Scientific Research Publishing

Open Journal of Pediatrics, 2023, 13, 473-483
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

Outcome after Discharge from Hospital of Children with Complicated Severe Acute Malnutrition and Predictors Factors of Non-Response during Outpatient Treatment, in Senegal

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How to cite this paper: Ba, A., Thiongane, A., Niang, B., Keïta, Y., Ly, F., Ndongo, A.A. and Ndiaye, O. (2023) Outcome after Discharge from Hospital of Children with Complicated Severe Acute Malnutrition and Predictors Factors of Non-Response during Outpatient Treatment, in Senegal. *Open Journal of Pediatrics*, **13**, 473-483.
https://doi.org/10.4236/ojped.2023.134053

Received: May 16, 2023
Accepted: July 10, 2023
Published: July 13, 2023

Abstract

Introduction: Malnutrition is a public health problem. It is responsible for high morbidity and mortality in children aged 6 - 59 months. The aim of this study was to determine the outcome of children with complicated severe acute malnutrition after hospital discharge. **Methods:** This is a descriptive and analytical cross-sectional study conducted from March 1 to November 31, 2021 at the Albert Royer Children's Hospital. Children discharged from hospital for complicated severe acute malnutrition were included. **Results:** A total of 103 children were included. The mean age of children at hospitalization was 16.41 ± 10.11 months and mean duration of follow-up after hospital discharge was 29.63 ± 8.59 months. Three children (2.91%) died after hospital discharge. The mean z-score of the weight-for-current height was −1.34 ± 1.08. Almost a quarter (24.27%) of the children remain acute malnourished with 3.88% of severe acute malnutrition (SAM). The predictors' factors associated with non-response were weaning before 2 years of age (ORaj: 12.21; 95% CI [6.82 - 18.44]; p = 0.04) and tuberculosis (ORaj: 21.06; 95% CI [12.54 - 41.09]; p = 0.03). **Conclusion**: The rate of recovery of nutritional status in children with complicated severe acute malnutrition is satisfactory. Ablactation before the age of two and the existence of tuberculosis are significantly associated with non-recovery of nutritional status.

Keywords

Children, Severe Acute Malnutrition, Recovery, Non-Response

1. Introduction

Malnutrition is a public health problem, particularly in developing countries. Acute malnutrition affects 52 million children under the age of 5 with 17 million in severe form worldwide. Asia and Africa are most affected by the burden of malnutrition (96%), with two-thirds and one-quarter of children under five suffering from acute malnutrition respectively [1] [2]. It has a negative impact on health, increases the risk of mortality and causes intellectual or cognitive deficiencies in children, preventing them from reaching their full potential [3]. Severe acute malnutrition can be defined by a weight-for-height index of less than −3 z-score, a brachial circumference of less than 115 mm, and bilateral pitting edema in children aged 6 to 59 months [4]. The risk of death is 9 to 11 times higher in severe acute malnutrition. However, most deaths occur in children with mild to moderate malnutrition [5] [6]. Malnutrition is implicated in approximately 45% of deaths in children under 5 years of age, accounting for more than 3 million deaths per year [7]. Studies in Africa and Asia have reported recovery rates of 25% to 95% and 50% to 93% respectively in children followed for SAM in hospital and community settings. [8]. In Senegal, 8% of children suffer from acute malnutrition, and 1% of them have a severe form [9]. Fewer or no studies have examined the outcome of children who were hospitalized for severe acute malnutrition with complications discharged from hospital. The aim of this study was to assess the outcome of children hospitalized for severe acute malnutrition with complications after discharge.

2. Methods and Materials

2.1. Study Design

This is a descriptive and analytical cross-sectional study conducted from 1st March to 31st November 2021 at the Albert Royer's Children Hospital (HEAR). This is the largest pediatric hospital in the country and is of the highest standard for our country with medical and surgical ward. Children of all ages are referred to it from secondary or peripheral health facilities as well as from other hospitals of the same standing (level III). It has a nutritional recovery and education center. Most children from the Dakar region with severe pathologies, or even patients from other regions, are treated at CHNEAR.

2.2. Populations

All children aged 6 - 59 months who were hospitalized for complicated severe acute malnutrition at Albert Royer's Children Hospital were taken as the study population.

2.3. Eligibility Criteria

All children aged 6 - 59 months hospitalized for complicated severe acute malnutrition discharged from hospital, whose nutritional management was continued on an outpatient clinic, and whose parents were reachable and willing to participate in the study. While those children aged 6 - 59 months with congenital malformations were excluded.

2.4. Data Collection

Patients were identified from registries and hospitalization records for the years 2018 and 2019. Parents were called by telephone and an appointment was scheduled at their convenience. For all included patients, we collected epidemiological data (age, gender, address, feeding; mother's age, education, marital status and occupation, clinical manifestations (palor, oedemas, complications such as fever, cough and/or breathing difficulties, diarrhea, vomiting,) and nutritional status (weight, height, weight for height or body mass index for age) on the medical record and during appointment. Children were weighed using the Seca digital scale with tare function. Height was measured with the UNICEF height gauge, in the supine position for patients who were less than equal to 24 months and were unable to stand by themselves and in the standing position for children who were more than 24 months and can stand by themselves developmentally. Height, weight, and age data were used to calculate Z-scores for the weight-for-height (W/H) indices according to reference curves provided by the World Health Organization (WHO). Z-scores were calculated with the Anthro program (WHO Anthro, Geneva, Switzerland) [9].

2.5. Statistical Analysis

Qualitative variables are described according to frequencies, proportions and their confidence intervals. Quantitative variables are described according to the mean and standard deviation when the distributions were normal, in median and quartiles in the opposite case. A univariable logistic regression was first performed to select the variables (with a p-value < 15%) potentially associated with malnutrition. In the second step, these selected variables were introduced into a multi-variable model. A top-down stepwise regression strategy was used to identify factors associated with persistent malnutrition with a p-value < 5%. All analyses were performed with R software.

3. Results

A total of 155 children were hospitalized during the two years for severe acute malnutrition with complications. Among them, 16 children died during hospitalization, 15 parents of children could not be reached, and 24 parents declined the invitation to participate in the study (**Figure 1**). One hundred and three children were included in the study. The sex ratio was 1.23.

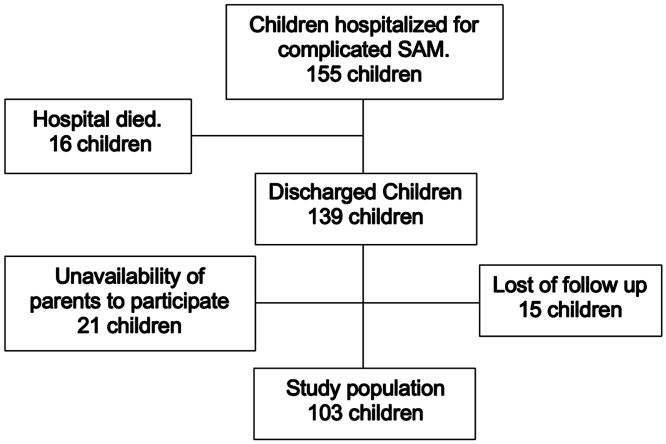

Figure 1. Study population.

The mean age of children at hospitalization was 16.41 ± 10.11 months and 46.03 ± 13.43 months at the time of the study. The age groups 6 - 12 months (28.16%) and 12 - 18 months (25.24%) were the most frequent. The mean age of the mothers was 29.75 ± 5.73 years. The sociodemographic characteristics of the children and their mothers are shown in **Table 1**.

3.1. Medical Complications and Clinical Features of SAM during Hospitalization

At hospitalization, the children had marasmus (76.70%), kwashiorkor (15.53%) and a mixed form (7.7%). The mean z-score of weight for height was −4.76 ± 0.32. The main infectious complications were dominated by pneumonia (47.67%) including 6 cases (4.65%) of tuberculosis, anemia (47.57%) and hydro electrolytic disorders (40.78%) with 15.53% of severe acute dehydration with shock. Two children (2.34%) had HIV infection.

3.2. Present Nutritional Status

The mean duration of follow-up after hospital discharge was 29.63 ± 8.59 months. Three children (2.91%) died after hospital discharge. Slightly more than two-thirds (75.73%) of the children had made a full recovery. The mean weight-for-height ratio z-score was −1.34 ± 1.08. The median weight-for-height ratio z-score was −1.22 with extremes of −3.98 and 1.73. The nutritional status of the children is shown in **Figure 2**.

In univariate analysis (**Table 2**), there were no significant differences according to gender ($p = 0.59$), feeding ($p = 0.19$), address ($p = 0.38$), mothers' level of education ($p = 0.25$) and the presence of edema ($p = 0.85$), anemia ($p = 0.96$) and HIV infection ($p = 0.42$). In contrast, children who were 6 - 12 months old at hospitalization ($p = 0.04$) and those with tuberculosis ($p = 0.01$) were the most affected by malnutrition. After multivariate analysis by top-down stepwise logistic regression method (**Table 3**), the most predictive factors for nonrecovery were ablactation before 2 years of age (AOR: 12.21; IC 95% [6.82 - 18.44]; $p = 0.04$) and tuberculosis (AOR: 21.06; [12.54 - 41.09]; $p = 0.03$).

Table 1. Child and mother socio-demographic characteristic.

Characteristics	Frequency	Percentage (%)
Sex		
Male	57	55.34
Female	46	44.66
Feeding		
Weaning before 2 years of age	34	33
Weaning after 2 years of age	13	12.6
Breastfeeding in process	56	54.4
Child's age at hospitalisation (months)		
6 - 12	29	28.10
13 - 24	55	53.40
25 - 59	19	18.50
Present child's age (months)		
18 - 24	2	1.94
25 - 59	85	82.53
60 - 90	16	15.53
Address		
Urban	23	22.33
Suburban	77	74.76
Rural	3	2.91
Mother's age (years)		
15 - 20		4.85
21 - 35		76.70
≥36		18.45
Mother's marital status		
Monogamous married	76	73.79
Polygameous married	27	26.21
Mother's education		
No schooling	71	68.93
Primary	21	20.39
Secondary	10	9.71
Universitary	1	0.97
Mother's occupation		
Housewife	93	90.29
Income generating activity	8	7.77
Employee	2	1.94

Table 2. Risk factors of non-recovery (univariate analysis).

Univariable logistic regression	Severe acute malnutrition non-recovery			
	yes; n (%)	no; n (%)	total	p-value
Sex				
Male	15 (26.32)	42 (73.68)	57	0.59
Female	10 (21.74)	36 (78.26)	46	
Feeding				
Weaning before 2 years of age	7 (20.59)	27 (79.41)	34	0.19
Weaning after 2 years of age	1 (7.69)	12 (92.1)	13	
Breastfeeding in process	17 (30.36)	39 (69.64)	56	
Child's age at hospitalization (months)				
6 - 12	5 (17.24)	24 (82.76)	29	0.04
13 - 24	15 (27.27)	40 (72.73)	55	
25 - 59	11 (57.89)	8 (42.11)	19	
Address				
Urban	4 (17.39)	19 (82.61)	23	0.38
Suburban	28 (36.36)	49 (63.64)	77	
Rural	2 (66.67)	1 (33.33)	3	
Mother's education				
No schooling	12 (16.90)	59 (83.10)	71	0.25
Primary	4 (19.05)	17 (80.95)	21	
Secondary	2 (0.20)	8 (0.80)	10	
Universitary	0	1 (100)	1	
Clinical form of malnutrition				
Oedematous	5 (20.83)	19 (79.17)	24	0.85
No oedematous	20 (25.32)	59 (74.68)	79	
Tuberculosis				
Yes	3 (75.00)	1 (25.00)	4	0.01
No	22 (22.22)	77 (77.78)	99	
Anemia				
Yes	12 (24.49)	37 (75.51)	49	0.96
No	13 (24.07)	48 (75.93)	54	
VIH Infection				
Yes	0	2 (100)	2	0.42
No	25 (24.75)	76 (75.25)	101	

Table 3. Risk factors of non-recovery (multivariate analysis).

Multivariate logistic regression: variables	ORaj	95% IC	p-value
Feeding			
Weaning before 2 years of age	12.21	6.84 - 18.44	0.04
Weaning after 2 years of age	1		
Breastfeeding in process	2.63		
Tuberculosis			
Yes	21.06	12.54 - 41.09	0.02
No	1		

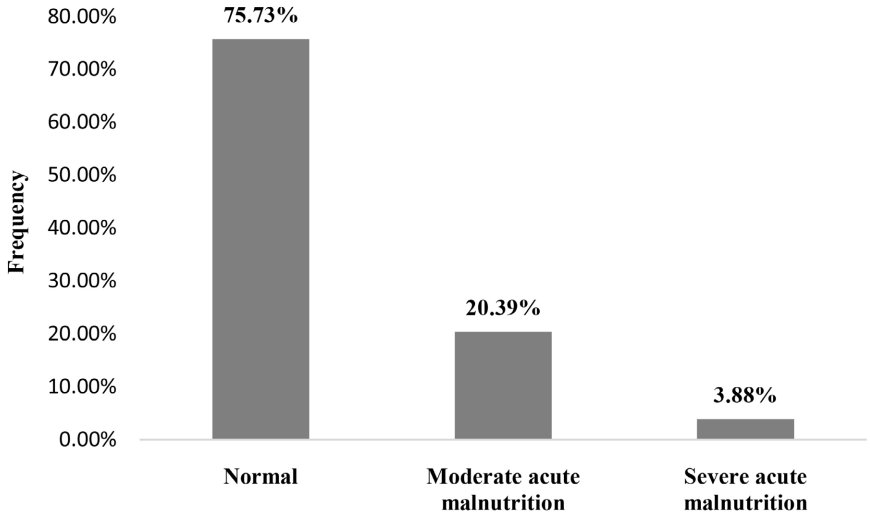

Figure 2. Present nutritional status.

4. Discussion

This work showed that the recovery rate of children at least one year after hospitalization for severe acute malnutrition with complications is quite satisfactory at 75.73% and that ablactation before 24 months and the existence of tuberculosis on admission are the two most predictive factors for non-recovery. This rate is in line with the international standard which predicts a recovery rate for severe malnutrition of more than 75% [10]. In sub-Saharan Africa, a meta-analysis found a combined prevalence of 71.2%, with better results in East, Central and North Africa with 71.4%, 84.7% and 78.9% recovery respectively. West Africa (60.9%) and South Africa (64.7%) had the lowest rates [8]. In Ethiopia, two meta-analyses reported a cumulative prevalence of nutritional recovery of 70.5% and 72.02% with variations according to region. The best results were noted in the Oromia region (80.29%) [11] [12]. The recovery rate was much better in Zambia and Zimbabwe, 86.6% and 87.8% respectively for HIV-infected and uninfected children [13]. The rate of lost to follow-up ranged from 0.0% to 45% [14]. It was 6% in Nigeria [15], 34.2% in Burkina Faso [16], and 10% in Ethiopia

[17]. Although WHO recommends inpatient follow-up for SAM with complications and continued management in the community after resolution of complications and for uncomplicated SAM [18], hospitalized children continued to be followed up in the hospital after discharge by medical staff. This may contribute to the loss of sight, especially since the majority of our study population lived in suburban areas, which were generally poorly developed, whereas the hospital was located in an urban area. A study in Mali found a higher proportion of dropouts and noncompliance with appointments among children followed up in health facilities compared with those followed up by community health workers close to their homes [19]. In the work of Kangas ST *et al.*, the recovery rate was slightly better for children followed by community health workers than for those followed by health workers [20].

In our study, delayed recovery was associated with ablactation before two years of age and the existence of pulmonary tuberculosis at admission. The existence of disease or infection during follow-up has been reported in Burkina Faso [20], South Africa [21], and Ethiopia [22].

The interaction between infection and nutrition has been reported by WHO and operates in a bidirectional manner. Infection alters nutritional status through decreased food intake secondary to the anorectic effect of cytokines, increased losses due to increased protein catabolism, fever and chills, loss of urinary nitrogen, and inflammation-related malabsorption [23] [24] [25] [26]. The association between tuberculosis and malnutrition is well known [27] and delayed nutritional recovery in tuberculosis has been reported in several studies [28] [29].

In our study, 3.88% of children remained severely malnourished. This rate is much lower than that reported in Nigeria (18.1%) [30]. In our study, 2.91% of children died after discharge. This rate is slightly higher than that reported in Burkina Faso (2.2%) [16], but much lower than that found in Jigawa state in Nigeria (6.6%) [30]. The low death rate could be explained by the follow-up of children at the hospital level by pediatricians who detect and manage morbidities early.

5. Conclusion

In conclusion, the nutritional recovery rate of children formerly hospitalized for severe acute malnutrition with complications is globally satisfactory with low mortality. The existence of tuberculosis and ablactation before the age of two is factors of non-recovery of nutrition. It is therefore essential to respect the feeding recommendations for infants and young children and to insist on primary prevention of tuberculosis.

6. Limitations

Limitations of this study include the unavailability of some parents of formerly malnourished children to participate in the study, and the absence of a harmonized protocol for outpatient follow-up of children, with a lack of clinical data in

some medical records during outpatient follow-up.

Acknowledgements

We would like to acknowledge all the children and parents who agree to participate in this study. Special thanks go to nutritional recovery and education center manager and the supervision on duty.

Conflicts of Interest

The authors declare that they have no conflicts of interest and no financial disclosure.

References

[1] UNICEF, WHO, International Bank for Reconstruction and Development/The World Bank (2019) Levels and Trends in Child Malnutrition: Key Findings of the 2019 Edition of the Joint Child Malnutrition Estimates. World Health Organization, Geneva.

[2] Kambale, R.M. and Francisca, I.N. (2022) Optimising the Management of Acute Malnutrition. *The Lancet Global Health*, **10**, e453-e454. https://doi.org/10.1016/S2214-109X(22)00087-0

[3] Dipasquale, V., Cucinotta, U. and Romano, C. (2020) Malnutrition in Children: Pathophysiology, Clinical Effects and Treatment. *Nutrients*, **12**, Article No. 2413. https://doi.org/10.3390/nu12082413

[4] WHO (2013) Guideline: Updates on the Management of Severe Acute Malnutrition in Infants and Children. World Health Organization, Geneva.

[5] Adepoju, A.A. and Allen, S. (2019) Malnutrition in Developing Countries: Nutrition Disorders, a Leading Cause of Ill Health in the World Today. *Paediatrics and Child Health*, **29**, 394-400. https://doi.org/10.1016/j.paed.2019.06.005

[6] Ulahannan, S.K., Wilson, A., Chhetri, D., Soman, B. and Prashanth, N.S. (2022) Alarming Level of Severe Acute Malnutrition in Indian Districts. *BMJ Global Health*, **7**, e007798. https://doi.org/10.1136/bmjgh-2021-007798

[7] World Health Organisation Malnutrition Key Fact. https://www.who.int/fr/news-room/fact-sheets/detail/malnutrition

[8] Desyibelew, H.D., Bayih, M.T., Baraki, A.G. and Dadi, A.F. (2020) The Recovery Rate from Severe Acute Malnutrition among under-Five Years of Children Remains Low in Sub-Saharan Africa. A Systematic Review and Meta-Analysis of Observational Studies. *PLOS ONE*, **15**, e0229698. https://doi.org/10.1371/journal.pone.0229698

[9] WHO (2006) WHO Child Growth Standards: Length/height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development. World Health Organization, Geneva.

[10] The Sphere Project: Humanitarian Charter and Minimum Standards in Disaster Response. https://www.humanitarianlibrary.org/sites/default/files/2014/02/1257.pdf

[11] Wagnew, F., Dessie, G., Takele, W.W., Tadesse, A., Islam, S.M.S., Mulugeta, H., *et al.* (2019) A Meta-Analysis of Inpatient Treatment Outcomes of Severe Acute Malnutrition and Predictors of Mortality among Under-Five Children in Ethiopia. *BMC Public Health*, **19**, Article No. 1175. https://doi.org/10.1186/s12889-019-7466-x

[12] Yazew, K.G., Kassahun, C.W., Ewnetie, A.W., Mekonen, H.K. and Agagez, E.S. (2019) Recovery Rate and Determinants of Severe Acute Malnutrition Children Treatment in Ethiopia: A Systematic Review and Meta-Analysis. *Systematic Reviews*, **13**, Article No. 323. https://doi.org/10.1186/s13643-019-1249-4

[13] Bwakura-Dangarembizi, M., Dumbura, C., Amadi, B., Chasekwa, B., Ngosa, D., Majo, F.D., *et al.* (2022) Recovery of Children Following Hospitalisation for Complicated Severe Acute Malnutrition. *Maternal & Child Nutrition*, **18**, e13302. https://doi.org/10.1111/mcn.13302

[14] O'Sullivan, N.P., Lelijveld, N., Rutishauser-Perera, A., Kerac, M. and James, P. (2018) Follow-up between 6 and 24 Months after Discharge from Treatment for Severe Acute Malnutrition in Children Aged 6 - 59 Months: A Systematic Review. *PLOS ONE*, **13**, e0202053. https://doi.org/10.1371/journal.pone.0202053

[15] Adegoke, O., Arif, S., Bahwere, P., Harb, J., Hug, J., Jasper, P., *et al.* (2021) Incidence of Severe Acute Malnutrition after Treatment: A Prospective Matched Cohort Study in Sokoto, Nigeria. *Maternal & Child Nutrition*, **17**, e13070. https://doi.org/10.1111/mcn.13070

[16] Somassè, Y.E., Dramaix, M., Bahwere, P. and Donnen, P. (2016) Relapses from Acute Malnutrition and Related Factors in a Community-Based Management Programme in Burkina Faso. *Maternal & Child Nutrition*, **12**, 908-917. https://doi.org/10.1111/mcn.12197

[17] Bitew, Z.W., Alemu, A. and Worku, T. (2020) Treatment Outcomes of Severe Acute Malnutrition and Predictors of Recovery in Under-Five Children Treated within Outpatient Therapeutic Programs in Ethiopia: A Systematic Review and Meta-Analysis. *BMC Pediatrics*, **20**, Article No. 335. https://doi.org/10.1186/s12887-020-02188-5

[18] Collins, S., Dent, N., Binns, P., Bahwere, P., Sadler, K. and Hallam, A. (2006) Management of Severe Acute Malnutrition in Children. *Lancet*, **368**, 1992-2000. https://doi.org/10.1016/S0140-6736(06)69443-9

[19] López-Ejeda, N., Charle-Cuellar, P., Alé, F.G.B., Álvarez, J.L., Vargas, A. and Guerrero, S. (2020) Bringing Severe Acute Malnutrition Treatment Close to Households Through Community Health Workers Can Lead to Early Admissions and Improved Discharge Outcomes. *PLOS ONE*, **15**, e0227939. https://doi.org/10.1371/journal.pone.0227939

[20] Kangas, S.T., Marron, B., Tausanovitch, Z., Radin, E., Andrianarisoa, J., Dembélé, S., *et al.* (2022) Effectiveness of Acute Malnutrition Treatment at Health Center and Community Levels with a Simplified, Combined Protocol in Mali: An Observational Cohort Study. *Nutrients*, **14**, Article No. 4923. https://doi.org/10.3390/nu14224923

[21] Grimbek, A. and Saloojee, H. (2022) Clinical and Growth Outcomes of Severely Malnourished Children Following Hospital Discharge in a South African Setting. *PLOS ONE*, **17**, e0262700. https://doi.org/10.1371/journal.pone.0262700

[22] Tadesse, Z., Tesome, D.F., Lakew, A.M., Debalkie, G. and Gonete, K.A. (2021) Time to Nutritional Recovery and Its Determinants Among Children Aged 6 to 59 Months with Severe Acute Malnutrition Admitted to Stabilization Centers of Waghimra Zone, Northeast Ethiopia. *Ecology of Food and Nutrition*, **60**, 751-764. https://doi.org/10.1080/03670244.2021.1907746

[23] Scrimshaw, N.S., Taylor, C.E. and Gordon, J.E. (1968) Interactions of Nutrition and Infection. World Health Organization, Geneva.

[24] Krwinkel, M.B. (2012) Interaction of Nutrition and Infections Globally: An Overview. *Annals of Nutrition and Metabolism*, **61**, 39-45. https://doi.org/10.1159/000345162

[25] Katona, P. and Katona-Apte, J. (2008) The Interaction between Nutrition and Infection. *Clinical Infectious Diseases*, **46**, 1582-1588. https://doi.org/10.1086/587658

[26] Farhadi, S. and Ovchinnikov, R. (2018) The Relationship between Nutrition and Infectious Disease: A Review. *Biomedical and Biotechnology Research Journal*, **2**, 168-172. https://doi.org/10.4103/bbrj.bbrj_69_18

[27] Vijayakumar, M., Bhaskaram, P. and Hemalatha, P. (1990) Malnutrition and Childhood Tuberculosis. *Journal of Tropical Pediatrics*, **36**, 294-298. https://doi.org/10.1093/tropej/36.6.294

[28] Wagnew, F., Dejenu, G., Eshetie, S., Alebel, A., Workut, W. and Abajobir, A.A. (2019) Treatment Cure Rate and Its Predictors among Children with Severe Acute Malnutrition in Northwest Ethiopia: A Retrospective Record Review. *PLOS ONE*, **14**, e0211628. https://doi.org/10.1371/journal.pone.0211628

[29] Desyibelew, H.D., Fekadu, A. and Woldie, H. (2017) Recovery Rate and Associated Factors of Children Age 6 to 59 Months Admitted with Severe Acute Malnutrition at Inpatient Unit of Bahir Dar Felege Hiwot Referral Hospital Therapeutic Feeding Unite, Northwest Ethiopia. *PLOS ONE*, **12**, e0171020. https://doi.org/10.1371/journal.pone.0171020

[30] John, C., Diala, U., Adah, R., Lar, L., Envuladu, E.A., Adeleji, I., *et al.* (2018) Survival and Nutritional Status of Children with Severe Acute Malnutrition, Six Months Post-Discharge from Outpatient Treatment in Jigawa State, Nigeria. *PLOS ONE*, **13**, e0196971. https://doi.org/10.1371/journal.pone.0196971