Time To Relapse of Severe Acute Malnutrition And Its Determinants Among Children Treated In The Health Posts of Hadiya Zone, Southern Ethiopia.

Abera Lambebo (lambebo70@gmail.com)
Debre Berhan University https://orcid.org/0000-0002-1580-0364

Desselegn Temiru
Jimma University College of Public Health and Medical Sciences

Tefera Belachew
Jimma University College of Public Health and Medical Sciences

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Abstract

Background: In developing countries including Ethiopia, children under five years old are likely to suffer from repeated bouts of SAM. There is lack of study that documented time to relapse of SAM and its determinants.

Objective: This study aimed to identify time of relapse and its determinants among children discharged after treatment for SAM in health facilities of Hadiya Zone, South, Ethiopia

Methods: An institution based retrospective cohort study was carried out from data spanning from 2014/2015 to 2019/2020. After checking all the assumptions, multivariable CPH model was fitted to isolate independent determinants of time to relapse. All tests were two sided and statistical significance at P values <0.05.

Result: The mean(±SD) time for relapse of SAM among under five children was 22(±9.9) weeks from discharge to relapse time. On multivariable CPH model, the hazard of relapse for SAM was significantly higher for children who had edema (AHR =2.02, 95%, CI: 1.17-3.50), age of 6-11 months (AHR = 5.2, 95%, CI:1.95-13.87), had discharge low MUAC (AHR = 12.95%, CI: 7.90-19.52)

Concussion: The finding showed that children discharged from SAM are likely to have relapse in 3 weeks.

Introduction

Malnutrition is a significant global public health burden with greater concern among children under five years in Sub-Saharan Africa (1). Nearly half of all deaths in children under five children are attributable to undernutrition that puts them at greater risk of dying from common infections through increasing the frequency and severity of such infections and delaying recovery(2).

In Ethiopia, over 25,000 children with severe acute malnutrition are admitted every month and the survivors are more likely to perform poorly in school and, once grown up, girls are more likely to suffer from complications during childbirth (3). Severe acute malnutrition (SAM) is a life-threatening condition among the children with SAM being nine to 11 times more likely to die than a non-malnourished child (4, 5). Early identification of severe acute malnutrition is important for initiating treatment and minimizing the risk of complications which can be done in both community and health-care settings using appropriate indicators (6). It can also be prevented by specific interventions including promotion of exclusive breastfeeding, vaccination, and timely health care seeking behaviors (7).

Malnutrition has many unpleasant results on child health during illness and after discharge. Many children younger than five years in developing countries are exposed to multiple risks, including poverty, malnutrition, poor health and non-stimulating home environments. These can detrimentally affect their cognitive, motor and social emotional development (8) leading to repeated bouts of severe acute
malnutrition. Nearly half of all deaths in under five children are attributable to undernutrition through increasing the frequency and severity of infections and delaying recovery (9). Relapse after treatment is also another challenge of SAM case happening usually at four months or 16 weeks post-discharge (10). Close follow-up of children with SAM after discharge is crucial for successful management of complications including relapse and mortality during this period. Weekly follow-up for at least two months is recommended, as these patients have a tendency of suffering from relapse. A quarter of these children fail to be followed up in six months due to migration, social, political and logistic reasons (11).

Knowledge of time to relapse and its determinants shades a light on the preventive measures to be instituted at the home environment as well as in the health facilities. In Ethiopia, there is luck of study that address time to relapse among children with SAM. This study sets out to document time to relapse among children with SAM. This study is of paramount importance in generating evidence for focusing on post discharge status of SAM children.

**Methods**

**Study area and design**

An institution based retrospective cohort study was conducted among a cohort of children admitted for treatment of SAM from 2014 to August 30, 2020 in 20 selected health posts in Hadiya Zone, SNNPR, Ethiopia. The data were abstracted from the medical’s records of children from August 1–30, 2020 using a format prepared for the purpose.

In Hadiya Zone, according to the May 24, 2004 World Bank Memorandum, 6% of the inhabitants have access to electricity, a road density of 104.1 kilometers per 1000 square kilometers compared to the national average of 30 kilometers (12). The average rural household has 0.6 hectare of land compared to the national average of 1.01 hectare (13). A fifth (22.8%) of the population has non-farm related jobs compared to the national average of 25% and a regional average of 32%. Seventy four percent of eligible children were enrolled in primary and 21% in secondary schools (14). This zone is characterized by a predominant agricultural activity especially the enset, combined with grain including, barley and maize and rearing domestic animals (15).

In Hadiya Zone, there were 280 Health Posts (HPs), 60 rural Health Centers, one University teaching Hospital and 3 primary level Hospitals. Hadiya zone is divided into 11 districts for administrative purposes. The woredas were; East Bedewacho, Siraro Bedewacho, West Bedewacho and Shone town administration separated from the rest of the zone by Kembeta Tambaro and the administrative center of Hadiya is Hosanna (16). Of which this was study conducted in two woredas and one town administration among 20 health posts with highest number of cases East Bedewacho Siraro Bedewacho and Shone Town administration. The health posts were selected based on number of SAM cases.

**Population**
All records of under-five children who were admitted to the selected health posts in the three woradas from November, 2014 to August 30, 2020 were source population. A total of 900 child records were eligible from which 760 were selected by simple random sampling technique using ENA SMART software. Cards of children with incomplete records, unknown admission dates and unknown discharge dates were excluded.

**Sample Size and Sampling Procedure**

Sample size was determined from a study conducted in North Gondar Zone, Northwest Ethiopia (17). Then, it is calculated by medcalc©version 119.1.1.3 survival analysis (logranktest) at http://www.medcal.org (18). Diarrhea on admission was used as the main exposure variable with outcome of 75% giving AHR of 0.81 a total event needed of 484. As we selected zones to woradas and from worada to Kebeles, a design effect of 1.5 was considered giving a final sample size of 726. Finally, the records were collected from the card room based on the medical record number of the selected participants and the data were collected from these records.

**Measurement**

A data extraction tool was prepared from the national treatment protocol for the management of SAM (3), SAM registration booklet with complete registration, health management information system (HMIS) register was used. The data extraction format used consisted of socio-demographic data (age, sex), time (time for first admission, time for discharge and time for re-admission) and anthropometric measurements (height, weight, MUAC, edema). Four data collectors (MPH) and one supervisor were recruited based on their experience in data collection. Data collectors received a one-day training on the extraction tool and deployed to collect data once the principal investigator was convinced about their competency. The primary investigator of the study and the supervisors critically followed the data collection process to minimize missing information and inconsistencies.

**Operational definition**

Relapse/repeated episodes: admission of a child with a diagnosis of SAM after being discharged with a status of recovery (19).

Wasting: weight-for-height Z-score < -2. It often indicates recent and severe weight loss, although it can also persist for a long time (20).

Severe acute malnutrition (SAM): It is diagnosed by weight for- height below – 3 SD of the WHO standards, by a MUAC < 11.5 cm and by Clinical sign like bilateral edema (21,23).

Kwashiorkor or edematous malnutrition; is also form of severe under nutrition, the child's muscles were wasted, but wasting may not be apparent due to generalized edema or swelling from excess fluid in the tissues (21,24).
Criteria for discharging children from treatment; weight-for-height/length is $\geq -2$ Z-scores and having no oedema for at least two weeks, or mid-upper-arm circumference is $\geq 125$ mm and no oedema for at least 2 weeks (25).

Data Processing and Analysis

Data were coded, entered into Ep-data version 4.2 software and exported to SPSS for windows version 25 software for analysis. The presence of missing values, possible outliers, and multicollinearity were checked through exploratory analysis.

Both bi-variate and multivariable Cox regression analyses were performed. Kaplan Meier hazard curve with the log-rank test was fitted to identify the presence of a difference in recovery rate among the categorical variables. Mantel-Cox and Generalized Wilcoxon test of equality of survival distributions is significant and one minus survival function line is also parallel for those candidate variables of multivariable Cox regression (Fig. 1 and Fig. 2).

For the different levels, under-five children with SAM were followed in weeks from admission to the occurrence of the event (relapse). Person-time was calculated and the incidence was determined. In this study, person-time was reported in child-week. Child-week are total follow up times of each child from admission to the occurrence of the events (relapse or censored)

Those variables with $p \leq 0.25$ in the bi-variate Cox-regression were selected for the multivariable Cox-regression analysis. All statistical tests were considered significant at $p$-values of $< 0.05$.

Ethical Considerations: Before starting the data collection process, the study was ethically approved by Jimma University Health Research Ethics Review Committee (IHRERC). An official letter was written from Jimma University to the Hadiya Zonal Health Office.

Informed written consent was obtained from all health extension workers of selected health posts and woreda health office, confidentiality of the study documents and the abstracted information was ensured according to the principle of Helsinki declaration ethical code for human subjects.

Results

The medical charts of 726 SAM cases admitted in the 20 health posts in the last five years were reviewed. With regard to admission characteristics, 51% were females, 24.2% were in the age of 6–11 months followed by those in the age group of 12–23 months (20.2%). Overall, 88.2% (95% CI: 85.8–90.2) were new admission, while 11.8% (95% CI: 9.8–14.2) were relapsed cases

During the first admission, 33.3% had edema and the mean weight of children during admission was 7.94((± 2.36) kg. Similarly, the mean(± SD) MUAC of children during admission was 10.60(± 0.76) cm. Regarding the outcome of SAM treatment during first admission, 91.9% were cured and followed by those
who died (2.8%). The mean(± SD) time for recovery from severe acute malnutrition was 10(± 3.3) weeks for the first admission. The mean discharge weight was 11.15(± 2.1) Kg and mean discharge MUAC was 11.57(± 0.81) cm (Table;1)

**Time to relapse of SAM:** a total of 11.8% cases were relapsed cases readmitted with severe acute malnutrition in last five years. The mean time for relapse of severe acute malnutrition was 22(± 9.9) weeks the date of discharge from the first admission with minimum and maximum time for relapse being 9 and 67 weeks, respectively.

There was disparity in the meantime to relapse by gender. The mean time to relapse was 21(± 8.6) weeks for male children, whereas it was 24(± 11.1) weeks for female children. Likewise, the mean relapse time among edematous children was 22(± 11.77) weeks. The mean relapse time was shorter (15 ± 3.52) weeks for children 48–60 months, while it was longer (21 ± 8.4) for children aged 24–35 months (Tabel2).

**Determinants of time to Relapse:** In Cox Proportional Hazards Model, after adjusting for background variables, children in the younger age (6–11 months) had 5.2 times increased hazard of relapse (AHR = 5.2, 95% CI:1.95–13.87) compared to age group of 48–60 months. Similarly, having edema on the first admission increased the hazard of relapse twice (AHR = 2.02, 95% CI: 1.17–3.50) compared to non-edematous children. The hazard of relapse was 12 times higher among children who had an outcome of not cured on discharge from the first treatment (AHR = 12.42, 95% CI: 7.90-19.52) compared to cured ones.

**Discussion**

We found out that the mean(±SD) time for relapse of severe acute malnutrition among under five children was 22(±9.9) weeks, which is a long relapse time compared to the report from Nigeria (26). This may be due to differences in study design as study conducted in Nigeria was prospective cohort conducted for only six months, while this study captured data over five years in addition to being a retrospective cohort which may result differences.

In this study, the frequency of relapse was 11.8% for severe acute malnutrition, which is similar to the report of a study in Burkina Faso (27). This may show the communality of the problem in developing countries, especially in Sub-Saharan Africa, where the home environment is not usually altered although the child is treated for severe acute malnutrition in the health facility, which could lead to relapse. For SAM cases treated at home, there could also be sharing of the Ready to Use Therapeutic Food (RTUF) resulting in suboptimal treatment and a possibly relapse. This calls for addressing the home environment especially for maternal / care givers’ knowledge as an underlying cause of malnutrition through behavior change communications.

On multivariable analyses, variables that were independent determinants of the hazard of relapse of severe acute malnutrition were: age, having edema on the first admission and not being cured on the first discharge.
This study showed that as the age of the child increased the hazard of time to relapse was higher. Children in the age group of 6-11 months had 5.2 times higher hazards of relapse compared with those in the age of 48–60-months which is consistent with the report of another cross-sectional study conducted in Afar region of Ethiopia\(^{(28)}\). This may be due to the fact that children at this age are mostly dependent on maternal source of energy. Moreover, physiologically childhood is the age when there is the highest demand for energy kg/day. It may also be due to increased chance of readmission for SAM children at this age as the younger ages are likely to more frequently encounter the regular(routine) screening that is going on with the community for all children below 59 months.

Similarly, having edema on the first admission increased the hazard relapse twice compared to non-edematous children. This may be related to early discharge from the program as weight is discharge criteria for SAM cases at health post. Children with edema may have false weight as remnant of nutritional edema. As nutritional oedema affects the function of the glycocalyx are dependent upon sulphated proteoglycans and other glycosaminoglycans fundamentally related to a defect in Sulphur metabolism which can explain all the clinical features of the condition, including the formation of oedema\(^{(29)}\). Children may have false weight that related to prior edema.

Likewise, children who were not cured during discharge from the first admission had more than 12 times higher hazard of relapse compared to cured ones. This finding is similar to the report of a study conducted in Ethiopia\(^{(30)}\). This may be due to the fact that treatment discontinuation like defaulting may increase the risk of readmission as children are not fully treated for the metabolic and nutritional derangements that occurred with severe acute malnutrition.

The results have practical implications for the management of children with SAM. The fact that SAM children with edema and those who were not cured during discharge of the first admission had high hazard of relapse calls for reconsideration of the SAM management protocol and the discharge criteria. It also implies the need for strict monitoring of edema before discharge and follow up of SAM cases to avoid defaulters and partially treated cases through strong awareness creation and counseling of mothers/care givers.

In this study an effort was made to cover 20 health posts to minimize sampling error. As there is no prior study on time for relapse this study will give new insight for researchers and program planners. As this study is retrospective cohort study, we acknowledge the limitation of not being able to assess multiple determinants, which should be addressed in future study using a prospective cohort design.

**Conclusion**

The finding showed that children discharged from severe acute malnutrition are likely to have relapse in three weeks’ time given the prevailing situation of the home environment. Having edema during admission, younger age and being cured at the first discharge were independent determinants of relapse. The results imply the need for reviewing follow-up system after discharge and working on the caring
practices through behavior change communication to improve the home environment. There also a need for revising the discharge criteria for edematous children rather than basing only on weight change.

Declarations

**Ethical Approval and Consent to participate;**

Before starting the data collection process, the study was ethically approved by Jimma University Health Research Ethics Review Committee (IHRERC). An official letter was written from Jimma University to the Hadiya Zonal Health Office.

Informed written consent was obtained from all health extension workers of selected health posts and woreda health office, confidentiality of the study documents and the abstracted information was ensured according to the principle of Helsinki declaration ethical code for human subjects.

**Consent for publication;** All authors in this work agreed to publish on this journal.

**Availability of data and materials;** all data and materials are available for journals.

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**Authors' contributions;**

**AL;** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing and original draft.

**DT;** Conceptualization, Data curation, Formal analysis, Writing and review & editing.

**TB;** Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Software, Supervision, review & editing.

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**Authors' information;**

Abera Lambebo; Department of Public Health Collage of Health science, Debre Berhan University, Debre Berhan Ethiopia. PhD candidate for human nutrition and dietetics in Jimma university Email lambebo70@gmail.com

Deselegn Temiru; Department of Nutrition and dietetics, Faculty of Public Health, Jimma university, Jimma Ethiopia. Philosophical doctor in nutrition and associate professor of nutrition in Jimma
university. Email: dessalegn97@gmail.com

Tefera Belachew; Department of Nutrition and dietetics, Faculty of Public Health, Jimma university, Jimma Ethiopia. Philosophical doctor of nutrition and professor of nutrition in Jimma university. Email: teferabelachew2@gmail.com

References

1. Obasohan PE, Walters SJ, Jacques R, et al. Risk Factors Associated with Malnutrition among Children Under-Five Years in Sub-Saharan African Countries: A Scoping Review. International journal of environmental research and public health. 2020;17(23).

2. UNICEF. 2020.

3. Lanyero B, Teka G, Negash TZ. 2019. [February 20, 2021]. Available from: https://www.afro.who.int/news/ethiopia-sets-new-standards-management.

4. Pravana NK, Piryani S, Chaurasiya SP, et al. Determinants of severe acute malnutrition among children under 5 years of age in Nepal: a community-based case–control study. 2017;7(8):e017084.

5. AAH. 2019. Available from: https://www.actionagainsthunger.org/research/sam-relapse.

6. WHO. 2019. [February 24/2021]. Available from: https://www.who.int/elena/titles/full_recommendations/sam_management.

7. Sand A, Kumar R, Shaikh BT, et al. Determinants of severe acute malnutrition among children under five years in a rural remote setting: A hospital based study from district Tharparkar-Sindh, Pakistan. Pakistan journal of medical sciences. 2018;34(2):260-5.

8. Grantham, Cheung, Cueto, et al. Developmental potential in the first 5 years for children in developing countries. Lancet 2007;369:60-70.

9. UNICEF. 2020. [March 2/2021]. Available from: https://data.unicef.org/topic/nutrition/malnutrition/.

10. Lelijveld N, Musyoki E, Adongo SW, et al. Relapse and post-discharge body composition of children treated for acute malnutrition using a simplified, combined protocol: A nested cohort from the ComPAS RCT. PloS one. 2021;16(2):e0245477.

11. UNICEF. 2020. [March 2/2021]. Available from: https://www.unicef-irc.org/article/959-challenges-in-the-management-of-malnut.

12. World Bank. 2003. Available from: https://openknowledge.worldbank.org/handle/10986/5985.

13. al. KDe. Comparative national and regional figures comes from the World Bank publication, “Tenure Security and Land Related Investment”, WP-2991 Archived at the Wayback Machine. 2007.
14. World Bank. 2006. Available from: http://siteresources.worldbank.org/INTETHIOPIA/Resources/PREM/FourEthiopiasrev6.7.5.May24.pdf.

15. VALENTINA PEVERI. NUTRITION AND IDENTITY IN HADIYA ZONE (SOUTH-CENTRAL ETHIOPIA). University of Bologna, Department of Historical, Anthropological and Geographical Sciences, 1997.

16. Wikipedia. Ethiopia. The free encyclopedia 2019.

17. Mamo WN, Derso T, Gelaye KA, et al. Time to recovery and determinants of severe acute malnutrition among 6–59 months children treated at outpatient therapeutic programme in North Gondar zone, Northwest Ethiopia: a prospective follow up study. Italian Journal of Pediatrics. 2019;45(136).

18. MedCalc Statistical Software version 19.1.3. MedCalc Software. In: Ostend B, editor. 2019.

19. Akparibo R, CK Lee A, Booth A, et al. Relationships between recovery and relapse, and default and repeated episodes of default in the management of acute malnutrition in children in humanitarian emergencies. 2015.

20. WHO. Organization. Wh, editor: WHO. 2020. Available from: https://www.who.int/news-room/factsheets/detail/malnutrition.

21. UNICEF. UNICEF Strategic Plan 2014-2017 contact: Director, Division of Policy and Strategy. In: Plaza U, editor. New York, NY 10017 2014.

22. UNICEF. UNICEF Data: Monitoring the situation of children and women. 2019.

23. WHO, UNICEF. WHO child growth standards and the identification of severe acute malnutrition in infants and children. 20 Avenue Appia, 1211 Geneva 27, Switzerland; 2009.

24. WHO. WHO child growth standards and the identification of severe acute malnutrition in infants and children. 2009.

25. WHO. Guideline: Updates on the management of severe acute malnutrition in infants and children. WHO Library Cataloguing-in-Publication Data. 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int). WHO Press; 2013.

26. Adegoke O, Arif S, Bahwere P, et al. Incidence of severe acute malnutrition after treatment: A prospective matched cohort study in Sokoto, Nigeria. Matern Child Nutr. 2021;17(1):e13070.

27. Somasse YE, Dramaix M, Bahwere P, et al. Relapses from acute malnutrition and related factors in a community-based management programme in Burkina Faso. Matern Child Nutr. 2016;12(4):908-17.
28. Gebre A, Reddy PS, Mulugeta A, et al. Prevalence of Malnutrition and Associated Factors among Under-Five Children in Pastoral Communities of Afar Regional State, Northeast Ethiopia: A Community-Based Cross-Sectional Study. Journal of nutrition and metabolism. 2019;2019:9187609.

29. Golden MH. Nutritional and other types of oedema, albumin, complex carbohydrates and the interstitium - a response to Malcolm Coulthard's hypothesis: Oedema in kwashiorkor is caused by hypo-albuminaemia. Paediatrics and international child health. 2015;35(2):90-109.

30. Abate BB, Tilahun BD, Kassie AM, et al. Treatment outcome of Severe Acute Malnutrition and associated factors among under-five children in outpatient therapeutics unit in Gubalafto Wereda, North Wollo Zone, Ethiopia, 2019. PloS one. 2020;15(9):e0238231.

**Tables**

Table;1 Profile of admitted children with severe acute malnutrition (SAM) in Sothern Region Hadiya zone Ethiopia.
| Variable                        | Frequency (%) |
|--------------------------------|---------------|
| Sex                            |               |
| Male                           | 352 (48.5)    |
| Female                         | 374 (51.2)    |
| Age                            |               |
| 6-11 months                    | 176 (24.2)    |
| 12-23 months                   | 147 (20.2)    |
| 24-35 months                   | 136 (18.7)    |
| 36-47 months                   | 172 (23.7)    |
| 48-60 months                   | 95 (13.1)     |
| Edema during admission         |               |
| Yes                            | 242 (33.3)    |
| No                             | 484 (66.7)    |
| Outcome                        |               |
| Cured                          | 667 (91.9)    |
| Dead                           | 6 (0.8)       |
| Defaulter                      | 20 (2.8)      |
| Unknown                        | 11 (1.5)      |
| Non response                   | 6 (0.8)       |
| Transfer out                   | 16 (2.2)      |
| Type of admission              |               |
| New                            | 640 (88.2)    |
| Relapsed                       | 86 (11.8)     |

Table 2: Mean time of relapse among children with severe acute malnutrition (SAM) in Sothern Region Hadiya zone Ethiopia.
Table 3. Multivariable Cox proportional hazards model identifying the determinants of time to relapse among children with severe acute malnutrition (SAM) in Sothern Region Hadiya zone Ethiopia

| Variable                        | Mean time of relapse in weeks | ±SD |
|---------------------------------|------------------------------|-----|
|                                 | Mean                         | SD  |
| Sex                             |                              |     |
| Male                            | 21                           | 8.6 |
| Female                          | 23                           | 11.1|
| Age in months                   |                              |     |
| 6-11                            | 21                           | 21.4|
| 12-23                           | 25                           | 25.2|
| 24-35                           | 26                           | 15  |
| 36-47                           | 21                           | 8.3 |
| 48-60                           | 15                           | 3.5 |
| Edema during first admission    |                              |     |
| Yes                             | 22                           | 11.8|
| No                              | 22                           | 8.7 |
| Outcome of treatment            |                              |     |
| Cured                           | 23                           | 11.8|
| Not cured                       | 21                           | 7   |

SD: standard deviation.
| Variables                      | B   | P   | AHR | 95% CI       |
|-------------------------------|-----|-----|-----|--------------|
| Sex                           | -   | -   | -   | -            |
| Male                          | -   | -   | 1.00| -            |
| Female                        | -0.32| 0.16| 0.72| 0.46-1.14    |
| Admission edema               | -   | -   | -   | -            |
| Yes                           | 0.70| 0.01| 2.02| 1.17-3.50    |
| No                            | -   | -   | 1.00| -            |
| Admission MAC                 | -0.10| 0.53| 0.90| 0.65-1.25    |
| Age of the child in month     | -   | -   | -   | -            |
| 6-11                          | 1.65| 0.001| 5.200| 1.95-13.87   |
| 12-23                         | 0.79| 0.151| 2.194| 0.75-6.41    |
| 24-35                         | 0.80| 0.131| 2.230| 0.79-6.31    |
| 36-47                         | 0.86| 0.090| 2.369| 0.87-6.42    |
| 48-60                         | -   | -   | 1.00| -            |
| Outcome during the first discharge | -   | -   | -   | -            |
| Cured                         | -   | -   | 1.00| -            |
| Not cured                     | 2.519| 0.001| 12.42| 7.90-19.52   |

MUAC: Mid upper arm Circumference.
CI: Confidence interval.
AHR: adjusted hazard Ratio.
Figure 1

One minus survival function test for edematous children in Hadiya zone Southern Ethiopia
Figure 2

One minus curve for testing parallel hazards assumption among children in Hadiya zone Southern Ethiopia

Supplementary Files

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- SurvivalandRelapse19.sav