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Original Article

Recovery Rate and Associated Factors of Children Aged 6-59 Months with Severe Acute Malnutrition at Inpatient Unit of Galkio General Hospital, Puntland, Somalia

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Keywords:

Severe Acute
Malnutrition,
Recovery,
Inpatient.

Background: -Around 24 million children under the age of five are suffering from severe acute malnutrition globally, including 19 million acutely malnourished children in developing countries. In Sub-Saharan Africa, it is common, affecting approximately 3% of children at any given time and is linked to the annual mortality of hundreds of thousands of children. **Objective:** to assess the recovery rate and associated factors of children aged 6-59 months admitted with severe acute malnutrition at Galkaio General Hospital in 2022. **Method** Hospital-based cross-sectional study design was conducted in the Galkio District of Puntland Somalia. Data were collected using a retrospective review of patient records and an abstracting sheet intended for this purpose was used to extract data on required variables. Data was entered into EpiData version 3.1 and then exported to SPSS version 20 for analysis. Bivariable and multivariable logistic regression models were fitted to identify factors associated with treatment outcomes. Adjusted Odds ratio with its 95% CI is reported and a P-value less than 0.05 was considered to declare the presence of a significant association. **Results** The recovery rate of the reviewed records was 73.2% while 26.8% were not recovered. Children who were breastfeeding at the time of admission were 43% (AOR = 0.577 (0.359-0.928)) less likely to recover than those who were not breastfeeding. Children who took Amoxicillin as routine medication were 1.8 times more likely to recover as compared to those who did not. (AOR = 1.836(1.132-2.977) Children who were completely and partially vaccinated (AOR: 3.451(1.998–5.960) were 3.4 times more likely to recover than those who had not been vaccinated. **Conclusion:** The overall recovery and other outcome indicators were in the range of the minimum international Sphere standard. Children who were breastfeeding at the time of admission and were administered Amoxicillin did better than their counterparts in terms of recovery.

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INTRODUCTION

Severe Acute Malnutrition (SAM) is defined as a weight-for-height (W/H) ratio of less than -3 standard deviations (SD) below the median reference population, or W/H below 70%, or the presence of nutritional oedema, or a mid-upper arm circumference (MUAC) of less than 110 mm in children aged 6 to 59 months [1].

Globally, around 24 million children under the age of five suffer from severe acute malnutrition, including 19 million in developing countries. In Sub-Saharan Africa, SAM is common, affecting approximately 3% of children under five at any given time. It is associated with the annual mortality of hundreds of thousands of children [3].

Severe acute malnutrition remains a leading cause of illness and death among children in Sub-Saharan Africa. Malnutrition is widespread in the region, with 38.6% of children under five in southern and central Somalia stunted, 28.4% underweight, and 7.2% wasted [4].

Treatment outcomes are categorized as recovered, defaulted, died, medically transferred, or non-respondent based on the WHO management protocol [2]. Recovery, death, and default rates are considered acceptable when above 75%, below 10%, and 15%, respectively, and alarming when below 50%, above 15%, and above 25%, respectively. Additionally, weight gain, length of stay, and coverage are regarded as appropriate when above 8 g/kg/day, 4 weeks, and 50–70%, respectively, and alarming when below 8

g/kg/day, above 6 weeks, and below 40%, respectively [5].

There are two main approaches to managing SAM. Patients who have lost their appetite and have serious medical complications are admitted for inpatient care to stabilize their condition. Patients with good appetite, no severe medical issues, and no oedema or marasmic kwashiorkor are managed through outpatient therapeutic programs (OTP) [2].

However, little is known about the recovery rate and its influencing factors in the study area. Therefore, this study aims to assess the recovery rate and associated factors among children hospitalized with SAM at Galkayo General Hospital.

METHOD AND MATERIALS**Study Area and Period**

The study area of this research is the district Galkio is the capital of the Northern Mudug region of Somalia. The city of Galkio is divided into two administrative areas separated by a district boundary, with the northern districts governed by Puntland State and the southern districts governed by Galmudug State. Total population of 80,000. Geographically, Galkio town is divided into four main villages; Israac, Garsoor, Hormar, and Wadajir. It has 5 hospitals. The study was conducted from June 2022 to July 2022 (36).

Galkayo General Hospital in Puntland, Somalia, was selected for this study due to its strategic

importance in treating children with severe acute malnutrition (SAM). The region faces ongoing challenges such as conflict, displacement, food insecurity, and poor access to healthcare, all of which contribute to high malnutrition rates among children aged 6–59 months.

Study Design

A hospital-based retrospective cross-sectional study design was used. A retrospective cross-sectional study was chosen because it is cost-effective, uses existing hospital records, and allows quick analysis of recovery outcomes and related factors without needing to follow patients over time. This design is practical in low-resource settings like Galkayo General Hospital and helps provide valuable insights efficiently.

Source of Population:

The source of the population was all children aged 6–59 months who were admitted to inpatient therapeutic feeding units with the diagnosis of severe acute malnutrition at Galkayo General Hospital.

Study population: All children aged 6–59 months who were admitted to inpatient therapeutic feeding units with the diagnosis of severe acute malnutrition from January 2018 to December 2021

Inclusion Criteria

Children 6–59 months of age with SAM who have been admitted and treated at the therapeutic feeding unit (TFU) of the hospital from January 2018 to December 2021 were eligible for the study.

Exclusive Criteria

Records with incomplete information were excluded.

Sample Size Determination

The single population proportion formula was used to calculate the required sample size to address the study objectives. Due to the lack of prior research on the prevalence of severe acute malnutrition and recovery rates in Somalia, an estimate from a similar setting was utilized. A study conducted in Ethiopia reported a recovery rate of 58.4% for children with severe acute malnutrition, which was used as the reference proportion for the sample size calculation.

Calculated Sample Size

$$n_i = (Z^2 \times p \times (1 - p)) / d^2$$

$$n_i = (1.96)^2 \times (0.584) \times (1 - 0.584) / (0.05)^2$$

$$n_i = (3.8416) \times (0.584) \times (0.416) / 0.0025$$

$$n_i = 373$$

$$n_i = (1.96)^2 \times (0.584) \times (1 - 0.584) / (0.05)^2$$

$$n_i = (3.8416) \times (0.584) \times (0.416) / 0.0025$$

$$n_i = 373$$

The fore Sample size =

373 after adding 10% of the non-response rate, a total of **410** children was required for this study.

N = desired sample size

Z = 1.96 the factor from the normal distribution

P = recovery rates of children who had been managed for SAM 0.584(58.4%)

D = margin error.

The Sample Size for the Second Objective

Two population proportion formulas were used to determine a sample size for the second objective which is associated factor identification, two key predictors from the previous study were selected according to the following assumptions and computed by EPINFO version 7.

Table 1: Sample Size Determination for Second Objective's Specific Objective Two

Key variables	Exposed	Recovery rate		Outcome in exposed	Ratio	Assumption	AOR	Total Sample size
		Yes	No					
Nutrition type	Edematous	77(89.5)	9(105)	72	1	95% CI, power 80%	0.27	82((3)
	Wasted	198(94.3)	12(5.7)					
Sex	Male	118(50.4)	105 (62.9)	49.5	1	95% CI, power 80%	1.86	340((20)
	Female	116(49.6)	62 (37.1)					

Since the sample size of the first objective is greater than the second one, which is 410, the greater one will be our final sample size for this study, which is **410**.

Sampling Procedure

The study participants were selected by a simple random sampling technique from the registration logbook based on their unique identification number.

Data Collection Method

Data were collected from the SAM registration logbook and medical record charts. A standard checklist extracted from the registration book was used for data collection. The checklist includes demography (age, sex,), anthropometry (weight and height/length, MUAC), presence or absence of oedema, immunization status, medical diagnosis at admission (co-morbidities), and treatment outcome of severe acute malnutrition.

Data Collection Procedure

Four data collectors (diploma nurses), who had experience and training in SAM management, and two supervisors had been recruited, and two days of training were given. Records of eligible children were retrieved from the registration book; records with incomplete information were excluded. Records that have admission type, sex, place of residence, age of the child, anthropometry measurements, medical

complications, routine medications, and the outcome of the child were retrieved. All the data were collected using a pre-tested checklist.

Data Quality Control

A checklist was prepared after reviewing different literature to record the necessary information from the registration book. Prior to the start of data collection, two days of training were given to the data collectors about the study objectives and how to fill in the checklist.

Data Processing and Analyzing

Data were entered into Epi Info version 3.1 statistical software and then exported to SPSS version 20 for analysis. Cross-tabulation and frequency tables were used to report the descriptive data. In the binary logistic regression analysis odds ratios (OR), 95 % confidence intervals (CI) and p-values were used to determine the factors that were associated with treatment outcome. Variables with $P < 0.25$ in the bivariate analysis were included in the model at multivariate analysis. A p-value of less than 0.05 was considered statistically significant. Results were summarized and presented in graphs and tables.

RESULTS

Sociodemographic, Admission Type Category, SAM Category, Breastfeeding and Referral Status of the Child Characteristics

Records of 410 Children between the Age of 6-59 Months with the Diagnosis of Severe Acute Malnutrition (SAM) Admitted to TFU from January 2018 to December 2021 in Galkio.

Variables	Category	Frequency	Percent (%)
Age	6-11 months	167	41.2
	12-23 months	154	37.6
	24-59 months	89	21.2
Sex	Male	226	55.1
	Female	184	44.9
Residence	Urban	157	38.3
	Rural	253	61.7
Breastfeeding on admission	Yes	191	46.6
	No	219	53.4
Admission Type	New admission	257	62.7
	Readmission	153	37.1
Referral Status	Health Center	100	24.4
	Health Post	117	28.5
	Outreach	59	14.4
	Self-Referral	118	28.8
	Others	16	3.9
Admission criteria	Only Edema	95	22.7
	Only wasting	149	36.3
	Both Edema and wasting	103	25.1
	Only MUAC	63	15.4

General Hospital; 167 (41.2%) were between the ages of 6-11 Months, 154 (37.6) between 12-23 Months and 87 (21.2%) were in 24-59 Months. The mean (\pm SD) of the age of the admitted children was 18.23 (\pm 11.769) months. Almost more than half 226(55.1%) of the admitted children were Male. More than half 253 (61.7%) came from the Rural areas. The majority of the children 257 (62.7 %) were newly admitted whereas 152(37.81%) were readmitted to the program. Severe wasting of admission 149 (36.3%), 93 (22.7%) were admitted only for oedema, 63 (15.4%) and the remaining 103(25.1%) were admitted for both Wasting and

Edema. Most of the admitted children in the program were self-referred 118 (28.8%).

Medical Co-morbidity

All children admitted to the stabilizing centre had at least one form of co-morbidity. The most common medical co-morbidities accompanied by SAM children at the time of admission were Anemia 53.2% Followed by pneumonia 51.5%, vomiting 45.6% Malaria 35.1% Diarrhea 32.2% and Tuberculosis (TB) 30.5% Regarding the appetite almost 65.9% Had poor appetite based on standard SAM protocol.

Table 2: Distribution of Medical Co-morbidity Information on Record Review of SAM Children 6-59 months at Galkaio General Hospital, Somali Puntland from January 2018 up to December 2022.

Medical Co-morbidity	Category	Frequency	Percentage (%)
Pneumonia	Present	211	51.5
	Absent	199	48.5
Temperature	Fever (> 37.5)	130	31.7
	Hypothermia (<35)	187	45.6
	Normal	93	22.7
Vomiting	Present	187	45.6
	Absent	223	54.4
Appetite at Admission	Good	140	34.1
	Poor	270	65.9
Diarrhea	Present	132	32.2
	Absent	274	66.8
Type of Diarrhea	Watery	104	25.4
	Dysentery	80	19.5
	Others	31	7.6
TB	Present	125	30.5
	Absent	225	54.9
	Unknown	60	14.6
Anaemia (pale conjunctiva and palmer pallor and/or a haemoglobin count of <11g/dl)	Present	218	53.2
	Absent	192	46.8
Malaria	Present	144	35.1
	Absent	193	47.1
	Unknown	73	17.8

Routine Medication and Treatment

Admitted cases with severe acute malnutrition in the therapeutic feeding unit followed the Somalia guidelines for management of severe acute malnutrition. Out of 410 children whose

medication records were available for review, the most prescribed medications were IV antibiotics 54.4%, Amoxicillin (56.3%), Deworming (52.9%), folic acid (54.1%) vitamin A (36.3%), IV Fluid (45.9%) where the number of fully immunized (50.7%).

Table 3: Information of the Treatment Given on Record Review of SAM Children 6-59 Months at Galkaio General Hospital, Somali Puntland from January 2018 up to December 2021.

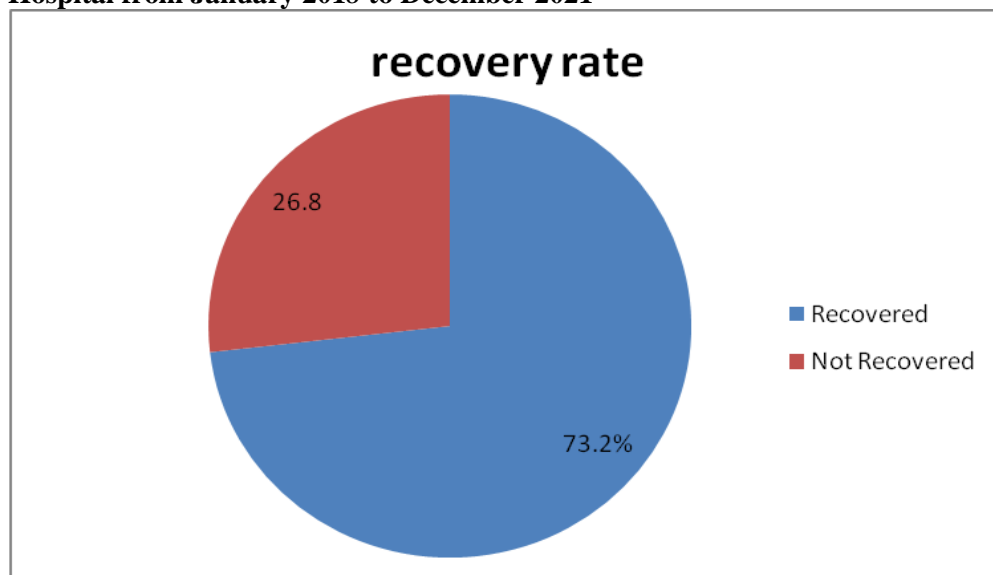
Treatment Given	Category	Frequency	Percent (%)
IV Fluid	Yes	188	45.9
	No	222	54.1
IV Antibiotic	Yes	223	54.4
	No	187	45.6
Amoxicillin	Yes	231	56.3
	No	179	43.7
Vitamin A	Yes	149	36.3
	No	191	46.6
	Not applicable	70	17.1
Deworming (Albendazole or Mebendazole)	Yes	217	52.9
	No	161	39.3
	Not applicable	32	7.8
Measles vaccine	Yes	201	49.0
	No	152	37.1
	Not Applicable	57	13.9
Folic Acid	Yes	222	54.1
	No	188	45.9
Fully Immunized	Fully Immunized	208	50.7
	Partially Immunized	161	39.3
	Not started	41	10.0

Recovery Rate from SAM

The 410 of SAM children admitted From January, 2018 to December 2021, in the stabilization center of Galkaio General Hospital were reviewed.

Overall proportion of recovery 300(73.2%), Defaulter 82 (20.0%), Death8 (2.0%), non-response 13((3.2) and medical transfer 7(1.7) were observed .

Figure 1: Recovery Rate of Reviewed Records of SAM Children Admitted to Galkio General Hospital from January 2018 to December 2021



Bivariate and Multivariate Analysis Results

The association of independent variables with the dependent variable was investigated using both bivariate and multivariate logistic regression techniques. A bivariate logistic regression analysis was run for the following independent variables, Sex, Age, Residence type of Malnutrition, Breast feeding at admission, appetite at admission, medical co-morbidities like pneumonia, Diarrhea, Malaria Anemia, TB and routine medications like IV fluids, IV antibiotics, Amoxicillin, Vitamin A, Measles, Deworming and Folic acid.

Accordingly, after bivariate analysis of different variables, breastfeeding on admission, immunization status, and provision of

Amoxicillin and folic acid were found to be associated with recovery rate in severely malnourished children admitted to the Hospital. ($P - \text{value} < 0.25$) and hence were used in multivariate analysis.

The result of the multivariate analysis showed Children who were breastfeeding at the time of admission were 43% (AOR = 0.577 (0.359-0.928) less likely to recover than those who were not . Children who did take Amoxicillin as routine medication were 1.28 times more likely to recover as compared to those who did not. Children who were completely and partially vaccinated (AOR: 3.451(1.998–5.960) were 3.4 times more likely to recover than those who had not been vaccinated,

Table 4: Bivariate Logistic Regression Analysis of SAM Children with 6-59 Months at Galkio General Hospital, Somali Puntland from January 2018 up to December 2021.

Variable	Category	Treatment outcome		COR 95% CI	P-value
		Recovery Frequency %	Not-recovery Frequency %		
Age	6-11	123(72.8)	46(27.2)	1	
	12-23	115(74.7)	39(25.3)	0.927(0.522-1.648)	0.797
	24-59	62(71.3)	25(28.7)	0.841(0.466-1.516)	0.565
Sex	Male	165(73.0)	61(27.0)	1	
	Female	135(73.4)	49(26.6)	1.019(0.656-1.581)	
Residence	Urban	112(71.3)	45(28.7)	1	
	Rural	188(74.3)	65(25.7)	1.162(0.744-1.816)	0.509
BF admission	Yes	149(78.0)	42(22.0)	1	
	No	151(68.9)	68(31.1)	0.626(0.401-0.978)	0.040
Appetite admission	Good	99(70.7)	41(29.3)	1	
	Poor	201(74.4)	65(25.6)	1.206(0.765-1.902)	0.419
Vomiting	YES	137(73.3)	50(26.7)	1	
	NO	163(73.1)	60(26.9)	0.991(0.639-1.537)	0.970
Diarrhea	YES	98(74.2)	34(25.8)	1	
	NO	199(72.6)	75(27.4)	0.921(0.574-1.476)	0.731
Tuberculosis (TB)	YES	89(71.2)	36(28.8)	1	
	NO	166(73.8)	59(26.2)	1.213(0.602-2.466)	0.588
Anemia	PRESENT	158(72.5)	60(27.5)	1	
	ABSENT	142(74.0)	50(26.0)	1.078(0.696-1.672)	0.736
Malaria	YES	109(75.7)	35(24.3)	1	
	NO	141(73.1)	52(26.9)	0.698(0.374-1.302)	0.259
Amoxicillin	YES	187(81.0)	44(19.0)	1	
	NO	113(63.1)	66(36.9)	0.403(0.258-0.630)	0.000
Vitamin A	YES	102(68.5)	47(31.5)	1	
	NO	143(74.)	48(25.1)	1.690(0.867-3.293)	0.123
Measles Vaccine	YES	138(68.7)	63(31.3)	1	
	NO	121(79.6)	31(20.4)	1.170(0.611-2.241)	0.636
Folic Acid	Yes	149(67.1)	73(32.9)	1	
	No	151(80.3)	37(19.7)	1.999(1.268-3.154)	0.003
Deworming	Yes	174(80.2)	43(19.8)	1	
	No	102(63.4)	59(36.6)	0.741(0.312-1.764)	0.499
Immunization status	Fully immunized	178(85.0)	30(14.4)	0.460(0.208-1.015)	0.054
	Partially immunized	92(57.1)	69(42.9)	2.045(0.958-4.365)	0.064
	Not Immunized	30(73.2)	11(26.8)	1	

Table 5: Multivariate Logistics Regression Analysis of SAM Children with 6-59 Months at Galkio General Hospital, Somali Puntland from January 2018 up to December 2021.

Variable	Category	Treatment outcome		AOR 95% CI	P-value
		Recovery Frequency %	Not-recovery Frequency %		
Breastfeeding on admission	Yes	149(78.0)	42(22.0)	0.577(0.359-0.928)	0.023
	No	151(68.9)	68(31.1)	1	
Amoxicillin	YES	187(81.0)	44(19.0)	1.836(1.132-2.977)	0.014
	NO	113(63.1)	66(36.9)	1	
Folic acid	YES	149(67.1)	73(32.9)	1.373(0.827-2.282)	0.220
	NO	151(80.3)	37(19.7)	1	
Immunization status	Fully immunized	178(85.0)	30(14.4)	3.451(1.998-5.960)	0.000
	Partially immunized	92(57.1)	69(42.9)	1.826(0.810-4.117)	
	Not Immunized	30(73.2)	11(26.8)	1	

DISCUSSION

The findings of this study showed that the overall recovery rate for complicated SAM was 73.2%, while the remaining 26.8% ended with non-recovery outcomes (a combination of defaulters, deaths, and medical transfers). This recovery rate is slightly below the minimum acceptable standard of >75% recommended by the Sphere standard and the National SAM Guideline protocol [5]. Similarly, this rate is lower than those reported in other studies, including Woldiya Hospital (85%) [3], Debre Markos and Finote Selam Hospitals (77.9%) [23], Jimma Specialized Hospital (87%) [35], and Southern Ethiopia (82.4%) [26].

However, this study's recovery rate is higher than those found in studies conducted in Uganda [15], Sekota [35], Felege Hiwot Hospital [20], Dire Dawa Dilchora Referral Hospital, and Tamale Teaching Hospital [16]. Variations in patient care level, hospital caseload, availability of updated SAM management guidelines, and staff knowledge and adherence to the severe acute malnutrition management protocol may explain these differences.

The current study also revealed that children who received amoxicillin had 1.8 times higher odds of recovery compared to those who did not receive

the antibiotic (Adjusted Odds Ratio [AOR] = 1.836; 95% Confidence Interval [CI]: 1.132–2.977). This finding aligns with studies conducted in Southern Ethiopia [28] and Wolaita [3], as well as clinical trials in India where antibiotics were used as part of SAM treatment [36]. The increased likelihood of recovery may be attributed to the supportive role of antibiotics, particularly amoxicillin, in treating small bowel bacterial overgrowth in SAM patients [2].

Additionally, children who were fully or partially vaccinated had 3.4 times higher odds of recovery than unvaccinated children (AOR = 3.451; 95% CI: 1.998–5.960). This result is consistent with a study conducted at Felege Hiwot Hospital [20].

Interestingly, the study found that children who were breastfeeding at admission were 43% less likely to recover compared to those who were not breastfeeding (AOR = 0.577; 95% CI: 0.359–0.928). This finding corresponds with a study conducted in Dire Dawa [37] but differs from a study in Woreda, Tigray region, which reported nearly equal chances of recovery regardless of breastfeeding status at admission [38]. These discrepancies may be due to differences in the sampled age groups or variations in feeding practices across the study areas.

CONCLUSION AND RECOMMENDATION

Conclusion

Proper management of severe acute malnutrition significantly contributes to saving the lives of many children. This study aimed to evaluate the effectiveness of treatment for severe acute malnutrition in children under five years of age. The proportion of recovery observed was close to the acceptable global Sphere standard of greater than 75%. Notably, children who were breastfed at the time of admission and received Amoxicillin demonstrated better recovery rates compared to those who did not, highlighting the importance of breastfeeding and appropriate antibiotic use in improving treatment outcomes.

Recommendations

Based on the findings of this study the following recommendations are forwarded:

For the Hospitals

- The hospitals should design appropriate and ongoing supervision mechanisms for defaulter tracing.
- All results of the investigations should be clearly documented in the patient card to prevent future incompleteness of the records.
- Strong monitoring and evaluation of the program, ensuring sustained resource follow and timely provision of routine medications will have crucial roles in improving the recovery rate and establishing an appropriate SAM management system in the Hospital.

For Researchers

Further prospective studies are required in order to determine risk factors for the treatment outcome of severe acute malnutrition at TFU as this is a hospital-based secondary data analysis.

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