-use therapeutic foods (RUTF) administered at home. If properly combined with a facility-based treatment of malnourished children with medical complications and implemented on a large scale, CMAM could prevent the deaths of hundreds of thousands of children [1].

In Ethiopia majorities of children with severe acute malnutrition presented to hospital or health center to be treated at therapeutic feeding center. But due to many factors like late presentation of cases, co-morbidities and error in managing, many children are dying any way. And the major determining factors for poor treatment outcomes are not well understood particularly in Sekota hospital. So the purpose of this study was to assess factors affecting treatment outcome among under five children with severe acute malnutrition that were managed at stabilization centers in Sekota Hospital Amhara region [9].

Statement of the problem

Over the last decade, major improvement in the survival of children with SAM treated in outpatient set-ups have been achieved [1]. However, the mortality rate of children with complicated SAM that receive treatment in inpatient set up has remained unacceptably high [4,10]. Such high mortality in inpatient units has been attributed to either co-morbidities such as HIV, TB, diarrhea, malaria or other infection or to poor adherence to the WHO therapeutic guidelines [4,8,9].

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 set-ups 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.

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 reported that stunting, wasting and underweight are very high [10,11].

Study conducted in south Ethiopia and Jimma-south west Ethiopia-revealed that the recovery rate and defaulter rate were remote from the international acceptable standard ranges [12].

This implies that investigating this important to obtain evidences regarding the in-patient survival status and determining predictors of mortality. Therefore the purpose of this study to determining the survival status and predictors of mortality among children aged 0-59 months with severe acute malnutrition that were admitted to stabilization center in Sekota hospital, Amhara region.

Literature Review

Epidemiology of under nutrition

Ethiopia faced with an endemic malnutrition problem whose major contributing factors are low availability and access to food in terms of quantity, quality and diversity; poor child care practices, poor hygiene and sanitation, as well as low availability and access to optimal health care services [10].

Under nutrition is associated with high morbidity and > 50% of all childhood mortality in resource-poor settings [5,7]. The risk of dying from any cause increases 8 times in a child with severe underweight [11]. Because of this high risk of death, many children with severe acute malnutrition are managed in hospitals. Unfortunately, many of them die anyway.

The alterations in their physiological and metabolic functions predispose them to complications including hypoglycemia, hypothermia, electrolyte imbalance, heart failure and infections. If the condition is not diagnosed and treated promptly and appropriately, death is imminent, and the case fatality rate is over 50% in some hospitals [3,19].

Consequences of malnutrition

Poor nutrition during pregnancy reduces physical development that may lead to miscarriages, low birth weight or worse still, still birth, prenatal death and irreversible brain damage to the unborn child. Low birth weight babies have a high risk of frequent infections and deaths. Furthermore, a child with poor nutritional status is highly susceptible to frequent illnesses due to an impaired immune system that reduces child survival; physical and mental development could lead to poor school performance.

Malnutrition in children affects mental and physical development resulting in poor learning outcomes and professional capabilities. It also weakens one's immunity and affects the economic development of a nation [13]. Every year some 10.6 million children die before they reach their fifth birthday. Seven out of every ten of these deaths are due to diarrhea, pneumonia, measles, malaria or malnutrition. Malnourished children are much more likely to die with or without complications than their well-nourished counterparts. Malnourished children do not respond to medical treatment in the way they do when well-nourished [8].

Management of severe acute malnutrition

It is known that children with severe acute malnutrition must be treated differently from other children because their physiology is seriously affected. This makes management of severe acute malnutrition in developing countries like Ethiopia very important. Ministry of Health (MOH) in collaboration with UNICEF, WHO and other key partners developed National Guidelines for the management of severe acute malnutrition in Ethiopia, in order to standardize and improve the quality of care for severely malnourished children across the country [13]. In these National Guidelines, the 10 WHO steps for the management of severe acute malnutrition were adopted.

The use of WHO guidelines on the management of severe acute malnutrition [10] has led to successful treatment and reduction in mortality from this condition in both emergency and hospital settings. They focus on ten general principles of management targeted at

controlling or recognizing and treating the complications of severe acute malnutrition. A recent review of over 140 studies agrees that the protocolized management would improve case fatality rates in children with this condition [10,13].

The quality of health care provided in any health institution plays a major role in patient outcome, regardless of the hospital setting. In some high-income countries, the incidence of errors in management of hospital patients, which often goes unnoticed, is reportedly close to 17%. While many of these errors are preventable, one fifth of them result in death or permanent disability. In many health institutions, children do not receive adequate ambulatory and/or institutional care. Surveys have revealed that many sick children are not properly assessed and treated [14-16]. Often severely ill children who require admission receive inadequate triage, assessment and treatment and, when admitted, insufficient monitoring. This adversely affects the outcome of a significant proportion of hospitalized children, especially those with severe acute malnutrition, resulting in unnecessary suffering or avoidable death for many children each year.

According UNICEF evaluation study conducted in Ethiopia shows that: The "Protocol for the Management of Severe Acute Malnutrition" (2007) stipulates that SAM cases with complications admitted to inpatient care require separate wards. With staff specially trained on SAM treatment, a three phased approach for treatment (Phase 1= administration of F75; Transition phase = introduction of F100 or RUTF, and Phase 2 = treatment with F100 or RUTF) and daily progress measured on multi-charts. The three phased approach is a critical concept in the guidelines as Phase 1 promotes recovery of electrolyte balance and metabolic function rather than weight gain and the transition phase permits gradual weight gain [17-29]. The stabilization center geographic services coverage also has improved significantly. The overall coverage of TFU compared to estimated need (the total number eligible facilities) is currently 24.6%. A total of 473 sites (HCs and hospitals) are providing TFU services in the 622 woredas, which means there are now 0.7 TFU per woredas. The majority of hospitals (93%) and only 22% of HCs provide TFU services. These data clearly show that more effort is required to reach the recommended level of one in-patient unit per woredas. A barrier to reaching the TFU goals as per the guidelines is that infrastructure does not exist in many health facilities to allow establishment of a separate inpatient ward [30].

According to evaluation these study following gaps were identified for the stabilization centers: Few health facilities especially HCs adhered to the protocols. There were gaps and treatment errors in the services. Children were not given routine drugs such as Amoxicillin. Children who should be treated in phase two (using RUTF) were treated in phase one, while some who can be treated in OTP were being treated in TFU. Some indications of weak capacity included inappropriate admissions of children; delayed transfer of cases from phase to phase and to discharge, and poor record keeping. The space allocated to the TFU was often too limited. Which increase cross infection and increased risk of mortality [30].

Challenges in the management of severe acute malnutrition

Nutrition Rehabilitation Units are faced with a lot of challenges in handling cases of severe acute malnutrition. Some of the challenges include; limited in-patient capacity, lack of enough skilled staff in the hospitals to treat the large numbers needing care, the centralized nature of hospitals promotes late presentations and high opportunity cost for careers, serious risk of cross infections for immune suppressed children with severe acute malnutrition and mortality rates before and after discharge [12,13].

Co-morbidities: Mechanisms of humoral and cellular immune-suppression have been widely studied in the past and more recently using modern technology [17-19,22]. Severe acute malnutrition affects all organs in the body including the immune system. It is now established that severe acute malnutrition can lead to an immune compromised state involving both humoral and cellular immunity; this has been referred to as Nutritionally Acquired Immunodeficiency Syndrome (NAIDS). However, the extent and severity of the condition is not easily assessed. Immunological depletion predisposes these children to acute bacterial/viral infections and chronic infections such as tuberculosis, necessitating adequate investigation and prompt management with appropriate antibiotics. For resource-poor settings, the option of empirical antibiotic coverage has been recommended [19,20,22].

A cohort of 430 children aged 6-59 months old with complicated SAM admitted to Zambia University Teaching Hospital's stabilization center the majority of the children, 67.3% (261/388), presented with diarrhea; 38.9% (162/420) tested HIV positive [25]. Another study conducted in Jimma specialized teaching hospital shows among the 215 severely malnourished children 25 (11.6 %) were HIV infected.

Treatment outcomes of children with complicated SAM

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 [29].

A cohort of 430 children aged 6-59 months old with complicated SAM admitted to Zambia University Teaching Hospital's stabilization center; 40.5% (174/430) of the children died. The median Length of stay of the cohort was 9 days (IQR, 5-14 days); 30.6% (53/173) of the death occurred within 48 hours of admission. Children with diarrhea on admission had two and half times higher odds of mortality than those without diarrhea; Adjusted OR = 2.5 (95% CI 1.50- 4.09). The odds of mortality for children with HIV infection were higher than children without HIV infection [25].

A study conducted in Jimma specialized teaching hospital shows among the 215 severely malnourished children; the recovery rate was 68% and 86.6%, and mortality was 16% and 7.4% in HIV infected and uninfected children [29]. Similarly study done in southern region of Ethiopia on treatment outcomes of children with severe acute malnutrition admitted to stabilization centers 87% (11,191) were cured while 3.6% (468) had died. The average length of stay was 25 and 21 days with an average weight gain of 14 and 13.4 g/kg/d for children with severe wasting and edematous malnutrition, respectively [31].

Therefore doing further research that identifying area of improvement in child survival, especially at stabilization center that helps to make evidence based decision is needed, and this study will

help to assess the survival status and identify predictors of mortality among children admitted at stabilization center.

Conceptual Frame Work

Significance of the study (Figure 1)

This study was conceptualized to generate baseline data on survival status and predictors of mortality among children aged 0-59 months admitted to stabilization centers in Sekota hospital, The premise for the study was anchored in the evidence indicating that as identifying area of improvement and taking appropriate decision in this area helps; the services will improve, more clients access the available services and overall effectiveness treatment at stabilization center improves. This makes possible improved uptake of service, adherence to prevention and treatment, ultimately reduce the morbidity and mortality of children aged 0-59 months due to sever acute malnutrition. In addition this study will contribute to decision makers by documenting gaps and help policy makers to pick and apply lessons learned to ensure a successful strategy to combat under five malnutrition and related consequences. Another contribution will be towards baseline information for zone/ region regarding performance of stabilization centers in managing severe acute malnutrition.

So that this research focused on assessing survival status and identifies predictors of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization centers. Generally the findings of this research will fill this gap and open the floor for further investigation by other researchers.

Objective of the study

Objective

To assess survival status and identify predictors of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization center in sekota hospital 2014.

Specific objectives

- To determine the prevalence of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization center in sekota hospital, January 1/2011 to December 30/2013.
- To estimate the mean survival time of children aged 0-59 months with severe acute malnutrition admitted to stabilization center in sekota hospital January 1/2011 to December 30/2013.
- To identify the predictors of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization center in sekota hospital January 1/2011 to December 30/2013.

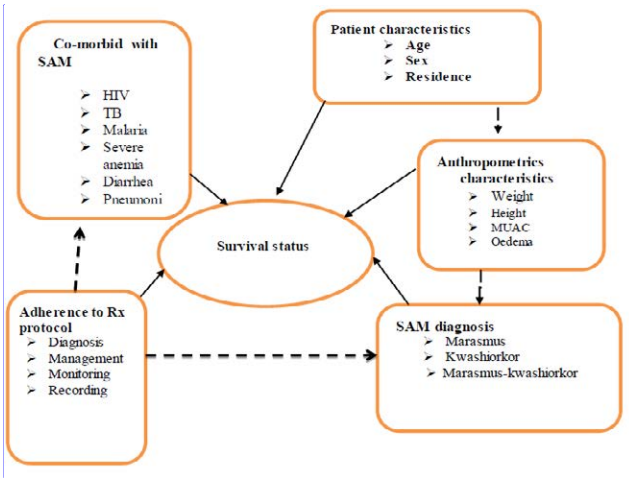

Figure 1: Schematic presentation of conceptual frame work developed by reviewing related literatures.

Method and Materials

Study area and study period

The study was conducted in Sekota Hospital Waghemar zone, of Amhara regional state 2014, which is located 719 km from Addis Ababa. Waghemar zone has seven woredas and one hundred twenty five kebeles and has estimated populations about 481,063 from this about 241,140 are males and 239,923 are females. There are 65,136 under five children. Regarding public health facilities there is one referral hospital, twenty nine health centers and 125 health posts. Most of these people are agro pastoralist and prone to recurrent food insecurity. The common health problems in this zone are: malaria, diarrhea, under five-pneumonia and malnutrition [32].

Study design

A retrospective cohort study with record review was conducted to determine survival status and predictors of mortality among children age 0-59 months with severe acute malnutrition that were admitted to stabilization center in sekota hospital from January 1/ 2011 to December 30/2013.

Populations

Source population

All children aged 0-59 months with severe acute malnutrition admitted to stabilization centers in Sekota Hospital, from January 1/2011 to December 30/ 2013.

Study population

Exposed children: All children aged 0-59 months with severe acute malnutrition those who had HIV, and/or TB and/or severe anemia and/or malaria admitted stabilization center in Sekota hospital from, January 1/2011 to December 30/2013.

Unexposed children: All children aged 0-59 months with severe acute malnutrition had no the above listed Co- morbidity at admission to stabilization center in Sekota hospital, from January 1/2011 to December 30/2013.

Inclusion and exclusion criteria

Inclusion criteria

All Children aged 0-59 months with complicated severe acute malnutrition that were admitted to stabilization center at Sekota hospital, between, January 1/2011 to December 30/2013.

Exclusion criteria

- Children with incomplete anthropometric data

- Children whose treatment outcome not recorded
- Children whose admission date and discharge date not recorded
- Children with congenital anomalies, heart diseases

Sample size determination and sampling technique

The sample size was calculated by Epi info considering the following assumptions: 95% CI, power 80%, ratio of unexposed to exposed 1:2, outcome (death in this case) for unexposed group 7.4% and for exposed group 16% (29). So that the sample size in unexposed group is 294 and for exposed group 147 which gives 441.

Parameters

P1- expected prevalence of death among exposed children =16%
P2- expected prevalence of death among unexposed children =7.4% Zβ – 1- β =80% = 0.84

Zα/2 – standardized normal distribution at 95% CI = 1.96

Hence, a sample size of 441 individual records of children that have been managed for complicated severe acute malnutrition was estimated for this study (Figure 2).

Measurements

Variables

Independent variables

- Patient characteristics (age, sex, residence)
- Anthropometrics (weight, height, MUAC, oedema)
- Co-morbidities (HIV, malaria, TB, severe anemia)
- Severe acute malnutrition diagnosis (marasmus, kwashiorkor marasmus-kwashiorkor)
- Medication (routine antibiotic, Vit.A, folic acid, De-worming, antimalaria, ReSomal) and special medication (IV fluid, IV antibiotic, blood transfusion)

Dependent variables: Time to event of children with severe acute malnutrition aged 0-59 months that have been admitted to stabilization center between January 1/2011 to December 30/2013.

Event: death; Times to event: time to death from admission till death happen.

Data collection instruments

A check list was developed from standard treatment protocol for the management of severe acute malnutrition, SAM registration log book, SAM monitoring multi chart and reviewing related literatures to collect the required individual information from the relevant documents. The check list consists of the following data:

- Patient related data (age, sex, residence)
- Anthropometric measurements (height, weight, MUAC, Oedema)
- Co-morbidities
- Types of severe acute malnutrition
- Feeding phase and types of feeding, frequency of feed and amount per feed

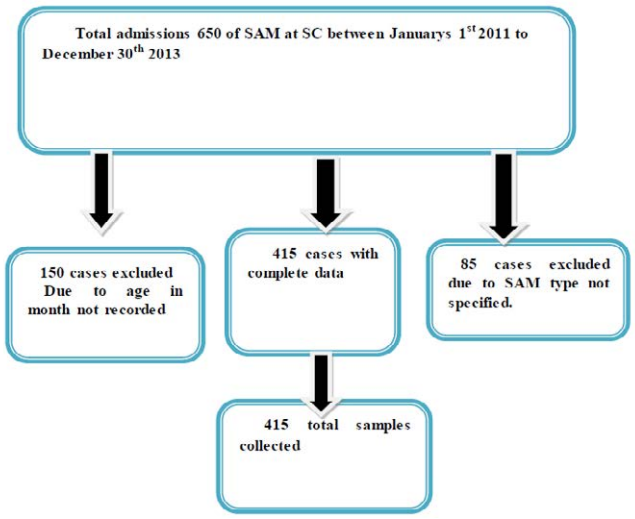

Figure 2A: Flow diagram of sample size selection.

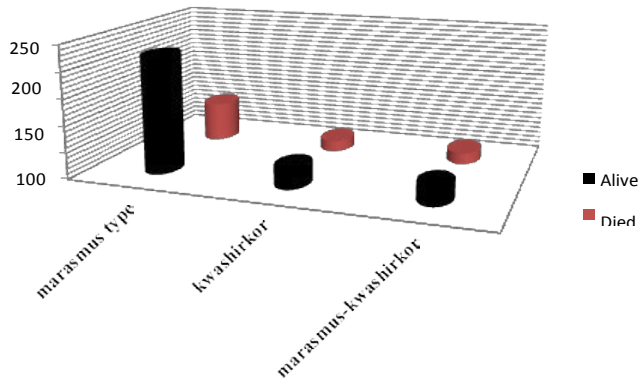

Figure 2B: Types of sever acute malnutrition and their end outcome, among children aged 0-59 month admitted to stabilization center in sekota hospital January 1/2011 to December 30/2013.

- Medication given
- Health information on different topics
- End status

Data collection and quality management: Three data collectors and one supervisor were recruited for data collection, who have experience on SAM and who were trained on SAM management. To keep data quality supervisor and data collectors were oriented on how and what information they should collect from the targeted data sources. Completeness and consistency of the collected data were checked on daily bases during data collection by supervisor and the principal investigator. Whenever there appears incompleteness and ambiguity of recording, the filled information formats were crosschecked with source data soon. Individual records with incomplete data were excluded.

Data processing and analysis

Data were cleaned, edited and coded before data entry. The template scheme for data entry was developed and pre-tested for ranges & allowed legal values by entering questions using Epi data version 3.1

and exported to SPSS for windows version 16 for analysis. Exploratory data analysis was carried out to check the levels of missing values, presence of influential outliers, multi co-linearity.

Bivariate analysis was done to identify associations between dependent and independent variables. Hazard ratio, 95%CI and P-value were used to assess the strength of association and statistical significance. Kaplan Meier estimator was used to estimate mean survival time during the treatment period and log rank tests, to compare survival curves. Variables significant at P <0.25 level in the bivariate analysis were included in the final Cox- regression analysis, to identify independent predictors of mortality. Any statistical test was considered significant at P level less than 0.05. Covariates were checked for interaction effect. Finally the Cox regression model for its fitness to the data and its adequacy was checked.

Ethical clearance

The study was carried out after getting approval from the ethical clearance committee of Jimma University, College of Public Health and Medical Sciences through Department of biostatistics and epidemiology. Then, data was collected after getting consent from sekota Hospital. As the study was conducted through review of medical records, there was no harm to individual patients.

Dissemination of research finding

Findings of the study will be submitted and presented to Department of biostatistics and Epidemiology College of Public Health and Medical Science of Jimma University. The dissemination will also goes to the Sekota hospital, zone health office, different NGOs. Publication of the research finding also considered.

Operational Definitions

- Adherence and practice of care provider: if record reviewed reveled treated children were in accordance to national treatment protocol starting from admission to discharge, all procedures and steps appropriate to child need said to be care provider is adhered and practiced to treatment protocol
- Censoring: right censoring, are those cases as defaulters, recovered or none recovered. Left censoring: in this study there was no left censoring this is because all cases admitted alive and the event will be considered starting at admission date and will be followed for a maximum of forty days.
- Complete record: if age in months, sex of the child, admission date and time, SAM type, type major complications, discharged date and treatment outcome recorded.
- Co-morbidities: children with severe acute malnutrition, who have TB, and/or HIV and/or malaria and/or severe anemia co-infection at admission to stabilization center.
- Recovered: Patient that has reached the discharge criteria.
- Dead: Patient that has died while he/ she was in the programme at this stabilization center.
- Defaulter: Patient that is absent for 2 consecutive weighing (2 days in in-patient).
- None recovered: Patient that has not reached the discharge criteria after 40 days in the in- patient programme.
- Severe anemia: If the hemoglobin concentration is less than 40g/l or the packed –cell volume is less than 12% the child has very severe anemia.
- Survival: lack of experience of death. It is being alive and not experiencing SAM related death during hospitalization period.

Results

Between January 1/2011 to December 30/2013: 650 children were admitted to stabilization at Sekota hospital. From the total 650 cohort of children 235 were excluded, because of incomplete record with regard to age in month and types of severe acute malnutrition not specified.

Socio-demographic characteristics of the cohort

From a total of 441 expected sample size, the data were collected on 415 child's record with response rate 94.1%. Three hundred one (72.5%) children were rural residence. Among admitted children 212 (51.1%) were male children. The mean age of the study participant was 22.18 months (SD = ± 13.12 months). From 415 children, 154 (37.1%) were in the age group of 12-23 months. And the median survival time of the cohort was 10 days (95% CI = 9.23, 10.77 days) (Table 1).

Types of severe acute malnutrition at admission at stabilization center

From a cohort of 415 records reviewed; two hundred ninety nine (72.1%) had marasmus type of severe acute malnutrition, and seventy six (25.42%) children were died. Fifty nine (14.5%) children had

Variables	Category	Number (%)
Sex	Male	212(51.1)
	Female	203(48.9)
Residence	Urban	114(27.47)
	Rural	301(72.53)
Age group	0-5	26(6.27)
	6-11	67(16.15)
	12-23	154(37.12)
	24-35	92(22.17)
	36-47	46(11.08)
	48-59	30(7.22)

Table 1: Socio-demographic characteristics of children admitted to stabilization center at Sekota hospital, January 2011 to December 2013 (N= 415).

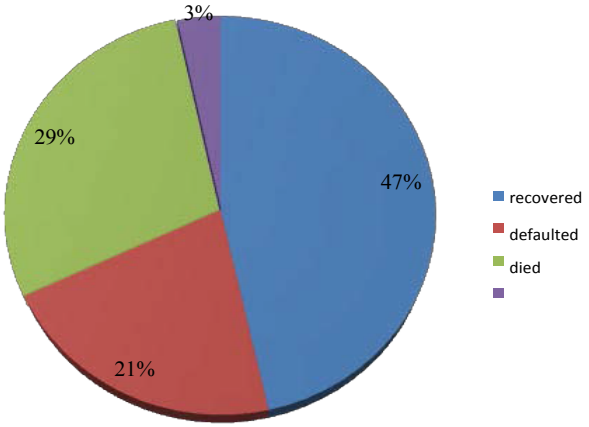

Figure 3: End status of children aged 0-59 months admitted to stabilization canter, Sekota hospital January 1/2011 to December1/ 2013.

Kwashiorkor at admission with twenty one (35.6%) were died. Fifty seven (14.2%) had marasmus-kwashiorkor, and twenty two (38.6%) children were died at stabilization center (Figure 3).

Co-morbidities at admission

Regarding to the presences of co-morbidities with severe acute malnutrition at admission, one hundred eighty five (44.6%) study participants had diarrhea at admission time, and seventy seven (18.6%), fifty five (13.3%), twenty one (5.1%), seventeen (4.1%), thirteen (3%) and nine (2.2%) of children had malaria, pneumonia, dehydration, human immune virus, skin lesion and tuberculosis at admission (Table 2).

Survival analysis

A total of 415 were followed for median of 10 days. The minimum follow up time was 1day and the maximum was 32 days. During the follow up period 119 (28.67%) children were died, with 80 (67.22%) were died within forty eight hour (HR= 0.7). The remaining 296 (71.32%) were alive to the last censoring date. The estimated mortality rate was 13%, 7% and 2% at 2, 4 and 6 days of their hospitalization (Table 3).

From a total of 415 of the children who were treated for complicated SAM at stabilization center between January 1/2011 to December 30/2013: one hundred ninety one (46%) were recovered, one hundred nineteen (28.7%) were died, eighty nine (21.4%) were defaulted and sixteen (3.9%) children were discharged as none recovered (Figure 4). After bivariate analysis conducted socio-demographic characteristics of the children , SAM type (age, sex, type of severe acute malnutrition) (Table 4), and among co-morbid and medications (malaria, TB, HIV, diarrhea, pneumonia, anaemia, and medication vitamin A, folic acid, routine antibiotics and intra venous antibiotics (Table 5) were found to be candidate for Cox – regression analysis (P - value less than 0.25).

Estimate of mean survival time among children admitted to stabilization center

As the result shows the overall death was 119 (28.7%). To show the hazard of death during the course of intervention period, Kaplan Meier survival curves were used over different factors. To test the significance of the observed difference in survival time curves between each factor, the log-rank test was used. There is a significantly different survival time among children with and without severe anemia (Log-rank test, x2 27.86, p-value 0.000), malaria (Log-rank test, x2 20.27, p-value 0.000), TB (Log-rank test, x2 5.785, p-value 0.016), on the other hand children who have been managed and received treatment had higher mean survival time when compared to those children not treated by IV antibiotics (log-rank test x2 =34.089, p = 0.000) (Table 6).

Variable	Number (%)
Co- morbid	
TB	9(2.2)
HIV	17(4.1)
Malaria	77(18.6)
Severe Anemia	12(2.9)
Pneumonia	55(13.3)
Diarrhea	185(44.6)
Dehydration	21(5.1)
Skin Lesion	13(3.1)
Others	26(6.3)

Table 2: Types of Co-morbidity children aged 0-59 months with severe acute malnutrition admitted to stabilization center in Sekota hospital, January 1/2011 to December 30/ 2013.

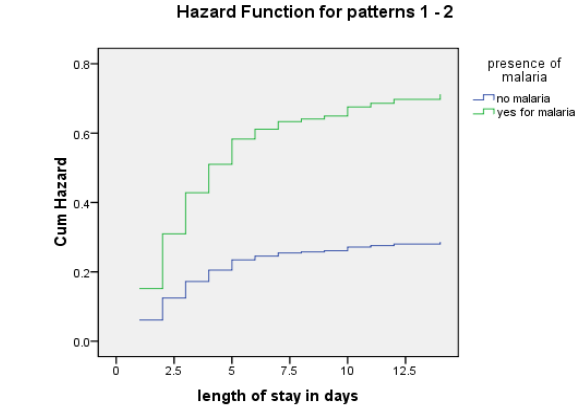

Figure 4: Shows the difference in hazard of death among children with severe acute malnutrition those with malaria at admission at stabilization center in sekota hospital January 2011 to December 2013.

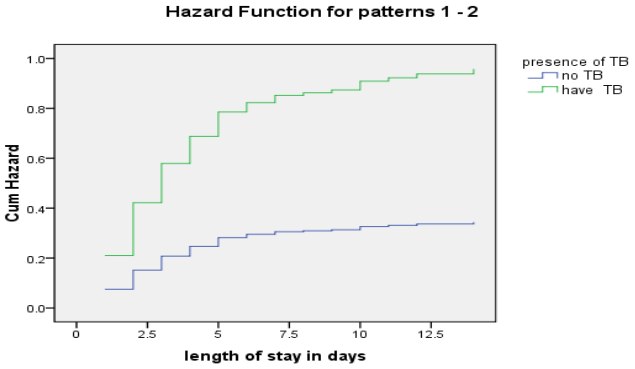

Figure 5: Difference in hazard of death among children with severe acute malnutrition those with TB at admission at stabilization center in sekota hospital January1/ 2011 to December30/ 2013.

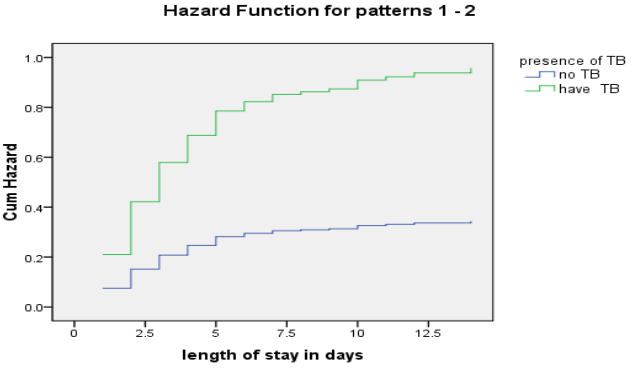

Figure 6: Difference in hazard of death among children with severe acute malnutrition those with TB at admission at stabilization center in Sekota hospital January1/ 2011 to December30/ 2013.

There is also significant difference in hazard of death among children who had malaria and severe anemia when compared to children without this complication at admission (Figures 5 and 6).

Interval Start Time	No. Enteri Interval	Number With drawing	Number Exposed to Risk	Number Of Terminal Events	Proportion Terminatin g	Proportion Surviving	Cumulative Proportion At End of Interval	Hazard Rate
0	415	0	415.000	31	.07	.93	.93	.04
2	384	4	382.000	49	.13	.87	.81	.07
4	331	10	326.000	24	.07	.93	.75	.04
6	297	25	284.500	7	.02	.98	.73	.01
8	265	28	251.000	2	.01	.99	.72	.00
10	235	48	211.000	4	.02	.98	.71	.01
12	183	43	161.500	1	.01	.99	.70	.00
14	139	36	121.000	1	.01	.99	.70	.00
16	102	15	94.500	0	.00	1.00	.70	.00
18	87	20	77.000	0	.00	1.00	.70	.00
20	67	29	52.500	0	.00	1.00	.70	.00
22	38	16	30.000	0	.00	1.00	.70	.00
24	22	5	19.500	0	.00	1.00	.70	.00
26	17	5	14.500	0	.00	1.00	.70	.00
28	12	6	9.000	0	.00	1.00	.70	.00
30	6	5	3.500	0	.00	1.00	.70	.00

Table 3: Actuarial Table estimates of the cumulative occurrence of death for 415 children aged 0-59 months admitted to stabilization center in Sekota hospital January 1/2011 to December 30/2013.

Independent predictors of mortality among children admitted to stabilization center

In order to reveal the effect level of independent variables to survival (death) due to complicated severe acute malnutrition, multivariate Cox-regression was computed over the age group, sex, hemoglobin level, co-morbidity (malaria, severe anemia, diarrhea, HIV, TB), medication (routine antibiotic, folic acid, Vit. A and IV antibiotic) were candidate for multivariate Cox- regression. As the final multivariate Cox-regression analysis table shows variables that have significant level at 95% CI and p value < 0.05 were considered in predicting mortality of children aged 0-59 months with complicated severe acute malnutrition admitted to stabilization center were malaria, severe anemia, moderate anemia, TB and among the medications; folic acid, IV antibiotics had effect on child mortality.

As the analysis result indicate 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).

The result also shows that there was significant difference in the hazard of death among children who had been treated with medication than those children not managed. As shown in the above table (Table 5), 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, 95% 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) (Table 7).

Discussion

This study aimed at identifying predictors of mortality among children aged 0-59 months with severe acute malnutrition admitted to stabilization center in Sekota hospital. In this study the result showed majority 301(72.5%) of the children referred to stabilization center were from rural residence. The median age of the children at admission was 19 months (IQR= 12-29) months. The reason for the high number of cases of SAM to be among the age group 12 to 29 months might be due reasons like low rate of continued breast feeding and poor complementary feeding practices among children of this age. Regarding the type of severe acute malnutrition, marasmus was the most prevalent 299(72.05%) type of severe acute malnutrition which is in line with the study done in Dhaka city of Bangladesh (61%) [34]. But the finding was different from study conducted at southern Ethiopia (47%) [29]. This variation may be explained by the fact that different factors are reasons for the cause of severe acute malnutrition. Edematous type of SAM was 28% in this study higher than the study done in Niger (15%) [33]. but lower than in the study done in Southern Ethiopia (53%) [29]. Diarrhea was the most prevalent (44.6%) co-infection with SAM in this study and the other co- morbidities being Malaria, Pneumonia, Dehydration, HIV, severe anemia and clinical form of TB their respective prevalence being (18.6%), (13.3%), (5.1%), (4.1%), (2.9%) and (2.2). Although the percentage of this co- morbidities differ from country to country, other studies had also indicated these co morbidities are common in children with SAM [34]. Concerning end status of children admitted to the stabilization center between January1/2011 to December30/2013, this study revealed that 193 (46.5%), 89(21.4%), 119(28.7%) and 14 (3.4%) of admitted children recovered, defaulted, died and none recovered respectively. The percentage of recovered children was lower when compared to the percentage in a prospective cohort conducted at Zambia (53.7%) [35] And very much lower than the finding of the study done in southern Ethiopia (87%) [29]. the percentage of died children

in this study (28.7%) was lower when compared to the study in Zambia mention above (40.5%) [35]. But higher than that of the study done in southern Ethiopia mentioned above (3.6%) [34]. When compared to the minimum SPHERE standard and national management protocol for severe acute malnutrition managed at stabilization centers, the percentage of recovered children 46.5% in this current study was less than the minimum SPHERE standard and national management protocol for severe acute malnutrition managed at stabilization centers (>75%). The percentage of children who died (28.7%) was also higher than the minimum SPHERE standard and national management protocol for severe acute malnutrition managed at stabilization centers (<10%). This low recovery, high death and defaulter rate might be due to late presentation to the stabilization center, mismanagement especially at the first day of admission, the hospital being far for most cases and parents discontinuing treatment due to financial problems to purchase drugs and care takers food.

Variable	Frequency	Died No (%)	Censored (No, %)	**CHR(95%CI)	P-value
Sex					
Male	212	70 (33)	142 (67)	1.55 (1, 2.38)	0.047*
Female	203	49 (24.1)	154 (75.9)	1	
SAM type Marasmus	299	76 (25.42)	223 (74.58)	1	
kwashiorkr	59	21 (35.6)	38 (64.4)	1.62 (0.9,2.93)	0.11*
Marasmus kwashiorkor 57		22 (38.6)	35 (61.4)	1.84 (1.02,3.34)	0.04*
Age group					
0-5	26	11 (42.3)	15 (57.7)	1.56 (0.54,4.49)	0.41
6-11	67	13 (19.4)	54 (80.6)	4.75 (1.86,12.14)	0.01*
12-23	154	40 (26)	114 (74)	3.257 (1.46,7.27)	0.001*
24-35	92	24 (26.1)	68 (73.9)	3.24 (1.38,7.61)	0.01*
36-47	46	15 (32.61)	31 (67.39)	2.36 (0.92,6.08)	0.01*
48-59	30	16 (53.3)	14 (46.7)	1	

Table 4: Bivariate analysis of child characteristics and SAM type on predictors of survival among children aged 0-59 months admitted to stabilization center in sekota hospital, January 1/2011 to December 30/ 2013. (*Indicates variables that have p-level less than 0.25 in univariate analysis; ** CHR crude hazard ratio)

Malaria	Yes	39 (48.15)	42 (58.85)	2.95 (1.78, 4.88)	0.001*
	No	80 (23.95)	254 (76.05)	1	
Diarrhea	Yes	29 (18.83)	125 (81.17)	2.24 (1.39, 3.61)	0.00*
	No	90 (34.48)	171 (65.52)	1	
TB	Yes	5 (71.43)	2 (28.57)	6.45 (1.23, 33.70)	0.03*
	No	114 (27.94)	294 (72.06)	1	
HIV	Yes	5 (50)	5 (50)	2.55 (0.73, 8.98)	0.14
	No	114 (28.15)	291 (71.85)	1	
Types of anemia					
Severe	12	10 (83.33)	2 (16.67)	36.11 (7.52,173.42)	0.001*
Moderate	29	14 (48.28)	15 (51.72)	6.57 (2.78, 15.53)	0.001*
Mild	200	71 (35.5)	129 (64.5)	2.61 (2.14, 6.11)	0.001*
Normal	174	23 (13.22)	151 (86.78)	1	

(*indicate significance level P< 0.25; ** CHR crude hazard ratio)

Table 5: Bivariate analysis of medication and Co-morbidity as predictors of mortality among children aged 0-59 months admitted to stabilization centre in sekota hospital January 1/2011 to December30/ 2013.

Variables	Category	Survival Status		Mean Survival time
		Died	Censored	
		No (%)	No (%)	
Malaria	Yes	39 (48.15)	42 (51.85)	16.4
	No	80 (23.95)	254 (76.05)	25.0
TB	Yes	5 (71.43)	2 (28.57)	11.43
	No	114 (27.94)	294 (72.06)	23.73
Severe	Yes	10 (83.33)	2 (16.67)	4.67
anemia	No	109 (27.05)	294 (72.95)	24.01
IV.antibiotic	Yes	43 (17.99)	196 (82.01)	26.72
	No	76 (43.18)	100 (56.82)	17.98

Table 6: Mean survival time of children aged 0-59 months with severe acute malnutrition admitted to stabilization center sekota hospital January1/ 2011 to December 2013.

Variables		Died	Censored	AHR (95% CI)	P- value
		No (%)	No (%)		
Sex Male	212	70 (33)	142 (67)	0.679 (0.63, 0.99)	0.05
Female	203	49 (24.1)	154 (75.9)	1	

(*indicates variables that have significant p- value less than 0.05 in multiple Cox-regression analysis.; **AHR: adjusted hazard ratio)

Table 7: Multivariate Cox- regression analysis on independent predictors of mortality among children aged 0-59 months, with severe acute malnutrition admitted to stabilization center at Sekota hospital January 1/2011 to December 30/2013.

As indicated in the result of this study, mortality rate was higher in children with anemia, malaria, and tuberculosis than in children without these co morbidities. Accordingly, the hazard rate of death among children with severe anemia in this study was more than six and half times than children with no anemia (AHR =6.71, 95%CI= 3.22, 13.97). Research conducted in Nigeria also showed the case fatality rate of severe anemia was 13.6% [36]. Furthermore, the hazard of death due to TB was about three times higher as compared to children with no TB (AHR= 2.88, 95%CI= 1.72, 4.65). this current study also indicated children with severe acute malnutrition who had malaria at admission period had more than two times hazard of death as compared to children without malaria (Hazard ratio 2.13, 95%CI = 1.12, 7.35). Although being HIV positive was not an independent predictor of mortality in children with SAM in this study, it was among the co morbidities which are independent predictors of mortality in other studies. for instance, a retrospective cohort study conducted from data of severely malnourished children hospitalized, between2006-2009, at a feeding therapeutic center, based on inpatient treatment approach, in Ouagadougou Burkina-Faso showed Mortality risk was 3.71, 95% IC [2.51 - 5.47] for HIV infected children with SAM [37]. Similarly, a cohort study conducted in South-West Ethiopia showed mortality rate was 4(16%) among HIV an infected child which was higher than the mortality rate in HIV uninfected children 14(7.4%) [28].

The result of this finding also showed there was significant difference in the hazard of death among children who were treated with medication and those children not treated. As shown in the above table (Table 7), children not supplemented with folic acid during their hospitalization had about two and half times 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 with vitamin A was higher than in non-supplemented children (AHR= 1.53, 95%CI= 1.05, 2.24). Children who have complication that need special antibiotics, but not managed had hazard of death about 3 times higher as compared to the same cases managed by special antibiotics (AHR=2.72, 95%IC = 1.90, 4.00). The findings of this study might suffer from the fact that the study used secondary data from records. For all children immunization status was not recorded and the effect of immunization on survival of children with SAM not assessed. Adherence and practice of health professionals according to the standard protocol cannot be identified from records.

Conclusion and Recommendations

Conclusions

Based on the finding of this study, the overall status of children aged 0-59 months with complicated severe acute malnutrition that were managed at sekota stabilization center was less than the minimum SPHERE standard and national management protocol for SAM.

The mortality rate was higher than the acceptable level which is less than 10% at stabilization centers. In addition to this, 50% of deaths were within forty eight hours of admission. Having malaria, severe anemia, and tuberculosis (TB) as co-infection with severe acute malnutrition were found to be independent predictors of mortality. Provision of medications like folic acid and intravenous antibiotics for that in need have also paramount effect in saving the life of children with severe acute malnutrition in the stabilization center.

Recommendations

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

For Sekota referral health care providers:

Children admitted to stabilization center in this hospital are not recovering well. So proper diagnosis and management of cases in accordance to the protocol permits should strictly follow.

Treatment of complication like malaria, severe anemia and TB needs focus.

Proper monitoring and documentation of records needs improvement.

For Sekota zonal health office and concerned bodies

- There is need for programmed supervision and monitoring in managing SAM in line with the national management protocol.
- Malaria, severe anemia, and TB were the predominant causes of death for children with severe acute malnutrition in this zone. So the role of health extension worker in preventing and managing this condition in their community needs improvement.
- Beside the most affected children with severe acute malnutrition was aged 6-24 month's group. Therefore implementation and integration of child survival policy including infant and young child feeding(IYCF) should be improved

Screening, case identification, management, referral and follow up of cases of children with severe acute malnutrition at the community level should be given an attention. These may be the most effective way to reduce complicated SAM, mortality at hospital and rehabilitation center.

The finding of this paper may serve as base line data, so all concerned bodies should investigate farther for improvement of child survival.

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