RESEARCH PAPER

Management of Children with Severe Acute Malnutrition: Experience of Nutrition Rehabilitation Centers in Uttar Pradesh, India

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Objective: To assess the effectiveness of facility-based care for children with severe acute malnutrition (SAM) in Nutrition Rehabilitation Centers (NRC).

Design: Review of data.

Setting: 12 NRCs in Uttar Pradesh, India.

Participants: Children admitted to NRCs (Jan 1, 2010 - Dec 31, 2011).

Intervention: Detection and treatment of SAM with locally-adapted protocols.

Outcomes: Survival, default, discharge, and recovery rates.

Results: 54.6% of the total 1,229 children admitted were boys, 81.6% were in the age group 6-23 months old, 86% belonged to scheduled tribes, scheduled castes, or other backward castes, and 42% had edema or medical complications. Of the 1,181 program exits, 14 (1.2%) children died, 657 (47.2%) children defaulted, and 610 (51.7%) children were discharged The average (SD) weight gain was 12.1 (7.3) g/kg body weight/day and the average (SD) length of stay was 13.2 (5.6) days. 206 (46.8%) children were discharged after recovery (weight gain ≥15%) while 324 (53.2%) were discharged, non-recovered (weight gain <15%)

Conclusions: NRCs provide life-saving care for children with SAM; however, the protocols and therapeutic foods currently used need to be improved to ensure the full recovery of all children admitted.

Keywords: *Child, Management, Protein energy malnutrition, Severe wasting.*

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Severe acute malnutrition (SAM) remains a major killer of children as mortality rates in children with severe wasting - a widespread form of SAM - are nine times higher than those in well-nourished children [1]. India's third National Family Health Survey (NFHS-3) indicates that the prevalence of severe wasting is 7.9% as per WHO Child Growth Standards [4]. Therefore, at any point in time, an average eight million Indian children under age five years are severely wasted [5] and are dangerously undernourished to survive, grow and develop to their full potential.

In the state of Uttar Pradesh – the most densely populated state of India - NFHS-3 indicates that 14.9% of children 0-59 months old are wasted and 5.2% (an average 1.2 million children at any point in time) are severely wasted [4]. The response to SAM in Uttar Pradesh is led by the National Rural Health Mission (NRHM). Currently, this response relies on a network of Nutrition Rehabilitation Centers (NRCs), where children with SAM receive therapeutic care following protocols based on the guidelines for the management of SAM by the World Health Organization (WHO) [7] and the Indian Academy of Pediatrics (IAP) [8].

The objective of the analysis presented here is to assess the effectiveness of NRCs in providing therapeutic care for children with SAM in Uttar Pradesh and to inform the future design and implementation of programs for the provision of care for children with SAM in Uttar Pradesh and in India.

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METHODS

For the purpose of this analysis, we retrieved the data of all children with SAM admitted from 1 January, 2010 to 31 December, 2011 to the 12 functional NRCs of Uttar Pradesh.

The detection of children with SAM was ensured in the villages by the community workers of the Integrated

Child Development Services (ICDS) program either as part of monthly growth monitoring and promotion sessions at the ICDS center (passive case finding) or in the context of community drives for the identification of children with SAM (active case finding). During passive case finding sessions the weight and mid-upper-arm circumference (MUAC) of children 6-59 months old were measured, and the presence of bilateral pitting edema was assessed. During active case finding sessions the MUAC of children 6-59 months old was measured and the presence of bilateral pitting oedema was assessed. All children with bilateral pitting edema, and/or MUAC <115 mm, and/or weight-for-age z-score (WAZ) below -3 SD of WHO Child Growth Standards [9] were referred to the NRC.

At the NRC, the age, weight, height/length, MUAC, presence/absence of bilateral pitting edema and appetite were assessed in all children. SAM was defined as per WHO recommendations by the presence of bilateral pitting edema or the presence of severe wasting. Severe wasting was defined as per WHO recommendations by a MUAC below 115 mm and/or a weight-for-height/length z-score (WHZ) below -3SD of WHO Child Growth Standards [10]. All children 6-59 months with SAM were admitted to the NRC.

At the NRC, a physician conducted a clinical examination in children to detect the presence/absence of medical complications (altered alertness, respiratory tract infections, diarrhea/severe dehydration, high fever/malaria, tuberculosis, and/or severe anemia) using the criteria for the Integrated Management of Neonatal and Childhood Illnesses (IMNCI) [11]. Children with medical complications, and/or bilateral pitting edema, and/or with poor appetite were fed a locally-prepared therapeutic formula meant as a substitute for F-75 (herewith referred to as F75-proxy) to provide 100 kcal/kg/day (***Web Table* I**). These children were fed F75-proxy every two hours for two days while their medical complications were treated and monitored by a physician. After completion of the initial 48 hours in the NRC, these children were fed a locally prepared therapeutic formula meant as a substitute for F-100 (herewith referred to as F100-proxy) (***Web Table* I**) six times a day for 48 hours to initiate rapid weight gain (rehabilitation phase). Children with normal appetite and free of bilateral pitting edema and medical complications were fed F100-proxy from the day of admission. After completing four days at the NRC, children were fed F100-proxy alternated with a locally prepared semi-solid food (***Web Table* II**) until the child was discharged from the NRC. All children admitted to the NRC were administered micronutrients, namely vitamin A (one age-appropriate preventive dose), folic acid, zinc, potassium and magnesium in sufficient doses during the entire period of stay in the NRC as well as broad spectrum antibiotics for 7-10 days.

Children were discharged from the NRC when they met the following discharge criteria: (*i*) the child was active and alert; (*ii*) the child had no signs of bilateral pitting edema, fever, and/or infection; (*iii*) the child had completed all age-appropriate immunizations; (*iv*) the child was being fed 120-130 kcal/kg weight/day; and (*v*) the primary caregiver knew the care that the child needed to receive at home. Once discharged from the NRC, children were to be followed up in the community by the ICDS or NRHM workers to ensure that the child was enrolled in and benefited from ICDS Supplementary Nutrition Program, and that the child returned for a follow up visit to the NRC every 15 days during the six weeks following discharge (*i.e.* three follow up visits).

Data management: Data recording was done in the registers maintained at the NRCs. Data entry and data analysis preserve children's anonymity by using children's unique identification number only. Data management was done with support by NRHM, Government of Uttar Pradesh. Data analyses were conducted using Stata Software 12.1 (Stata Corp LP).

RESULTS

A total of 1,264 children 6-59 months old were referred to the NRCs; 35 children (2.8%) did not meet the admission criteria (***Table* I).** Of the 1,130 children with severe wasting 1,013 children (89.7%) had a weight-for-height/length z-score (WHZ) below -3 SD, 907 children (80.7%) had a MUAC <115 mm, and 799 children (70.7%) had both a weight-for-height/length z-score (WHZ) below -3SD and a MUAC <115 mm.

The program outcomes recorded are detailed in ***Table* II**. 610 children (51.7% of the exists) were discharged from the program when they met the discharge criteria; the average weight gain of these children while in the NRC - determined as the total individual weight gain (after loss of edema in the case of children who had edema at admission) of all the discharged children divided by 610 - was 12.1 ± 7.3 g/kg body weight/day and their average length of stay in the NRC - determined as the sum of the number of days in the NRC of all discharged children divided by 610 – was 13.2 ± 5.6 days (***Web Table* III**).

Only 154 (25%) of the 610 discharged children, came back for three follow up visits after discharge, 175 (29%) came back for two follow up visits, 219 (36%) came back for one follow up visit and 62 (10%) did not come back for any follow up visit. Of the 62 discharged children

TABLE I CHARACTERSTICS OF THE STUDY CHILDREN

Category	*Number (%)*
Children referred to NRCs	1,264 (100)
Not admitted	35 (2.8)
Children admitted to NRCs	1,229 (100)
Girls	558 (45.4)
Age	
6-11 mo	489 (39.9)
12-23 mo	514 (41.8)
24-35 mo	147 (12.0)
36-47 mo	32 (2.6)
48-59 mo	47 (3.8)
Caste	
Scheduled Tribe (ST)	148 (12.0)
Scheduled Caste (SC)	420 (34.2)
Other Backward Class (OBC)	425 (34.6)
Clinical findings	
Social identity not recorded	70 (5.7)
With bilateral pitting edema	99 (8.1)
With severe wasting	1,130 (91.9)
With medical complications	417 (36.9)
With complicated SAM*	516 (42.0)

**SAM with edema and/or medical complications.*

who did not come back for any follow up visit, 50 (80%) had been discharged, recovered while 12 (20%) had been discharged, non-recovered (data not presented). The program performance indicators are shown in ***Web Table* III**. Of the 1,181 program exits (deaths, defaulters and discharged), the proportion of children who died was 1.2% and the proportion of children who defaulted was 47.2 %.

DISCUSSION

The program achieved survival outcomes that compare favorably with national and international standards of care (<10% child deaths) [12,14]. This is important as the primary objective of NRCs is to reduce fatality rates among children with SAM. More than half (58.2%) of the children admitted to the NRCs had uncomplicated SAM (no edema and/or medical complications). International guidelines recommend that children with uncomplicated SAM be cared for through a community-based program for the management of SAM [13] as these children are at a significantly lower risk of death than children with complicated SAM and can be cared for at home if an appropriate community-based therapeutic feeding program is in place. The data presented here indicate that in the NRCs in Uttar Pradesh, the death rate among children with complicated SAM was six times higher than among children with uncomplicated SAM.

The proportion of children who defaulted (45.3%) was significantly above national and international standards of care (<15%) [12,14]. High defaulter rates have been reported by other facility-based interventions for children with SAM in India [15]. Undoubtedly, the high defaulter rates observed raise a question about the quality and relevance to families of the care provided at the NRCs. This merits further investigation for corrective action.

Only 51.7% of the children admitted were discharged. The average weight gain of these children while in the NRC compares favorably with the nationally and internationally-agreed upon minimum average weight gain (≥8 g/kg body weight/day) for programs that treat children with SAM [12,14]. This average weight gain is significantly higher than that achieved by therapeutic feeding programs in India using energy dense local foods in hospital-based nutrition rehabilitation units (5g/kg body weight/day) and so is the proportion of discharged children who achieved rapid catch up growth *i.e.* >10g/kg/day (37.4% *vs*. 12%) [15]. However, only 46.8% of the 610 children discharged gained at least 15% of their initial weight, the minimum weight gain recommended by WHO and India's Ministry of Health to discharge children as recovered [12,14]. The proportion of children discharged is below the national and international standard of care (>75%) for programs that treat children with SAM [12,14]. The average length of stay of children who were discharged, recovered and children who were discharged, non-recovered was not significantly different, indicating that the main difference between these two groups was not the length of stay but the ability to gain weight while in the NRC.

Thus, NRCs provide live-saving care for children with SAM as demonstrated by the high survival rates of the program. However, other than survival, program outcomes are below optimal. Two program outcomes - the high defaulter rate and the low recovery rate are of particularly concern. 53% of the discharged children did not fully recover (weight gain <15%), primarily because their average daily weight gain was sub-optimal. Therefore the protocols and therapeutic foods currently used need to be improved and include the use of appropriate therapeutic foods (F 75 and F 100) containing all nutrients in appropriate concentration for the optimal recovery of children with SAM.

Community-based therapeutic care for children with uncomplicated SAM needs to become a key component of the continuum of care for children with SAM. 58% of

TABLE II OUTCOMES IN STUDY CHILDREN WITH SEVERE ACUTE MANAGEMENT (SAM) ADMITTED TO NUTRITION REHABILITATION CENTERS UTTAR PRADESH (JAN 1, 2010 TO DEC 31, 2011), INDIA

Outcomes	*Complicated SAM** *(N=516), n (%)*	*Uncomplicated SAM#* *(N=713), n (%)*	*All children with SAM (N=1229), n (%)*
Admitted			
Exits	483 (93.6)	698 (97.9)	1,181 (96.1)
Transfers	33 (6.4)	15 (2.1)	48 (3.9)
Exits			
Deaths	12 (2.5)	2 (0.3)	14 (1.2)
Defaulters	237 (49.1)	320 (45.8)	557 (47.2)
Discharged	234 (48.4)	376 (53.9)	610 (51.7)
Discharged			
Recovered	86 (36.8)	200 (53.2)	286 (46.8)
Non-recovered	148 (63.2)	176 (46.8)	324 (53.2)

**SAM with edema and/or medical complications; #SAM without edema or medical complications.*

TABLE III PROGRAM PERFORMANCE INDICATORS IN NUTRITION REHABILITATION CENTERS UTTAR PRADESH (JAN 1, 2010 TO DEC 31, 2011), INDIA

Outcomes	*Complicated SAM** *n (%)*	*Uncomplicated SAM#* *n (%)*	*All children with SAM n (%)*
Deaths	12 (2.5)	2 (0.3)	14 (1.2)
Defaulters	237 (49.1)	320 (45.8)	557 (47.2)
Discharged, recovered	86 (17.8)	200 (28.7)	286 (24.2)
Discharged, non-recovered	148 (30.6)	176 (25.2)	324 (27.4)
Total exits	483 (100.0)	698(100.0)	1,181 (100.0)

**SAM with edema and/or medical complications; #SAM without edema or medical complications.*

the children admitted could have been treated in their communities as they had uncomplicated SAM. Global evidence shows that good quality ready-to-use therapeutic foods are effective in supporting rapid catch-up growth in children with SAM [16] and can be safely used in community-based programs [13]. There is emerging consensus as to why and how they can be used in India [17-19]. With an effective community-based program for early detection and treatment, most children with SAM can be cared for by their mothers and families at home while Nutrition Rehabilitation Centers (NRCs) are reserved for children with SAM and medical complications.

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WHAT IS ALREADY KNOWN?

- In Uttar Pradesh, the response to SAM relies on a network of Nutrition Rehabilitation Center (NRCs) where children with SAM receive therapeutic care

WHAT THIS STUDY ADDS?

- NRCs provide live-saving care for children with SAM as indicated by survival rates of over 98%; however, default and recovery rates are below standards.

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