# Predictors of Time to Recovery from Severe Acute Malnutrition among Children Aged 6-59 Months Treated in Outpatient Therapeutic Feeding in Girar Jarso District, North Shoa Zone, Oromia Region: Three Years Retrospective Cohort Study


By; Abdulbari Abdulkadir (BSc)

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**Jimma, Ethiopia**

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By; Abdulbari Abdulkadir (BSc)

**Advisors**: Fasil Tessema (MSc, Associate professor)

Ayantu Kebede (BSc, MPHE)

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## Abstract

**Background:** World Health Organization recommends outpatient therapeutic feeding program as a standard treatment protocol for the management of uncomplicated severe acute malnutrition. This program has been decentralized to health post in Ethiopia. However, time to recovery from severe acute malnutrition under this program varies.

**Objective**: This study identified determinants of time to recovery from severe acute malnutrition

**Methods:** Three years institution based retrospective cohort study was conducted in Girar Jarso district from January 2015 to December, 2017. Six of 17 health posts, selected by lottery method and 363 charts of children were selected by simple random sampling. Data extracted retrospectively by checklist and data collectors were nurses. The study variable includes; socio-demographic characteristics, anthropometries, co-morbid conditions and routine medications. Difference in rate of survival for grouped factors was assessed by Kaplan-Meier curves with log-rank test. Cox-proportional hazard regression was used to identify predictor factors. Proportionality of hazard over time was assessed graphically by log minus log survival. Effect was reported by adjusted hazard ratio with its 95%CI at p-value <0.05.

**Results:** Total 342 charts of children included in this study. Proportion of recovery, defaulter, and not-responded to treatment were 85.1%, 6.4%, 8.5% respectively with no death. The median time to recovery was 42 days. Children, who received vitamin A (AHR= 2.9, 95% CI, 1.6- 5.2), referred by community volunteers for treatment (AHR =1.3, 95%CI, 1.01-1.7), vaccinated (AHR= 2.0, 95%CI, 1.3- 3.1), family travel ≤ 30 minute to treatment site (AHR =1.5, 95%CI 1.13 -1.9), without diarrhea (HR=1.36, 95%CI 1.01-1.86), and without pneumonia (HR=1.8, 95%CI, 1.2-2.6), recovered by higher rate at any unit time during follow-up period than their counter group.

**Conclusions**: Receiving Vitamin A, being vaccinated, referred by community volunteer for treatment and not having diarrhea and pneumonia were significant predictors of time to recovery from severe acute malnutrition. Community referral and routine immunization should be strengthened. The service providers should adhere to guide line to prevent co-morbid condition.


***Key words**: Time to recovery, severe acute malnutrition, OTP, Ethiopia, 2018*

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## Table of Contents

## List of Tables

## List of Figures

## Acronyms and Abbreviation

| | |
|---|---|
| AHR | Adjusted Hazard Ratio |
| CMAM | Community Based management of malnutrition |
| DHS | Demographic and health survey |
| HR | Hazard Ratio |
| IMCI | Integrated Management of Childhood Illness |
| IU | International Units |
| mm | Millimeter |
| MUAC | Mid Upper Arm Circumference |
| NCHS | National Centre for Health Statistics of USA (anthropometric standards) |
| NRU | Nutrition Rehabilitation Unit |
| OPD | Out Patient Department |
| ORS | Oral Rehydration Salt |
| OTP | Out-patient Therapeutic feeding Program |
| RDA | Recommended Dietary Allowances |
| RUTF | Ready-to-Use Therapeutic Food |
| RWG | Rate of Weight Gain |
| SAM | Severe Acute Malnutrition |
| SNNP | Southern Nation Nationalities and Peoples |
| SFP | Supplementary Feeding Program |
| TFP | Therapeutic Feeding Program |
| TFU | Therapeutic Feeding Unit |
| UNICEF | United nation children's fund |
| WHO | World health organization |
| W/H | Weight for Height |
| W/L | Weight for Length |

# 1. Introduction

## 1.1 Background

Severe Acute Malnutrition (SAM) is defined as weight for height ratio(WFH) of <70% or Z-score of ≤-3 standard deviation of the median reference population, the presence of bilateral pitting edema of nutritional origin, or a mid-upper-arm circumference (MUAC) of less than 110 mm in children aged 6–59 months(1–3).

Globally about 50 million under five children are estimated to be wasted, of whom 19 million (35%) are severely wasted. Disorder is associated with 1 to 2 million preventable child deaths each year. Approximately 875,000 deaths, or 12.6% of all deaths in under five children attributed to acute under nutrition(4).

In WHO Africa regions, prevalence of SAM among children under 5years decreased from 38% to 32% between 2000 and 2015. However number of affected children increased from 50.4 million to 58.5 million in the same year with 10 countries having very high prevalence ≥40% including Ethiopia(5).

The 2016 National Demographic Health Survey (DHS) showed that the prevalence of wasting, underweight and stunting in Ethiopia were 10, 29 and 38%, respectively. Among 10% wasted children, 3% were severely wasted. In Oromia Region the prevalence of underweight and wasting, as 22.5% and 10.5% respectively with 3.5% severely wasted and 17.1% severely stunted under five children(6).

Over the last one and half decades, there has been a paradigm shift in the treatment of severe acute malnutrition, from inpatient management to community-based therapy with ready-to-use therapeutic foods(7–9).Community based management of acute malnutrition is a proven approach to manage6- 59 month malnourished children without medical complications. These programs uses new, ready-to-use, therapeutic foods and are designed to increase access to services, reduce opportunity costs, encourage early presentation and compliance, and thereby increase coverage and recovery rates(7,10).

Outpatient therapeutic feeding program (OTP) is component of community based program, which offers services to severely undernourished children(11,12). According to the protocol for management of SAM, Mid Upper Arm Circumference (MUAC) of less than 110 mms and/or weight-for-height ratio of less than 70% or presence of bilateral pitting edema of

nutrition origin are admission criteria to OTP with no medical complication and passed appetite. Once admitted to the OTP, children receives different amount of Plumpy 'Nut sachets according to their body weight. They are also supplemented with the routine medications such as Vitamin A, Folic acid, antibiotics, de-worming tabs and measles vaccine during the course of treatment(1,13).

Program has its cutoff criteria for exit, which is different for different types of malnutrition. The possible outcomes sated out by sphere standard includes recovery, defaulter, non-respondent, medical transfer or died. (14). Outcome of OTP is measured against Sphere standard which declares that recovery/cure rate of greater than 75%, defaulter rate of less than 15 % ,death rate less than 10%, average weight gain greater than or equal to 8 g/kg/day and average length of stay of less than 4 weeks(14).

## 1.2 Statement of the Problem

Globally from more than 34.6 million uncomplicated cases of severely undernourished children aged 6-59 months reported, 2.6 million cases were admitted to OTP with only 30 countries achieved recovery rate of ≥75% during 2016(12). In Ethiopia numbers of children with SAM admitted into therapeutic feeding program at national level in 2015 were 29,722. Oromia is the most affected region, accounting for 47% of the admissions(15).Recent reviews indicated that undesired outcomes from treatment of SAM in outpatient therapeutic feeding program ranges from 3.4 to 35 percent in Ethiopia(16,17).

According to treatment protocol maximum period stated for cure is 8 weeks in Ethiopia. The average length of stay under the OTP intervention varies from study to study and in different settings. Studies conducted in Northern and Southern Ethiopia revealed average length of stay in outpatient therapeutic feeding program at health post level as longer than the sphere standards(18,19). Different studies identified median time to recovery as 42 days(20), 49 days(18) and 25 days (21)from severe acute malnutrition under OTP intervention. Recent review indicated that the median time to recovery ranges from 18-56 days(22,23).

Studies suggested that age, sex, distance of child's residency from program care giver's, co-morbid conditions, types of malnutrition, base line anthropometry values, taking amoxicillin, vitamin A and de-worming, as determinant factors for time to recovery (18,20,24,25).

Ethiopia has made remarkable progress in scaling-up nutrition interventions, to reduce child mortality (which accounts for 57% of all under five child death) and reversing trends of malnutrition. This has been seen with the establishment of over 12,000 Out-patient Therapeutic Program (OTPs) up from 5,000 sites in 2009, in more than 500 districts across the country. Currently three out of four health posts has been treating children with malnutrition. In addition to this with deep interest to standardize and improve SAM treatment outcomes, guidelines, protocols and training materials were developed and continuously being updated(22,26).

However, children treated in this program recovered at different time during the follow up period and there are children who didn't recover after stayed in program for 56 days of follow-up. In addition to this predictors of time to recovery specifically season of admission, vaccination status and breast feeding status of the child, were not significantly investigated(5) Which can affect time to recovery from severe acute malnutrition.

Breast feeding child may recover earlier than the child that do not breast feed with ready to use foods. Similarly vaccinated children may recover from SAM because they may have improved immunity to prevent infectious disease specifically diarrheal disease and pneumonia which are the main risk factor for malnutrition. Children who admitted to treatment during production time may recover from SAM, at higher rate than those who admitted during harvesting time. This might be due to availability of variant food type at house hold level during this season.

In line with this, there was no study conducted in North Shoa Zone of Oromia region. However, as it was suggested by Joint statement of WHO and UNICEF, Universities should conduct research on the optimal means of community based management of acute malnutrition (CMAM) at community level to ensure program effectiveness and sustainability(27).

This implies that conducting study was important to obtain evidences on determinants of time to recovery. Hence, this study was conducted with aim of determining predictors of time to recovery from Severe Acute Malnutrition among children aged 6-59 months treated in Outpatient Therapeutic Feeding Program in Girar Jarso District, North Shoa Zone, Oromia.

## 2. Literature Review

Despite numerous advances made in improving child health, severe acute malnutrition remains the major killer of under five children. However, few countries in high prevalence areas have specific national policies aimed at addressing severe acute malnutrition comprehensively(28–30).

Three out of four children diagnosed with SAM are uncomplicated and the majority have a good appetite for ready-to-use therapeutic foods (12,20). Modern protocols for management of SAM combined with close monitoring can greatly reduce unfavorable outcome and minimize the length of follow-up(17).

### 2.1 Time to recovery from SAM under OTP

According to International SPHERE standard outcomes of severely malnourished children who treated in OTP should ≥ 75% cure, <10% death, <15 % defaulter and ≥ 8gm/kg/days of average weight gain within 28 days of follow-up period(14). Study conducted in Ghana outpatient clinic revealed median time to recovery of 45 days (34). In Uganda, 86% performance rate was achieved by OTP at primary health care and the average follow up period was 38 days(35).Study in Kenya at primary health care setting revealed that the median follow p period of 28 days(36).

A variation in recovery rate from the program has been reported since the integration of OTP in Ethiopia. Report from OTP integrated to government run health centers in south-west Ethiopia showed a median time to recovery of 49 days (37).A study conducted in south Ethiopia shows that the average length of stay in the program was 35 days for patients with severe wasting and 21 days for patients with edematous malnutrition(38).

The study done in Tigray region reported median time to recovery of 49 days. The prospective cohort study in the same region revealed median time to recovery of 42 days(39,40). Fifty eight percent of children admitted to OTP were recovered with median recovery time of 28 days in Bahirdar (41).

### 2.2 Determinants of time to recovery

Time to recovery from SAM is affected by multitude of factors(42,43). Finding from different study conducted in sub-Saharan Africa shows varying degree of prediction level for different factors. According to study from Kenya a child above 2 years have 25% higher risk of recovery from SAM in OTP program than <2 years old children(36). Children less than 24

months have 4.4 times high risk of early recovery from the program than those of older children(44). Male children have 30 % higher risk of recovery than female(39).

Study conducted in Ghana and Uganda doesn't show significant association of age and sex with time to recovery from Severely under nourished children in OTP(34,35,45). Similarly in study conducted in Tigray region, and Southern parts of Ethiopia age and sex were not determinant of time to recovery from SAM at outpatient therapeutic feeding program(38,46). While, study conducted in Bahirdar reported that compared to male, females were 86% times more likely to recover early from SAM in therapeutic feeding program(41).

Study conducted in northern part of Ethiopia identified, taking amoxicillin, and de-worming drugs as positive predictors for time to recovery from severe acute malnutrition(40). Child who took amoxicillin has higher chance of early recovery from SAM than children who didn't receive it and children who took vitamin-A as routine medication were had 80%increased risk of recovered as compared to those who didn't took it(46). However study conducted in Kenya, Uganda and India taking amoxicillin, vitamin A and measles vaccine were not significant predictors of time to recovery(36,45,47).

Different studies reported that time to recovery from OTP among children whose mothers travel short distance to health facility was much lower than that of children whose mothers travel longer distance (35,36,40). However, many of studies conducted in Ethiopia didn't showed level of contribution of short distance to treatment site on time to recovery from severe acute malnutrition.

Study conducted in Ethiopia reported that children who were fully vaccinated had better rate of recovery than those children who hadn't been vaccinated yet (41). However, majority of studies didn't reported vaccination status as predictor variables and the way different literatures classified vaccination status varies from study to study.

The children with no diarrhea at a point of time during intervention had higher probability of getting recovered early from SAM as compared to the patients with diarrhea and those admitted without vomiting at a point of time during the treatment had 10% times higher risk of getting recovered early from SAM as compared to those with vomiting (40). In contrast to this study conducted in Kenya, Uganda and Yemen reported null effect of co-morbid condition on rate of recovery from severe acute malnutrition(36,44,45).

Pneumonia and diarrhea are the common co-morbid condition that child with malnutrition are prone to develop. Hence, they can greatly affect the rate of recovery from severe acute

malnutrition. Studies conducted in southern and southwestern Ethiopia revealed that having pneumonia as predictor of recovery rate from SAM under OTP treatment(18,20,48). Similarly study conducted in Uganda, and Ghana showed significant effect of pneumonia and diarrhea on rate of recovery in under five children with SAM(34,35).

Skin lesion predisposes malnourished children to different external and internal infection. Hence contribute to low rate of recovery from SAM. Prospective cohort study conducted in Ethiopia reported that skin lesion significantly associated to low rate of recovery from severe acute malnutrition(18).

Children with different types of malnutrition on admission shows varying rate of recovery severe acute malnutrition under OTP. Study conducted in India and Tanzania showed that children with Marasmic types of malnutrition recovered with higher rate than those of Children with kwashiorkor type malnutrition. Similar finding was reported from study conducted in Tigray region in Ethiopia(18,45).

According to study conducted in Uganda, Ghana and Kenya, readmitted children recovers by lower rate than the rate of children who admitted to OTP for the first time or who had not been admitted in the last three months(34–36). However, in Ethiopia no study had reported the effect of types of admission on cure rate from severe acute malnutrition(40).

Under outpatient therapeutic feeding, being admitted with edema statistically associated with lower rate of recovery over time during follow up period in different studies. However children admitted with mid-upper arm circumference of < 11.0cm and WFH ratio of < 70% didn't showed significant effect on rate of recovery over time. Study conducted in Southern Ethiopia reported that being admitted with WFH ratio of < 70% had statistically significant effect on time to recovery from severe acute malnutrition under Plumpy'Nut intervention(24,40,45).

Generally from literatures the effect of different variables was tried to seen in different studies. Finding of the studies varies with design, setting and the way of categorizing the variables. As tried to show by presenting results of different studies above, effects of characteristic of children like, age, sex, types of malnutrition, admission criteria, co-morbid conditions and routine medication like vitamin A and de-worming drugs on time to recovery from SAM have been studied. However effect of season of enrollment to treatment, child vaccinated at least once, being referred by community volunteers for treatment and breast feeding on time to recovery was not investigated yet, if so which help to improve program outcome and shorten duration of follow-up time.

## 2.3 Conceptual Frame work

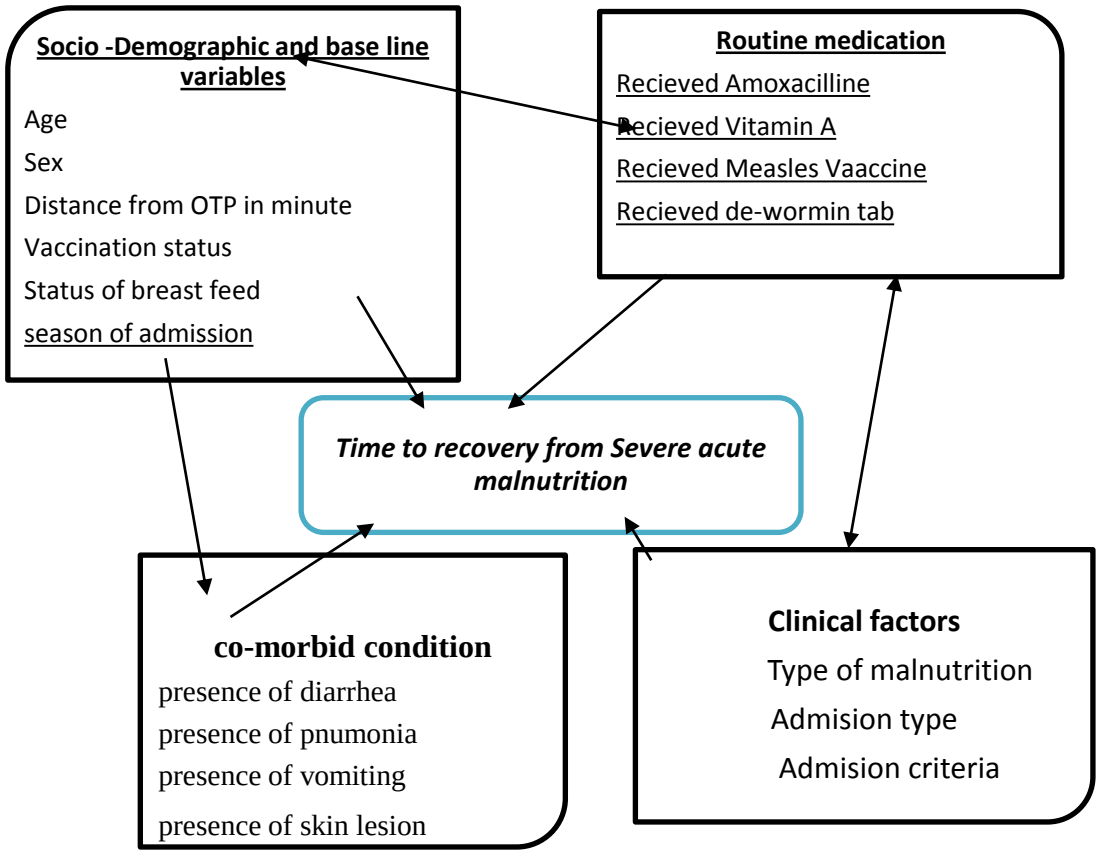



Figure 1: Conceptual frame work for determinants of time to recovery from severe acute malnutrition among 6-**59** month old children in Outpatient therapeutic feeding program.

(Source: adapted by investigator after review of different literatures)

## 2.4 Significance of the study

This study determined predictors of time to recovery from severe acute malnutrition among children treated in OTP site at health post level in Girar Jarso districts, That would add significant input, by identifying factors that favor rate of early recovery from severe acute malnutrition, for the program to set long-term planning for outpatient therapeutic feeding program in particular and community based management of severe acute malnutrition in general and will provide significant input for policy makers, and researchers.

# 3. Objective

## 3.1 General Objective

To determine predictors of time to recovery from severe acute malnutrition among children age 6-59 months treated in OTP, Girar Jarso district, North Shoa Zone, Oromia Region, 2015-2017.

## 3.2 Specific Objectives

- To determine predictors of time to recovery for severely under nourished children treated in Outpatient therapeutic feeding.

# 4. Methods and participants

## 4.1 Study area and period

This study was conducted in Girar Jarso district of North Shoa Zone, Oromia Region which is found at 155 km away from Addis Ababa to the North part of the country. It is 995 square km wide and founds at 9035m-9049 m above sea level. It is geographically bounded by Amhara region on the North, by Yaya Gullalle woreda on the South, by Degam woreda on the west and south west and by Hidabu Abote woreda on the West. Based on the 2007 G.C census's population projection, the district has a total population of 87,209, of whom 43,255 are male with 14,302 under five children. There are 3 Health Center and 17 rural health posts with no urban health post in the districts. All government run health institutions in the district have been providing community based management of severe acute malnutrition since 2008 G.C. Study period was from January 1/2015 to February 28/2018.

## 4.2 Study design

Institution based Retrospective Cohort Study was Conducted

## 4.3 Population

### *4.3.1 Source population*

Children aged 6-59 months treated for severe acute malnutrition in outpatient therapeutic feeding program.

### *4.3.2 Study population*

Randomly selected chart of children aged 6-59 months which were enrolled to Outpatient Therapeutic feeding program at health post in Girar Jarso district from January 01/ 2015 to December 30/2017.

### 4.3.3 Sampling unit

Record of child who was treated for severe acute malnutrition under OTP in Girar Jarso district during study period

### *4.3.4 Inclusion and exclusion criteria*

#### *4.3.4.1 Inclusion criteria*

Child aged 6- 59 months, enrolled to OTP with MUAC<11.0cm, WFH< 70%, or Bilateral pitting edema of nutrition origin, who received treatment from January 1, 2015, to February 28, 2018 with the last date of admission on December 30, 2017

#### 4.3.4.2 *Exclusion criteria*

Children transferred in from inpatient management after improvement, those children who enrolled to OTP by refusing inpatient admission and those children transferred out after admitted to selected health posts

## 4.4 Sample size and sampling methods

### 4.4.1 *Sample size determination*

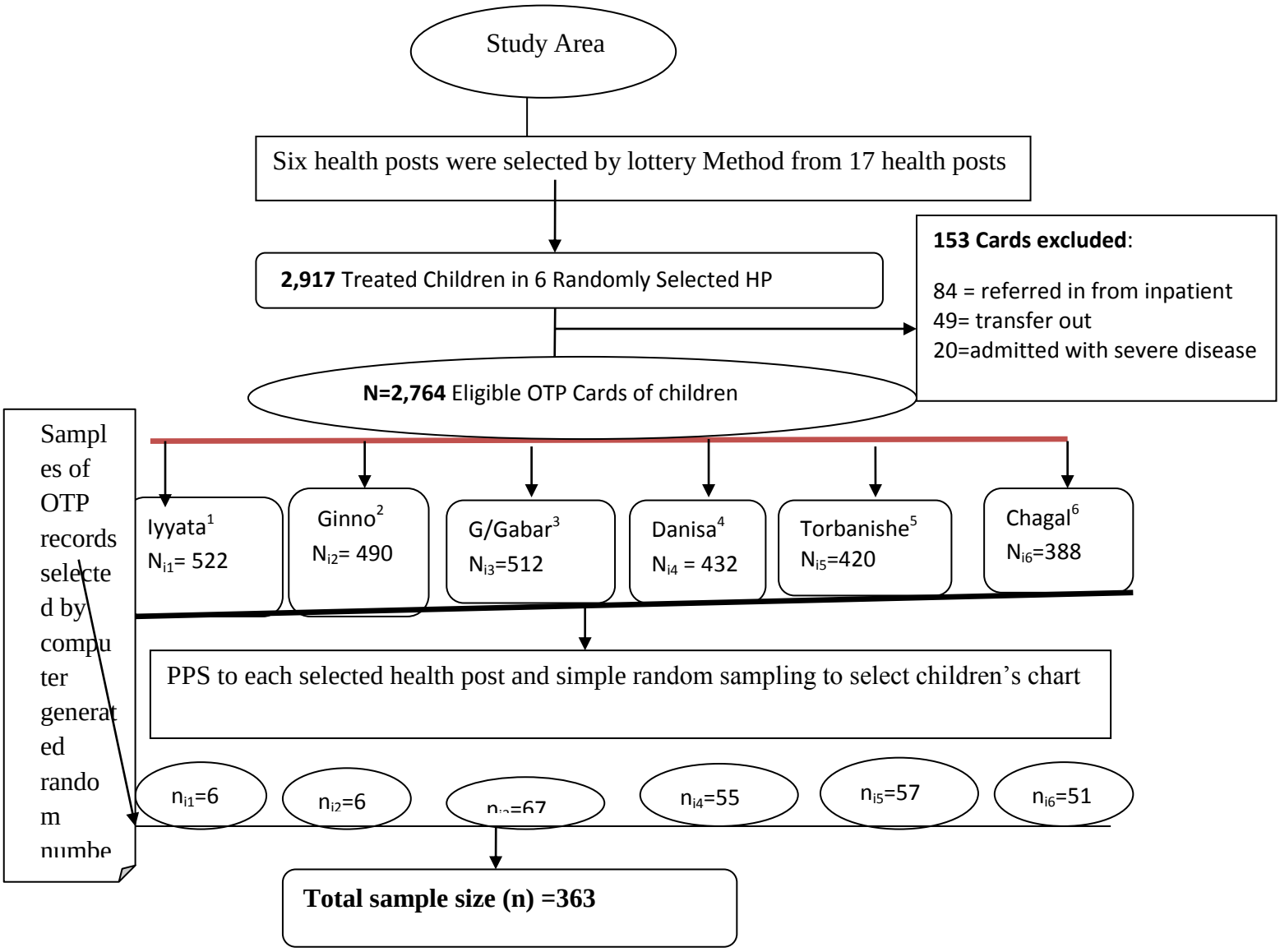
Sample size was determined by using Open Epi, version 3, (open source calculator) by considering assumption of; 5% level of significance, 80% power, one to one exposed to unexposed ratio, P1: proportion of recovery for Marasmic children as Percent of un-exposed with Outcome which was 25%, p2: proportion of Recovery for children with kwashiorkor type malnutrition, as Percent of exposed with outcome, which was 39% , hazard ratio of (b) = 0.62, and overall proportion of recovery (d=58%), which provide maximum sample size of 363. The proportion was taken from a study conducted in Enderta District, Ethiopia, from January-April 2012(41).

$$n=\frac{(z_2^{\alpha}+z\beta)2}{b^2P1P2d}=363$$ (D. A. Schoenfeld, 1983; **39**: 499–503.)

n= Estimated Sample size, $Z_{\alpha}$ =1.96 (significance level =5%), $z_{\beta}$ = 0.84(Power of the study =80%)

### 4.4.2 Sampling technique

Multi stage sampling was used. Girar Jarso woreda has a total of 17 rural kebeles with one health post per kebele. Six health posts were selected by lottery method. The total sample size was proportionally allocated based on numbers of children treated during the study period to selected health posts. Eligible chart of children with SAM were identified and sampling frame was developed by using individual OTP identification number. Finally, eligible number of OTP records were selected using simple random sampling technique by computer generated random number from each health posts (**Figure 2**).




*PPS: population proportional to size HP: health post, OTP: outpatient therapeutic feeding program, N: Eligible number of children treated at specific Hp in the three year period N*: represents final sample size for this study*

$n_i = \frac{N_i \times n}{N}$ *formula used for population proportional to size allocation*

Where;- $\mathbf{n_i}$– Sample size in selected health post **N**- Total of children treated during study period $\mathbf{N_i}$ – Number of children treated in specific health post during the study period **n** - calculated sample size for this study

Figure 2: Schematic presentation of Sampling procedure for charts of severely malnourished children treated in OTP, Girar Jarso district, north shoa zoneOromia, 2015-2017.

## 4.5 Data collection instruments and procedure

Data was extracted by check list, which was adopted from Ethiopian Federal Ministry of Health, the 2016 Guide line for management of children with SAM under OTP (13). The information collected covers; characteristics of children including age, sex, OTP site, patient baseline information, date of admission, type of admission, admission anthropometry, appetite test, vaccination status, status of breast feed and provision of routine medication (Amoxicillin, De-worming, Measles vaccine and Folic acid), presence of co-morbid condition, follow up information on weight, MUAC, edema status, follow-up period, outcome, and date outcome ascertained. Data was extracted retrospectively from children's OTP cards. Four clinical nurses as data collectors and two health officers as supervisors were recruited.

## 4.6 Data quality assurance

Data extraction tool was adopted from pre-established known sources. Orientation was given for data collectors and supervisors on data extraction tool for one day. Situational analysis was conducted to check data completeness and available variables on 5% of the total sample size at yayyo health post. To ensure the completeness and consistency of information, the principal investigator and supervisors were made thorough check before receiving the filled format from each data collectors on daily bases. Data was coded, and entered into Epi data version 3.1 with double data entry for verification.

## 4.7 Measurement and Definition of Terms

### 4.7.1 Variables

**Dependent variable:**

- Time to recovery from severe acute malnutrition.

**Independent variables;-**

- Socio demographic characteristics;- Age, Sex, Distance from OTP site, Season of admission, Breast feeding status, Vaccination status
- Clinical related factors :- Types of malnutrition, Types of admission, base line anthropometry,
- Co-morbid conditions :- presence of pneumonia, diarrhea, skin lesion, vomiting
- Routine medication ; Amoxicillin, measles vaccine, vitamin A, folic acid, de-worming tablets

### 4.7.2 Definition of terms and Operational definitions

**Severe acute malnutrition** (SAM): weight for height/length (W/H or W/L) of < 70% or MUAC < 11cm or / with bilateral pitting edema

**Complicated SAM**: child with weight for height/length (W/H or W/L) of < 70% or MUAC < 11cm or / with bilateral pitting edema and with any of severe disease (severe pneumonia, severe diarrhea, profuse vomiting, extensive skin lesion, Anemia)

**Discharge criteria**: W/H≥85% on more than one occasion and no edema for 14 days if present on admission.

**Co-morbid condition**: In this study refers any disease on admission and during follow-up for which severity is not specified.

**Recovered:** when a child attained target >W/H -2 Z-score or attained 15%weight gain (target weight) or MUAC > 12.5 cm and no edema for two consecutive visits for edematous children.

**Defaulter;** a child that is absent for three consecutive weeks and confirmed by home visit as alive.

**Non-responded to treatment;** a child that has not reached discharge criteria after staying under OTP intervention for 56 days

**Died**; death of a child aged 6- 59 months while on follow up once enrolled to OTP (within 56 days of enrollment).

**Unknown:** child that absent for 3 consecutive weeks in outpatient care (21 days) but the outcome (actual defaulting or death) is not confirmed/ verified by a home visit.

**New admission:** children directly enrolled to the program to start the nutritional treatment, **Readmission:** is previously defaulted before reaching the discharge criteria, and is reenrolled within 2 months of defaulting.

**Routine medication:** provision of Amoxicillin for seven days, folic acid 5mg once at first visit, Vitamin A on day one and for all children at fourth visit, de-worming on 7$^{th}$ days of admission for children >24 month aged children and measles vaccine for all children at 4$^{th}$ visit.

**Weight gain (g/kg/day):** is average weight (in gram) increase for every Kg of body weight of the child per day. It is determined by:-

$$\text{Weight gain} = \frac{\text{Discharge weight (gm)} - \text{Admisiion weght in (gm)}/\text{MinimumWeightduringfllow} - \text{upperiod}}{\text{Numberofdaysfromadmissiontodateoutcomeascertained}}$$

**Average weight gain =** sum of weight gains in gm/ no of 6-59 months children. The rate of MUAC gain in mm/day and weight gain in g/kg/day was calculated for children who were cured and defaulted before leaving the program.

**MUAC gain**= $\frac{\textbf{DischargeMUACinmm}-\textbf{AdmissionMUACinMM}}{\textbf{MinimumMUACduringfollo}-\textbf{upperiod}}$ X number of days from admission to date outcome ascertained

(**Sources**; WHO, updated guide line for management of SAM, 2013, and Ethiopian FMOH updated guide line for management of SAM, 2016)

**Distance from OTP site**: was distance from health post to child's care giver home measured in minute on foot. We used the average distance of one house hold from the health post 30 minutes as per recommendation of Ethiopian federal ministry of health for decentralization of health post.

**Vaccinated**; in this study refers those children who received routine vaccination doses fully and partially

**OTP site;** in this study indicates only outpatient therapeutic feeding program at health post level.

**Incomplete chart**: chart of children that didn't had date of admission, treatment outcome and date final outcome ascertained

**Censored:** in this study refers those severely malnourished children admitted to treatment but leave the program not recovered (defaulted and not responded to treatment)

**Event**; was recovery of severely malnourished children while leaving the outpatient therapeutic feeding program.

**Time to event**: was the period in which final outcome was ascertained, which is measured in dates from date of admission to date final outcome was ascertained.

**Risk**; in this study indicates the positive effect to recovery from severe acute malnutrition under OTP program

## 4.8 Data Management

After verified for entry error by double data entry on Epi data version 3.1, data was exported to SPSS version 23.0 for analysis. Exploratory analysis was carried out to check the levels of missing values, presence of outliers and multi-co linearity. Different variables were transformed to other variables for analysis purpose. Proportion of OTP outcomes were described as recovered, defaulted and not responded to treatment. Treatment outcomes were described against each of explanatory variables.

The primary outcome variable was time, measured from admission to date final outcome ascertained and the other outcome variable was recovery from severe acute malnutrition. The outcome was coded into recovered and censured for statistical analysis.

Life table analysis was conducted to measure incidence of recovery over intervention period. Difference in rate of survival for grouped factors over intervention period was assessed by Kaplan–Meier survival curve and significance of the observed difference was tested by log-rank test at 5% significant levels.

Simple Cox- proportional hazard regression was used to select candidate variables for multivariable Cox proportional hazard model at p-value < 0.25 and interaction effect between covariates was checked at 5% significant level by likely hood ratio test. Co-varieties which were independent predictor's of time to recovery were modeled by Multivariable Cox proportional hazard model, by controlling the confounding effect of other covariates. Before fitting the Final model, assumption of proportionality of hazard over time was assessed graphically by log minus log survival curve. Effect was reported by Adjusted hazard ratio with its 95% CI and statistical significances declared at $p<0.05$.

## 4.9 Ethical clearance

Ethical clearance was obtained from Jimma University's Institutional review board with Ref/no IHRPGD/3047/18 on 28/02/2018 prior to the conduct of the study and was communicated to local officials of the study area. Data was kept confidential and secure. Names of children on OTP records were not included in the data extraction form.

## 4.10 Plan for dissemination

Findings of this study will be submitted to Jimma University, department of Epidemiology and will be communicated to local official of the study area. It will be further communicated on different scientific conference and workshops in appropriate media. All effort will be used to publish on scientific journal.

# 5. Result

## 5.1 Non-Response Rate

From a total of 363 randomly selected charts of children on OTP 21(6.5%) were excluded from analysis because of incompleteness for base line data (Date of admission (11), Treatment outcome (4), Date treatment outcome ascertained (6)).

## 5.2 Descriptive result

### 5.2.1 Base line Characteristics of Children

The study included 342 eligible children who had been managed for SAM under the OTP. Children >24 months age were 66(19.3%), while ≤ 24 months age were 276(80.7%). The mean age of the children at admission was 17.45months (SD ± 8.55months). Among treated children 181(53.1%) were female while 161(46.9%) were males.

About one third, 118(34.5%) of family/care giver's travel on foot for more than thirty minutes to reach health post and while the average distance from home to the OTP center for all children was 44.9 (±20.5SD) minutes on foot.

Among ≤ 24months age children, 161(58.3%) were breast feeding of whom 138(85.7%) were cured while 12(7.4%) were defaulted from follow-up. Among 115(42.7%) not breast feed children, 93(81%) were cured while 14(12.2%) were non-responded to treatment.

From study participants 266(78.9%) children were vaccinated fully or partially, while 71(21.1%) were not vaccinated with five missing value for vaccination. Among Vaccinated children 259(97.4%) were cured.

There were 306(89.2%) new admission from which 262(85.9%), 26(8.5%) and 18(5.6%) were cured and non-responded to treatment and defaulted respectively. From total of 36(10.9%) re-admitted children 28(77.8%) were cured while 5(14.0%) and 3 (8.2%) of children defaulted from follow-up.

Different criteria were considered for admission of children to OTP. Regarding the criteria, majority 274(80.4%) of the children were admitted with mid upper arm circumference ≤ 11.0cm while 35(10.1%, and 32(9.4%) were admitted by Weight for height ratio<-3SD and with Edema respectively. Among children admitted with MUAC ≤11.0cm 88.3% were cured and 7% were

defaulted, while 68.6% and 17.1% of children admitted with weight for Height < -3 SD were cured and non-respondent to treatment respectively.

Regarding season of admission 150(46.0%) was enrolled during harvest season (June to November) while 190 (56.0%), enrolled during production season (December to May). The rate of defaulting from program was high 14(9.3%) for children admitted during harvest season. Cure rate was 126(84.0%) and 165(86.0%) for children admitted during harvest and production season respectively (**Table 1**).

Table 1:- Baseline characteristics of Children by treatment outcomes, Girar Jarso district, North Shoa Zone, Oromia, 2015-2017

| Variables | Total n(%) | Treatment outcomes | | |
|---|---|---|---|---|
| | | Cured | Defaulted | Not-responded to treatment |
| | | n (%) | n (%) | n (%) |
| **Age** | | | | |
| >24 month | 66(19.3) | 55(83.3) | 3(4.5) | 8(12.2) |
| ≤ 24months | 276(80.7) | 236(85.5) | 19(6.9) | 21(7.6) |
| **Sex** | | | | |
| Male | 161(46.9) | 136(85) | 12(7.5) | 12(7.5) |
| Female | 181(53.1) | 155(85.6) | 9(5) | 17(9.4) |
| **Vaccination status** | | | | |
| Vaccinated | 266(78.9) | 259(97.4) | 5(1.9) | 2(0.7) |
| Not vaccinated | 71(21.1) | 27 (38.0) | 17(24.0) | 27(38.0) |
| **BF status if ≤ 24 month age** | | | | |
| Yes | 161(58.3) | 138(85.7) | 12(7.4) | 11(6.9) |
| No | 115(42.7) | 93(81.0) | 8(6.8) | 14(12.2) |
| **Types of admission** | | | | |
| New admission | 306(89.2) | 262(85.9) | 18(5.6) | 26(8.5) |
| Re-admission | 36(10.8) | 28(77.8) | 5(13.9) | 3(8.3) |
| **Admission Criteria** | | | | |
| MUAC<11cm | 274(80.4) | 242(88.3) | 13(4.7) | 19(7.0) |
| WFH< -3SD | 35(10.3) | 24(68.6) | 5(14.3) | 6(17.1) |
| Presence of edema | 32(9.4) | 25(78.0) | 3(9.4) | 4(12.6) |

| | | | | |
|---|---|---|---|---|
| **Season of admission** | | | | |
| Harvest season (June to November) | 150(44.0) | 126(84.0) | 14(9.3) | 10(6.7) |
| Production season (December to May) | 192(56.0) | 165(86.0) | 8(4.0) | 19(10.0) |
| **Distance from HP on foot** | | | | |
| >30 minute | 118(34.5) | 113(95.7) | 3(2.5) | 2(1.8) |
| ≤ 30 minute | 224(65.5) | 178(79.5) | 19(8.5) | 27(12.0) |

***MUAC: mid upper arm circumference, WFH: weight for height ratio BF: Beast feeding***

### 5.2.2 Co-morbid condition

This study explored 214(62.6%) children with at least one co-morbid condition on admission, who were managed under the OTP. The cure rate for children admitted with co-morbid conditions was179(82.9%), with cure rate for those without medical condition on admission of 112(89%).The most frequently registered medical problem was pneumonia 131(38.3%) followed by diarrhea, 121(35.4%) and the least was vomiting 43(12.8%).

Children with pneumonia, 37(56.9%), diarrhea66 (68.7%), vomiting 14(64.0%), and skin lesion69 (75.8%) on admission showed lower cure rate than those children without medical condition. Higher defaulting rate were reported from children with vomiting (16.3%) (**Table2**)

Table 2:- Observed medical complication and treatment outcomes of children, Girar Jarso district North Shoa Zone Oromia, 2015-2017.

| variables | n(%) | Treatment outcomes | | |
|---|---|---|---|---|
| | | Cured n(%) | Defaulted n(%) | Not-responded to treatment N(%) |
| **Presence of medical condition on admission** | | | | |
| yes | 216 (63.2) | 179(82.9) | 17(7.9) | 20(9.2) |
| No | 126(36.8) | 112(89.0) | 5(3.9) | 9(7.1) |
| **Diarrhea** | | | | |
| yes | 121(35.4) | 93(76.9) | 15(12.4) | 13(10.7) |
| No | 221(64.6) | 198(89.6) | 7(3.2) | 16(7.2) |
| **Pneumonia** | | | | |
| yes | 131(38.3) | 113(86.3) | 10(7.6) | 8(6.1) |
| No | 209(61.5) | 176(84.2) | 12(5.8) | 21(10.0) |
| **Vomiting** | | | | |
| yes | 43(12.8) | 31(72.0) | 7(16.3) | 5(11.7) |
| No | 294(87.2) | 256(87.0) | 14(4.8) | 24(8.2) |

| | | | | |
|---|---|---|---|---|
| **Skin lesion** | | | | |
| yes | 82(24.0) | 62(75.6) | 7(8.6) | 13(15.8) |
| No | 260(76.0) | 229(88.0) | 15(5.8) | 16(6.2) |

### 5.2.3 Routine medicines administration

In this study, all children had taken Plumpy 'Nut. However, 59 (17.3%) of the eligible children did not receive at least one of the routine medications (Amoxicillin, Vitamin A, measles vaccine, and de-worming tablets).

The most administered medicine was amoxicillin 270(78.9%) followed by de-worming tablets 51(76.5%) and Vitamin A 151 (44.2%). Children who received at least one routine medication had 249 (88.0%) cure rate. The rate of recovery for children who received Vitamin A, Amoxicillin and de-worming tablets were,276(98.0%), 237 (87.8%) and 39(76.5%) respectively(Table 3).

**Table 3**: Provision of routine medication and treatment outcomes among children treated in OTP, Girar Jarso district, North Shoa zone, Oromia, 2015-2017.

| **Variables** | **Routine medication received n (%)** | **Treatment outcomes** | | |
|---|---|---|---|---|
| | | Cured n (%) | Defaulted n (%) | Not responded to Treatment n (%) |
| **Amoxicillin** | | | | |
| Yes | 270(78.9) | 237(87.8) | 14(5.2) | 19(7.0) |
| No | 72(21.1) | 54(75.0) | 8(11.0) | 10(14.0) |
| **Measles vaccine** | | | | |
| Yes | 48(14.0) | 37(77.1) | 3(6.3) | 8(16.6) |
| No | 294(86.0) | 254(86.4) | 19(6.5) | 21(7.1) |
| **De-worming** | | | | |
| Yes | 51(77.3) | 39(76.5) | 3(5.9) | 9(17.6) |
| No | 15(22.7) | 14(93.3) | 0 | 1(6.7) |
| **Vitamin A** | | | | |
| Yes | 281(82.0) | 276(98.0) | 1(0.6) | 4(1.4) |
| No | 61(18.0) | 15(24.6) | 21(34.4) | 25(41.0) |

### 5.2.4 Program Outcomes

The study showed 291(85.1%) of the children who had been managed for SAM were recovered. Proportion of children cured at 5th, 6th, and 7th visit were 66%, 28% and 10% respectively. The incidence density of recovery was 2 children per100 person days with total of 14,383person days of follow up. The median time to cure from severe acute malnutrition was 41.87 days (IQR, 35, 49), with average weight and MUAC gain of 5.74gm/kg/day and 0.43mm/day respectively.

Cumulative proportion of recovery from SAM at 42 days for both edematous and non-edematous children was 35% while for children admitted with MUAC >11.0 cm and ≤11.0 cm was 45% and 33% respectively. The cumulative proportion of recovery from SAM at end of 56th days for children admitted with and without co-morbid condition was 79% and 100% respectively.

The defaulter rate was 22(6.4%) with rate of not responded to treatment of 29(8.5%) and no recorded death. The mean length of stay under OTP was 44.54 Days (±12 SD). The median time to default from program was 29.68 days, with all defaulting occurs before 42 days on follow-up. The average weight and MUAC gain for defaulters before leaving the program were 3.07gm/kg/day and 0.18mm/day respectively.

## 5.3 Analytical result

### 5.3.1 Rate of Survival over time and statistically observed difference for grouped factors

Among base line variables, sex, age category, edema status, admission types, admission criteria, and season of admission didn't showed difference on survival function.

Being vaccinated, traveling ≤30 minutes on foot to OTP site, Being referred for treatment by volunteer, those children who Received Vitamin-A, de-worming tab and measles vaccine as routine medication, children without any co-morbid condition on admission, without pneumonia and diarrhea and those admitted with MUAC >11.0cm had better rate of surviving in the program with statistically significant deference on log rank test as compared to their counterpart (**Table 4**).

Table 4: Difference on survival rate for children treated in OTP on Log-Rank test, Girar Jarso district, North Shoa Zone, Oromia Region, 2015-2017.

| Variable | Cured | Censored | Log-rank | P-value (=) |
|---|---|---|---|---|
| **MUAC** | | | | |
| ≤ 11.0cm | 266 | 12 | 4.93 | 0.026 |
| >11.0 cm | 25 | 39 | | |
| **Who refer the child** | | | | |
| Volunteer | 139 | 33 | 5.5 | 0.019 |
| Self | 148 | 18 | | |
| **Breast feeding status** | | | | |
| Yes | 138 | 23 | 118 | 0.0001 |
| No | 93 | 22 | | |
| **Pneumonia** | | | | |
| Yes | 113 | 18 | | |
| No | 176 | 33 | 35.2 | 0.0001 |
| **Vaccinated** | | | | |
| Yes | 259 | 5 | 60.63 | 0.0001 |
| No | 27 | 44 | | |
| **At least one medical complication on admission** | | | | |
| Yes | 179 | 37 | | |
| no | 112 | 14 | 16.5 | 0.0001 |
| **provided Vitamin- A** | | | | |
| Yes | 276 | 5 | 68.4 | 0.0001 |
| No | 15 | 46 | | |
| **Distance from OTP site** | | | | |
| ≤30 minute | 178 | 46 | 13.3 | 0.0001 |
| > 30 minute | 113 | 5 | | |
| **provided measles vaccine** | | | | |
| Yes | 37 | 11 | 16.95 | 0.0001 |
| no | 254 | 40 | | |
| **provided de-worming** | | | | |
| Yes | 37 | 10 | 3.96 | 0.046 |
| No | 18 | 1 | | |

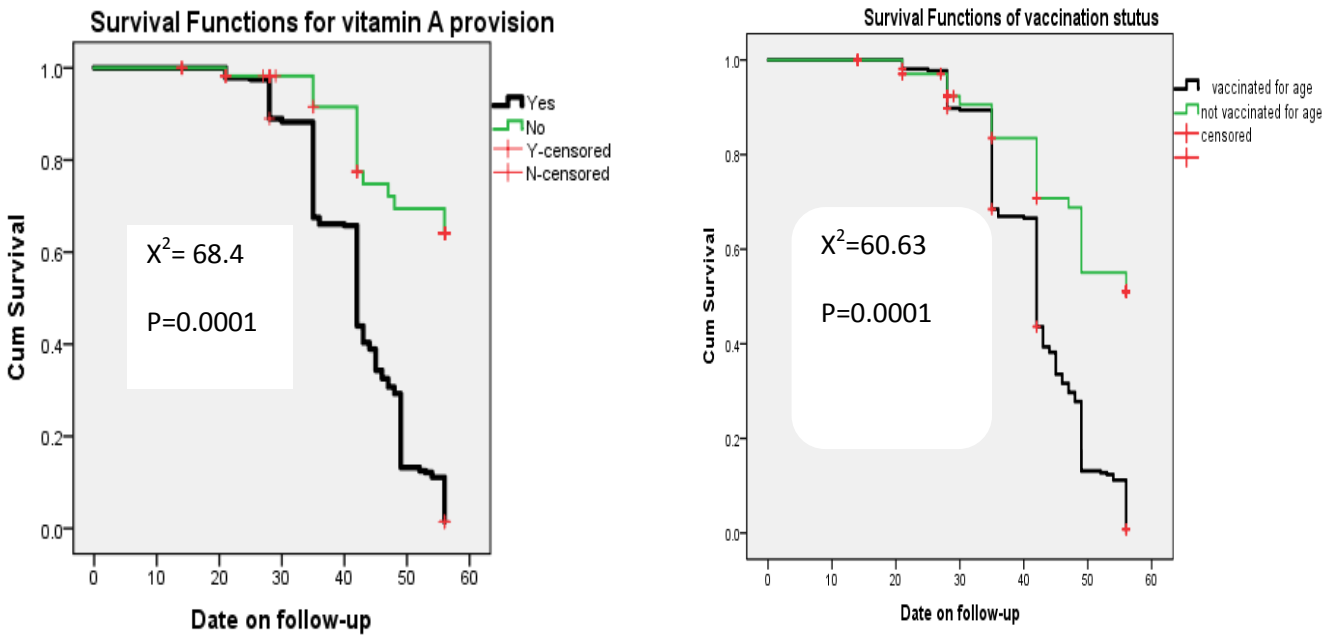



**Figure 3:-** Kaplan-Meier curves displaying the estimated survival probability for different groups of children treated for SAM in OTP, Girar Jarso district, Oromia, 2015-2017.

(The KM survival curves for grouped factor were identified by color and pattern differences. Each vertical step in the curve indicates one or more events (recovery), and right-censored patients were indicated by a red mark on the curve at the censoring time. The log-rank test indicates a significant difference of survival/recovery for children who received Vitamin A, compared to those who didn't receive it and similarly for vaccinated children compared to those unvaccinated).

### 5.3.2 Determinants of time to recovery

On bi-variable Cox-proportional hazard regression, who refer the child for treatment, category of mid upper arm circumference, distance family/care givers travel to OTP site, vaccination status and presence of at least one co-morbid condition on admission among base line variables, and presence of diarrhea and pneumonia after 21 days of admission, receiving Vitamin A, Amoxicillin and measles vaccine as routine medication were significantly associated with time to recovery from severe acute malnutrition (**Table 5**). On likeli hood ratio test, covariates with possible interaction effect (vaccination status with vitamin A, Vaccination status with pneumonia and diarrhea, referred by and distance from OTP site) was assessed, however, no significant interaction effect was seen.

Table 5:- Candidate variables for time to recovery from severe acute malnutrition on Bi-variable Cox-proportional hazard model, for children treated in OTP, Girar Jarso district, Oromia, Ethiopia, 2015- 2017.

| Variables | Event | Censored | Wald | CHR(95%CI) | P- value(=) |
|---|---|---|---|---|---|
| **Age** | | | | | |
| ≤ 24 months | 236 | 40 | 0.446 | 0.9(0.67-1.2) | 0.504 |
| < 24 moths | 55 | 11 | | 1 | |
| **Sex** | | | | | |
| Male | 136 | 24 | 0.68 | 0.97(0.7-1.1) | 0.409 |
| Female | 155 | 26 | | 1 | |
| **Admission type** | | | | | |
| New | 262 | 43 | 0.244 | 0.9(0.6-1.1) | 0.63 |
| Re-admission | 28 | 8 | | 1 | |
| **Who refer the child** | | | | | |
| Self | 139 | 33 | 6.98 | 1.4(1.1-1.8) | 0.008* |
| Volunteer | 148 | 18 | | 1 | |
| **WFH** | | | | | |
| <60% | 24 | 10 | 1.14 | 1.3(0.8-1.9) | 0.29 |
| ≥60% | 255 | 39 | | 1 | |
| **Vaccinated** | | | | | |
| yes | 259 | 7 | 38.69 | 3.6(2.4-5.4) | 0.001* |
| no | 27 | 44 | | 1 | |
| **Breast feeding** | | | | | |
| Yes | 158 | 24 | 0.69 | 0.9(0.8-1.1) | 0.405 |
| No | 91 | 23 | | 1 | |
| **One co morbid on admission** | | | | | |
| Yes | 179 | 37 | 11.7 | 1.6(1.2-2.0) | 0.001* |
| No | 112 | 14 | | 1 | |
| **Diarrhea** | | | | | |
| Yes | 66 | 30 | 17.76 | 1.8(1.4-2.4) | 0.001* |
| No | 225 | 11 | | 1 | |
| **Pneumonia** | | | | | |
| Yes | 37 | 28 | 25.3 | 2.5(1.7-3.5) | 0.001* |
| No | 254 | 23 | | 1 | |
| **Amoxicillin** | | | | | |
| Yes | 237 | 33 | 3.65 | 1.4(0.9-1.8) | 0.055* |
| No | 54 | 18 | | 1 | |
| **Measles vaccine** | | | | | |
| Yes | 37 | 11 | 3.18 | 1.4(0.9-2.1) | 0.074* |

| | | | | | |
|---|---|---|---|---|---|
| No | 254 | 40 | | 1 | |
| **Vitamin A** | | | | | |
| Yes | 276 | 5 | 39.7 | 5.4(3.2-9.1) | 0.001* |
| No | 15 | 46 | | 1 | |
| **MUAC on admission** | | | | | |
| > 11.0 cm | 25 | 39 | 3.64 | 1.5(0.9-2.3) | 0.056* |
| ≤ 11.0 cm | 266 | 12 | | 1 | |
| **Edema status** | | | | | |
| Yes | 38 | 8 | | 1 | 0.586 |
| No | 251 | 43 | 0.29 | 0.9(0.6-1.3) | |
| **Distance from OTP** | | | | | |
| >30 minute | 113 | 5 | | 1 | |
| ≤30 minute | 178 | 46 | 20.79 | 1.8(1.4-2.3 | 0.001* |

**OTP; Outpatient therapeutic feeding, MUAC; mid-upper circumference WFH; weight for Height ratio**

**Multivariable Cox – Proportional Hazard Regression**

Age, sex, status of breast feed, WFH ratio at admission, admission criteria, edema status, presence of at least one co-morbid condition on admission, and provision of amoxicillin, de-worming tab and measles vaccine didn't have significant effect on time to recovery from SAM.

Final model was built by, referred by volunteer for treatment, being vaccinated, provision of vitamin A, presence of diarrhea, traveling ≤ 30 minute on foot to treatment center and presence of pneumonia as independent predictors of time to recovery from severe acute malnutrition (**Table 6**).

Result was interpreted as, children who received Vitamin A (AHR= 2.9, 95% CI, 1.6- 5.2), recovered 2.9 times higher at any time during the follow-up period than the rate of those who didn't receive it. Those children who referred by community volunteers (AHR =1.3, 95%CI, 1.01-1.7) recovered 1.3 times higher at any unit time during follow-up than those self-referral. Vaccinated children (AHR= 2.0, 95%CI, 1.3- 3.1) may recover from severe acute malnutrition 2 times more frequently per unit time than unvaccinated children. Children whose family/care givers travel ≤ 30 minute to OTP site (AHR =1.5, 95%CI 1.13 -1.9) may recover from severe acute malnutrition 1.5 times more frequently, per unit time than those who travels longer distance.

At any time during follow-up period, children without diarrhea (HR=1.36, 95%CI 1.01-1.86) had 1.36 times higher rate of recovery from severe acute malnutrition than those children without

diarrhea. Children without pneumonia (HR=1.8, 95%CI, 1.2-2.6) had 1.8times higher rate of recovery from severe acute malnutrition at any time during follow up period than those with pneumonia.

Table 6:- Independent predictors of time to recovery from severe acute malnutrition on multivariable Cox- Proportional hazard model for children treated in OTP Center in Girar Jarso district, North Shoa zone, Oromia Region, 2015-2017.

| Variables | Cured | Censored | AHR (95%CI ) | P-Value (=) |
|---|---|---|---|---|
| **Who refer the child** | | | | |
| Community Volunteer | 139 | 33 | 1.3(1.01-1.7) | 0.003 |
| Self | 148 | 18 | 1 | |
| **Diarrhea** | | | | |
| Yes | 93 | 28 | 1 | 0.039 |
| No | 198 | 23 | 1.36(1.01-1.86) | |
| **Pneumonia** | | | | |
| Yes | 113 | 18 | 1 | 0.003 |
| No | 176 | 33 | 1.8(1.2-2.6) | |
| **Provision of Vitamin A** | | | | |
| Yes | 276 | 5 | 2.9 (1.6-5.2) | 0.001 |
| No | 15 | 46 | 1 | |
| **Vaccinated** | | | | |
| Yes | 259 | 5 | 2(1.3-3.1) | 0.002 |
| No | 27 | 44 | 1 | |
| Distance from OTP site | | | | |
| ≤30 minute | 178 | 46 | 1.5(1.13-1.9) | 0.004 |
| > 30 minute | 113 | 5 | 1 | |

# 6. Discussion

By this study we identified relatively better treatment outcome from OTP, lower rate of weight gain and longer median time to recovery from SAM compared to SPHERE standard, but acceptable range to Ethiopian national guide line for management of severe acute malnutrition at outpatient treatment center. The study also identified being referred by community volunteer for treatment, being vaccinated for age, receiving Vitamin A as routine medication, not having diarrhea and pneumonia as independent predictors of time to recovery from severe acute malnutrition.

In this study cure rate was 85.1% and this finding is above the sphere standard which states recovery rate should be greater than 75%(14). When this result is compared with a study conducted in four regions of Ethiopia; it is above the recent total average of the four regions (79%) and Tigray regional average (72%) but still it is lower than that of Amhara regional average (87%) and SNNPR regional average (90%)(48).

The median length of stay under OTP is (42 with (IQR 35-49 days) for recovered/cured children. It is found to be the same 42 days with a retrospective cohort study conducted in shebedino and kamba districts of southern Ethiopia(18,38,48).The overall mean length of stay (in days) of the malnourished children on the outpatient therapeutic feeding program was (44.54(±12) days). This result is by far outside of the acceptable minimum SPHERE standards (28 days); yet, it is well within the standard Ethiopian protocol for management of SAM which allows children enrolled to OTP to stay under treatment to at most 56days(13).

By this study season of admission was not significantly associated to time to recovery. This finding is in line with study conducted in southern Ethiopia where children who enrolled to treatment in summer season were with longer time to recovery from AM under OTP(38). This discrepancy might be due to the study design and the categorization of season that the current study used.

Breast feeding status during admission for children ≤ 24 months were not significant predictor of time to recovery by this study. Similarly no studies conducted in Ethiopia identify it, as a predictor of time recovery from severe acute malnutrition under outpatient therapeutic feeding program.

Children, who referred by community volunteers for treatment, recover 1.3 times higher than the rates of those self-referrals. This might be due to the possible early screening and refer for treatment by volunteer community health worker which help to identify the disorder and encourage early initiation of treatment.

Vaccinated children (HR=2) may recover from severe acute malnutrition two times more frequently per unit time than the rate of unvaccinated children. However study conducted in northern Ethiopia showed no effect of vaccination status on time to recovery from SAM. This might be explained by effect of vaccination on preventing co-morbid condition hence improve recovery time from malnutrition in Vaccinated children.

Severely malnourished children who received Vitamin A, recovered 2.9 times higher than the rate of those who didn't receive it. This finding is consistent with finding of retrospective study at health post level in Sidama zone which reported 1.89 times higher risk of recovery for children who received at least one routine medication either on admission, or on follow-up period (AHR, 1.89) (20).

At any time during follow-up period, children without diarrhea had 1.36 times higher rate of recovery than the rate of those children with diarrhea. This finding is consistent with the finding of retrospective study in Tigray region which reports 2.2 higher risk of recovery from SAM in children without diarrhea(39) and study in Amhara region which shows 2.45 higher risk of recovery among children without diarrhea (41).

However in study conducted in northern , southern and southwest Ethiopia not having diarrhea was not significantly associated with early recovery from malnutrition(18,38).This discrepancy might be due to the possible better adherence to treatment protocol for management of severe acute malnutrition.

Children without pneumonia had 1.8times higher rate of recovery from severe acute malnutrition at any time during follow up period than those with pneumonia. This finding is in line with reduced probability of early recovery by 47% in children who had at least one co-morbidities (20). The possible reason might be a child with co-morbidities needs a longer follow-up time, increased nutrient loss, and more nutrient requirement with decreased nutrient absorption and utilization as compared to malnourished children in the absence of co-morbidity.

In this study, children whose family/care givers travel shorter distance to treatment center recover1.5 times higher the rates of those who travel longer distance. This finding is in line with reports of different studies that time to recovery from OTP among children whose mothers travel short distance to health facility was much lower than that of children whose mothers travel longer distance (35,36,40).This might be due to better adherence to treatment hence better follow-up for early detection and management of co-morbid conditions which can contribute for delay in time to cure.

This Study was conducted with better design and analysis methods. It assessed different factors that might affect time to recovery from malnutrition. The findings are strong and reliable to apply for the general children population under treatment.

However, Data was collected retrospectively from patient's files in the context of routine care and hence there might be a certain degree of under or over reporting of events. Indeed it did not assess the information on treatment compliance at home level such as proper provision of the treatment to the indexed child at home and effect of the environmental and house hold level variables, because this information are not indexed in the standard OTP record cards. Finally not considering non response rate during sampling is the limitation of this study.

# 7. Conclusion and Recommendation

## 7.1 Conclusion

Among the treatment outcome standards/indicators of OTP, the overall recovery rate, rate of defaulter and non- response rate were within the recommended standards of sphere project. However mean length of stay in the program and mean weight gain in gram per kilogram of body weight per child was worse than the sphere standards.

Children who received Vitamin A as routine medication, referred by community volunteers for treatment, those who didn't had pneumonia and diarrhea, family/care givers travel ≤30 minute on foot to Outpatient therapeutic feeding and those vaccinated had higher rate of recovery from severe acute malnutrition, at any time during follow-up period as compared to their counterparts.

## 7.2 Recommendation

To improve recovery rates over time;-

- District health Office and program managers need to give emphasize on strengthening;
  - Routine immunization for all children,
  - Provision of Vitamin A as routine medication, for children in OTP
  - Community health worker/volunteers for early detection and referral of child with malnutrition to treatment center,
- Service providers should adhere to national protocol for SAM case management hence will be able to prevent admission with co-morbid condition and its occurrence on follow-up period
- FMOH should consider revising the guide line for management of SAM by clearly prohibiting admission of child with any of co-morbid condition.
- Further research is necessary to address environmental and house hold level factors by prospective study

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## Annexes: - Data Extraction checklist

Data Extraction checklist for study on predictors of time to recovery from SAM, for severely malnourished children treated at Outpatient therapeutic feeding program, 2018 (*source: Ethiopian FMOH guide line for management of SAM 2016*)

| | | | | |
|---|---|---|---|---|
| Registration number | ---------- | | | |
| OTP site | ---------- | | | |
| Date of admission | Date/ month/ year/ _____ | | | |
| Distance from house (in minutes ) | ---------- | | | |
| Age in month | ---------- | | | |
| sex | 1, Male | 2, Female | | |
| Referred by | 1, Volunteers | 2, Self-referred | | |
| Admission type | 1, New | 2, Readmission | | |
| **Base line Anthropometrics value** | | | | |
| Weight ( kg) | | | | |
| MUAC (cm) | | | | |
| Edema (0, +, ++, +++) | | | | |
| W/H ratio (%) | | | | |
| Admission criteria | 1, MUAC | 2, W/H ratio | 2, edema | 3, all/two of the option |
| Vaccination status | 1, vaccinated | 2, not vaccinated | | |
| Diarrhea | 1, yes | 2, no | | |
| Vomiting | 1, yes | 2, no | | |
| Breast feeding status if ≤24 months | 1, yes | 2, no | | |
| Cough /pneumonia | 1, yes | 2, no | | |
| Skin lesion | 1, Yes | 2, no | | |
| Anemia | 1, yes | 2, no | | |
| Body temperature | | | | |

**DATA ON FOLLOW UP PERIOD**

| Variables | Weeks on follow-up | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Admission** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Date | | | | | | | | | |
| Weight( kg) | | | | | | | | | |
| Height (cm) | | | | | | | | | |
| W/H% | | | | | | | | | |
| MUAC (cm) | | | | | | | | | |
| Edema (0,+,++,+++) | | | | | | | | | |
| **Presence of co-morbid condition** | | | | | | | | | |
| Diarrhea yes/ no | | | | | | | | | |
| Vomiting yes/no | | | | | | | | | |
| pneumonia yes/no | | | | | | | | | |
| Skin lesion (yes/no) | | | | | | | | | |
| Anemia yes/ no | | | | | | | | | |
| Body temperature | | | | | | | | | |
| **Provision of Routine medication** | | | | | | | | | |
| Amoxicillin yes/ no | | | | | | | | | |
| Measles yes /no | | | | | | | | | |
| VIT- A yes/no | | | | | | | | | |
| De worming if > 24 months yes/no | | | | | | | | | |
| Folic acid yes /no | | | | | | | | | |
| RUTF (by packets) | | | | | | | | | |
| Outcome (**C, D, UK, DF, NR** | | | | | | | | | |

**C=**Cured; **D**=Dead (confirmed by home visit); **UK**=Unknown (patient that has left the program but his outcome (actual defaulting or death) is not confirmed/ verified by a home visit **DF**=Defaulter (patient that is absent for 2 consecutive weighing and confirmed by a home visit); **NR**=Not responded to treatment (patient that has not reached the discharge criteria after 8 weeks in the program); **MT**=Medical transfer; **TT**=Transfer to other OTP

**Home visit**

Date _____Reason for Home visit _____finding _____

**Transfer in and out during the treatment of severe malnutrition**

Unique SAM number_____

Date of admission (dd/mm/yy) _____

Date of TI/TO _____