ORIGINAL RESEARCH

Treatment Outcome and Associated Factors of Acute Malnutrition Among Children in the Therapeutic Feeding Center of Public Hospitals in Addis Ababa, Ethiopia: An Institutional-Based Cross-Sectional Study

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Background: Severe acute malnutrition is the most prevalent reason for admission to a pediatric unit, and it is a leading cause of mortality in many countries, including Ethiopia, at 25% to 30%, where it affects both developed and developing countries. The objective of this study was to assess treatment outcomes and associated factors among children aged 6–59 months with severe acute malnutrition.

Methods: A cross-sectional study was conducted using secondary data from medical records of patients enrolled in the therapeutic feeding center from January 2016 to March 2019. There were 385 samples collected at 3 public referral hospitals in Addis Ababa, which were selected by simple random sampling. A structured questionnaire was used to collect data from the available individual folders and registers. The data analysis was performed using binary and multivariable logistic regression models. The odds ratio with 95% CI was used to identify predictor variables. Variables that have a p-value <0.05 were considered significant.

Results: Children who had tuberculosis were 79% less likely to recover than those who had no tuberculosis. In this study, deaths accounted for 9.1%, recovered were 72.2%, and defaulters accounted for 11.6% with a mean length of stay of 18.6 (CI: 16.9, 20.2) days and an average weight gain of 7.2 g/kg/day (CI: 5.7, 8.2).

Conclusion: Treating comorbidities on time can help children to recover early and reduce readmission. Integration of severe acute malnutrition screening into all service delivery points can help early identification and treatment. In the meantime, treating them with ready-to-use therapeutic feeding has a significant change in recovery.

Keywords: severe acute malnutrition, length of hospital stay, treatment outcome, Ethiopia

Background

Severe acute malnutrition affects more than 19 million children worldwide, with Africa identified as a hotspot for the disease.[1] Malnutrition is responsible for approximately one-third of the over 8 million deaths of children under the age of five worldwide.[1,2] Wasting, stunting, and being underweight are all symptoms of malnutrition and anthropometric markers for determining a child's nutritional condition.[3] Between 1990 and 2014, the global prevalence of stunting decreased from 39.6% to 23.8%, even though it.[4]

Severe acute malnutrition (SAM) is the most prevalent reason for admission to a pediatric unit, and it is responsible for 25% to 30% of deaths in many impoverished countries.[5] According to the 2016 cost of hunger report, almost half a million Ethiopian youngsters needed SAM therapy.[6] Every year, nearly 5.9 million children die before their fifth birthday all across the world.[7] According to the conclusions of the research, Ethiopia's overall annual cost of under-nutrition is projected to be Ethiopic birr 55.5 billion, or 16.5% of GDP (Gross Domestic Product) in 2009.[4]

Malnutrition interacts with other major causes of death, accounting for anywhere from 35% to 50% of all fatalities in children under the age of five; it affects school performance and increases the risk of maternity-related complications.[5,8] SAM continues to be a public health issue, particularly in poor nations. Following programmatic methods for diagnosis and case can result in lower mortality rates and better outcomes.[9,10] Survival has been found to improve with effective screening to appropriately enroll patients in outpatient programs.[9] The world's wasted rate was 7.5%, putting the lives of 50 million youngsters at jeopardy. Around the globe, one out of every thirteen children is squandered.

Ethiopia has a long history of food insecurity and nutritional problems, which have afflicted a substantial section of the population as a result of repeated droughts. Despite many initiatives to address the issue, there is no more explicit data on children's treatment outcomes. Moreover, given the reality that Addis Ababa is the capital city of Ethiopia and has better infrastructure and supply than the rest of the region, the prevalence of SAM is expected to be lower and management to be better, but still, there is a high prevalence of malnutrition in Addis Ababa, despite the availability of treatment for children with SAM in hospitals and health centers by TFU (Therapeutic feeding unit) and OTP (Outpatient Therapeutic care Programs). This analytic cross-sectional study assessed the treatment outcomes of already managed severely malnourished children and determined the contextual factors of treatment outcome in three public hospitals in Addis Ababa. In addition, this study covers a wider range of target populations, which can represent public hospitals in Addis Ababa.

Methods
Study Area
According to Addis Ababa city administration health bureau health planning unit projections, the projected population accounted for 3,515,678 where males accounted for 708,193 and females for 2,807,485, in which under-5-year children accounted for 251,560 and those under 1 year accounted for 78,639.[12] There are 10 sub-cities and 116 woredas offices. There are 5 specialized federal hospitals in that area. From this, Gandhi and Ras Desta Damtew Memorial hospitals did not provide severe acute malnutrition management services during the study time. Finally, Yikatit 12 hospital medical college, Minillik II referral hospital, and Zewditu memorial referral hospital were included in the study from January 2016 to March 2019.

Study Design
An institutional based across-sectional study was conducted by secondary data review.

Sample Size Determination
The sample size was determined by single population proportion by considering the following statistical assumptions: two-sided significance level Z $\alpha/_2$ = Z value at 95% confidence interval = 1.96 and p = 58.4% proportion of occurrence of cure rate (recovery rate). The proportion is taken from a study conducted at Bahir Dar Felege Hiwot referral hospital, where the recovery outcome is lowest and you get the maximum sample size.[5] By considering a 10% non-response rate, the final sample size was 412.

Operational Definitions
Severe acute malnutrition (SAM): -malnutrition level encompassing children 6–59 Months, with < −3 z-scores, and/or MUAC < 11.5 cm, and/or bilateral pitting nutritional edema People with SAM have higher morbidity and mortality risks.[13] Stabilization Center (SC): A hospital or health center unit that provides inpatient care to severely malnourished patients who have complications and/or a lack of appetite. If OTP is not available in the catchment area, SCs offer full inpatient care with Phase 1, Transition Phase and Phase 2 with an average length of stay (ALS) of 2–3 weeks.[13]

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Data Collection Procedures

The structured data collection tool was developed in English after reviewing different kinds of literature and yellow cards, which are used for SAM client follow-up. The questioner has three parts: socio demographics, anthropometric measurement, treatment, and supplementary protocol. The data was extracted or collected by 5 trained nurses working in TFC from the available standardized history sheet, medical log book, and individual follow-up chart (Figure 1).

Quality Assurance

The training was given to recruited facilitators on the objectives and relevance of the study, data collection and confidentiality of the information. Besides this, after data collection, the principal investigator checked the completeness of about 10% of the randomly selected filled questionnaires was cross-checked with the respective original data on patients' follow-up charts and registration books by supervisors. Before transferring it into computer software, a non-overlapping numerical code was given for each question, and coded data was cleaned and entered into Epi-data version 3.1 prepared templates.

Data Processing and Analysis

Before the data entry, the questionnaires were checked for completeness and consistency and were coded. Data were coded and double-entered into Epi Info 3.5.4 before being exported to SPSS Version 20 for processing and analysis. Descriptive statistical methods were computed to determine the mean, standard deviation, frequencies, and percentages. Logistic regression analysis was performed separately for three variable blocks. Crude odds ratios and corresponding 95% confidence intervals were used to quantify the unadjusted strength of association between the independent and the outcome variable. Independent variables which resulted in a p-value of less than 0.2 in the unadjusted model were candidates to be considered for the final multivariable model. Multivariable logistic regression was fitted to obtain an adjusted odds ratio after controlling the confounding effect of different variables and to determine factors associated with the outcome variable. All variables included in the final model and resulting in a *p*-value less than 5% have a statistically significant association with the outcome.
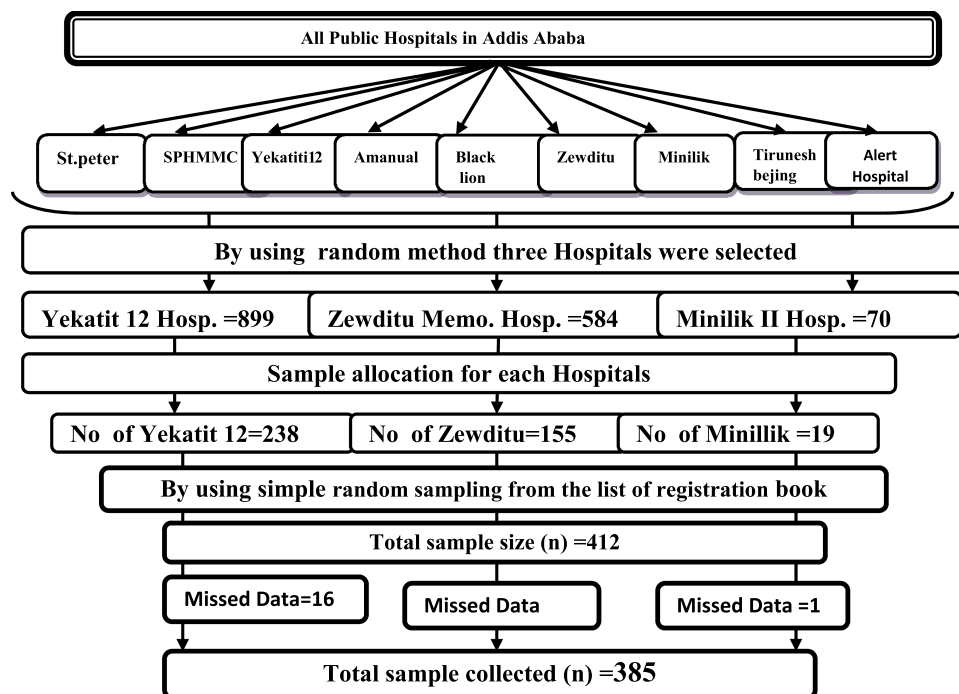

Figure 1 Sampling procedure.

Results

Socio-Demographic Characteristics of Study Participants

Data was collected from 3 public hospitals. Of the total of 412 samples, 385 (93.4%) were collected. The remaining 27 records were incomplete or missed and were not included in the analysis. From a total of 385 severely malnourished admitted children's records, more than half (54%) of the children were male and 314 (81.6%) were less than 24 months of age. The mean age of children was 18.02 (10SD) months. Nearly 7 in ten (69.1%) of the children admitted came from Addis Ababa. Most of the admitted children (86.8%) were new cases. Regarding the season of admission, most of the children were admitted in the winter season which accounted for 28.3% followed by autumn (26.4%) (Table 1).

Malnutrition Status

Three quarter (75%) of the children had wasting in which 58.4% of children were severely wasted and 16.6% were moderately wasted. Moreover, 74% of the children were stunted. Again, it was found that 76.6% of children were severe underweight. Of those total children, 17.4% were edematous/ kwashiorkor and 13% marasmic kwashiorkor. A little more than a third (34.8%) of the children had micro-cephalic and 27 (7%) of them had macro cephalic which is not related to the nutritional status of the child. From a total of 385 SAM children, 60.8% of them were exclusively breastfeed. More than half of 53.0% of the children started complementary feeding on time (at 6 months). More than three quarter 77.4% of the children were fully vaccinated the rest were either partially vaccinated or not vaccinated at all (Table 2).

Supplementations

Nearly ninety-five percent of children were started there feeding by F-75 milk. And 74.4% of children were supplemented with F-100 the next predominant supplementation was RUTF in which approximately 73%, children who took ReSoMal accounted 52% and the least is ferrous sulfate nearly 3% (Figure 2).

Table 1 Socio-Demographic Characteristics of SAM Children in Public Hospitals of Addis Ababa 2019

Variables	Category	Frequency	%
Age in month	6–11	123	31.9
	12–23	155	40.3
	24–35	76	19.7
	36–47	16	4.2
	48–59	15	3.9
Sex	Male	210	54.5
	Female	175	45.5
Place of residence	Addis Ababa	266	69.1
	Out of Addis Ababa	119	30.9
Admission criteria	New	334	86.8
	Readmission	51	13.2
Admission season	Summer	91	23.6
	Autumn	102	26.5
	Spring	83	21.6
	Winter	109	28.3

Table 2 Distribution Nutritional Status, BF and Immunization Status of SAM Children Aged 6–59 Months in Public Hospitals of Addis Ababa 2019

Variable	Category	Frequency	%
Wasting	Severe wasting	225	58.4
	Moderate Wasting	64	16.6
	Normal	96	24.9
Kwashiorkor	Yes	67	17.0
	No	318	83.0
Marasmic-kwash	Yes	51	13.0
	No	334	87.0
Stunted	Stunted	285	74.0
	Normal	100	26.0
Underweight	Severe Underweight	295	76.6
	Moderate Underweight	44	11.4
	Normal	46	11.9
Macro_microcephally	Micro cephalic	134	34.8
	Macro cephalic	27	7.0
	Normal	224	58.2
Breastfeeding	Exclusive breast feeding	234	60.8
	Mixed feeding	94	24.4
	Not breast feed	57	14.8
Timely complementary feeding	Yes	204	53.0
	No	181	47.0
Vaccination	Vaccinated	298	77.4
	Partially vaccinated	39	10.1
	Not vaccinated	48	12.5

The Magnitude of Treatment Outcome

Concerning the treatment outcomes of children with SAM at discharge, 72.2% recovered, 9.1% died, 11.6% defaulted from TFCs and 6.7% were transferred out to the higher hospital for further management and health centers for nutritional follow up. From 278 recovered children 73% were wasted children from 35 died children 17.7% were kwashiorkor, From 46 defaulter children 15.2% marasmic-kwash (Figure 3).

Length of Hospital Stay and Average Weight Gain

The mean length of hospital stay is 18.6 days with (CI: 16.9, 20.2). Length of stay at the hospital was divided by week, 50% of the children stayed at the hospital for at least 3 weeks, 34% of children were discharged after 2 weeks of admission, 15.3% after 1 week of admission and follow up. The minimum day spent at Hospital was 3 days and the maximum day was 120 days. The Average days of Hospital stay for recovered children is 18.5 days (CI: 17.0–20.0), and
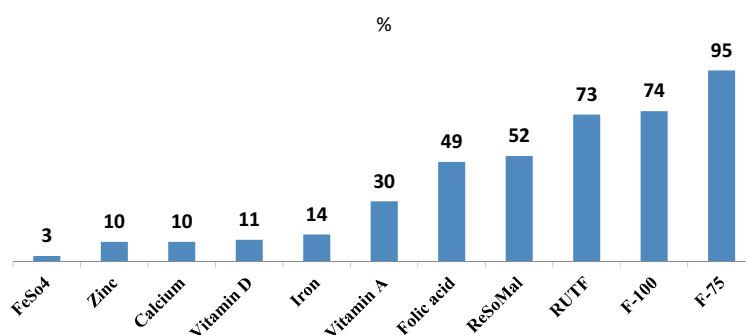
Figure 2 Distribution of supplementation provided for SAM children in Public hospitals of Addis Ababa.
Abbreviations: FeSo₄, iron sulphate; ReSoMal, rehydration solution for malnutrition; RUTF, ready-to-use therapeutic food F-75; F-100, therapeutic feedings.

18.7 days (CI: 14.2–23.1) additionally edematous children stayed 19.7 days (CI: 16.47–22.99) in the hospital while wasted children stayed 17.8 days (CI: 16.06–19.45). The mean length on stabilization phase was 11.8 days with (CI: 10.5, 13.0). The length of stabilization phase was also divided by weeks. Accordingly, 44.9% were transferred to the Phase II after a week, 31.2% after 2 weeks, 12.5% after 3 weeks and 11.5% stayed on stabilization phase for more than 4 weeks. The minimum day on the stabilization phase was 2 days and the maximum were 105 days. The mean length of stabilization phase for recovery children were 11.7 days (CI: 10.50–12.90) and for other outcomes 11.9 days (CI: 8.90–14.91). The average weight gain of the children was 6.9g/kg/day (CI: 5.9–8.2) and the mean weight gain for recovered children was 7.2g/kg/day (CI: 5.91–8.20) and 6.3g/kg/day (CI: 5.9–8.2) for other outcomes. The mean weight gains for died children were 3.8g/kg/day (CI: 5.90–8.21).

Variables Associated with Recovery Outcome by Multivariable Analysis

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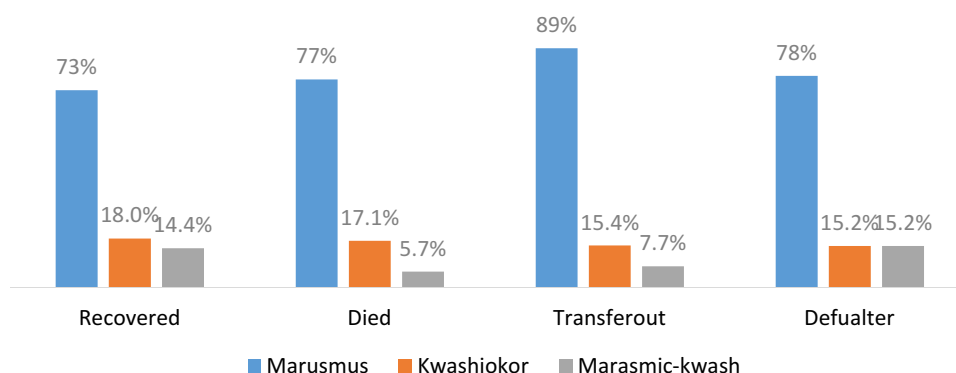

Figure 3 Distribution of treatment outcome by type of SAM in children at public hospitals of Addis Ababa 2019.

Table 3 Variables Significantly Associated with Treatment of Children in Addis Ababa Public Hospital 2019

Variables	Categories	Treatment Outcome		COR at 95% CI	AOR at 95% CI	P-value
		Recovered	Otherwise			
Age in month	< 24	221	93	1	1	
	≥ 24	57	14	1.71 (0.91, 3.23)	1.75 (0.74, 4.11)	0.2
Sex	Male	162	48	1	1	
	Female	116	59	0.58 (0.37, 0.91)	0.60 (0.31, 1.15)	0.12
Admission Criteria	Readmission	33	18	1	1	
	New	245	89	0.67 (0.36, 1.24)	0.34 (0.14, 0.83)	**0.02***
Hospital Acquired infection	No	36	19	1	1	
	Yes	242	88	1.45 (0.79, 2.66)	0.79 (0.32, 1.95)	0.61
Rickets	No	55	31	1	1	
	Yes	223	76	0.61 (0.36, 1.01)	0.56 (0.27, 1.18)	0.13
Tuberculosis	No	8	13	1	1	
	Yes	270	94	0.21 (0.09, 0.53)	0.21 (0.06, 0.70)	**<0.01****
Number of co morbidities	1—2	135	67	1	1	
	3+	143	40	0.56 (0.6, 0.89)	0.69 (0.36, 1.31)	0.26
RUTF	NO	28	77	1	1	
	Yes	250	30	0.04 (0.03, 0.09)	0.04 (0.02, 0.08)	**<0.01****
LOHS	1 week	25	34	1	1	
	2nd week	97	34	3.88 (2.03, 7.41)	3.38 (1.40, 8.16)	**<0.01****
	3 and more weeks	156	39	5.44 (2.91, 10.16)	6.48 (2.60, 16.16)	**<0.01****
Weight gain	1kg	223	94	1	1	
	2–3Kg	53	12	1.86 (0.95, 3.64)	1.49 (0.61, 3.64)	0.38
	More than 3Kg	2	1	0.84 (0.08, 9.41)	0.26 (0.02, 3.65)	0.32
Diuretics	Yes	22	36	1	1	
	No	85	242	1.70 (0.97, 3.12)	3.33 (1.38, 8.01)	**<0.01****

Notes: 1= reference group, *p-value < 0.05, **p-value <0.01.
Abbreviations: LOHS, Length of hospital stay; INO$_2$, intranasal oxygen; RUTF, Ready to use therapeutic feeding.

Discussion

The factors of severe acute malnutrition among children at Addis Ababa Public Hospital, Ethiopia, were investigated in this study. The child's admission criteria, TB, RUTF supplementation, diuretic therapy, and length of hospital stay were all found to be predictors of recovery. The minimal criterion for discharges from targeted supplemental feeding programs, according to the SPHERE association and Ethiopian national SAM management protocol, is fewer than 10% mortality, higher than 75% recovery, and less than 15% defaulting.[14,15] In this study, 9.1% of the participants were deceased, 72.2% were recovered, and 11.6% were defaulters.

Even though the mortality rate and defaulter rate did not meet the SPHERE project's minimum criteria, they were acceptable The recovery rate in this study was lower than the recommended rate, indicating that more research into the

management of severe acute malnutrition patients is required.[10,16] According to studies conducted in Zambia, Uganda, Gonder, Hawassa University Hospital, Bahir Dar Hospital, and Sekota, recovery outcomes are worse than the international standard.[5,17–22] In comparison to the standard, research conducted in India and Tigray had a greater recovery rate.[23,24]

The average length of hospital stay in this research was 18.5 days, which falls within the SPHERE project's acceptable range of fewer than 28 days.[14] Similarly, several studies done in various countries, such as India, Uganda's Tamale hospital, Zambia, and Tigray indicate shorter hospital stays,[20,21,23,24] while studies conducted in Gonder and Ayder hospitals show the same length of hospital stay.[19,25]

Children who stayed in the hospital for more than a week had a better chance of recovering. Another study done in the Yirgalem and Gurage zones found that when the length of hospital stay is extended by one day, the likelihood of recovery increases as well.[26,27] The length of hospital stays was also found to be a major factor in recovery in this study. A prolonged stay in the hospital can allow for visits with various senior doctors and correct diagnosis and treatment, resulting in a better recovery outcome as the hospital stay lengthens.

Children who are newly entered have a better probability of recovering than those who have been readmitted. The findings of this study are supported by studies conducted in Bahir Dar, west Ethiopia, and the Hadiya zone.[5,22,28,29] This might be because re-admitted children have recurring infections and are afflicted by a vicious malnutrition loop. Furthermore, feeding frequency, feeding quantity, and the family's economic situation can all play a role in why the kid returns to the hospital on a regular basis, either for recovery or being lost to the system.

TB was also discovered to be a predictor of recovery, with children who had TB being 79% less likely to recover than their peers. According to various research,[17,18] tuberculosis is the most common co-infection of malnutrition. In studies done in Zambia, Waghimra, Bahir Dar, and South Ethiopia, TB was a predictor of recovery.[17,21,22,30] Malnutrition has been shown to be a risk factor for progression from TB infection to active TB illness, as well as a predictor of increased risk of mortality and TB relapse at the time of diagnosis of active TB.[13]

Supplementing with RUTF was shown to be related to a higher rate of recovery. RUTF is a paste-food high in energy, minerals, and vitamins that is used to treat SAM. RUTF is a food-and-medicine combination that was administered to children with severe malnutrition throughout the transition phase and phase 2 (rehabilitation phase) to help them gain weight.[11,15,31] Not only during outpatient management programs, but also throughout the rehabilitation phase, RUTF Plumpy'nut packages have been supplemented.[11,31]

RUTF supplementation decreases all-cause mortality compared to F-75 and F-100 therapy in studies conducted at the Ayder, Bahir Dar Felege Hiwot, and Jimma University hospitals.[22,25,32] In addition, according to a systematic review study, RUTF is 51% more likely to achieve nutritional recovery.

Diuretic-treated children had a worse recovery rate than their non-diuretic peers. Giving a diuretic to a kid might exacerbate their electrolyte imbalance and perhaps result in mortality.[10,13] Children with severe anemia were given PRBC transfusions and were given diuretics to thin their blood and create a place for it. The aim of administering a diuretic before a blood transfusion is to avoid congestive heart failure from overwhelming the circulatory system in patients with transfused.[13,15] Unless diuretics should not be used for the treatment of edema, furosemide is the preferred diuretic for this purpose.[10,13] This might be because diuretics are used extensively in children with anemia, heart disease, and other illnesses.

The research's strength is that it was conducted at a facility and addressed severe acute malnutrition, as well as covers a wide range of study areas in Addis Ababa. One of the drawbacks is that the data was taken from secondary sources, and the quality of anthropometric assessment, diagnosis, and treatment of SAM children was not cross-checked using a WHO-recommended measuring technique.

Furthermore, the study analyzed the discharged children's recorded data to assess treatment outcomes and associated factors. As a result, this study was limited to evaluating treatment outcomes exclusively using medical records since additional characteristics such as distance from hospitals, parental education and economic status, and factors associated with health care providers could not be included.

Conclusion

In this study, the defaulter and mortality rates were reduced, in which the exit indication was fulfilled, but the recovery rate was lower than expected. Average weight gain and the average length of hospital stay are also important indicators of SAM management. The national recommendation for weight gain is 8 g/kg/day and less than 28 days in a hospital stay. Even if the length of hospital stay met the standard, the average weight gain was less than the recommendation of 7.2 g/kg/day, and the children in this care did not thrive. Children with at least two comorbidities or more are more likely to die in this research region. Children with tuberculosis who were not given plumpy nuts (RUTF), readmission, and a hospital stay of one week or less, as well as those who were given diuretics, had a reduced probability of improving.

Ethics Approval

Ethical clearance was based on Helsinki declaration obtained from the SPHMMC's institutional review board with reference Number of P.M.23/586 and Addis Ababa city Government health bureau with a reference number of A/A/H/B 317/227. As the study was conducted through a review of records, no consent was obtained from the mothers or caregivers of the study subjects. No personal identifiers were used to collect the data to maintain confidentiality. All medical records and individual charts were made as per the regular practice of the pediatric ward department.

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Author Contributions

All authors made substantial contribution to the work reported conception and study design, execution, acquisition of data, or analysis and interpretation of data; took part in drafting the article, critically reviewing for important intellectual content; gave final approval of the version to be published, have agreed on the journal to which the article was submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no competing interests in this work.

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