

Outcome of Nutritional Rehabilitation Centre based care for children with Severe Acute Malnutrition in Uttar Pradesh, India: Cross sectional Study

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ORIGINAL STUDY

Outcome of Nutritional Rehabilitation Centre Based Care for Children with Severe Acute Malnutrition in Uttar Pradesh, India: Cross Sectional Study

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Abstract

Background and aim: Nutritional Rehabilitation Centres (NRCs) have been established for the facility-based management of children with severe acute malnutrition (SAM). The present study was conducted in two such centres in Uttar Pradesh, India to understand the epidemiological and clinical profile of admitted children and their outcome of treatment.

Materials and methods: A facility based cross-sectional study was conducted in the Nutritional Rehabilitation centres at Lucknow and Barabanki district hospitals. All Children aged one to fifty-nine months admitted to these centres from July 1, 2018 to June 30, 2019 were included in the study.

Results: Around 28% infants diagnosed with SAM were less than 6 months of age. Majority (64.9%) of the admitted children were discharged with more than 15% of weight at admission, 28.9% were non-responders, 6.2% were defaulters and there were no deaths during the study period. Referrals directly from the community were seen in only 25.8% cases.

Conclusion: Considering that around one-fourth of the children were discharged without adequate weight gain, measures to promote follow up should be given more focus. Referral from community level should be strengthened and more attention should be given for prevention of malnutrition in infants less than 6 months.

Keywords: Severe acute malnutrition/therapy, Severe acute malnutrition/rehabilitation, Treatment outcome, Nutritional status, India/epidemiology

1. Introduction

Malnutrition is a major impediment to holistic growth of children and thereby the development of any nation. Severe Acute Malnutrition (SAM) is the most extreme and visible form of undernutrition [1]. Severe acute malnutrition is defined as very low weight-for-height/length (Z-score below -3 SD of the median World health Organisation (WHO) child growth standards), or a mid-upper arm circumference <115 mm, or by the presence of nutritional oedema [2].

A novel initiative has been taken up for tackling severe acute malnutrition under National Rural Health Mission (NRHM) by establishing Nutritional Rehabilitation Centres (NRCs). These centres are set up in the health facilities for inpatient management of severely malnourished children, with counselling of mothers for proper feeding [3].

Around 1151 NRCs have been established across the country to provide facility-based care for children with Severe Acute Malnutrition (SAM) and medical complications [4]. These centres have been a boon to the battle against malnutrition. The

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present study was conducted to understand the epidemiological and clinical profile of children admitted in the NRCs in Uttar Pradesh and their outcome of treatment.

2. Materials and methods

A facility based cross-sectional study was conducted in the Nutritional Rehabilitation centres at Lucknow and Barabanki district hospitals. All Children aged one to fifty-nine months admitted to these centres from July 1, 2018 to June 30, 2019 were included in the study. Infants less than one month of age, children over 60 months and those with congenital disorders were excluded from the study. Data was collected from the case records maintained at the NRCs. Outcomes were defined as per the operational guidelines for NRCs [2]. For age-appropriate immunisation status, if all vaccines as per the National Immunisation Schedule for the age of the child were given, immunisation was considered to be “complete”; if few vaccines have been given, it was considered “partial” and if none of the vaccines were given, vaccination status was marked “not immunised”.

Data analysis was done with IBM SPSS version 23. Descriptive statistics was used to summarise the data. Appropriate tests for association (Paired *t*-test and independent samples *t*-test for comparison of mean, Chi Square test for categorical variables) and co-relation statistics were used. All tests were performed at 5% level of significance and *p*-value less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the institutional ethics committee and written permission was taken from the Medical Officers-In charge of the two NRCs.

3. Results

Almost equal proportion of girls (50.2%) and boys (49.8%) were admitted to the NRC during the study period. The study sample included 225 children between one to fifty-nine months of age. Mean age was 14.23 ± 11.4 months. Majority were less than 24 months (86.7%). Out of this, 53.8% were less than 1 year and 63 infants (28%) were less than 6 months. There was no significant difference in the mean age of boys and girls admitted in the NRC ($t = 0.29$, p value = 0.76).

Majority of the study population were from rural areas (47.8% girls and 50.9% boys) followed by slums (42.5% girls and 34.8% boys). Most of the families of the admitted children (60.9%) practised Hindu religion and majority (57.3%) belonged to SC/ST communities.

It was found that 34 (15.1%) study participants (19 girls and 15 boys) were not immunised. There was

no statistical significance between gender and immunisation status ($\chi^2 = 0.474$, $p = 0.49$).

Majority of the children (64.4%) were referred by medical officers in Primary Health Centres (PHCs) or Community Health Centres (CHCs). Around 25.8% were referred directly from the community by Rashtriya Bal Suraksha Karyakram (RBSK) screening, Accredited Social Health Activists (ASHAs) or Anganwadi Workers (AWWs) and the rest by relatives or private health facilities (7.6%) and NGOs (2.2%). This referral pattern was similar for boys and girls [Table 1].

Diarrhoea and fever were the most common symptoms at the time of presentation to the NRCs. It was seen that more girls (47.7%) presented with diarrhoea while majority of the boys presented with fever (43.7%), as shown in Table 2.

Although majority (59.6%) of the children were alert on admission, it was seen that 17.2% of the children were lethargic and 13% were irritable. Around 9.4% of the children had severe visible wasting at the time of admission and 3.3% had pedal oedema. Dehydration was seen in 9.6% children while 2.6% had hair and skin changes. None of the participants had cyanosis or eye changes [Table 2]. Majority (82.7%) of the admitted children had anaemia ($Hb < 11g\%$). There was no significant difference between gender and anaemia ($\chi^2 = 0.18$, $p = 0.98$).

The mean duration of stay at the NRC was 14 ± 4 days. The minimum length of stay was 1 day and the maximum was 28 days. Majority (55.6%) of the children were admitted for 7–14 days at the NRCs and there was no significant difference between mean duration of stay of boys and girls ($t = 0.66$, $p = 0.50$).

The overall mean weight of the children at the time of admission was 5.32 ± 1.90 Kg; for boys 5.56 ± 1.99 kg and for girls 5.09 ± 1.80 kg. The overall mean weight of children at the time of discharge from the NRCs was 6.12 ± 2.07 kg; for boys 6.35 ± 2.11 kg and for girls 5.88 ± 2.01 kg (Supplementary Tables 1 and 2). Statistically significant difference was observed between the mean weight at discharge and the mean weight at admission for the study participants ($t = 34.49$, $p < 0.01$).

Mean MUAC at the time of admission was 11.0 ± 1.22 cm (10.9 ± 1.25 cm in girls and 11.1 ± 1.19 cm in boys) and 11.3 ± 1.46 cm (girls, 11.2 ± 1.4 cm and 11.4 ± 1.5 cm for boys) at the time of discharge. Statistically significant difference was observed between the mean MUAC at discharge and at admission for boys ($t = 2.1$, $p = 0.04$), girls ($t = -2.3$, $p = 0.02$) and overall, for all admitted children ($t = -3.1$, $p = 0.002$).

Table 1. Sociodemographic characteristics and referral pattern among the children admitted to the Nutritional Rehabilitation Centres.

		Girls (n = 113) n (%)	Boys (n = 112) n (%)	Total (N = 225) n (%)
Age (months)	≤6	34 (30.1)	29 (25.9)	63 (28.0)
	6–12	27 (23.9)	31 (27.7)	58 (25.8)
	13–24	36 (31.9)	38 (33.9)	74 (32.9)
	25–36	9 (8.0)	10 (8.9)	19 (8.4)
	37–59	7 (6.1)	4 (3.6)	11 (4.9)
Mean age in months± SD		14.46 ± 12.1	14.00 ± 10.7	14.23 ± 11.4
Area of Residence	Rural	54 (47.8)	57 (50.9)	111 (49.3)
	Urban	11 (9.7)	16 (14.3)	27 (12.0)
	Slum	48 (42.5)	39 (34.8)	87 (38.7)
Religion	Hindu	67 (59.3)	70 (62.5)	137 (60.9)
	Muslim	46 (40.7)	42 (37.5)	88 (39.1)
Caste	General	15 (13.3)	15 (13.4)	30 (13.4)
	OBC	37 (32.7)	29 (25.9)	66 (29.3)
	SC/ST	61 (54.0)	68 (60.7)	129 (57.3)
Age-appropriate Immunization (N = 222)	Not Immunized	19 (17.0)	15 (13.6)	34 (15.1)
	Partially Immunized	37 (33.0)	55 (50.0)	92 (40.9)
	Completely Immunized	56 (50.0)	40 (36.4)	96 (42.6)
Referral	Medical officers at PHCs/CHCs	71 (62.8)	74 (66.1)	145 (64.4)
	ASHAs, AWWs or RBSK screening	32 (28.3)	26 (23.2)	58 (25.8)
	Private health facilities or relatives	9 (8.0)	8 (7.1)	17 (7.6)
	NGOs	1 (0.9)	4 (3.6)	5 (2.2)

The average daily weight gain was 12.4 ± 8.2 g/kg/day and ranged from 0 to 80.66 g/kg/day. There was no significant difference in the rate of weight gain between boys and girls ($t = 0.35$, p value = 0.72). The two children with no weight gain had defaulted from the NRC care.

At the end of treatment, 64.9% of the admitted children were discharged with more than 15% of weight at admission while 28.9% did not gain weight

adequately and hence were considered as non-responders. Defaulting from the NRC was seen in 6.2% of the admissions and no deaths were reported [Table 4]. There was no statistical difference in the outcomes with respect to gender ($\chi^2 = 6.28$, $p = 0.11$) [Table 3]. Those children who were admitted for 7–14 days had achieved 15% weight gain than other groups and this was statistically significant ($\chi^2 = 7.623$, p value = 0.02).

Table 2. Symptoms, clinical signs and laboratory findings of children at admission to NRCs.

Symptoms	N ^a	Girls n (%)	Boys n (%)	Total n (%)
Fever	215	50 (44.2)	49 (43.7)	99 (46.0)
Diarrhea		54 (47.7)	45 (40.1)	99 (46.0)
Anorexia		29 (25.6)	24 (21.4)	53 (24.7)
Respiratory symptoms		12 (10.6)	15 (13.3)	27 (12.6)
Vomiting		12 (10.6)	14 (12.5)	26 (12.1)
Clinical Signs				
Palmar pallor	192	22 (22.9)	33 (34.4)	55 (28.6)
Altered sensorium				
Irritable		10 (10.4)	15 (15.6)	25 (13.0)
Lethargic		13 (13.5)	20 (20.8)	33 (17.2)
Severe visible wasting		5 (5.2)	13 (13.5)	18 (9.4)
Hair changes		3 (3.1)	2 (2.1)	5 (2.6)
Skin lesions		2 (2.1)	3 (3.1)	5 (2.6)
Dehydration	188	4 (4.3)	14 (14.9)	18 (9.6)
Pedal oedema	209	3 (2.9)	4 (3.8)	7 (3.3)
Laboratory Investigations				
Mild Anemia (Hb = 10–10.9)	163	15 (17.4)	10 (13.0)	25 (15.3)
Moderate Anemia (Hb = 7–9.9)		46 (53.5)	39 (50.6)	85 (52.7)
Severe Anemia (Hb < 7)		12 (14)	12 (15.6)	24 (14.7)
Hypoglycemia (RBS<54 mg/dl)	135	1 (1.5)	0	1 (0.7)
Total leucocyte count >11,000	159	38 (50.0)	30 (36.1)	68 (42.8)

^a Sample size is smaller than 225 because of incomplete data in the NRC records.

Table 3. Duration of stay and outcome of care at the NRCs.

	Girls n (%)	Boys n (%)	Total n (%)	p-value
Duration of stay				0.06
<7 days	2 (1.8)	9 (8.0)	11 (4.9)	
7–14 days	68 (60.2)	57 (50.9)	125 (55.6)	
≥15 days	43 (38.1)	46 (41.1)	89 (39.6)	
Mean length of stay (days)	14.17 ± 3.6	13.79 ± 4.8	14 ± 4.0	0.50
Mean weight gain (Kg)	0.81 ± 0.37	0.80 ± 0.37	0.78 ± 0.34	0.84
Average rate of weight gain (g/kg/day)	12.4 ± 8.2	12.5 ± 10.1	12.17 ± 5.7	0.72
Children attaining >15% weight gain n (%)	78 (69.0)	68 (60.7)	146 (64.9)	
Non-Responders n (%)	26 (23.0)	39 (34.8)	65 (28.9)	0.11
Defaulters n (%)	9 (8.0)	5 (4.5)	14 (6.2)	

Table 4. Comparison of acceptable standards of outcomes of Nutritional Rehabilitation Centre care and the study results.

	Study Results	Acceptable outcome
Recovery rate	74.2%	>75%
Death rate	NIL	<5%
Defaulter rate	6.2%	<15%
Weight gain (g/kg/day)	12.17 ± 5.7	≥8
Length of stay (days)	14 ± 4	7–28

4. Discussion

This cross-sectional study included 225 children with SAM admitted in two NRCs in Uttar Pradesh, India. It was seen that almost equal proportion of girls and boys were admitted to the NRCs and majority of the children were less than 24 months of age. Singh et al. in their analysis of NRCs in Uttar Pradesh in 2010-11 described that girls constituted 45.4% of the admissions and majority were aged 12–23 months (41.8%) followed by 6–11 months (39.9%) [5]. Our findings with respect to age distribution are also similar to the study by Baruah M N et al. in Assam where 52% of the children admitted to the NRC of a tertiary care teaching hospital were less than 24 months of age but majority (54.7%) were girls [6]. Meanwhile, children aged more than 24 months constituted the majority (58.57% and 58.23% respectively) in the studies by Bhimani NR et al. in Gujrat and Hashmi G et al. in Karnataka [7,8]. Girls constituted 49.64% and 51.76% of the study population respectively in the aforementioned studies.

It is to be noted that 28% infants were diagnosed with SAM in the first six months of life. Of these, 13.6% were pre-term, 83.1% were term and 3.4% were post-term. Secondary analysis of National Family Health Survey-4 (NFHS-4) data by Choudhary et al. found that prevalence of severe wasting among infants aged less than six months was 14.8% in India and ranged from 3.5 to 21% across different states [9]. According to NFHS-4, 41.6% of children under six months are exclusively breastfed [10]. There is a need to probe malnutrition in this period when exclusive breastfeeding is to be the source of nutrition. Treating malnourished infants under 6

months of age is important to avoid malnutrition-associated mortality in the short-term and adverse health and development outcomes in the long-term [11].

In our study, majority of the children were referred to the NRC by medical officers at PHCs and CHCs while only 25.8% were referred directly from the community by RBSK screening, ASHAs or AWWs. Similar results were seen in the study by Baruah M N et al. in Assam, in which 39.3% were referred by physicians and 28% by Anganwadi workers [6]. In contrast, Kumar B et al. in 2011-12, showed that 95% of the referrals to the NRCs studied in Madhya Pradesh were from village level health workers [12]. Similarly, in Gujrat, Bhimani NR et al. found that 76.9% of the referrals were through the ASHAs or AWWs [7]. Referrals directly from community can be an indicator of adequate screening and can ensure early detection and management of SAM. Village Health, Sanitation and Nutrition days (VHSNDs) can serve as platform for monitoring and early detection of SAM. Community health workers need to be trained adequately to detect and refer children with malnutrition.

As per the operational guidelines for NRCs, acceptable weight gain is ≥ 8 g/kg/day and length of stay is 7–14 days. The mean duration of stay at the NRCs in our study was 14 ± 4 days and the mean rate of weight gain was 12.17 ± 5.7 g/kg/day. Around 70.2% had gained more than 15% of admission weight. Those children who were admitted for 7–14 days had achieved 15% weight gain than other groups. In the study by Taneja G et al. in Madhya Pradesh in 2008-09, the average duration of stay at the NRCs was similar (13.81 ± 2.73 days) but the average weight gain was lower (9.25 ± 5.89 g/kg/day) [13]. Shah RK et al. found mean duration of stay of 15.6 days in their study in Gujrat in 2011-12 but in the study by Hashmi G et al. in Gulbarga, the average length of stay at the NRC was only 7.17 ± 1.6 days [8,14]. The average weight gain for this study group during their stay at the centre was 7.9 ± 1.6 g/kg/day and 86% of the children did not achieve more than 15% of their initial weight. Even in the study by Baruah M N et al. in Assam, the average

weight gain for the entire study group was 9.25 ± 5.89 g/kg/day and the mean duration of stay was 12 days [6].

Majority (82.7%) of the admitted children had anaemia, of which 14.7% had severe anaemia. There was no association between anaemia and weight gain at the NRC. A study in Burkina Faso indicated that anaemia did not have a negative impact on recovery if treated according to the protocol for management of SAM [15]. But Asres DT et al. in their study in Ethiopia, found that SAM Children who had no anaemia at admission were 1.6 times more likely to recover earlier compared to anaemic children [16]. Haemoglobin examination and correction of anaemia should be stressed upon. This is also a reminder that prophylactic iron supplementation to infants and young children should be strengthened.

As per the operational guidelines for NRCs, the acceptable recovery rate, death rate and defaulter rate are $>75\%$, $<5\%$ and $<15\%$ [2]. In our study, at the end of treatment, 74.2% of admitted children were discharged with adequate weight gain, 19.6% were non-responders and 6.2% were defaulters. In their study on the children admitted to the NRC at a tertiary care hospital in Karnataka, Dhanalakshmi K et al. found that the recovery rate was 81%, defaulter rate was 12.09% and death rate was 6.52% [17]. Aguayo et al., in their study in Jharkhand between 2009 and 11 found that only 39.4% of the admitted children gained 15% or more of their initial weight and 18.4% had defaulted

[18]. The good recovery rate and low defaulter rate in our study are optimistic findings but around one fourth of the child were discharged without adequate weight again. The most crucial stage is following up these children after discharge. The proportion of children under actual follow up at the NRCs in which the study was done to the number due for follow up was only 45.8%, 57.1% and 57.4% for the years 2017-18, 2018-19, 2019-20. Improvement in these rates will determine the long-term outcome.

5. Conclusion

Although majority of children with SAM had good outcome after care at the NRCs, around one fourth of children were discharged without adequate weight gain. Even those who had good outcome of care can fall into severe malnutrition category in the absence of adequate follow up. Strengthening of community level screening and referrals will enable early detection and referral of children with SAM. More impetus should be given to prevent and detect malnutrition in infants less than 6 months. Measures to prevent, diagnose and treat anemia in children should be promoted.

Funding

Nil.

Appendix

Supplementary Table 1. Mean weight, rate of weight gain and average length of stay at NRCs for girls.

Age group (months)	n (%)	Mean weight at admission kg	Mean weight at discharge kg	t-test	p-value	Mean rate of weight gain g/kg/day	Proportion of children who attained $>15\%$ weight gain	Proportion of children with average weight gain ≥ 8 g/kg/day
0–6	34 (30.0)	3.25 ± 1.20	3.86 ± 1.38	13.6	<0.01	16.2 ± 6.7	28 (82.4)	33 (97.1)
7–12	27 (23.9)	5.11 ± 1.09	5.88 ± 1.24	15.3	<0.01	10.7 ± 5.1	20 (74.1)	19 (70.4)
13–24	36 (31.9)	5.82 ± 0.90	6.68 ± 1.01	16.8	<0.01	10.2 ± 3.3	25 (69.4)	27 (75.0)
25–36	9 (8.0)	6.43 ± 1.43	7.37 ± 1.54	7.4	<0.01	10.9 ± 4.7	8 (88.9)	7 (77.8)
37–60	7 (6.2)	8.54 ± 0.9	9.69 ± 1.37	7.4	<0.01	9.6 ± 4.1	4 (57.1)	4 (57.1)
Overall	113	5.09 ± 1.8	5.88 ± 2.01	25.1	<0.01	12.2 ± 5.7	78(69.0)	90(79.6)

p value <0.05 = significant, <0.01 = highly significant.

Supplementary Table 2. Mean weight, rate of weight gain and average length of stay at NRCs for boys.

Age group (months)	n (%)	Mean weight at admission kg	Mean weight at discharge kg	t-test	p-value	Mean rate of weight gain g/kg/day	Proportion of children who attained $>15\%$ weight gain	Proportion of children with average weight gain ≥ 8 g/kg/day
0–6	29 (25.9)	3.29 ± 1.06	3.92 ± 1.15	11.4	<0.01	17.54 ± 8.59	24 (82.8)	24 (82.8)
7–12	31 (27.8)	6.63 ± 0.96	7.51 ± 1.04	16.1	<0.01	9.63 ± 4.13	21 (67.7)	22 (71.0)
13–24	38 (33.9)	6.63 ± 0.96	7.51 ± 1.03	16.9	<0.01	9.63 ± 4.19	20 (52.6)	25 (65.8)
25–36	10 (8.9)	7.11 ± 2.07	8.10 ± 2.16	5.7	<0.01	8.95 ± 5.19	5 (50.0)	6 (60.0)
37–60	4 (3.5)	8.88 ± 1.96	9.36 ± 2.27	1.9	0.15	4.18 ± 2.29	0	0
Overall	112	5.56 ± 1.9	6.35 ± 2.1	23.5	<0.01	12.5 ± 10.1	68(60.7)	77(68.8)

p value <0.05 = significant, <0.01 = highly significant.

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