

ORIGINAL ARTICLE

Predictors of Recovery Rate in Treatment of Children with Severe Acute Malnutrition Using Outpatient Therapeutic Feeding Program in Shalla District, South West Ethiopia

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ABSTRACT

Background: Recovery rate of children with severe acute malnutrition can be affected by several factors. The study accentuated on identifying recovery rate and its predictors in treatment of children with severe acute malnutrition using Outpatient Therapeutic Feeding Program in Shalla Health District, South West Ethiopia.

Methods: Institutional based retrospective cohort study design was employed. A record of 1004 was collected and analyzed. Kaplan Meier procedure, Log rank test and multiple variable cox proportional hazard regression were used in order to test the significant relationship between recovery rate and independent factors.

Results: The finding of the study revealed that 90.9% of children recovered with a median recovery time of 45 days with an interquartile range (IQR) from 5 to 7 weeks. The recovery rate among those who received amoxicillin was 5.86 (Adjusted Hazard Ratio (AHR)=5.86, 95% CI: 4.55-7.55) times higher than those who did not receive. Additionally, the finding of the study showed that the recovery rate of children who had diarrhea was 49% (AHR=0.51, 95% CI: 0.44-0.59), vomiting was 61% (AHR=0.39, 95% CI: 0.33-0.46), and among those who were admitted with edema was 30% (AHR=0.70, 95% CI: 0.58-0.84) that were less likely than those admitted without edema.

Conclusion: It was identified that medication with amoxicillin was taken as a predictor that positively affected the time to recover. But; diarrhea, vomiting and edema were recognized as factors affecting recovery time negatively. Thus, early identification and management of diarrhea, vomiting and edema as well as regular management of cases with antibiotics is recommended to improve recovery rate.

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Introduction

Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients

or impaired nutrient utilization (1). Severe acute malnutrition can be classified as weight to height ratio below the mean National Center for Health

Statistics reference values, which is called wasted; the presence of bilateral pitting edema of nutritional origin, which is called edematous malnutrition; or a mid-upper-arm circumference of less than 115 mm in children less than age of 5 years (2, 3). Globally, it is estimated that there were nearly 20 million children who were severely and acutely malnourished; most of them live in South Asia and Sub-Saharan Africa (4).

Around 85% cases of severe acute malnutrition can be admitted and managed directly at outpatient level therapeutic feeding center mainly at Health post, Health center and even to hospital. Outpatient Therapeutic feeding Program (OTP) can be organized from health facilities that have inpatient services for severe acute malnutrition, but it can be also organized in absences of inpatient cases; if outpatient cases exist in the facility. The children with Severe Acute Malnutrition (SAM), and in absence of complications admitted to OTP Program follow the treatment plans including routine drugs and ready to use therapeutic feeding for subsequent weeks of visits at health facilities (2, 3).

Outpatient management of uncomplicated severe acute malnutrition at community level have major public health impacts on reducing case fatality due to severe acute malnutrition. If appropriate protocol as per World Health Organization (WHO) standard is followed, case fatality rate can be decreased to less than 5% both in the community and in health-care facilities (5). In Ethiopia, malnutrition remains a serious health problem affecting children under five years, and is a significant contributor to morbidity and mortality. According to Ethiopia Demographic and Health Survey of 2016, nearly four out of ten Ethiopian children under-five years (38 percent) are stunted (short for their age), 10 percent are wasted (thin for their height), and 24 percent are underweight. Regardless of being in a good track of progress in reduction of under-five years mortality rate, Ethiopia still suffers from SAM which has been high and at the same time its prevalence has not been significantly reduced during the past three decades. The recovery rates of cases were also affected by different predictors during the course of the treatment (6).

Analysis of Shalla District annual nutrition report showed that prevalence of severe acute malnutrition among under-five years during the last four years (2015 to 2018) was 57%, 71%, 51% and 45.87%, respectively. This data revealed that Shalla district was one of Hotspot district with high severe acute malnutrition cases in west Arsi zone (7). This study was designed to assess the recovery rate and its predictors among children aged 6-59 months those

treated on OTP to show the clear predictors of the recovery time. Thus, it will contribute to the possible predictors of recovery time and indicate intervention to improve the program.

Materials and Methods

The study was conducted in Shalla Woreda, West Arsi Zone, Oromia, Ethiopia. The woreda is located 280 km far from capital city, Addis Ababa and 32 km from Zonal city Shashemene (7). The total population of the district for 2019 G.C. was 196,395 (8% urban and 92% rural), of which 7008 were pregnant women and 32267 under-five children. The district contains 2 urban and 37 rural kebeles (7). Agriculture is the primary economic activity in the district. Around 95% of the population is engaged in this economic activity. The major cereal crops produced in the district were maize, wheat and teff. In addition, other cereal crops produced in the district were horse bean, barley and chick peas (7). According to Shalla District Water supply office report, water coverage for the district was 41.2% in 2019. The health service coverage of the district was 95%. The health institutions found in the district were seven health centers, 38 health post and 5 private clinics. All Health posts found in the district were providing outpatient therapeutic feeding program for children with severe acute malnutrition. Moreover, they were providing stabilization center for complicated severe acute malnutrition cases (7).

A sample record of children aged 6-59 months with severe acute malnutrition who were treated on OTP between January 1, 2016 and December, 30 2018 at Shalla district Health center were taken and was considered as a study sample. Institution based retrospective cohort study was utilized at Shalla district health facilities drawing up on all records of children aged 6-59 months with severe acute malnutrition who were treated on OTP dated from January 1, 2016 to December, 30 2018. The data was collected from May 28, 2019 to June 27, 2019. Sample size for recovery rate and predictors of time to recovery was calculated using single population proportion and double population proportion, respectively. Largest sample size using double population proportion was used.

Among sample size found using Epi Info (version 7 stat calc programs), a sample size of 628 was used from predictors of OTP treatment with amoxicillin (8), assuming assumptions, percent of unexposed gap of 33% and AHR (Adjusted Hazard Ratio) of 1.24; because it was the largest estimated sample size and was sufficient for recovery rate and its predictors. After adjustment for design effect (1.5)

and data incompleteness (10%), the sample size for predictors of recovery rate was turned to 1036. In Shalla district, there were seven health centers and 38 health posts. Populations living in the district were assumed to be more or less homogenous. As a result, 18 health posts grouped in three Primary Health Care Unit (PHCU) were selected by simple random sampling using lottery method presuming that there was no information lost with the unselected health posts.

The OTP protocol for management of SAM works was equally applied to all health post. OTP Register of children used for SAM was from 18 health posts in the district. Samples were allotted to each health post were proportional to their report and a design effect of 1.5 was used to avoid the effect of multistage sampling. In addition, the first study unity (records) was selected using simple random sampling technique. Finally, the children records were selected by systematic sampling from each institution based on their unique identification number using OTP Register. The dependent variable in the study was time to recovery from OTP Service and its observed predictors were socio-demographic characteristics including age and sex of children, distance from home to health facility, residence, and referred person for the child to health facility and baseline characteristics like anthropometry measurements, admission medical history, intake of routine medication, appetite test on admission with Plumpy' Nut, and diagnosis on admission, admission status (new, readmission or return after default).

Recovered/Cured were those children who have become free from medical complications, and edema and have achieved and maintained sufficient weight gain (when they reach 85% weight for length) (2). Recovery rate was defined as the proportion of children treated and discharged as recovered from SAM during a specified period. It was calculated as the number of patients recovered and discharged, divided by the total number of children enrolled in the OTP over the same period multiplied by hundred (2, 9). Defaulter rate was explained as every child admitted into the program and expected to visit OTP every week with the support of guidance/parent in order to receive ready to use therapeutic food (RUTF), and any medication required according to the program protocol until recovered. If a child missed out on two consecutive weeks, then they were considered to have defaulted from the program. Defaulted children were calculated as the number of children defaulted during a specified period divided by the total number of children discharged from OTP over the same period multiplied by 100 during given period of time (2, 9).

Case fatality rate was characterized as the number of deaths from SAM during the period under review divided by the number of children admitted with SAM in the same period multiplied by 100 during given period of time (2). Censored was described as children discharged from OTP with outcome rather than recovery (death, default, medical transfer, unknown). Average weight gain (g/kg/day) was determined to be equal to the difference in weight (in grams) at discharge—and weight at admission (in grams) divided by the product of admission weight (kg) and number of days between admission and discharge (9). The length of days to recovery was illustrated as the number of days from admission to recovery or discharge (2). To evaluate the OTP intervention, the outcome indicators for this study were compared with the recommended minimum standard indicators. The minimum set of principles and minimum humanitarian standards in four technical areas of humanitarian response (SPHERE) standard indicators were usually used by humanitarian organizations to assess the performance of therapeutic feeding interventions.

The data was extracted from the selected OTP Card and OTP Register log book using a structured checklist which was developed based on review of similar literature and existing register in facility. OTP Card of children treated between January 1, 2016 and December, 30 2018 were reviewed. The employed structured format was prepared in English language. The whole collected data was supervised by one health officer who had training on management of severe acute malnutrition on the daily bases. Two days training for data collectors and supervisors was given to have a clear understanding about the objective of the study and data collection procedure. The pre testing of structured format was conducted on 5% sample at Siraro district prior to actual data collection process and structured format checked for completeness daily by immediate supervisors and principal investigators. After checking for consistency and completeness, the supervisors submitted the filled questionnaire to the principal investigator who also rechecked to maintain the quality of data. Data were cleaned and entered by the principal investigator, and field supervision and spot-checking were also carried out.

Data were entered and analyzed using SPSS software (version 20, Chicago, IL, USA). The risk period began at the date when the child entered in the program and was ended on the date when the child was cured, defaulted, died, transferred out or quitted the program with unknown status. Kaplan Meier procedure with Log rank test was used to compare the survival status of children. Cox

proportional hazard regression was used to test the significant relationship between time to recovery and independent factors. Variables having p value < 0.25 in bivariate analysis were entered into multivariate analysis and the final model was interpreted using AHR with p value of < 0.05 at 95% CI. The assumption of proportional hazard ratio was checked by using statistical method and the finding from global goodness-of fit test (Schoenfeld's method) method supported proportional hazard assumption.

This research proposal was approved by the Ethical Review Committee of Madda Walabu University before the actual research work. An official letter of permission (ethical clearance) was obtained from the Ethical Committee of School of Health Science, Department of Public Health, Madda Walabu University to the Oromia Regional Health Bureau. Written permission was also obtained from Oromia Regional State Health Bureau, West Arsi Zone and Shalla District. The objective of the study was explained to PHCU Director of Public Health Facilities and Health Extension Worker and informed verbal consent was obtained to extract data from OTP Card and OTP Register. In order to assure confidentiality, the data were extracted without any personal identifiers and data were used only for this research purpose only.

Results

The study included records of 1004 children admitted to OTP service during January 1, 2016 and December, 30 2018, while 18 health posts were found In Shalla District. Among the children whose record reviewed median age at admission was 16 months with IQR of 25 months (Table 1). Out of 1004 children admitted to OTP Service, 790 (78.7%) were self-referred; while 840 (83.7%) were new admission to the service. Eighty hundred and twenty four (82.1%) started OTP service at health post. The recovery rate from severe acute malnutrition was 913 (90.9%) and 40 (4%) children that defaulted from the program before their

treatment outcome to be determined. Children who were treated for SAM at OTP Service, 843 (84%) got amoxicillin as routine medicine and 469 (47%) of children were given vitamin A during their treatment plan for malnutrition. Despite this, folic acid supplementation was not implemented during the study period. Among children whose record reviewed, 630 (63%) and 484 (48%) had diarrhea and vomiting, respectively. Almost three quarters (74%) of children had skin infection during their admission to OTP Program.

The median time of recovery for male children was 7 weeks (95% CI: 6.8-7.2) and female children was 6 weeks (95% CI: 5.5-6.3). This implies that there were significant differences between recovery time among male and female children at Log Rank Chi-Square=7.5 ($p=0.006$). The median time of recovery for self-referred children was 7 weeks (95% CI: 6.9-7.1) and children referred by community volunteer was 6 weeks (95% CI: 5.8-6.2). This indicates that there was significant differences between recovery time among community volunteers and self-referred at Log Rank Chi-Square=20.1 ($p=0.001$).

The median recovery rate for children who took amoxicillin as routine medicine was 6 weeks (95% CI: 5.8-6.2) and children who did not take amoxicillin was 8 weeks (95% CI: 5.8-6.2). This shows that there was significant differences between recovery time among children who took amoxicillin and did not take amoxicillin at Log Rank Chi-Square=270.1 ($p=0.001$). The median recovery rate for children who had diarrhea was 7 weeks (95% CI: 5.8-6.2) and children who had not diarrhea was 5 weeks (95% CI: 4.9-5.1). It was shown that there were significant differences between recovery time among children who had and who did not have at Log Rank Chi-Square=129.4 ($p=0.001$). The median recovery rate for children who had vomiting were 7 weeks (95% CI: 5.8-6.2) and children who did not have vomiting was 5 weeks (95% CI: 4.7-5.2). It was indicated that there was significant differences between recovery time among children who had vomiting and who did

Table 1: Sociodemographic status of children admitted to OTP Service, Shalla District Health Facilities, West Arsi Zone, South West Ethiopia, 2019 (n=1004).

| Variable | Category | Frequency | Percent |
|-----------------------------|------------------------|-----------|---------|
| Sex of child | Male | 525 | 52.3 |
| | Female | 479 | 47.7 |
| Age of child in month | 6 months to 24 months | 676 | 67.3 |
| | 25 months to 59 months | 328 | 32.7 |
| Place of residence | Rural | 824 | 82.1 |
| | Urban | 180 | 17.9 |
| Distance to health facility | <2 hours | 839 | 83.6 |
| | ≥2 hours | 165 | 16.4 |

OTP: Outpatient herapeutic feeding program

not have at Log Rank Chi-Square=7.8 ($p=0.005$).

Moreover, the median recovery rate for children who had cough was 7 weeks (95% CI: 6.8-7.1) and children who did not have cough was 6 weeks (95% CI: 5.7-6.2). This implies that there was significant differences between recovery time among children who had and who did not have cough at Log Rank Chi-Square=129.4, ($p=0.001$). The other median recovery rate for children who had edema was 8 weeks (95% CI: 7.7-8.3) and children who did not have edema was 6 weeks (95% CI: 5.6-6.3). There was significant differences between recovery time among children who had edema during admission and who did not have at Log Rank Chi-Square=129.1 ($p=0.001$).

The observed difference between different variables was assessed using Kaplan Meier survival curves using log rank test. As a result, sex of children, initial referral status, amoxicillin taken, diarrhea, vomiting, cough and edema were found to have statistically significant association with recovery

time. Therefore, these variables were included into proportional hazards Cox model (Table 2).

The time to recovery among children who received amoxicillin was 5.86 (AHR=5.86 (95% CI: (4.55-7.55)) times higher than those who did not receive amoxicillin during admission time. In addition, the time to recovery of children who had diarrhea was 49% (AHR=0.51, 95% CI: 0.44-0.59) less likely than their counter parts. Besides this, children who had vomiting were 61% (AHR=0.39; 95%; CI: 0.33-0.46) less likely to recovery than who did not have vomiting. Moreover, the time to recovery of children with cough was 0.51 times less (AHR=0.51; 95% CI: 0.29-1.11) than their counter parts. The time to recovery of children admitted with edema was 0.70 times (AHR=0.70; 95% CI: 0.58-0.84) less likely than children admitted without edema (Table 3).

Discussion

The aim of this study was to assess predictors of

Table 2: Bivariate Cox-regression analysis for predictors of recovery rate from SAM under OTP Service among children admitted to OTP Service, Shalla District Health facilities, West Arsi Zone, South West Ethiopia, 2019 (n=1004).

| Variables | Category | Cured | Censored | CHR | p value (CI) |
|-------------------------------------|---|-------|----------|------|-------------------|
| Sex | Male | 478 | 47 | 0.87 | 0.034 |
| | Female | 435 | 44 | 1 | |
| Distance to nearest health facility | Less than two hours | 769 | 70 | 1.36 | 0.001 (1.14-1.63) |
| | Two hours or more | 144 | 21 | 1 | |
| Referral status | Self | 723 | 67 | 0.93 | 0.69 (0.93-0.66) |
| | Community volunteer | 150 | 13 | 1.25 | |
| | Health Extension Worker (HEW) during home visit | 40 | 11 | 1 | |
| Diagnosis at admission | Marasmus | 628 | 41 | 0.9 | 0.63 (0.59-1.4) |
| | Kwashakor | 263 | 50 | 0.71 | |
| | Marasmic-Kwash | 22 | 0 | 1 | |
| Amoxicillin | Yes | 802 | 41 | 3.38 | 0.001(2.76-4.15) |
| | No | 111 | 50 | 1 | |
| Vitamin A supplementation | Yes | 447 | 22 | 1.29 | 0.001(1.13-1.45) |
| | No | 466 | 69 | 1 | |
| Mebendazole | Yes | 131 | 12 | 1.37 | 0.001(1.14-1.65) |
| | No | 782 | 79 | 1 | |
| Diarrhea | Yes | 570 | 60 | 0.54 | 0.001(47-62) |
| | No | 343 | 31 | 1 | |
| Vomiting | Yes | 453 | 31 | 0.87 | 0.031(0.76-0.99) |
| | No | 460 | 60 | 1 | |
| Cough | Yes | 361 | 39 | 0.87 | 0.041(0.76-0.99) |
| | No | 552 | 52 | 1 | |
| Skin infection | Yes | 672 | 68 | 0.68 | 0.001(58-0.79) |
| | No | 241 | 23 | 1 | |
| Edema | Yes | 270 | 60 | 0.52 | 0.001(0.45-0.60) |
| | No | 673 | 31 | 1 | |
| Temperature | 36-36.4 | 553 | 65 | 3.3 | 0.001(0.68-0.88) |
| | 35-37.4 | 357 | 23 | 4.1 | |
| | 37-539 | 3 | 3 | 1 | |

OTP: Outpatient herapeutic feeding program, SAM: Severe acute malnutrition, AHR: Adjusted hazard ratio, CHR: Crude adjusted hazard, 1=Reference category

Table 3: The overall predictors of recovery rate among children admitted to OTP Service, Shalla District Health facilities, West Arsi Zone, South West Ethiopia, 2019 (n=1004).

| Variable | Category | Cured | Censored | CHR | p value (95% CI) | AHR | p value (95% CI) |
|-------------|----------|-------|----------|------|-------------------|------|--------------------|
| Amoxicillin | Yes | 802 | 41 | 3.38 | 0.001 (2.76-4.15) | 5.86 | <0.01 (4.55-7.55) |
| | No | 111 | 50 | 1 | 1 | 1 | |
| Diarrhea | Yes | 570 | 60 | 0.54 | 0.001 (47-62) | 0.51 | <0.01 (00.44-0.59) |
| | No | 343 | 31 | 1 | | 1 | |
| Vomiting | Yes | 453 | 31 | 0.87 | 0.031 (0.76-0.99) | 0.39 | <0.01 (0.33-0.46) |
| | No | 460 | 60 | 1 | | 1 | |
| Edema | Yes | 270 | 60 | 0.52 | 0.001 (0.45-0.60) | 0.7 | <0.01 (0.58-0.84) |
| | No | 673 | 31 | 1 | | 1 | |

OTP: Outpatient herapeutic feeding program, AHR: Adjusted hazard ratio, CHR: Crude adjusted hazard, 1=Reference category

recovery rate in treatment of children with severe acute malnutrition using Outpatient Therapeutic Feeding Program in Shalla District, South West Ethiopia. Accordingly, the study showed that recovered children were 90.9% with a median recovery time of 45 days with IQR 5 to 7 weeks. The recovery rate was higher than minimum acceptable reference developed by sphere project (9). The incidence density of recovery at the study area was 2.1/100 person-day. The predictors identified to affect time to recovery were amoxicillin medication, diarrhea, vomiting, cough and edema. Another similar study conducted at Shebedino District illustrated that recovery rate of 78.7% with a median recovery time of 42 days (10). On the other hand, the reported median recovery time was slightly different with discrepancy of only three days, which might be due to differences in quality of service delivery and exposure to different predictors in the study area.

Higher achievement in recovery rate was observed in this study as compared to similar studies conducted in Gambia that was 80% (11), in Enderta District, Tigray Region was 76.8% (12), in Kamba District, South West Ethiopia was 67.7% (13), and in Wolaita Zone Southern Ethiopia was 64.9% (8). These could be due to the interventions made for longer periods and different partners who worked with governmental staff. The study also revealed that 40 (4%), 30 (3%) and 10 (1%) were defaulted, relapsed and dead during the treatment, respectively. These indicators were all lower than minimum acceptable reference developed by sphere project (9). The death rate in this study was higher than the study conducted in Bangladesh (0.1%) (14) and the study carried out at Dire Dawa (0.6%) (14). These could be due to higher prevalence of severe acute malnutrition in the study area. The death rate in this study was lower than study conducted in Zambia (2.8%) which might be due to difference in socioeconomic status of population and geographical location. The defaulter rate was lower in this study as compared to study

conducted in Bangladesh (7.5 %) (15), in Gambia (17.2 %) (11), and in Dire Dawa (11.2%) (14). These could be due to difference in health infrastructure study area and poor household food insecurity. The treatment outcome regarding transfer out for medical service according to this study was 1.1%. The finding of medical transfer was lower than the study conducted in Dire Dawa (2.1%) (14).

The time to recovery among children who took amoxicillin was 5.86 higher than those who did not take amoxicillin (AHR=5.86, 95% CI: 4.55-7.55). This finding is consistent with similar study conducted in different areas like Wolaita Zone, Ethiopia (8), Mali (16), and Sidama Zone (10). This improvement is due to the fact that children with severe acute malnutrition had been subjected to different infections that can be alleviated by antibiotic medication and improve cure rate as well as lowering the time to recovery. The time to recovery among children who had diarrhea was 0.51 higher than who did not have diarrhea (AHR=0.51, 95% CI: 0.44-.059). The finding is consistent with the study conducted in Durame (17).

The time to recovery among children who had vomiting was 0.39 higher than who did not have vomiting (AHR=0.39, 95% CI: 0.33-0.46). The finding is also consistent with the study conducted in Durame on factors affecting recovery (17). This is due to the effect of both diarrhea and vomiting on interference with nutrient absorption that can result to higher time of recovery from SAM. The time to recovery among children with edema was 0.7 times higher than who did not have edema (AHR=0.7, 95% CI: 0.58-.84). The finding is also consistent with the study conducted in Sidama Zone (10). Despite this, the finding contradicts with the finding with Shebedino (10) and Wolaita Zone (8). As the study was retrospective and was based on the secondary data, incomplete records were observed in some predictor variables, so that may underestimate or overestimate the outcome variable.

Conclusion

The median survival time to recovery at the study area was lower as compared to the national wide figure. Recovery rates in the study area were above the cut of points of the minimum standard sets in humanitarian and disaster prevention. Children who were supplemented with amoxicillin during admission, children who had diarrhea, children who had vomiting and children who had edema during admission significantly affected time to recovery. The recovery rate was above the minimum SPHERE international standard for the outpatient treatment of SAM. The median time to recovery in the study area was below the cut of point. Predictors identified as positively affecting the time to recovery was medication with amoxicillin intake whereas diarrhea, vomiting and edema were recognized to affect the time of recovery negatively. Routine medicine should be given timely to all children according to the national guideline for all children admitted to OTP. Based on these findings, recommendations would be early identification of cases with negative predictors and timely provision of medication for better treatment outcome and reducing their stay in the program. Lastly, for further investigation, we suggest a prospective cohort study to be conducted on problems related to care takers or family practice that could create additional effect on the effectiveness of the treatment.

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Conflict of Interest

None declared.

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