

Determinants of survival status of children treated for severe acute malnutrition at outpatient therapeutic program in Kembata Tembaro Zone, Southern Ethiopia

Wondwosen Fikreselam^{1*} and Samson Mideksa²

¹School of Nutrition, Food Science and Technology, Hawassa University, Hawassa, Ethiopia

²Knowledge Translation Directorate, Ethiopian Public Health Institute, Addis Ababa, Ethiopia

*Corresponding author: wondwosen2m@gmail.com; Cell phone: +251912098721; P. O. Box 05, Southern Ethiopia

Abstract

Background: Children in third world countries suffer from severe acute malnutrition in an extent of public health important. Thus, this study was conducted to assess determinants of survival status of children treated for Severe Acute Malnutrition at Outpatient Therapeutic Program in Kembata Tembaro Zone, Southern Ethiopia.

Methods: A retrospective facility based cross-sectional study was conducted in records of outpatient therapeutic program in 2017. Four hundred thirty three children represented by their Outpatient Therapeutic Program card were included from three woredas selected by simple random sampling technique. From these three woredas, 18 health posts were selected by simple random sampling. Population Proportion to size allocation was used to assign sample for each selected woredas. Systematic sampling technique was used to assign child card for each selected health posts in the study area. Data was entered, cleaned and analyzed in SPSS version 20. Bi-variable and multivariable cox regression models were fitted.

Results: At the program, 381(88%) at 95% CI children survived after complete length of stay. Children survival rate through time was affected in statistically significant figures by children reside in <30 minutes (AHR=1.28; (95% CI=1.04-1.58)), children without symptom were (AHR=9.17; (95% CI=1.27-66.38)), children with kwashiorkor were (AHR=1.94; (95% CI=1.45-2.60)) and provision of amoxicillin as supportive medications were (AHR=2.45; (95% CI=1.16-5.16)) at 95% confidence level in Log Rank test ($P<0.05$).

Conclusions: The survival rate was higher compared to acceptable minimum sphere standard. Besides, variables which affect the survival status of children were distance from residents' home to health post, being asymptomatic, type of malnutrition, and provision of amoxicillin.

Keywords: Outpatient therapeutic program, severe acute malnutrition, survival status, Southern Ethiopia, Kembata Tembaro

Introduction

Malnutrition is still a global public health problem contributing for under-five morbidity and mortality (Kassaw et al. 2021). It is a condition caused by a lack of or excess of one or more essential nutrients. In most cases, under nutrition is more prevalent in developing countries (WHO and UNICEF 2009). Severe acute malnutrition (SAM) poses an enormous threat to the survival of children (Carboo et al. 2020). It is a common cause of morbidity and mortality among under five children in Ethiopia (Lambebo et al. 2021). It is defined as a weight-for-height measurement of 70% or more below the median, or three SD or more below the mean National Centre for Health Statistics reference values, which is called "wasted"; the presence of bilateral pitting oedema of nutritional origin, which is called "edematous malnutrition"; or a mid-upper-arm circumference of less than 110 mm in children age 1–5 years (WHO 2013). Nutritional diseases and under nutrition are serious issues caused by insufficient food consumption, both in terms of quality and quantity. Calories, proteins, vitamins and minerals are the main deficiencies which results this problem (FMOH 2007). The immediate causes of malnutrition and child death are mutually reinforcing conditions of inadequate

dietary intake and infectious disease (Getnet et al. 2017). People with low income are disadvantaged and live most of their lives with inadequate access to safe and healthy food. Malnourished and sick people are less able to work efficiently, which affects their income and that of their families, resulting in less ability to purchase good food, thus aggravating the vicious circle (WHO 2008).

There were little studies conducted to elucidate the effectiveness of OTP in Ethiopia. But as indicated, SAM was identified as public health problem in Southern Nation Nationalities People Region (SNNPR) particularly in Kembata Tembaro zone. This study is designed to investigate the determinants of survival status of children treated for SAM at OTP among children aged 6-59 months through time in Kembata Tembaro Zone, Southern Ethiopia, 2017.

Materials and Methods

A retrospective institutional based cross-sectional study was conducted over the period from February 21st to March 10th, 2018 at Kembata Tembaro administrative Zone. By the year 2017 there are one governmental general hospital; three governmental primary hospitals, 31 health centers and 135 health posts providing health services for the community. There are also 10 medium

clinics, 38 primary clinics and one private pharmacy and 15 drug stores are among the private sectors serving the community, according to Zonal health Department report. According to the zonal health department's annual report, almost 1600 SAM children under the age of five were treated at OTP in 2017. According to Zonal agriculture report the main economic activity in the study area is agriculture (mixed farming). The major agricultural crops include wheat, maize, teff, barley, bean, pea and enset. The livestock population in the zone includes cows, oxen, goat, sheep, horse, mule, and chickens.

In 2017, the source population consisted of all SAM children who received treatment at 135 HPs in the Kembata Tembaro zone. The study unit comprised of all SAM children OTP cards from the 18 HPs in 2017. From January 1 to December 30, 2017, all SAM children admitted to OTP were included in the study. The study omitted children's cards with missing information.

Sample size for this study was calculated based on assumptions of single population proportion. The assumptions had been 95% confidence level or 5% margin of error and expected frequencies from study done in Wolaita Zone SNNPR 2015 $P = 40.3\%$ (0.4), $1-P = 59.7\%$ (0.6), $Z = 1.96$, and $d = 0.05$ (Kabalo et al. 2015). For the cards or registration books that were not well registered or ineligible assuming 5% the adjusted sample size were used $412 \times 5\%$ which was 433. There are seven Woredas and three administrative towns in Kembata Tembaro zone. For this study, a total of 18 OTP sites were chosen. Finally, using a systematic random selection approach, the children aged 6-59 months who had an OTP card were chosen from each HP based on their unique identifying number. The K value was determined at each health post to employ this method.

Structured data collection checklists were used to collect data from both children OTP cards and registration books. The main source of data was children cards and some variables missing in cards were checked from registration book. Pilot study was done in other Woredas of the Zone on 5% of the sample size of the study children OTP cards. Prior to the actual survey, adjustments were made to the checklist based on the results of the pilot study. Data were collected with close supervision at the time of collection. There were three data collectors and one supervisor participated in our data collection period. Data collectors were 10+3 educational level in nursing and experienced with data collection. They were trained for a day before data collection extensively.

Subsequent to proper collection, data were checked for completeness and consistency, carefully entered, thoroughly cleaned, coded and analyzed in SPSS version 20. Data cleaning procedures were carried out to assure data quality of both categorical and continuous variables. Using SPSS, descriptive statistics were presented. In addition, cox-regression and Kaplan-Meier also applied to identify determinants. To decide significance, p value < 0.05 was considered. The researchers coded the outcome as survived or censored and used Multivariate Cox-regression to determine the average hazard ratio by controlling the confounding effect of each factors. Candidate variables for multivariate cox regression were selected from bivariate cox regression ($P < 0.25$). Multivariate cox regression was carried out to identify predictor variables of survival rate at 95% confidence interval level. Variables found associated with survival rate were tested for effect on survival status of children in the program through time by Kaplan-Meier survival curve and significance was reported by Log Rank test ($P < 0.05$).

Ethical clearance was obtained from the Institutional Review Board (IRB) of Hawassa University Comprehensive Specialized Hospital. Prior to any enrollment of the children cards and registration, permissions were sought and obtained from HEWs. Ethical considerations were addressed and confidentiality was maintained.

Results

Socio-demographic characteristics: All the 433 of the children cards found out to be correctly identified as SAM and their socio-demographic characteristics are presented in the table 1. There was greater representation of 6 to 23 month old children 230(53.1%) and 237(54.7%) of children were female. Mean (SD) age of the children at admission was 23.28 (14.86) months. Children admitted from a distance of 30 minutes or more were 224(51.7%) with the mean (SD) distance of 31.8(20.0) minutes.

Routine medications and RUTF: All children in this study had taken Plumpy'Nut. However, 67(15.5%) of the eligible children for routine medication did not receive at least one of the routine medications. Around eighty one percent of the children were given amoxicillin and out of the total 203 eligible children for deworming, only 25% of them were dewormed. From children who took at least one routine medication and amoxicillin drug were cured 89.6% (328/366) and 90.7% (320/353), respectively (Table 1).

Table 1: Socio-demographic characteristics and Routine medications given for children with SAM treated at OTP in Kembata Tembaro Zone, Southern Ethiopia, 2017

Variables	Categories	Frequency	Percent	Survival	
				Yes	No
Age	6-23 months	230	53.1	202(87.8%)	28(12.2%)
	24-59 months	203	46.9	179(88.2%)	24(11.8%)
Sex	Male	196	45.3	163(83.2%)	33(16.8%)
	Female	237	54.7	218(92.0%)	19(8.0%)
Home to health post distance	<30 min	209	48.3	189(90.4%)	20(9.6%)
	≥30 min	224	51.7	192(85.7%)	32(14.3%)
Routine medications at least one	Yes	366	84.5	328(89.6%)	38(10.4%)
	No	67	15.5	53(79.1%)	14(20.9%)
Amoxicillin	Yes	353	81.5	320(90.7%)	33(9.3%)
	No	80	18.5	61(76.2%)	19(23.8%)
Deworming tabs for eligible children	Yes	51	25.1	47(92.2%)	4(7.8%)
	No	152	74.9	132(86.8%)	20(13.2%)
Folic acid	Yes	3	0.7	3(100%)	0(0.0%)
	No	430	99.3	378(87.9%)	52(12.1%)
Measles vaccine	Yes	18	4.2	14(77.8%)	4(22.2%)
	No	415	95.8	367(88.4%)	48(11.6%)
Vitamin A	Yes	79	18.2	75(94.9%)	4(5.1%)
	No	354	81.8	306(86.4%)	48(13.6%)

Types of malnutrition: Among the 433 patient cards included in the study, 78.5% (340), 19.4% (84) and 2.1% (9) were marasmic, kwashiorkor and marasmickwash, respectively. The overall proportion of recovery was 91.2% (310/340), 77.4% (65/84) and 66.7% (6/9) for children with marasmus, kwashiorkor

and marasmickwash, respectively. Most of the defaulters 77.8% (7/9) were from the marasmic group and 7.6% (33/433) children were referred to inpatient care due to complications developed during follow-up visits as indicated in the table 2.

Table 2: Proportion of treatment outcome with the type of malnutrition treated at OTP in Kembata Tembaro Zone, Southern Ethiopia, 2017

Variables	Frequency	Percent	Cured	Treatment outcome of the child			
				Defaulted	Died	Transfer out	Non responder
Marasmus	340	78.5	310	7	2	15	6
Kwashiorkor	84	19.4	65	2	0	16	1
Marasmickwash	9	2.1	6	0	0	2	1
Total	433	100	381	9	2	33	8

The overall median (inter quartile range, IQR) age was 15 months (8,22), 36 months (24,48) months and 24 months (12,36) for children with marasmus, kwashiorkor and marasmickwash, respectively. The

median (IQR) time to recovery was 42 days (40.4, 43.6) for children with marasmus, 35 days (31.6, 38.4) for children with kwashiorkor and 49 days (31.0, 67.0) for children with marasmickwash as shown in the table 3.

Table 3: Median and mean rates of recovered children from SAM treated at OTP in Kembata Tembaro Zone, Southern Ethiopia, 2017

Variables	Median age	Median recovery time	Recovered children	
			Mean rate of weight gain	Mean rate of MUAC gain
Marasmus	15 months	42 days	3.44 g/kg/day	0.24 mm/day
Kwashiorkor	36 months	35 days	3.50 g/kg/day	0.27 mm/day
Marasmickwash	24 months	49 days	3.53 g/kg/day	0.22 mm/day

Treatment outcomes: Based on the finding of this study, proportion of children who recovered from SAM after treated in OTP was 381 (88.0%). There are two (0.5%)

SAM children died while they were under the OTP treatment (table 4).

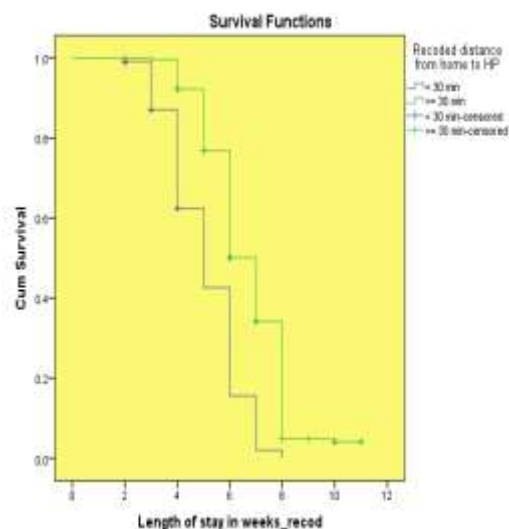
Table 4: Treatment outcomes of children with SAM treated at OTP in Kembata Tembaro Zone, Southern Ethiopia, 2017

Variables	Frequency (%)	Sphere Standards	
		Acceptable	Alarming
Proportion of children who recovered from severe acute malnutrition after treated in OTP (Recovery rate)	381 (88)	>75%	<5 0%
Proportion of severe acute malnourished children who defaulted from the OTP (defaulter rate)	9 (2.1)	<15%	>2 5%
Proportion of severe acute malnourished children who died while under the OTP intervention (death rate)	2 (0.5)	<10%	>1 5%
The average rate of weight gain (gm/kg /day) (rate of weight gain)	3.41	≥ 5	<8
Number of weeks that the children stay under the OTP (average length of stay)	6.07 weeks	<4 weeks	>8 weeks
Non-respondents	8 (1.8)		
Transfer out	33 (7.6)		

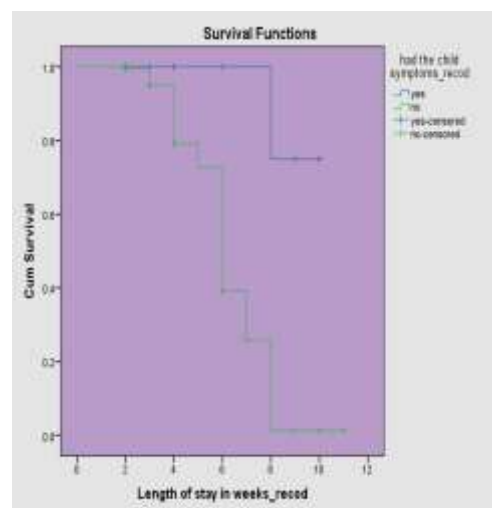
OTP intervention and both of them had at least one medical problem. Nine (2.1%) children defaulted from OTP follow-up. Mean (SD) length of stay for recovered children at OTP was 6.07 (95% CI=5.91, 6.22) (1.526) weeks. Children gain weight in average 3.41 g/kg/day for length of stay in the program and compared with the Sphere standard. No matter for how long they stayed under the OTP, the children who did not reach any of the discharge criteria (non-respondents) were 1.8% and 7.6% were transfer out to other institutions (Table 4).

Comparison of time to survive among the different groups (The KM survival curve) of SAM children

treated: To show the significance of the survival rates during the courses of intervention period, the researcher depicted the Kaplan Meier (KM) survival curves over different grouped factors of children was assessed using log rank test. Generally in all the cases, children managed inappropriately had lower recovery rate per week. That is, children with at least one symptom at admission and follow up, distance from participants' home to health post, type of malnutrition and those who did not receive routine drugs like amoxicillin had consistently lower recovery rate per week over the intervention period (Figures 1).



KM curve for distance from home to HP
Log rank test ($X^2=14.371$, $P<0.0001$)



KM curve for children had symptom or not
Log rank test ($X^2=16.675$, $P<0.0001$)

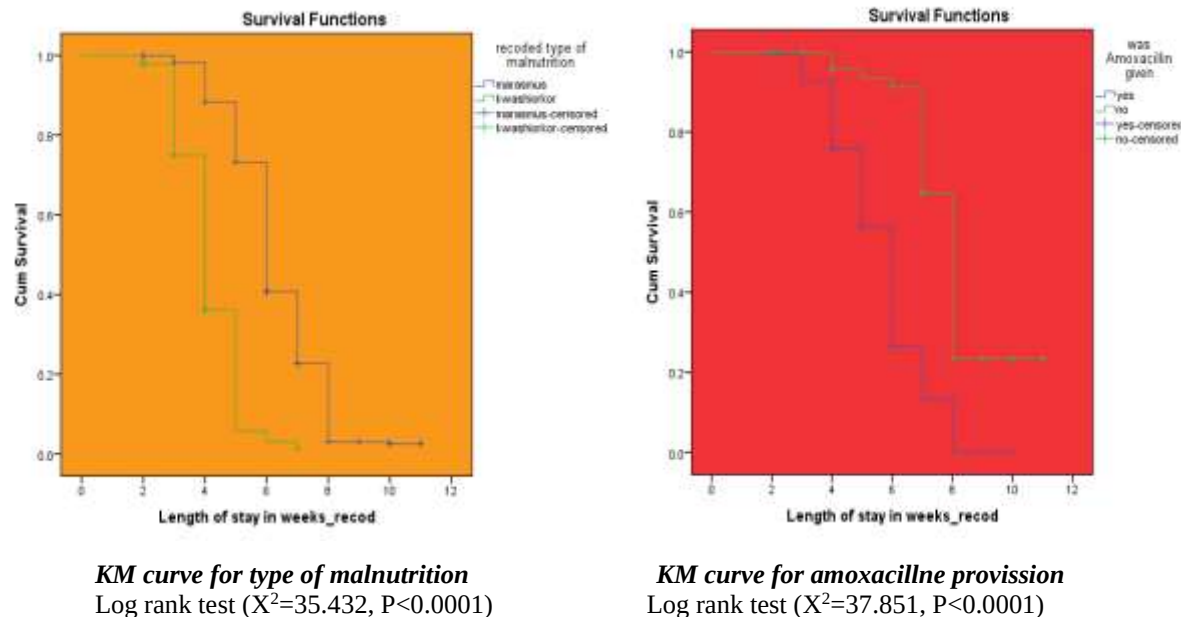


Figure 1: KM survival curves and Log-rank test for recovery rates over grouped factors

Table 5: Predictors of time to recovery in the bivariate and multivariate Cox Regressions in children with SAM treated at OTP in Kembata Tembaro Zone, Southern Ethiopia, 2017

Variables	Categories	Event No. (%)	Censored No. (%)	CHR(95% CI)	AHR (95% CI)
Distance from home to HP	<30 min	189(90.4%)	20(9.6%)	1.341(1.096,1.640)**	1.282(1.041,1.579)*
	≥30 min	192(85.7%)	32(14.3%)	1	1
Symptoms during Admission	Yes	1(8.3%)	11(91.7%)	1	1
	No	380(90.3%)	41(9.7%)	9.474(1.331,67.450)*	10.459(1.420,77.050)*
Weight of the child at admission	≤5 kg	39(78.0%)	11(22.0%)	1	1
	5-10 kg	277(90.2%)	30(9.8%)	1.199(0.858,1.677)	0.955(0.669,1.362)
	>10 kg	65(85.5%)	11(14.5%)	1.599(1.075,2.381)*	1.233(0.782,2.602)
Type of malnutrition	Marasmus	310(91.2%)	30(8.8%)	1	1
	Kwashiorkor	65(77.4%)	19(22.6%)	1.896(1.444,2.489)***	1.942(1.449,2.602)***
	marasmickwash	6(66.7%)	3(33.3%)	0.796(0.355,1.785)	1.205(0.522,2.784)
Routine medications (at least one)	Yes	328(89.6%)	38(10.4%)	1.750(1.307,2.343)***	0.762(0.341,1.702)
	No	53(79.1%)	14(20.9%)	1	1
Amoxicillin	Yes	320(90.7%)	33(9.3%)	1.861(1.412,2.452)***	2.449(1.163,5.158)*
	No	61(76.2%)	19(23.8%)	1	1
Deworming	Yes	47(92.2%)	4(7.8%)	1.170(0.839,1.633)	1.218(0.855,1.736)
	No	132(86.8%)	20(13.2%)	1	1
Measles vaccine	Yes	14(77.8%)	4(22.2%)	1.295(0.759,2.210)	1.574(0.864,2.866)
	No	367(88.4%)	48(11.6%)	1	1
Vitamin A	Yes	75(94.9%)	4(5.1%)	1.064(0.826,1.369)	0.920(0.690,1.229)
	No	306(86.4%)	48(13.6%)	1	1

*p-value <0.05, **p-value <0.01, ***p-value of <0.001

In the bivariate Cox regression model distance from home of resident to health post (CHR=1.341, 95% CI=1.096,1.640), symptoms during admission (CHR=9.474, 95% CI=1.331,67.450), admission weight (CHR=1.599, 95% CI=1.075,2.381), the type of malnutrition (CHR=1.896, 95% CI=1.444,2.489), routine medications at least one (CHR=1.750, 95% CI=1.307,2.343) and amoxicillin (CHR=1.861, 95% CI=1.412,2.452) were found to be significantly associated with survival time among children who recovered from OTP at 0.25 P-value (Table 5).

According to table 5, children reside in <30 minutes were with 1.28 times higher odds to survive than reside in ≥30 minutes. Similarly children without symptoms were 10.46 times achieve nutritional recovery [AHR=10.46 at 95% CI (1.42, 77.05)] compared to the reference. The likelihood of surviving was 1.94 times higher for children with kwashiorkor [AHR=1.94 at 95% CI (1.45, 2.60)] than marasmus. Children provided amoxicillin were 2.45 times more likely to recover than their counterparts [AHR=2.45 at 95% CI (1.16, 5.16)].

Discussion

The findings of this research mainly indicate determinants of survival status of children through time per length of stay at Kembata Tembaro zone, Southern Ethiopia. Children survival rate after full length of stay in the program was 381 (88.0%) and survival rate through time was affected in the significant level were: distance (time to travel) from resident home to health post, at least presence of one symptom, type of malnutrition and provision of supportive medication like amoxicillin at 95% confidence level in Log Rank test ($P<0.05$).

The study revealed that the survival, defaulter and death (mortality) rates were within the acceptable international sphere standards. But, the rate of weight gain and length of stay were below and over the standards respectively. Children with medical comorbidities were managed inappropriately under the OTP intervention and large proportion of children who received routine drugs partially. The survival rate in this study reported as 388 (88.0%) at 95% CI of was higher than the minimum international Sphere standard acceptable range (FMOH 2007; Sphere Association, 2018). The finding was higher compared to survival rates from studies done in Enderta woreda, Tigray Region 76.8% (Massa et al. 2016), 77.8% from study done in TFC of Jimma (Jarso et al. 2015), at Wolaita zone on treatment outcome 64.9% (Kabalo and Seifu 2017), and in Kamba district 67.7% (Shanka et al. 2015), and in OTP of India 57.4% (Burza et al. 2015). Yet, it was in line to 88.7% at Felege-Hiwot comprehensive specialized hospital, Northwest, Ethiopia (Kassaw et al.

2021), and 87% recovery rates from study done in TFC of southern region (Teferi et al. 2010). The discrepancies in the findings might be due difference in study settings (TFC and OTP), distance from residents home to HPs and provision of supportive medications.

The overall death rate 2(0.5%) is well within the minimum sphere standard (<10%). It is lower than similar studies conducted in the death rate 3.6% were reports from study done within TFCs in SNNPR, in Ethiopia (Teferi et al. 2010). It was in line to studies conducted in Wolaita Zone death rate 0.7% (Kabalo and Seifu 2016). The death rate was zero among the children without medical problems as compared to those with medical problems. Outpatient therapeutic program providers did not comply with SAM management protocol. As evidence, Children with medical problems were managed under the OTP since medications were provided to the children partially.

The defaulter rate 9(2.1%) in this study is within the acceptable range of the international standard. This is contained in the domain of global sphere standards. The children with medical comorbidities were defaulting at much higher rate. The overall defaulter rate in this study is lower as compared to similar study conducted an institutional based general prospective cohort study was conducted in OTP sites in Enderta woreda, Tigray, North Ethiopia 17.5% defaulted (Massa et al. 2016). Another institution based retrospective longitudinal study was carried out in Kamba District, South West Ethiopia on children who were treated on the OTP, 22.7% of children were defaulted (Shanka et al. 2015). On the other hand it is slightly higher than a research done in Wolaita zone, SNNPR, Ethiopia shown the defaulter rate was 1.7%. It is in line with a study conducted in Wolaita Zone default rate 2.2% (Kabalo and Seifu 2016). The result might be such difference because in our study area, OTP is implemented as one of the routine services in the health posts regardless of the non-existence of drought and it might not get same focuses as in hunger situations. This result signifies that applying strict follow ups on the children under treatment could result to better outcomes.

The average length of stay in this study under the OTP intervention was 6.07 weeks (42.49 days). This is by far outside of the acceptable minimum international standard (<28 days); yet it is well within the standard of the Ethiopian protocol for management of SAM which allows children to stay under treatment to utmost eight weeks (64days) to FMOH, 2007. This study is lower length of stay as compared to the study conducted in Sub-Saharan Africa length of stay an average of 55 days (Sadler 2010). The study is similar with the overall mean length of stay of the malnourished children was

44.1 days in Enderta Woreda, Tigray (Massa et al. 2016). The length of stay is higher as compared to the study conducted in TFCs in SNNPR, in Ethiopia an average of 25 and 21 days for children with severe wasting and edematous malnutrition, respectively (Teferi et al. 2010). The partial administration of routine medications and managing children with medical complications might also contribute to the delay of recovery from SAM. The researcher endeavored to demonstrate the effect of inappropriate management to recovery rate using the Kaplan Meier survival curves and Log-rank test. Children under five were carried by mothers or any other attendant for 30 minutes or more, with medical comorbidities, with marasmus and those who did not take routine medications had significantly lower recovery rate per week as compared to the children carried less than 30 minutes, without medical problems, with kwashiorkor and those who took routine drugs, respectively. These findings indicate that only by complying with the standard protocol for management of SAM; better program outcomes could be assured.

The acceptable weight gain rate for outpatient management of SAM according to the minimum Sphere standard was ≥ 8 g/kg/day. The weight gain rate in this research was 3.41 it is far below the minimum sphere standard. It is lower than studies done in Southern Ethiopia average weight gain of 14 and 13.4 g/kg/d for children with severe wasting and edematous malnutrition, respectively (Teferi et al. 2010), and conducted in OTP sites in Enderta Woreda, Tigray, North Ethiopia was 7.3 g/kg/day (Massa et al. 2016). But rate of weight gain in our study was higher than the study conducted in Wolaita Zone which was 2.2 g/kg/day for length of stay in the program (Kabalo and Seifu, 2016). Violating the standard protocol for SAM management affected the recovery rate and weight gain negatively. These discrepancies could also be resulted from sharing of the Plumpy'Nut with other members of a household or the caregivers might not force the index child to consume the right amount of the food.

The survival status of children was significantly affected by type of malnutrition and provision of amoxicillin as supportive medication at Log Rank test ($P < 0.05$). Despite the absence of clinical signs, severely malnourished children are nearly all infected, particularly if they have poor appetite. The severely malnourished children are also the most harbors of parasites which can directly consume nutrients and/or deter the absorption. Hence, these infections should be treated blindly. Yet, this study revealed that all eligible children were not administered the antibiotics and deworming (Chamois 2009). In this research amoxicillin

provision was significantly associated with survival rate. The finding was partially in agreement with study done in Tigray region (Yebyo et al. 2013), in prospective cohort study in Enderta Woreda, Tigray (Massa et al. 2016), on treatment outcome in Wolaita Zone (Kabalo and Seifu 2017) as their report indicated recovery rate was significantly associated with amoxicillin provision as supportive medication. This shows that amoxicillin provision is used to increase survival status of children; it may be due to decreasing infections. Beside this, marasmic children stayed longer on treatment compared to children with kwashiorkor. Regarding the factors associated with time to recovery, children with marasmus were found to stay longer on treatment and this was consistent with a study in Malawi, in which SAM children without edema were less likely to recover [hazard ratio, $HR = 0.80$, 95% CI (0.69–0.94)] (Chikhungu et al. 2014). Children admitted with kwashiorkor recover more likely than those with marasmus in retrospective longitudinal study done at Kamba (Shanka et al. 2015). This may be due to the schedule of the program, children with kwashiorkor discharged from the program if the edemas disappear for two consecutive weeks.

Limitations of the Study

The limitations of the retrospective data, including the incompleteness or loss of data, were evident in this study. Additionally, this study did not assure that RUTF (Plumpy'Nut) was not shared by other siblings in the household or that the sick child was fed appropriately. It also did not assess the household and environmental factors, and the socio-economic and demographic characteristics of the care taker and other important variables that would have associations with survival status of children. This information is not indexed in the standard OTP record cards.

Conclusions and Recommendations

The proportion of recovery rate, the defaulter and mortality (death) rates were within the acceptable range of minimum Sphere international standard for the outpatient treatment of SAM. However, the treatment duration (length of stay on treatment was 6.07 days) which was longer than the sphere recommendation. Similarly, the rate of weight gain was 3.41g/kg/day which was lower than the sphere recommendation. The survival rate from SAM per week was lower and significantly different among children travel ≥ 30 minutes, the children with at least one symptom, marasmic children and children did not take amoxicillin drug than the children travel < 30 minutes, without these medical problems, children with kwashiorkor and who took amoxicillin medication respectively. The health extension workers should design appropriate and

ongoing supervision mechanism for defaulter tracing. Because supportive medications add significant input in the program effectiveness, considerations needed in provision of those medications like amoxicillin in the program. Special focus should be given to young children by health care providers during outpatient therapeutic feeding program. Health care providers strongly advised to comply with OTP treatment protocols. This study can be used as a reference in priority setting, to bridge the knowledge gap of the community and designing effective nutritional programs. Researchers should conduct further prospective study for better information by including other factors not included under this study such as existence of sharing of Plumpy'Nut among siblings, proper provision of the treatment to the indexed child at home, breastfeeding information, household income level, perception of mother on the diseases, and effect of the maternal educational level.

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