Predictors of Nutritional Recovery Time among Children with Sever Acute Malnutrition Admitted at Outpatient Therapeutic Feeding Program in Shashemene Rural District, South Ethiopia

Desta Bukulu Jaro
Oromia Regional Health Bureau, Addis Ababa, Ethiopia.
destabukulu17@gmail.com

Abstract

Background: Severe acute malnutrition is one of the major public health problems. Most of the studies were retrospective and also lack the most important variables such as the wealth and food security status of the families and institutional factors which could affect the recovery time of children with SAM. **Objective:** To assess recovery time and its predictors among 6-59 month's children with severe acute malnutrition who are treated on OTP in Shashemene rural district health facilities. **Methods**: Institution based prospective cohort study was conducted among 279 children aged 6-59 months who are treated on OTP in Shashemene district. Children diagnosed as Sever acute malnutrition who visited the selected health facilities during the study period were the study population. The anthropometric measurement weight for height or the presence of bilateral edema was used to select sever acute malnutrition children. Primary Data was collected by face to face interview using structured questioners. The collected data was entered in to Epideta version 3.1 and exported to SPSS version 20 for analysis. The cox proportional regression was used to determine the predictors of recovery time. In bi-variable analysis co-variables with P-value of <0.25 were included in multi variable analysis. The final model was interpreted using AHR with 95%:CI at P-value of <0.05. **Results:** The median survival time to recovery at the study area was 6.0 weeks with5.0 to 7 weeks. Multi-variable analysis variables revealed that; the rate of recovery time was reduced by 29% among Children's having edema (AHR=0.71; 95%: CI ((0.51, 1.01)). Children received amoxicillin during admission were 5.85(AHR=5.85; 95%: CI (3.59, 9.52)) at higher risk of recovered earlier as compared to no received ones. Vomiting during admission reduced the risk of early recovery time by 62% (AHR=0.38: 95%: CI (0.28, 0.50)). Anemia during admission reduced the risk of early recovery time by (AHR=0.76; 95%: CI (0.45, 1.79). Children who got diversified foods during follow up time were 1.51(AHR=1.51; 95%: CI (1.11, 1.45)) times at higher risk for early recovery than the rate of their counter parts. **Conclusion:** the median survival time to recovery at the study area moderately consistent as compared to the national figure. The present study revealed that; children's having edema, presence of vomiting and anemia during admission were factors to reduce the risk of early recovery time. While; Children who were received amoxicillin and who got diversified foods during follow up time were at higher risk for early recovery.
Keywords; Recovery time, Sever acute malnutrition, outpatient, under five children and Shashemene district.

1. Introduction

1.1. Back Ground

Malnutrition is a state in which the physiological functioning of the child's body is impaired due to either under-nutrition or over nutrition. It typically develops when the growth velocity and brain development are especially high during 6 to 18 months of age(Tefera T, et al2020)

The Ethiopian government launched OTP in different Health centers and HPs., there are limited data on how long children will stay in Outpatient program to recover from severe acute malnutrition. This study aimed to assess the time to recovery and its predictors among children 6–59 months with severe acute malnutrition admitted to OTP in Oromia, southern parts of Ethiopia. According to global report acute malnutrition is a major cause of death among under-five children. Globally, in 2011 an estimated of 2 million children suffered from SAM. Out of them more than 80% were treated in four sub-Saharan Africa countries(Adimasu M. *et al.*, 2020)

Malnutrition remains one of the major obstacles to human well-being affecting all areas of a child's growth and development, and generally defined as a chronic condition which is a consequence of over or under consumption of any or several essential macro or micronutrients relative to the individual's physiological and pathological requirements (Chinyoka, 2014).

Out patient management of uncomplicated severe acute malnutrition at community level have major public health impact in reducing case fatality due to severe acute malnutrition. If appropriate protocol according to world Health organization standard is followed case fatality can be decreased to less than 5% both in the community and in health care facilities. (WHO, 2008)

In developing countries, undernutrition is associated with >50% of deaths caused by infectious disease.

Worldwide, there were around 60 million and 20 million children with moderate acute malnutrition and severe acute malnutrition (SAM), respectively(Adimasu *et al.*, 2020)According to the sphere standards, the recovery time of children hospitalized in stabilization centers should be less than four weeks and it is alarming if it takes longer than 6 weeks(Tefera, 2020)

SAM is the third most common contributing factor to the deaths of under-5 children worldwide. According to the World Health Organization, SAM causes 1 million deaths annually via increased susceptibility to death from severe infection(Adimasu *et al.*, 2020)

1.2. Problem statement

SAM is one of the main risk factors for morbidity and mortality among children and It has also significantly contributed for impaired intellectual development of children, increased the risk for disease and it is one of the main reasons for children's admission inout-patient treatment(Gebremedhin *et al.*, 2020).Today, SAM is a global public health problem that majorly affects the survival of children under five years of age(Mamo W. *et al.*, 2019).However, the prevalence of SAM varies in developed and developing countries(Adimasu *et al.*, 2020)

CMAM consists of four components such as stabilization care for acute malnutrition with complications, outpatient therapeutic care for severe acute malnutrition without complications, supplementary feeding for moderate acute malnutrition, and community mobilization(Asebe and Tadesse, 2021).

Outpatient therapeutic feeding is normally organized from the same facilities that have in-patients. However, out-patient care, in the community, should also be organized from health posts or even non-clinical facilities that are close to the patients' homes(FMOH, 2007).

The patients attend on a weekly basis. Most patients can be managed entirely on an out-patient basis; so that there are normally many more out-patients than in-patients. For each in-patient facility there should be several / many satellite out-patient distribution and assessment sites ("OTP sites") close to the community(FMOH, 2007) According to the World Health Organization (WHO) and the national guideline, children who have passed an appetite test and are judged to be clinically well should be treated on outpatient bases through the OTP(Teshome, Bosha and Gebremedhin, 2019).

According to the sphere standards, the recovery time of children hospitalized in stabilization centers should be less than four weeks and it is alarming if it takes longer than 6weeks(Tefera, 2020)But, children, due to various factors, do not get cured on time. The median nutritional recovery time of the entire cohort study shows recovery time analysis was 26 days(Gebremichael B.,et al , 2015).Though different interventions are being implemented in Ethiopia for prevention and treatment of severe acute malnutrition, Data from the previous five Ethiopia demographic and Health Surveys (2000, 2005, 2011, 2014 and 2016) showed that the nutrition indicators have not improved much over the past 16 years and some indicators have even shown a worsening trend(Ethiopian Public Health Institute (EPHI) and ICF, 2021).

In the region where the district is found the prevalence of wasting, underweight and stunting is very high; 10.3, 35.1 and 37%, respectively (CSA and ORC, 2016According to EDHS report Stunting, underweight, and wasting prevalence is higher among children in rural areas than those in urban areas. The proportions of children who are stunted and underweight decline with increasing mother's education and increasing household wealth. (CSA and ORC, 2016).

In areas where severe acute malnutrition is common inpatient management is difficulty due high cost for intervention and high risk of contamination when using F-75 and F-100.So outpatient management decreases the problem of contamination and decrease costs of intervention though its effectiveness should be assessed (FMOH ,2013 WHO ,2007; Chamois ;2009). So out patient management is preferred mode of treatment of uncomplicated severe acute malnutrition in age group of six months to five years.

In Ethiopia, malnutrition remains a serious health and welfare problem affecting the under-five children to whom it contributes significantly to mortality and morbidity. According to Ethiopia Demographic and Health Survey of 2016, nearly four in ten Ethiopian children under-five years of age (38 percent) are stunted (short for their age), 10 percent are wasted (thin for their height), and 26 percent are underweight (EDHS, 2016). Acute malnutrition, or wasting, exclusively is an attributable cause of 12.6% of the 6.9 million deaths among children under 5 years old(Fikrie, Alemayehu and Gebremedhin, 2019). Furthermore, especially in sub-Saharan and South-East Asian countries, it is responsible for nearly one million deaths each year by increasing susceptibility to death from severe infection(Fikrie, Alemayehu and Gebremedhin, 2019)

Analysis of Shashemene District annual report showed that prevalence severe acute Malnutrition among under five children during last four years (2015, 2016, 2017, and 2018) was 57%, 71%, 51% and 45.87% respectively.

Shashemene Woreda is characterized by its high number sever acute malnutrition who are admitted on OTP programs. A limited number of studies were only conducted in a retrospective cohort study design in the country and no studies were found in the study area. This study will thus provide an information on predictors of nutritional recovery time among children with severe acute malnutrition among children age 6-59 month who are managed

on OTP at Shashemene Rural district would help the health care provider to set a devotion. Moreover, this study could add to the literature by providing additional information about predictors of nutritional recovery time of sever acute mal nutrition children who are managed on OTP program in a specific locality.

Though Shashemene Woreda is one of Hotspot district by its high number of severe acute malnutrition in west Arsi zone there is limited information's on time to recovery and its predictors.

Even though sphere standards recommend shorter recovery times, most of the studies in Ethiopia showed that the median time to recovery was high and ranges from 14 days to 8.7 weeks. But, children, due to various factors, do not get cured on time. By understanding this problem, the FMOH of Ethiopia established the National Nutrition Program (NNP) to improve the nutrition service delivery in health facilities(Tefera, 2020)

Most of the studies were retrospective and also lack the most important variables such as the wealth and food security status of the families and institutional factors which could affect the recovery time of children with SAM. Therefore, this study was assessing recovery time and its predictors in outpatient treatment program prospectively, among children of age six months to five years in Shashemene Rural district, West Arsi Zone, South Ethiopia.

1.3. Significance of the Study

Determining recovery time and predictors among children with severe acute malnutrition is a prerequisite to develop appropriate recommendation to improve outpatient program. Therefore, the major significance of this study is to determine recovery time and predictors of the length of therapeutic feeding among children with severe acute malnutrition in Shashemene district.

The finding of the study will provide an important information's

- For health professionals who are currently working on the outpatient management program among malnourished under five children.
- For Health care and nutrition leaders of the study area and other ranges of similar programs.
- For Expertise and policy makers, to develop strategies and guidelines for scaling up the management guidelines for sever acute malnutrition in order to accelerate recovery time from SAM treatment in outpatient bases.

1.4. Objectives of the study

1.4.1. General Objectives

To determine the recovery time and its predictors among children age 6–59 months with SAM managed at outpatient therapeutic program.

1.4.2. Specific objectives

To assess the treatment out comes of children with severe acute malnutrition.

To determine the median recovery time of children from sever acute malnutrition.

To identify factors affecting recovery time from sever acute malnutrition.

2.1. Operational Definitions

Recovered: In this study recovery was measured by weight for height >/=-3 Z score and absence of bilateral edema.

Recovery time: number of days it takes from admission until a child is recovered from SAM.

censored; Children's who were not recovered until last follow up time recovery, loss to follow up, defaulted and died considered as censored.

Readmission: SAM cases that are declared cured or recovered but relapsed to be admitted (returned back for treatment).

Default: SAM cases that are against (care givers sign on behalf of their child to leave the treatment before the child is cured) or SAM cases that are lost with unknown status.

Death: is a patient who died while he/she is being treated in the program.

Predictors of length of Therapeutic feeding: total number of days that each child stays in the OTP until cured, and dividing this by the number of children cured for a specific month.

Food diversity score; Food diversity consumption score of the child was assessed using standard comprehensive questions (12 question), computed by SPSS and Average mean (6.7) was used as cut of point to categorize as poor and good.
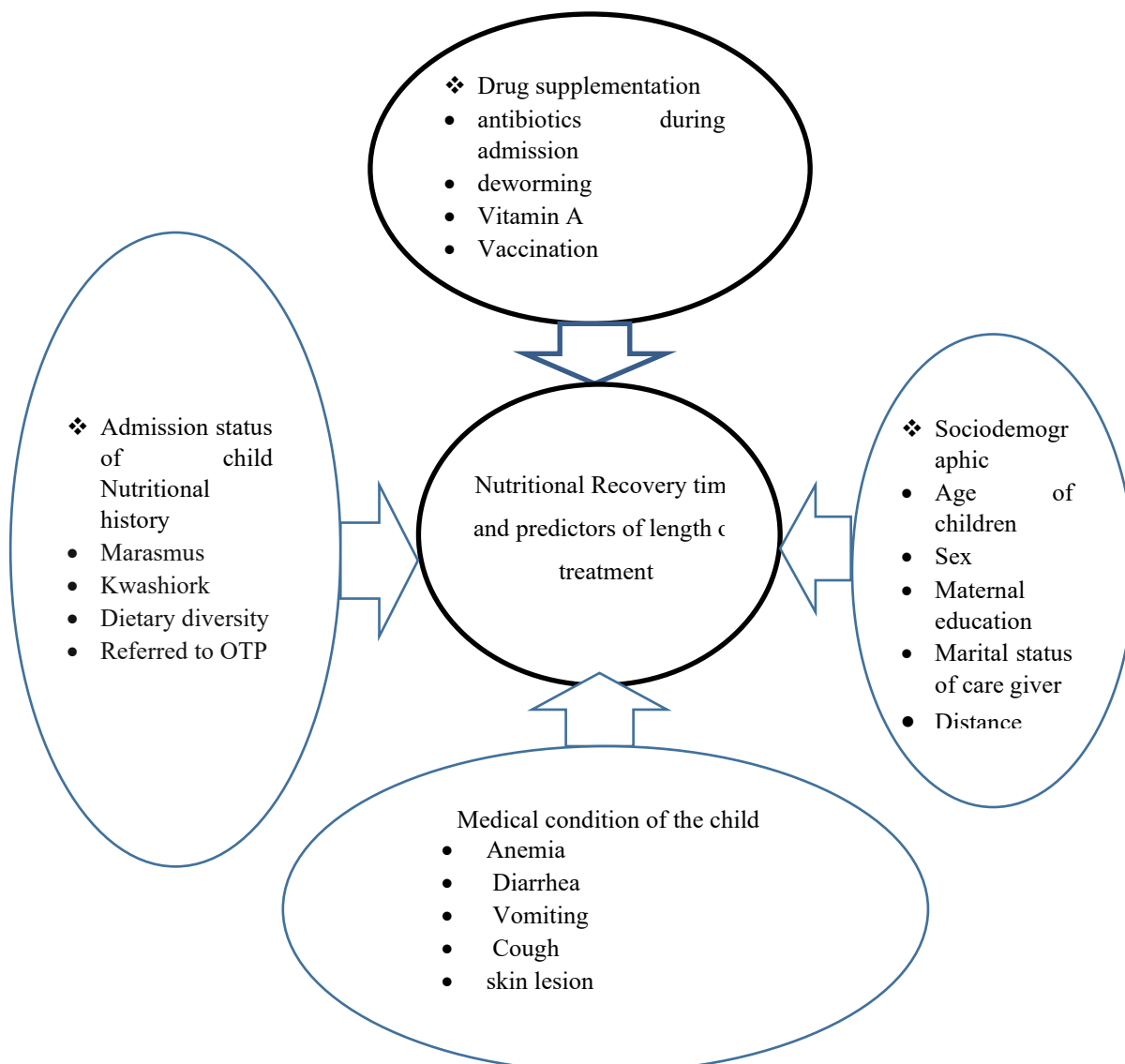
Figure 1.Conceptual framework adapted from different literature showing recovery time and predictors of Outpatient therapeutic program, Shashemene R. District.

3. Methods and Material

3.1. Study Area

The study will be conducted in Shashemene Woreda, West Arsi Zone, which is found in Oromia region of Ethiopia. The woreda is one of the 15 districts in West Arsi Administrative Zone of Oromia located 250 km from capital Addis Ababa, Ethiopia, according to projections based on 2011 central statistical authority(CSA) population census of Ethiopia and district Health office data, the total population for 2013 E.C estimated to 328,278(8% urban &92% rural) 13,131 pregnant women and 49,242 under-five years. The woreda has consists of 01 urban and 37 rural kebeles. Almost all inhabitant of the woreda use Afaan Oromo as first language. The health service facilities are 8 health centers. All Heath centers found in the district are providing outpatient therapeutic feeding program for children with uncomplicated severe acute malnutrition. In addition, all health center found in district provide stabilization center for complicated severe acute malnutrition management.

3.2. Source population

The source population comprises all children age between 6-59 month with SAM, who were admitted for SAM management and treated in outpatient program in Shashemene Rural district.

3.3. Study population and time

The study populations are all children 6-59 months of age who are diagnosed with uncomplicated SAM and enrolled in to the OTP program are eligible for the study. According to the national protocol, uncomplicated SAM

cases who are diagnosed as SAM with good appetite and no major medical complication or having weight for height measurement less than <-3 Z-score and or first or second degree bilateral pitting edema.

Data was collected from December 1,2021to February 28th of 2022 and treated for twelve consecutive weeks at 5 health center. All sever acute malnutrition cases were followed up to February,28, 2022. The cases were followed through weekly visits. Children's were followed until recovery, loss to follow up, defaulted and died but the maximum follow up period is 12 weeks.

3.4. Inclusion and Exclusion criteria
Inclusion criteria: - severe acute malnutrition who are attending OTP at selected health facilities of Shashemene rural district.
Exclusion criteria: - children with uncomplicated severe acute malnutrition who are attending on the OTP having any form of congenital abnormality. A patient who had diagnosed and started treatment at other hospital and referred to Shashemene rural district health facilities was also excluded.

3.5. Study design
Institution based prospective cohort study design based on Admitted SAM children aged 6–59 months, with SAM (WHZ score < -3SD) who are linked on OTP program.

3.6. Sample size determination
All children of age 6–59 months with SAM that have been admitted and treated at outpatient therapeutic feeding program(OTP) of the Health center and HPs from December,1/ 2022 to 28th of February,2022 are eligible for the study. The sample size is calculated by using Stat calc. Version 7.2.4.0 by taking Assumptions: that of Crude hazard ratio of 1.71, probability of outcome in unexposed group 40%, probability of recovery 52%, p-value 0.05, and power of 80% which finally results in 254 based on the study conducted in East Amhara, Northeast Ethiopia(Tefera C.et al., 2020). By adding a 10% defaulter rate, the final sample size was calculated as 279.

3.7. Data collection procedures
A structured questionnaire is developed in English and it translated to the local language Afan Oromo Structured interviewer administered questionnaire is used to collect information from each study participant. Mothers or caregivers of the selected children can be interviewed. Anthropometric measurements and physical examination are used to collect data from study participants. Body weight will be measured using a 25 kg hanging spring scale to the nearest 0.1 kg for children below the age of 3 years. For children less than 85 cm, the measuring board is placed on the ground and read to the nearest 0.1 cm in the horizontal position.

On the other hand, for children more than 85 cm, the measuring board is fixed where the ground is level by standing position and read to the nearest 0.1 cm. Similarly, MUAC was measured on the left upper arm of a child and its value is recorded to the nearest 1 mm.

3.8. Data Collection method
Measurements like medical complications and presence of bilateral pitting edema are recorded on admission and at follow-up on a standard individual treatment card. Appetite test is also conducted every week each visit for child enrolled in the program. A child is said to pass the appetite test when she or he is able to consume the amount of RUTF recommended for her or his body weight. Children who failed the appetite test in any visit are referred to inpatient care. At admission, the data collectors assessed the degree of pitting edema, hydration, dysentery, diarrhea, anemia, and other signs of infections. Each participant on OTP is visiting to their closest site weekly to receive food and a medical assessment. During every visit, the child will be examined and given a weekly supply.

3.9. Data Quality Management
Over all the whole data extraction was supervised by one Health officer who had training on management severe of acute malnutrition on the daily bases. Two days training for data collectors and supervisors was carried out to have a clear understanding about the objective of the study and data collection procedure. The pre testing of structured format was conducted on 5% sample at Shashemene district prior to data collection process and structured format checked for completeness daily by immediate supervisors and principal investigators. After checking for consistency and completeness, the supervisors submitted the filled questionnaire to the principal investigator who was also recheck to maintain the quality of data. Data were cleaned & entered by the principal investigator and strict daily field supervision and spot checking was carried out.

3.10. Study Variables
Dependent variable of the study is: Time to recovery.
Independent variables considered are: demographics variables such as age and sex of the child, distance of

residence from Health facility, status of admission, types of malnutrition, marital status of caretaker, paternal educational status, and occupation; socioeconomic and household food security, routine medications, and complications: amoxicillin, vitamin A, folic acid, Albendazole/Mebendazole, pneumonia, diarrhea, distance from the OTP sites, supposed severity of SAM by the caregivers, type of malnutrition (Marasmus or Kwashiorkor), dietary diversity, clinical symptoms (diarrhea, cough and fever), treatments, supplement.

4. Results

Socio-demographic characteristics of children with Care takers admitted at outpatient therapeutic feeding program in Shashemene rural district

A total of 279 sever acute malnutrition children were admitted in Shashemene rural district health facilities since December 01/2021 to28th of February 2022 with response rate of 100%. The mean age of children were 22.3 months with SD of 14.3. The minimum and maximum stay period is 3 and 8 weeks respectively. The median survival time to recovery at the study area was 6.0 weeks with5.0 to 7 weeks. Among 279 study subjects almost above half 151(54.1%) them were males and majorities 184(65.9%) were fin the age group of<3 years. Majorities of study subjects 223(79.9%) were rural residencies. Concerning marital status of care takers majorities were 194(69.3%) married. Of 279 care takers majorities educational status were primary followed by not educated (formal education) 82 (29.3%) and 79(28.2) respectively (table 1).

Table 1; Socio-demographic characteristics of children with Care takers admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

Variables	Category	Frequency	proportion
Sex	Male	151	54.1
	Female	128	45.9
Age	<3 years	184	65.9
	>/=3 years	95	34.1
Residence of child	Urban	223	79.9
	Rural	56	20.1
marital status of care taker	lives alone**	85	30.4
	Married	194	69.3
Religion	Muslim	158	56.4
	Orthodox	51	18.2
	protestant	70	25
educational status of care taker	No formal Education	79	28.2
	primary	82	29.3
	secondary	80	28.6
	college and above	38	13.6
Awaking distance from Health facility	</=30 min	231	82.8
	>30 min	48	17.2

*** Single, divorced, Widowed*

5.1. Admission status, disease and treatment given for during admission at outpatient therapeutic feeding program in Shashemene rural district.

Of 279 sever acute malnutrition children's admitted on OTP program majorities 228(81.7%) were admitted at health posts and majorities 237(84.9%) were admitted as new cases. Among a total of 279 admitted children majorities cases 184(65.9%) were marasmus followed by kuwasakor 85(30.5%) during admission (table 2).

Table 2; Admission status, disease and treatment given for during admission at outpatient therapeutic feeding program in Shashemene rural district 2022

Place of treatment	Health Post	228	81.7
	Health Centers	51	18.3
	self	50	17.9
	community volunteer	203	72.8
	chad	9	3.2
The child referred to OTP	hew during Home Visit	17	6.1
	New	237	84.9
	Defaulter	14	5
Admission status	readmission	28	10
	marasmus	184	65.9
	kuwasakor	85	30.5
Diagnosis at admission	maramickwas	10	3.6
	yes	235	84.2
Amoxicillin given	no	44	15.8
	yes	7	2.5
Antimalarial drug given	no	272	97.5
	yes	130	46.6
Vitamin A was given	no	149	53.4
	yes	47	16.8
Mebendazole was given	no	232	83.2
	yes	176	63.1
Did the child have diarrhea	no	103	36.9
	yes	134	48
Did the child have vomiting	no	145	52
	yes	112	40.1
Did the child have cough	no	167	59.9
	yes	3	1.1
did the child have bloody on stool	no	276	98.9
	yes	15	5.4
did the child have anemia	no	264	94.6
	yes	198	71
did the child have skin	no	81	29
	Community volunteers	50	17.9
	Self-referred	203	72.8
254(child referred by	HEWs during home visit	26	9.3

Treatment outcome of children admitted at outpatient therapeutic feeding program
Among 279 children admitted to OTP program;254(91.0%), 10(3.6%), 9(3.2%), 3(1.1%) and 3(1.1%) were recovered, defaulter, relapse, died and transferred out respectively.
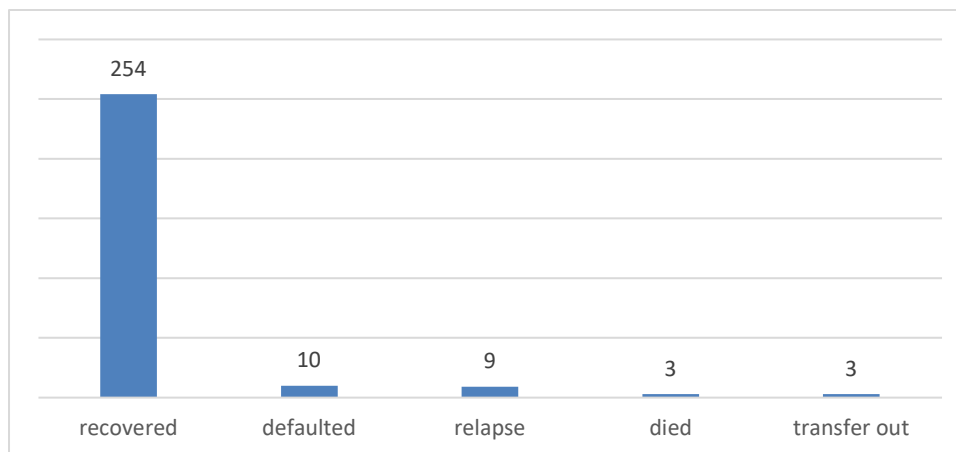
Figure 2; Treatment outcome of children admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

Food diversity score consumed by the child within one week's admitted at outpatient therapeutic feeding program in Shashemene rural district

Of 279 study subjects' majorities children; 178(63.8%), 170(60.9%) and168(60.2%) of them consume Do you give any porridge or gruel from food groups like corns, food made from oats, maize, barley, wheat, sorghum and food made from teff, like injera, kita, or porridge respectively in a week. About; 177(63.4%), 164(58.8%) and 155(54.5%) of them consume, pumpkin, carrots, squash, or sweet potatoes that are yellow, dark green, leafy vegetables like kale, spinach, or amaranth and chicken, duck, or other birds? and any eggs respectively. The overall of good Food diversity consumption score at the study area by children were 174(62.4%) (Table 3).

Table 3; Food diversity score consumed by the child within one week's admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

| Variables	Category	Frequency	Proportion
Do you give any porridge or gruel from food groups like corns	yes	178	63.8
	no	101	36.2
any other food made from oats, maize, barley, wheat, sorghum,	yes	170	60.9
	no	109	39.1
any food made from teff, like injera, kita, or porridge	yes	168	60.2
	no	111	39.8
any food made from teff, like injera, kita, or porridge	yes	178	63.8
	no	101	36.2
any pumpkin, carrots, squash, or sweet potatoes that are yellow	yes	177	63.4
	no	102	36.6
any dark green, leafy vegetables like kale, spinach, or amaranth	yes	177	63.4
	no	102	36.6
Any chicken, duck, or other birds? and any eggs	yes	164	58.8
	no	115	41.2
Do you have the access to any sea food such as fresh or dried fi	yes	152	54.5
	no	126	45.2
Did you given any foods made from *plant protein like beans, peas	yes	166	59.5
	no	113	40.5
Do you have the access to any food made from nuts or seeds such a	yes	152	54.5
	no	127	45.5
Did you give any foods made with oil, fat, or butter in the last	yes	178	63.8
	no	101	36.2
The overall Food diversity consumption score	poor	105	37.6
	good	174	62.4
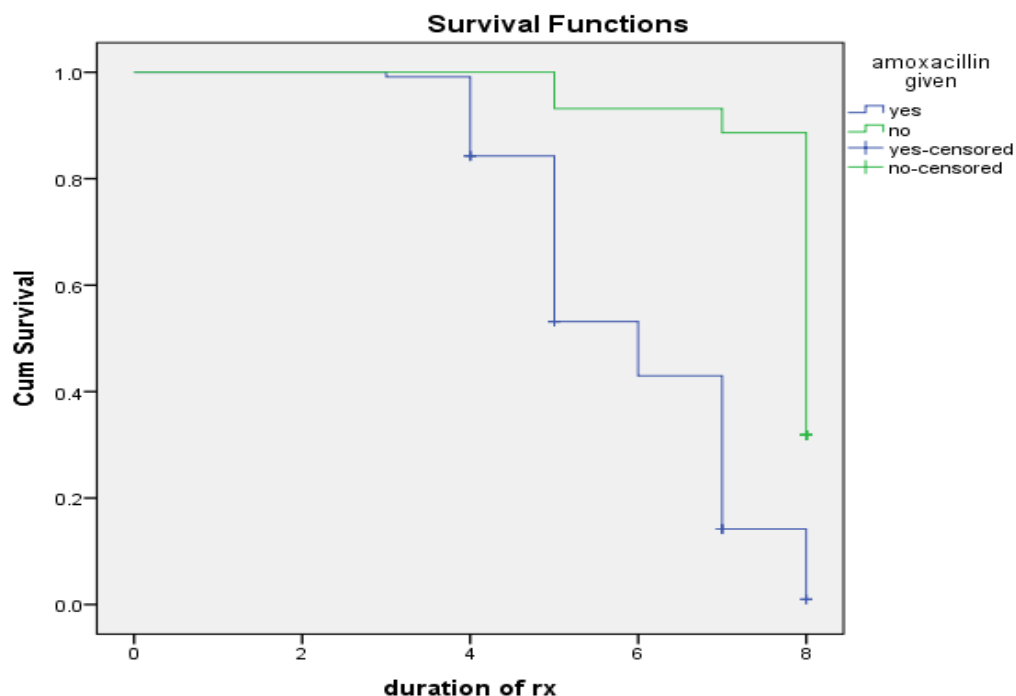
Figure 3; Survival function of children among *Amoxicillin treatment* received non received during admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

Children's with no Amoxicillin treatment during admission were longer survived on outpatient therapeutic unit treatment as compared to received treatment with long rank test of P-value <0.01 (figure 1).
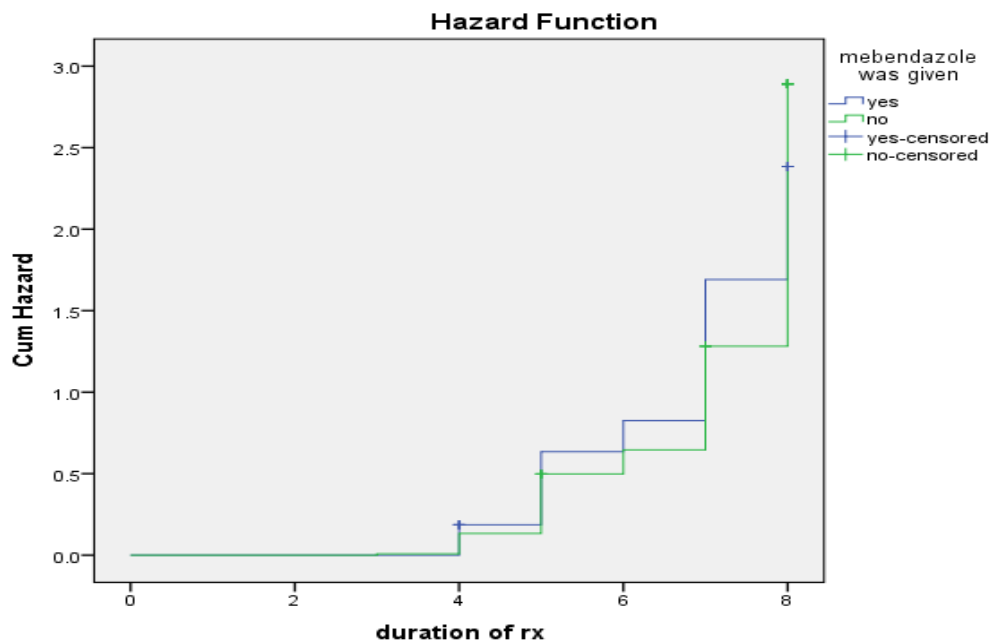

Figure 4; the hazard function of children among Albendazole received and non-received non received during admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

The hazard of recovery rate was higher among Children's received albendazole during addition as compared to non-received with long rank test of P-value=0.38 (figure 1).

5.2. Predictors of recovery time in bi-variable analysis among admitted at outpatient therapeutic feeding program

In bi-variable analysis co-variable like; marital status of care taker, edema present at admission, amoxicillin given

during admission, vitamin a was given, having; vomiting, cough, anemia, Skin lesion during admission, by whom Child referred to treatment site, Food diversity score during follow up time were nominated for multi-variable analysis (table 4).

Table 4; predictors of recovery time in bi-variable analysis among admitted at outpatient therapeutic feeding program in Shashemene rural district 2022

Variables	Category	Status Event (%)	Censored (%)	CHR(95%;CI)	P-value
Sex	Male	137(53.9)	14(56.0)	1.01(0.75,1.23)	0.74
	Female	117(46.1)	11(44.0)	1	
Age	</3 years	169(66.5)	15(60.0)	1.03(0.79,1.33)	0.84
	>/=3 years	85(33.5)	10(40.0)	1	
marital status of care taker	married	74(29.1)	11(44.0)	0.80(0.61,1.05)	0.1
	lives alone	180(70.9)	14(56.0)	1	
educational status of care taker	illiterate	71(28.0)	5(20.0)	1.04(0.75,1.37)	0.93
	Primary	73(28.7)	10(40.0)	0.93(0.69,1.25)	0.62
	Secondary and above	110(43.3)	10(40.0)	1	
Residency	Urban	206(81.1)	16(64.0)	1.03(0.75,1.41)	0.87
	Rural	48(18.9)	9(36.0)	1	
distance from Health facility	</=30 min	75(29.5)	10(40.0)		
	>30 min	179(7.5)	15(60.0)	1.18(0.85,1.65)	0.33
place of treatment	HP	206(81.1)	22	1	
	HC	48(18.9)	3	1.12(0.82,1.54)	0.45
diagnosis at admission	marasimic	170(6.9)	8(32.0)		
	kwasakor	72(28.3)	10(40.0)		
	maramickwash	12(4.7)	7(28.0)		
edema present at admission	yes	75(29.5)	16(64.0)	1.93(1.39,2.67)	<0.01
	no	179(70.5)	9(36.0)	1	
amoxicillin given during admission	yes	224(88.2)	11(44.0)	26.16(5.50,124.36)	<0.01
	No	30(11.8)	14(56.0)	1	
vitamin a was given	yes	124(48.8)	6(24.0)	1.37(1.06,1.78)	0.02
	No	130(51.2)	19(76.0)	1	
mebendazole was given	yes	40(15.7)	7(28.0)	0.95(0.78,1.33)	0.76
	no	214(84.3)	18(72.0)	1	
did the child have diarrhea	yes	160(63.0)	16(64.0)	1	
	no	94(37.0)	9(36.0)	1.01(0.77,1.28)	0.97
did the child have vomiting	yes	126(49.6)	8(32.0)	0.77(0.55,0.94)	0.02
	no	128(50.4)	17(68.0)	1	
did the child have cough	yes	103(40.6)	9(35.9)	0.90(0.70, 1.16)	0.42
	no	151(59.4)	16(64.1)		
did the child have anemia	yes	9(3.5)	6(23.8)	1	
	no	245(96.5)	19(76.2)	1.77(1.21.3.44)	0.03
did the child have skin lesion	yes	182(71.7)	16(64.0)	0.90(0.70,0.86)	0.04
	no	72(28.3)	9(36.0)	1	
Child referred by	Community volunteers	44(17.3)	6(23.8)	1.01(0.62,1.86)	0.79
	Self-referred	192(75.6)	11(44.2)	1.64(1.02,2.67)	0.04
	HEWs during home visit	18(7.1)	8(32.0)	1	
admission status recoded1	New	219(86.2)	18(72.3)	1.03(0.72,1.47)	0.89
	Re admission due to relapse/defaulter	35(13.8)	27.7)	1	
FDS	poor	20(80.0)	119(46.9)	1	
	good	5(20.0)	135(53.1)	1.22(1.25,2.56)	0.01

5.3. The overall predictors of recovery time among admitted at outpatient therapeutic feeding program

After controlling of possible confounder was made in multi-variable analysis variables like; the rate of recovery time was reduced by 29% among Children's having edema during admission time (AHR=0.71; 95%: CI ((0.51, 1.01)). Children who were received amoxicillin during admission were 5.85(AHR=5.85; 95%: CI (3.59, 9.52)) at higher risk of recovered earlier as compared to no received ones. The presence of vomiting during admission reduced the risk of early recovery time by 62% (AHR=0.38: 95%: CI (0.28, 0.50)). Presence of anemia during admission reduced the risk of early recovery time by (AHR=0.76; 95%: CI (0.45, 1.79). Children who got diversified foods during follow up time were 1.51(AHR=1.51; 95%: CI (1.11, 1.45)) times at higher risk for early recovery than the rate of their counter parts.

Table 5; the overall predictors of recovery time among admitted at outpatient therapeutic feeding program in shashemene rural district 2022

Variables	Category	Status Event (%)	Censored (%)	CHR(95%;CI)	P-value	AHR(95%;CI)	P-value
marital status of care taker	married	74(29.1)	11(44.0)	0.80(0.61,1.05)	0.1	0.96(0.73,1.27)	0.8
	lives alone	180(70.9)	14(56.0)	1		1	
edema present at admission	yes	75(29.5)	16(64.0)	0.51(0.39,0.68)	<0.01	0.71(0.51,1.01)	<0.01
	no	179(70.5)	9(36.0)	1		1	
amoxicillin given during admission	yes	224(88.2)	11(44.0)	3.52(2.37,5.22)	<0.01	5.85(3.59,9.52)	<0.01
	No	30(11.8)	14(56.0)	1		1	
child have vomiting	yes	126(49.6)	8(32.0)	0.88(0.59,0.94)	0.02	0.38(0.28,0.50)	<0.01
	no	128(50.4)	17(68.0)	1		1	
did the child have anemia	yes	9(3.5)	6(23.8)	0.62(0.32,1.20)	0.15	0.76(0.45,1.79)	0.76
	no	245(96.5)	19(76.2)	1		1	
did the child have skin lesion	yes	182(71.7)	16(64.0)	0.90(0.70,0.86)	0.04	0.70(0.51,0.91)	0.01
	no	72(28.3)	9(36.0)	1		1	
Child referred by	Community volunteers	44(17.3)	6(23.8)	1.01(0.62,1.86)	0.79	1.14(0.65,2.01)	0.64
	Self-referred	192(75.6)	11(44.2)	1.64(1.02,2.67)	0.04	1.35(0.83,2.21)	0.23
	HEWs during home visit	18(7.1)	8(32.0)	1		1	
FDS during follow up	poor	20(80.0)	119(46.9)	1		1	
	good	5(20.0)	135(53.1)	1.22(1.25,2.56)	0.01	1.51(1.11,1.45)	0.04

6. Discussion

The median survival time to recovery at the study area was 6.0 weeks with5.0 to 7 weeks. This result was low as compared with study done in North Gondar zone, Northwest Ethiopia, in North Shewa Zone of Oromia Region and in Dire Dawa, Eastern Ethiopia:the median time to recovery was 38.5 ± IQR of 14 days and 42 + IQR of 14 days respectively(Mamo *et al.*, 2019; Asebe and Tadesse, 2021). It was also low as compared to Study done in in Dire Dawa, Eastern Ethiopia; the median recovery time was 8.7 weeks (IQR: 5.0–14 weeks)(Atnafe, Roba and Dingeta, 2019). But this figure was high as compared to Study done at southern Ethiopia; Median nutritional recovery time was 22 and 29 days for edematous malnourished and severely wasted children respectively(Gebremichael, 2015). The time to recovery at the study area was also high as study done in Jimma South west Ethiopia Median time of recovery for our cohort of SAM children's was 19 days (95% CI: 17.95–20.05)(Tadesse, 2020).The difference showed because of giving a monthly supply of therapeutic food in an area when children enroll on OTP admission and appetite test was not checked and inappropriate quantity or inadequate to their weight of RUTF provided to them. This leads to prolonged duration of time to recover from SAM.In this study; the rate of recovery time was reduced by 29% among Children's having edema during admission time (AHR=0.71; 95%: CI ((0.51, 1.01)). Study done in therapeutic feeding centers, Southern Ethiopia indicates that; did not lose edema within four days of inpatient treatment (AHR = 2.3, 95 % CI: 1.1–4.8)(Gebremichael, 2015). The implication for this could be; the probability of surviving gets slimmer with inpatient complications and staying longer in stabilization centers.Children who were received amoxicillin during admission were 5.85(AHR=5.85; 95%: CI (3.59, 9.52)) at higher risk of recovered earlier as compared to no received ones. This finding is consistent with Study done in Southern Ethiopia, which indicates that; provision of special medication

antibiotic and blood at admission were found to be significant predictors of time-to recovery from SAM(Gebremichael, 2015). The finding from Northwest Ethiopia implies that; children taken amoxicillin were at higher rate of recovery time. (AHR = 2.304) with 95% CI (1.68–3.161). study done in Jimma South west Ethiopia; children's who were used amoxicillin (AHR=1.54, 95% CI: 0.008–2.34)(Tadesse, 2020). This can be explained by the following reasons; almost all children with SAM experience bacterial overgrowth in small bowl, this enteric bacterium frequently the source of systemic infection by translocation across the bowel wall. This results in malabsorption of nutrients, diarrhea and poor appetite. So, even if they do not have clinical signs of infection, they have to treat blindly(FMOH, 2007). Using Amoxicillin facilitates the recovery progress of children from SAM in OTP by suppressing bacterial growth in the small bowel.The presence of vomiting during admission reduced the risk of early recovery time by 62% (AHR=0.38: 95%: CI (0.28, 0.50)). Similarly, the findings from rural Bangladesh suggest that diarrhea and vomiting complicate and result in unfavorable nutritional consequences. This could be vomiting results in malabsorption of nutrients, poor appetite which can directly affects recovery rate.Presence of anemia during admission reduced the risk of early recovery time by (AHR=0.76; 95%: CI (0.45, 1.79). Study done at in Bahir Dar city, Northwest Ethiopia supports this finding having anemia at admission were significant predictors of recovery time(Asres T., et al, 2018). This finding is also in line with study done at Pawi General Hospital, Northwest Ethiopia; the high chance of recovery was found among children who had no anemia (AHR: 1.66 (95% CI: 1.23, 2.23))(Wondim, etal, 2020). Children who got diversified foods during follow up time were 1.51(AHR=1.51; 95%: CI (1.11, 1.45)) times at higher risk for early recovery than the rate of their counter parts. This could be because of child who uses good diversified foods were more built their body and not vulnerable easily for disease which results for high recovery rate as compared with a child using poor diversified foods. This can be explained because, even though RUTF provided as treatment for affected children, in food insecure households the actual amount of RUTF consumed by SAM children can be less than the amount provided due to sharing with other children in the household or use of RUTF as a commodity for meeting the household economies and food need, which endangers the child's recovery.

7. Conclusion

The median survival time to recovery at the study area moderately consistent as compared to the national wide figure. Multi-variable analysis variables revealed that; Children's having edema, presence of vomiting and anemia during admission were reduced the risk of early recovery time. While; Children who were received amoxicillin and Children who got diversified foods during follow up time were at higher risk for early recovery than the rate of their counter parts.

8. Recommendation

Health extension workers working at Shashemene district health department should have to early diagnose and enrolled Sever acute malnutrition children on OTP program before developing complication like Edema, Anemia and vomiting. Health department should give an emphasis for Children developing complications. The health care workers in Shashemene districts has to provide an antibiotic for admitted children with severe acute mal nutrition. Behavioral change and communication strategy should have to be designed for food diversification at national and regional level.

8.1. Strength

This study has its own strength and limitations. Since the study design was prospective follow up study and used as a primary data and temporality issue was clearly ascertained. Therefore, cause and effect relationship is Possible to establish.

8.2 Limitation; variables like Dietary diversity may under estimated or overestimated due to recall bias.

REFERENCES

Adimasu, M. *et al.* (2020) 'Recovery time from severe acute malnutrition and associated factors among under-5 children in Yekatit 12 Hospital, Addis Ababa, Ethiopia: a retrospective cohort study', *Epidemiology and Health*, 42, pp. 1–11. doi: 10.4178/epih.e2020003.

Asebe, D. S. and Tadesse, A. W. (2021) 'Time to Recovery and Determinants of Uncomplicated Severe Acute Malnutrition Among 6 – 59 Months Children From the Outpatient Therapeutic Feeding Program in North Shewa Zone of Oromia Region , Ethiopia . A Prospective Follow-Up'.

Asres, D. T., Prasad, R. P. C. J. and Ayele, T. A. (2018) 'Recovery time and associated factors of severe acute malnutrition among children in Bahir Dar city, Northwest Ethiopia: An institution based retrospective cohort study', *BMC Nutrition*, 4(1), pp. 1–8. doi: 10.1186/s40795-018-0224-0.

Atnafe, B., Roba, K. T. and Dingeta, T. (2019) 'Time of recovery and associated factors of children with severe acute malnutrition treated at outpatient therapeutic feeding program in Dire Dawa, Eastern Ethiopia', *PLoS ONE*, 14(6), pp. 1–16. doi: 10.1371/journal.pone.0217344.

Bantamen, G., Belaynew, W. and Dube, J. (2014) 'Assessment of Factors Associated with Malnutrition among Under Five Years Age Children at Machakel Woreda , Northwest Ethiopia : A Case Control Study Journal of Nutrition & Food Sciences', 4(1), pp. 1–7. doi: 10.4172/2155-9600.1000256.

Chinyoka, K. (2014) 'Impact of Poor Nutrition on the Academic Performance of Grade Seven learners: A Case of Zimbabwe', *International Journal of Learning and Development*, 4(3), p. 73. doi: 10.5296/ijld.v4i3.6169.

Desyibelew, H. D., Fekadu, A. and Woldie, H. (2017) 'Recovery rate and associated factors of children age 6 to 59 months admitted with severe acute malnutrition at inpatient unit of Bahir Dar Felege Hiwot Referral hospital therapeutic feeding unite, northwest Ethiopia', *PLoS ONE*, 12(2), pp. 1–12. doi: 10.1371/journal.pone.0171020.

Ethiopian Public Health Institute (EPHI) and ICF (2021) *Ethiopia Mini Demographic and Health Survey 2019: Final Report*. Available at: https://dhsprogram.com/pubs/pdf/FR363/FR363.pdf.

Fikrie, A., Alemayehu, A. and Gebremedhin, S. (2019) 'Treatment outcomes and factors affecting time-to-recovery from severe acute malnutrition in 6-59 months old children admitted to a stabilization center in Southern Ethiopia: A retrospective cohort study', *Italian Journal of Pediatrics*, 45(1), pp. 1–9. doi: 10.1186/s13052-019-0642-x.

FMOH (2007) 'E T H I O P I a – F E D E R a L M I N I S T R Y O F H E a L T H', *Protocol for the Management of Severe Acute Malnutrition Ethiopia*, pp. 1–122.

Gebremedhin, K. *et al.* (2020) 'Predictors of time-To-recovery from severe acute malnutrition treated in an outpatient treatment program in health posts of Arba Minch Zuria Woreda, Gamo Zone, Southern Ethiopia: A retrospective cohort study', *PLoS ONE*, 15(6 June). doi: 10.1371/journal.pone.0234793.

Gebremichael, D. Y. (2015) 'Predictors of nutritional recovery time and survival status among children with severe acute malnutrition who have been managed in therapeutic feeding centers , Southern Ethiopia : retrospective cohort study', *BMC Public Health*, pp. 1–11. doi: 10.1186/s12889-015-2593-5.

Getahun, Z. *et al.* (2001) 'The Ethiopian Journal of Health Development', 15(2), pp. 55–74.

Guidelines, N., Malnutrition, M. A. and Years, F. (2020) 'Participant ' s Manual', (May).

Kabthymer, R. H., Gizaw, G. and Belachew, T. (2020) 'Time to cure and predictors of recovery among children aged 6-59 months with severe acute malnutrition admitted in Jimma university medical center, southwest Ethiopia: A retrospective cohort study', *Clinical Epidemiology*, 12, pp. 1149–1159. doi: 10.2147/CLEP.S265107.

Mamo, W. N. *et al.* (2019) 'Time to recovery and determinants of severe acute malnutrition among 6-59 months children treated at outpatient therapeutic programme in North Gondar zone, Northwest Ethiopia: A prospective follow up study', *Italian Journal of Pediatrics*, 45(1), pp. 1–8. doi: 10.1186/s13052-019-0732-9.

Pal, A. *et al.* (2017) 'Prevalence of undernutrition and associated factors: A cross-sectional study among rural adolescents in West Bengal, India', *International Journal of Pediatrics and Adolescent Medicine*, 4(1), pp. 9–18. doi: 10.1016/j.ijpam.2016.08.009.

Republic, F. D. (2015) 'National Nutrition Programme Republic of Ethiopia', (June 2013).

Rytter, M. J. H. *et al.* (2017) 'Risk factors for death in children during inpatient treatment of severe acute malnutrition: A prospective cohort study', *American Journal of Clinical Nutrition*, 105(2), pp. 494–502. doi: 10.3945/ajcn.116.140822.

Simachew, Y., Zerfu, T. and Alemu, W. (2020a) '<p>Treatment Outcomes and Predictors of Recovery from Severe Acute Malnutrition Among Children Aged 6–59 Months Attending an Outpatient Therapeutic Program in Wenago District, Southern Ethiopia</p>', *Nutrition and Dietary Supplements*, Volume 12, pp. 189–200. doi: 10.2147/nds.s245070.

Simachew, Y., Zerfu, T. and Alemu, W. (2020b) '<p>Treatment Outcomes and Predictors of Recovery from Severe Acute Malnutrition Among Children Aged 6–59 Months Attending an Outpatient Therapeutic Program in Wenago District, Southern Ethiopia</p>', *Nutrition and Dietary Supplements*, Volume 12, pp. 189–200. doi: 10.2147/nds.s245070.

Tadesse, S. E. (2020) 'Time to Cure and Predictors of Recovery Among Children Aged 6 – 59 Months with Severe Acute Malnutrition Admitted in Jimma University Medical Center , Southwest Ethiopia : A Retrospective Cohort Study', pp. 1149–1159.

Tankoi, O. *et al.* (2016) 'International Journal of Public Health & Safety Determinants of Malnutrition among Children Aged 6-59 Months in', 1(3), pp. 1–18.

Tefera (2020) 'Time to Recovery and Its Predictors among Children 6-59 Months Admitted with Severe Acute

Malnutrition to East Amhara Hospitals, Northeast Ethiopia: A Multicenter Prospective Cohort Study', *Journal of Nutrition and Metabolism*, 2020. doi: 10.1155/2020/5096201.

Tefera, T. K. *et al.* (2020) 'Time to Recovery and Its Predictors among Children 6-59 Months Admitted with Severe Acute Malnutrition to East Amhara Hospitals, Northeast Ethiopia: A Multicenter Prospective Cohort Study', *Journal of Nutrition and Metabolism*, 2020. doi: 10.1155/2020/5096201.

Teshome, G., Bosha, T. and Gebremedhin, S. (2019) 'Time-to-recovery from severe acute malnutrition in children 6-59 months of age enrolled in the outpatient treatment program in Shebedino, Southern Ethiopia: A prospective cohort study', *BMC Pediatrics*, 19(1), pp. 1–10. doi: 10.1186/s12887-019-1407-9.

UNICEF (2013) 'Evaluation of Community Management of Acute Malnutrition (Cmam) Executive Summary', (May), p. 9.

UNICEF (2020) 'Treatment of Wasting Using Simplified Approaches: A Rapid Evidence Review', pp. 1–32.

Wondie, S. G. *et al.* (2022) 'Time to recovery and its predictors among children aged 6–59 months with severe acute malnutrition admitted to outpatient therapeutic program in Southwest Ethiopia: retrospective cohort study', *BMC Pediatrics*, 22(1), pp. 1–13. doi: 10.1186/s12887-022-03205-5.

Wondim, A., Tigabu, B. and Kelkay, M. M. (2020) 'Time to Recovery from Severe Acute Malnutrition and Its Predictors among Admitted Children Aged 6-59 Months at the Therapeutic Feeding Center of Pawi General Hospital, Northwest Ethiopia: A Retrospective Follow-Up Study', *International Journal of Pediatrics (United Kingdom)*, 2020. doi: 10.1155/2020/8406597.