Predictors for a Cure Rate of Severe Acute Malnutrition 6-59 Month Children in Stabilizing Center at Pawe General Hospital, Northwest Ethiopia: Retrospective Cohort Study

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Abstract: Malnutrition (over and undernutrition) is a major public health problem across the globe, especially undernutrition is responsible for one-third of the death of children in underprivileged populations. Each year more than 25 to 35 million under-five children have suffered from Severe Acute Malnutrition (SAM). The sub-Saharan African countries account for the lion's share of this case fatality rate. The case in Ethiopia is not different from other countries. This study's main aim is to assess predictors for the cure rate of Severe Acute Malnutrition in 6-59 month Children in stabilizing center at Pawe General Hospital, Northwest Ethiopia. A retrospective cohort study.

Methods: Hospital-based retrospective cohort study was employed among 454 admitted under-five SAM children from Januarys1st 2015-to December 30, 2019. Data were cleaned, coded, and entered into Epi-Data 3.1; then exported to STATA/SE- 14/R for analysis. Survival analysis was used to check each variable's proportional hazard assumption and no variable Schoenfield test <0.05. Variable with AHR at 95 % CI at P-value less than 0.05 considered as significant. Final model adequacy was checked by Nelson Alana and Cox Snell residual plot test.

Result: Totally 454 (90.4%) individual data were included for final analysis; Sixty-five percent of 65.4% (95%CI: 50.1-69.2) admitted children declared as cured, 16.52 % of them defaulted and 11.5% of children reported as dead. The median age and median cure time of SAM children were found at 2.2 years and 13 days (±7), respectively. Children diagnosed marasmus (AHR=1.56: 95% CI 1.08--2.2, p<0.018), with No nasal-gastric intubation (NGT) during admission (AHR= 1.31: 95%CI (1.04 --1.67, P<0.029) and taking F-100 milk (AHR=5.42 95% CI (2.92--9.85, p<0.001) were associated with treatment cure rate.

The conclusions: The overall treatment cure rate of this study was remaining low at 65.4% compared to the sphere standard sets reference (i.e., >75-77.9 %). Concerning associated factors addressing F-100 milk, making SAM under-five children with no NGT and increased treatment cure rate was independently associated with treatment cure rate.

Keywords: Treatment Cure rate, severe acute malnutrition, Under-five children, Pawe General Hospital.

INTRODUCTION

Childhood malnutrition is still a major global health problem, contributing to morbidity, mortality, and risk for disability [1]. It refers to a combination of nutritional disorders that include underweight (mixed), wasting (acute), stunting (chronic), and micronutrient deficiency [2]. Acute malnutrition is due to a recent failure to receive adequate nutrition and may be affected by repeated episodes of diarrhea and other acute illnesses [3]. Whereas chronic malnutrition might be adaptive physiologic and metabolic failure gaining of sufficient nutrients [2]. SAM is characterized by wasting and muscle is lost because of the body's process of mobilizing energy and nutrients. Children have clinical a triangular face, extended abdomen muscular hypotonic, ribs are visible and anal or rectal prolapse will be visible [4]. Kwashiorkor is expressed as changes to loss of muscle mass, enlarged tummy long-lasting characterized in oedema children [4,5]. Under nutrition is associated with >50 % of all childhood mortality in developing countries [5]. In fact, more than 150.8 million were stunted & 3.6 million under-five children death were linked to under nutrition [1,5,6]. The Sub-Saharan Africa countries account for the lion's share of these incidences of fatal mortality rate of Sever acute malnutrition. The underline reason are low coverage and quality of care for moderate acute malnutrition treatment at early stage [7] associated with poor adherence of health care providers for WHO SAM therapeutic guideline during inpatient treatment [1]. Medical complication such us (impaired consciousness, vomiting and anemia) contribute insufficient treatment recovery from SAM [5]. This is mostly in low- and

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middle-income countries make the problem more wide [4].

SAM is the top 3 killer for under-five children next to pneumonia and neonatal sepsis [3]. It is a reason for 20% of pediatric hospital admissions and responsible for inpatient 25 % death [1, 8]. In Ethiopia, bilateral combination effort of the health center with hospitals for moderate acute malnutrition oral therapeutic treatment decrease loads of SAM in stabilizing center [9, 10]. Nevertheless, the recovery rate after admission remaining challenging [2] and insufficient [6]. Studies suggest that the possible causes for the low treatment cure rate could be a late presentation of cases, socio-economical and comorbidity factors were mentioned [6, 11]. As one of the emerging and pastoralist regions, Benishangul Gumuze was shared the lion's share of malnutrition prevalence in Ethiopia, which is reported as (34%, 12%and 43% underweight, wasting, and stunting, respectively) [12]. Besides this, major determinant factors for poor treatment outcomes are not clearly narrated, particularly in the study area [11]. This study aimed to assess predictors for the cure rate of Severe Acute Malnutrition in 6-59 month Children in stabilizing center at Pawe General Hospital, Northwest Ethiopia. Retrospective cohort study

METHODS

Study Design and Area

A hospital-based retrospective cohort study was employed randomly selected 454 admitted severe acute malnutrition under-five children in SC within study periods of January 1, 2015, to December 31, 2019. The study was conducted in Pawe general hospitals at Metekel zone Benishangule Gumuz regions in North West Ethiopia. This is located 565 KM far from Addis Ababa, the capital city of Ethiopia. Totally in this region, more than 1,066,001 population has lived, the proportions of rural to urban residents was 78%with 22% respectively [12]. Pawe hospital has more than 151 beds. Nearly one-fourth (25%) of these beds are allocated in the pediatric ward, and half of this is reserved for treatment of SAM children in SC [13]. Following the time of SAM children admission for treatment in stabilizing center since 2015-2019, there were 1130 under-five children registered in the SAM registration log book with their treatment outcome. All SAM admitted children with medical complications (s) or failure to pass appetite test are admitted in stabilizing malnutrition for treatment for inpatient follow-up.

Source Population

All children 6-59 months of age admitted to Stabilizing center for the treatment of SAM from 2015-2019 E.C was considered as a source population for this study.

Study Populations

All under-five (6-59) month of age children admitted at stabilizing center as SAM for care from January 1, 2008, to December 31, 2012, were considered as the study population.

Sample Size Determination and Sampling Procedure

The sample size of this study was calculated by Epi-info version 7 based on double population proportion by using the power of the following assumption = 84%, a ½ =0.05 both side with 95% CI and Ratio 1.1, Proportion of case among non-exposed=7.6% and case among exposed group =15.9% with Adjusted Hazard ratio 2.1 [5]. Finally, the sample size will be 457, and using computer-generated simple random sampling technique was used to retrieve a total of 457 SAM treated children in SC.

Dependent Variables

- Treatment cure rate

Independent

- Age of children

- Residence of children

- Admission status

- Malnutrition status (marasmus, kwashiorkor, marasmus kwashiorkor, WFA, WFH, HFA)

- Concomitant disease (medical co-morbidly like TB, HIV, pneumonia, diarrhea, measles),

- Vaccination status,

- General danger sign during admission (impaired consciousness, vomiting everything, respiratory rate distress)

- Breastfeeding status

- Types of medication during admission

- Previous history of ARTI

Inclusion Criteria

All SAM under-five children treated in stabilizing center since 2015-2019 at Pawe general hospital diagnosed by WFH < 70% or WFH less than −3 Z-score or WFL < 70% or WFL less than −3 Z-score or MUAC <110 mm with length > 65 cm or presence of bilateral pitting edema/ complication treated and less than 59-month children diagnosed as SAM and admitted for treatment in SC [14]

Exclusion Criteria

On the way, children with incomplete records and admissions only with laboratory tests (albumin test) were excluded, and the final treatment result is not registered.

Operational Definitions

Event (cured): is computed as several SAM children discharged after cured or free from medical complication, edema and achieved sufficient MUAC (≥12.5 cm) and WFH (≥85%); these children were described as cured or recovered on their medical charts divided by the total number of SAM children admitted in SC [3, 15].

Kwashiorkor: is severe undernutrition or malnutrition in children resulting from a diet excessively high in carbohydrates and low proteins.

Marasmus: is undernutrition or malnutrition and emaciated that from the inadequate taking of carbohydrate food or metabolic disorders.

Marasmus-kwashiorkor: is a mixture of both kwashiorkor and marasmus. It is a problem of both carbohydrate and protein-containing food deficiency.

Data Collection Instrument and Quality Controls

Structured data abstraction tools were used for data collection purposes. The data abstraction tools were adopted from the Ethiopian federal ministry of Health (FMOH) updated SAM management guideline in 2013 with medical history sheet and published study. Three diploma nurses and a one-degree public health officer supervisor were recruited, and full two-day training was given before data collection processes. All data collectors had taken updated SAM management training and currently working at Pawe General Hospital. For the quality of the data collection process, the principal investigator and one supervisor were followed data overall data collection processes.

Data Processing and Analysis

Data entered into the computer using EPI-DATA version 3.1 and exported to STATA 14.1 for cleaning and analysis. Descriptive analysis, such as tables, graphs, Kaplan Meier survival curve, and the log-rank test was done. Hazard ratio with 95%CI and P≤0.05 was used to measure associated with the independent variable. The overall survival graph and hazard failure estimated curve was used to show the survival and hazard probability of the risk group. Cox-regression model was fitted to identify associated factors. All associated with the treatment cure rate in the bivariable analysis at a hazard ratio of P-value < 0.25 included in multivariable Cox-regression. Variables with an adjusted hazard ratio (AHR) in multivariable Cox-regression with their corresponding 95% confidence interval (CI) with P-value <0.05 were considered as significant predictors. Cox–proportional hazard assumption was checked by (log-log plot) and expected versus observed Kaplan Meier graph test for each variable with the Schoenfield residuals test for each variable; no variables less than <0.05. Multivariable cox regression was built by transforming Variables from bi-variable analysis using P<0.25 selection criteria to build final multi-variables models [8]. Finally, Nelson Alana checked model adequacy, and Cox Snell residual combination was used for checking final model adequacy.

RESULT

Baseline Socio-Demographic

Out of 457severly malnourished under-five children admitted to stabilizing center of Pawe general hospital during study periods January 1, 2015, to December 31, 2019,454 were included for final analysis.

The overall response rate was found at 99.34%. Three (0.65%) individual SAM children's file final treatment outcome is not known and excluded. The mean age of children was 26.1 months (±SD 17 months). More than half, 250(55.07%) of children were enrolled in the study were female, and 33.26 % of them were found in the age group of 6-11 months. of the total participant, 348(76.65%) of children were from rural areas. The majority of 281(62.9%) study participants were breastfeeding when they were admitted. Among the total study participant, 369(81.28%) were admitted as new cases of SAM children, with 348(76.65%) is from hospital diagnosis
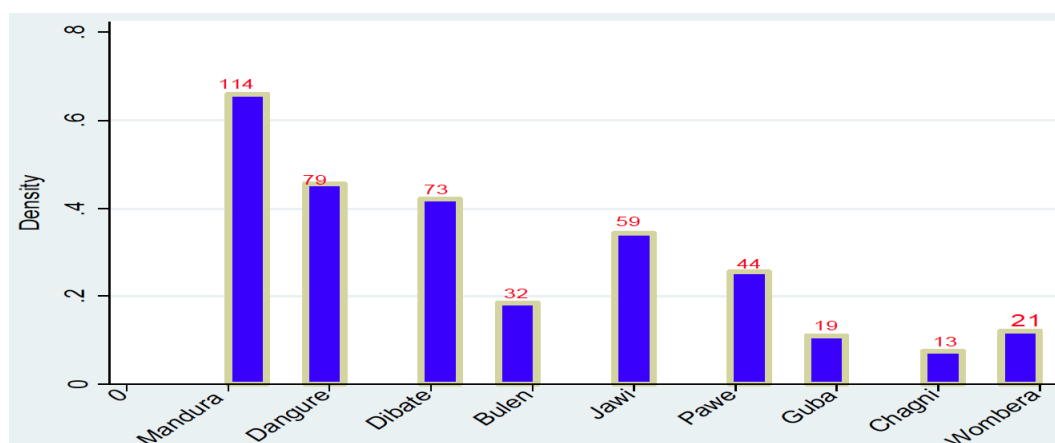
Figure 1: Indicator of severe acute malnutrition distribution frequency SAM woreda registered on malnutrition logbook based on children treated in SC since 2015-2019.

majority of the case were come for treatment were from 177(79%) Mandura woreda (Figure **1**).

Baseline Clinical Characteristics

Descriptive baseline result of SAM 6-59 moth children has at admission time, mean weight, and MUAC of children during admission 8.08kg (±SD 3.48) and 11.5(±SD 6.98) respectively. From the total stud participants, more than half of 251(55.76%) were non-edematous (marasmus case), whereas 133(29.3%) and 70(15.6%) cases were Marasmus-Kwashiorkor and edematous malnutrition (kwashiorkor), respectively.

From the total 251(55.26%) non-edematous malnutrition case, 64.9% e cured, 17.18% cases have defaulted, 9.9% have died, and 8.1% cases not recovered and transferred into the medical ward. Similarly 133(29.3%) Marasmus-kwashiorkor cases, 72.4%Cured, 12.9% died, 12.9% default and 4.3% not cured/ recovered.

Treatment Outcomes

Among 454 admitted SAM cases, 297(65.4%) 95%CI (50.12- 69.24) children declared as treatment cured in malnutrition registration logbooks, whereas 75(16.52%) cases have defaulted (abscond) from therapeutic feeding center, 52(11.45%) case have died during treatment, 31(6.83%) SAM children not responded for SAM treatment (Table **1**).

Comorbidity

Three hundred six (54.35%) under-five SAM admitted children in the therapeutic feeding unit (TFU) has at least one form of comorbidity. Among diagnosed comorbidity, 67.3% cases of marasmus-kwashiorkor, 49.89% cases of marasmus and 45.4% cases of kwashiorkor have comorbidity during admission time. The most commonly diagnosed comorbidity was pneumonia 226(48.8%), diarrhea 228(50.1%), anemia 144(31.8%), from the total 38(8.71%) children were HIV positive, and all these case in the above described were prevalent comorbidity among admitted under-five SAM children in TFC at Paw General Hospital. During admission, 371(81.72%) SAM children have altered body temperature (≥37.5 C') while 211(46.48%) children have vomiting.

Table 1: **Performance Indicator for TFU of Pawe General Hospitals as Compared with Sphere Project Based on 2016 Standard (N=454)**

Performance indicator	Pawe general hospital	SPHERE project reference value [15]		
		Overall	Acceptable	Alarming
Treatment cure rate	65.4%	77.9%	>75%	<50%
Defaulted rate	16.50%	12.3%	<15%	>25%
Death	11.36%	5.5%	<10%	>15%
Not respond for treatment	6.8%	4.8%	____	____
Average length of stay	11.65 day	11.1 days'	<28 days'	42days

Management Protocol of SAM Children

Management of admitted cases with severe acute malnutrition in the stabilizing center was based on national guidelines**.** From the finding of this study, 357(78.43 %) had given routing medication during inpatient treatment. Out of 228(50.22%) diarrhea cases, 220(96.6%) of them received zinc acetate.

The most frequently administered special medication was identified, amoxicillin 367(80.84%), gentamycin–ampicillin 357(78.47%), but nearly one five 21.06 % of under-five children case did not take any medication.

From the total participant, 431(94.93%) and 381(83.92%) took formula F-75 and F-100 milk, respectively, during inpatient waiting time. Nearly one-

fourth of 23.13% of children had resuscitated IV fluid. Whereas 203(45.1%) admitted, children have NGT during admission time. Whereas nearly half of 193(42.51%) children have got deworming after admission (Table **2**).

Kaplan-Meir Survival Estimates for Treatment Cure Rate

Totally 454 SAM under-five children produce 5044 days' of observation time in TFC obtained and the median cure time of SAM children in TFU was 13 days with (±7) with minimum and maximum 2 and 29 days respectively**.** The median survival rate was found 55.84% (51.1 ----60.7). There is a static treatment cure rate difference between marasmic SAM under-five children and other malnutrition P<0.005), children

Table 2: **Medication Distribution for 6-59 Month Age SAM Under-Five Children in Pawe General Hospitals North-West Ethiopia (n=454) 2020**

Medication within TFC		Recovered	Note recovered	Total children n=454
Routine-antibiotic	Yes	235(79.5%)	122(77.8%)	357(78.6%)
	No	62(20.5%)	35(22.2%)	97(21.06%)
Vitamin A	Yes	233(63.6%)	133(36.3%)	366(80.6%)
	No	64(72.7%)	24(27.3%)	88(19.4%)
Folic acids	Yes	217 (64.0%)	122(35.9%)	339(74.66%)
	No	80(69.5%)	35(30.4%)	115(25.35%)
Amoxicillin	Yes	245(66.8%)	122(33.2%)	367(80.8%)
	No	52(59.7%)	35(40.2%)	87(19.2%)
Ampicillin-Gentamicin	Yes	233(65.3%)	124(34.7%)	357(78.6%)
	No	64(65.9%)	33(34.0%)	97(21.4%)
Deworming	Yes	132(68.4%)	61(31.6%)	193(42.5%)
	No	165(63.2%)	96(36.8%)	261(57.5%)
F-75 milk	Yes	282(65.4%)	149(34.6%)	431(95.0%)
	No	15(65.2%)	8(34.8%)	23(5%)
F-100 mix	Yes	283(78.2%)	79(21.8%)	362(79.7%)
	No	14(15.2%)	78(84.8%)	92(20.2%)

Table 3: **Treatment Outcome Based on Indicators Under-Five Children Admitted by SAM in TFU, at Pawe General Hospitals Since 2015-2019, North-West Ethiopia (N=454)**

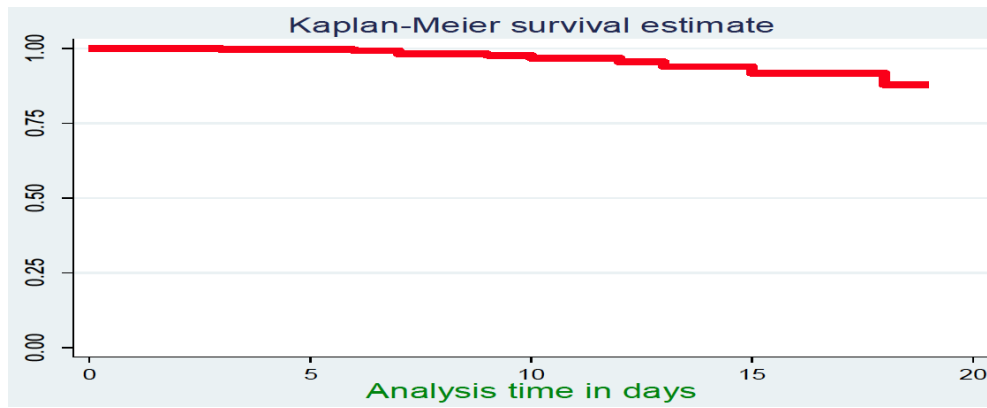| Indicators	Phase 1	Transition phase	Phase 2	Total No. of case
Treatment cure rate	70 (23.56)	96(32.32)	131(44.10)	297(65.5%)
Defaulted	23 (30.50)	30 (40.21)	22 (29.50)	75(16.57%)
Death	18(34.60)	15(28.80)	19(36.50)	52(11.40%)
Not cured/transferred	8(25.80)	14(45.10)	9(29.10)	31(6.8%)

Figure 2: Overall Kaplan Meier survival estimate of SAM 6-59 month for Predictors for a cure rate of Severe Acute Malnutrition 6-59 month Children in stabilizing center at Pawe General Hospital; 2020.

taking F-100 milk with no taking and having nasogastric tube (NGT) during admission and no during admission see (Figure **3**)

Hazard Estimate for Under-Five SAM Children in TFC

Among 454 admitted SAM children, 297(65.42%) cases declared as treatment cured in the logbook, whereas 157(34.58 %) cases were censored and had taken 1727 persons per day risk time observation (Figures **3-5**).

Factors Associated with a Treatment Recovery Rate

During bivariate analysis, 12 variables have P<0.25 and transported into multivariable Cox regression thus are, residence, sex, malnutrition types, vitamin A administration, comorbidity status, vomiting during admission, deworming, having anemia, having NGT during admission, diarrhea during admission, folic acids administration, routine antibiotic HIV status, were exported for multivariable Cox regression. After AIC and BIC model comparison and checking by Nelson
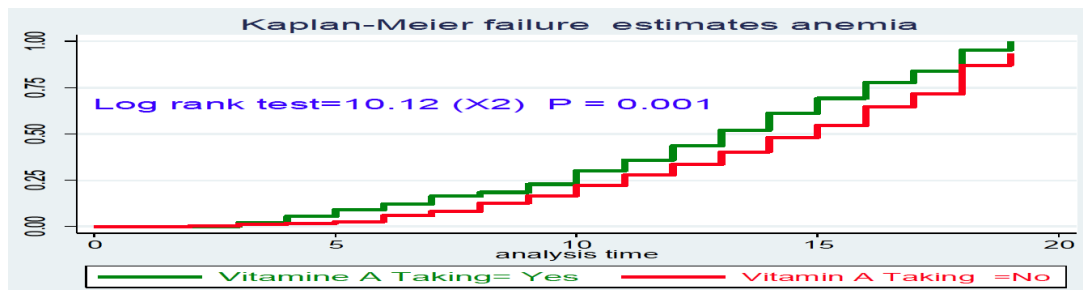

Figure 3: Log-rank survival estimations Predictors for a cure rate of Severe Acute Malnutrition 6-59 month Children in stabilizing center at Pawe General Hospital, Northwest Ethiopia 2020.
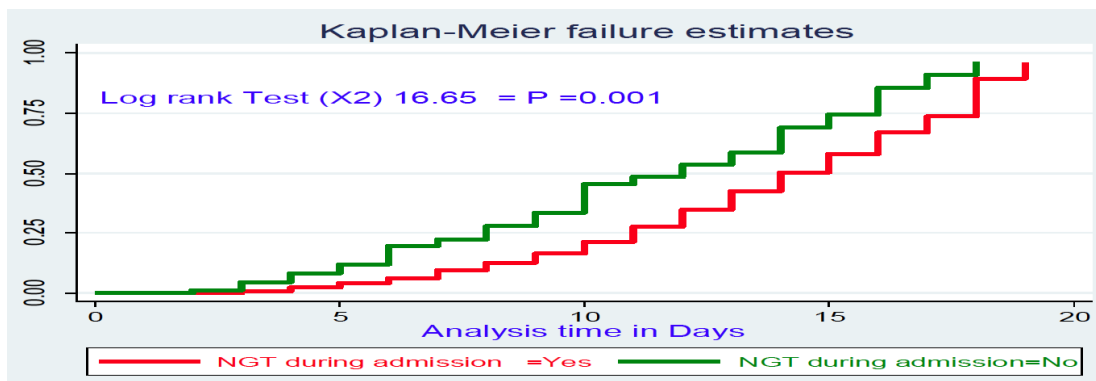

Figure 4: Log-rank survival estimations for treatment cure rate Children with no NGT during admission in SC at Pawe general hospital since 2020.
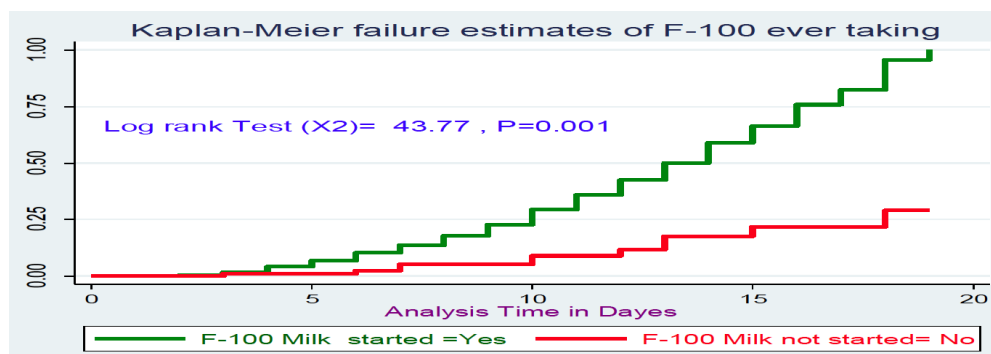
Figure 5: Log-rank survival estimations Predictors for a cure rate of Severe Acute Malnutrition 6-59 month Children in stabilizing center at Pawe General Hospital, Northwest Ethiopia 2020.

Table 4: Bi-Variable and Multivariable Cox-Regression Analysis of Factors Associated with Treatment Cure Rate Among Severe Acute Malnourished Admitted Children in Pawe General Hospitals 2020

Covariate		Event	Censored	CHR	AHR	P-value	log-rank (X^2)
Sex	Male	129	75	1.13(0.89 -- 1.43)	1.2 (0.96 , 1.55)	0.101	0.31
	Female	168	82	1	1		
Residence	Urban	84	22	1.45 (1.2 --- 1.89)	1.2(0.92 , 1.55)	0.188	3.26
	rural	213	135	1	1		
Malnutrition types							
	Marasmus	163	88	1.57(1.03 ---2.1)	1.56(1.08 2.27)	0.018 *	5.40
Marasmus-Kwashiorkor		96	37	1.64(1.2 ---- 2.05)	1.53(0.99 2.13)	0.07	1.49
Kwashiorkor		38	38	1	1		
Vitamin A	Yes	233	133	1.71(1.3 ---- 2.27)	0.97(0.90 1.98)	0.051	3.03
	No	64	24	1	1		
Comorbidity	Yes	164	81	1	1		
	No	133	76	0.96 (0.75 1.18)	1.01(0.78 , 1.29)	0.08	0.41
Deworming	Yes	132	61	1.09(0.85 1.36)	1.02(0.79 , 1.28)	0.90	0.01
	No	165	96	1	1		
NGT at admission	Yes	122	81	1	1		
	No	175	76	1.31(1.03 1.67)	1.31(1.04, 1.67)	0.029*	0.06
Anemia at admission	Yes	44	100	1	1		
	No	113	197	1.04(1.01 1.6)	0.92(0.72 , 1.2)	0.501	0.08
F-100 milk finished	Yes	283	79	5.37(2.88 9.65)	5.42(2.92, 9.85)	0.001*	4.83
	No	14	78	1	1		

Alan and Cox Snell residual test of final model adequacy the following, variables found for final model Cox regression. However, after controlling for potential confounders in multivariable Cox regression analysis sex of children, the residence of children, malnutrition types, Vitamin-A status, comorbidity status, NGT during admission, anemia during admission, F-100 after admission, and deworming were found for final model variables.

Therefore, SAM children being marasmus 1.56 times increased the probability of treatment cure as compared with the counterpart (AHR=1.56:95%CI: (1.08-2.27), P< 0.018. SAM under-five children with no NGT during admission had 1.31 times increased treatment cure than (AHR=1.31: 95% CI: 1.04-1.67 P≤0.029) as compared counterpart. Besides, children taking F-100 milk after admission 5.42 time's higher probability of cure as compared to their counterparts

SAM children or not taking F-100 glasses of milk (AHR=5.42: 95% CI: 5.42(2.92-9.85 P≤0.001).

4. DISCUSSION

This study-analyzed the treatment cure rate and its associated factors among 6–59 months admitted children in stabilizing centers. The finding of this study indicated the overall treatment cure rate of SC was found at 65.4% (95%CI: 50.12- 69.24), which is unacceptable and lower than sphere standards reference (i.e., exceed >75%) [15]. But this is nearly comparable with the study finding in Gonder 65.3% [16], Nekemte 66.8% [17], Hawassa Referral Hospital 67.7% [18]. This might be the socio-economic resemblance among the community. However, this result is not comparable to the finding in Yekatitie12 81.3% [19] and Hawass hospitals 87% [20]. The observed variation might be due to early and late coming variation for stabilizing treatment centers, and the resident in the study area are pastoralist dwellers in the countryside [14]; this makes little access to treatment centers in Ethiopia. Otherwise, they have to pay for public transport to stabilizing center, which could not always be possible as people in the rural area have lower economic income.

Also, the power of maternal decision-making ability for sick children at the house level has a great impact has an indispensable variation role [21].

The median treatment cure time in this study was lower than (i.e., 13 days) from the sphere project (i.e., < 28 days) [15]. The median treatment cure rate of this study is 12.7 days. This is consistent with Debre Markos hospitals and Gonder referral hospitals [3, 14]. However, there is a wide range of treatment cure rate difference when compared with the study done in [18, 20, 22, 23]. In fact, this is due to the different quality of health care provision Large-scale fortification of foods as a means of addressing micronutrient deficiencies [24]. However, this study found, there is a higher mortality rate of 11.45%, which is incomparable with the standard sphere project [15]. The difference may be due to a delay in seeking health care [3], medical complication [25]. This study revealed that having marasmus diagnosed for SAM children increases the probability of cure rate as compared with kwashiorkor diagnosed children. This might be due to free radical electron in edematous patient increase and killed physiological intracellular electrolyte also associated easily with the infectious disease [10]. Finally, SAM children ever started F-100 kinds of milk after admission to SC have a high cure rate. This is agreed with finding in Hawassa hospitals [6]. In fact, children who did not receive F-100 therapeutic milk had a 50% reduced treatment cure recovery time than those who took F-100 therapeutic milk [6]. This is the fact that F-100 has a higher calorie of 100 kcal/100 ml, which increases the daily weight gain and improves the outcome of children. In the same way, SAM children ever not taking Formula-100 pints of milk has significantly associated with mortality rate during SAM admission [6, 26]. On the other hand, SAM children have no nasal-gastric intubation (NGT) during SAM admission, independently associated with treatment cure rate. The fact that having NGT during admission SAM children receiving enteral nutrition causes several complications (like; diarrhea, vomiting, constipation, lung aspiration, tube dislodgement, hyperglycemia, and electrolytic alterations, will hinder treatment recovery [27].

CONCLUSION

This retrospective cohort study of multi-chart record review revealed that treatment cure rate is remaining low as compared to sphere standard sets in humanitarian and disaster prevention (or the SPHERE standards), and previous studies were done in regions of Ethiopia. According to this study finding ever started F-100 milk and having no NGT during admission was swiftly increase the treatment cure rate from SAM.

RECOMMENDATION

Intervention modalities that would address the identified factor are highly recommended for a better treatment cure rate. A prerequisite organized of health team must make in TFC to improve infant to stepwise starting F-100 milk efforts making to avoiding NGT for feeding and medications after admission.

ETHICAL CLEARANCE

Ethical clearance was obtained from the ethical review committee of Debre Markos University, College of Health Sciences (Ref. No: HSC/984/16/12). A formal letter was submitted to Pawe general hospital rechecked for permission to be done entitled research articles, Treatment cure rate and predictors for the cure of Severe Acute Malnutrition 6-59 month Children at stabilizing center in Pawe General Hospital, Northwest Ethiopia. Five-year retrospective cohort (Since 2015-2019). Finally, Pawe general Hospital also rechecked for ethical compatibility and permitted data access. As

the study was conducted through a review of records, no consent was obtained from the mothers or caregivers of the study subjects.

ABBREVIATIONS

AHR   = adjusted hazard ratio

CHR   = crude hazard ratio

CI   = confidence interval

FMOH = Ethiopian federal ministry of Health

MAM   = moderate acute malnutrition

MUAC   = mid-upper arm circumference

NGT   = nasal gastric intubation of feeding

SAM   = sever acute malnutrition

SC   = stabilizing center

SD   = standard deviations

TFC   = therapeutic feeding center

WFH   = weight for height

CONSENT FOR PUBLICATIONS

No consent for publications

AVAILABILITY OF SUPPORTING DATA

All the datasets analyzed for this study available in the corresponding author and in a reasonable request, and I will send for the necessary steps of editing for this study.

COMPETING INTERESTS

The authors declare that there are no competing interests.

AUTHOR INFORMATION

Fassikaw Kebede (FK) is the principal investigator of this research during designing, data collection, result analysis, and manuscript writing and submission of all processes. He is currently working as a full-time lecturer in the Epidemiology department Public Health, College of Health Science, Woldia University P.O.Box 300 Woldia, Ethiopia. The remaining authors NE, BN, MG, TT, and BW, participated in methodology, data analysis, and manuscript writing time.

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