



How effective is the integration of facility and community-based management of severe acute malnutrition in India?

B. Kumar,¹ J. Shrivastava,² S. Satyanarayana,³ A. J. Reid,⁴ E. Ali,⁴ S. Zodpey,⁵ M. Agnani⁶

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Setting: All children admitted to two nutritional rehabilitation centres (NRCs) during 2011–2012 in Madhya Pradesh, India.

Objective: To determine 1) adherence to in-patient care and follow-up visits, 2) attainment and maintenance of target weight gain, and 3) association with the children's demographic characteristics.

Design: A retrospective record review. The 74-day programme included 14 days of in-patient care, with subsequent home-based care and four follow-up visits to the NRC at 15-day intervals. The first three visits were part of the treatment, while the fourth was for assessment of sustained weight gain.

Results: Of the 1027 children admitted, 900 (88%) completed in-patient care. Of these, 685 (76%) attended the first three follow-up visits, 482 (70%) of whom gained >15% of their admission weight. Of these, 409 (85%) completed four visits, 314 (77%) of whom were able to sustain their weight gain. Those unable to gain >15% weight by the third visit had a significantly lower proportion of sustained weight gain at the fourth visit. Children aged ≥ 6 months had significantly higher odds (OR 4.5, 95%CI 3.1–6.2, $P < 0.05$) of completing in-patient care.

Conclusion: In-patient care combined with community-based follow-up was effective in adherence to follow-up visits; however, there is still room for improvement in attaining and sustaining the target weight.

India has a large proportion of the world's children with malnutrition, which remains a global problem.¹ Malnutrition exists in varying degrees of severity; children with severe malnutrition are prone to adverse health outcomes and death.² Severe acute malnutrition (SAM) among children aged 6–59 months is defined by a weight-for-height/length Z-score (WHZ) < -3 (Z-score in standard deviations [SDs] reflects the deviation from the median of World Health Organization [WHO] child growth standards), a mid-upper arm circumference (MUAC) < 115 mm or by the presence of nutritional oedema.² India's third National Family Health Survey conducted in 2006 showed that 6.4% of children aged < 5 years had a WHZ < -3 SD, i.e., about 8 million children in India at any time are estimated to have SAM.³

SAM has traditionally been treated with ready-to-use therapeutic food in clinical settings both in India and elsewhere. Until recently, there has been no large-scale programmatic intervention in India to identify and treat SAM. However, with the advent of the Na-

tional Rural Health Mission,⁴ which ensured the availability of additional resources, many Indian states have established nutrition rehabilitation centres (NRCs) for the treatment of SAM.⁵ NRCs are integrated facilities that employ a community-based approach for the management of SAM by providing initial treatment at the health facility with community follow-up. The success of such programmes depends largely on adherence to follow-up and sustained nutritional improvement after discharge from the health facility.

An NRC is a unit for in-patient, centre-based care of children with SAM or those at high risk of SAM. NRCs function along the lines of the WHO² and revised Indian Association of Paediatrics (IAP) protocols.⁶ The first of the NRCs was established in 2007 in the state of Madhya Pradesh, which has the highest rate of SAM in India.⁷ There are currently more than 250 NRCs across Madhya Pradesh. Other states, such as Jharkhand, followed a similar model; however, these facilities are called Malnutrition Treatment Centres (MTCs) in Jharkhand.⁸

Although broad operational guidelines for facility-based management of SAM are available at the national level, various states in India have tailored these to their own requirements.⁷ However, published literature on the functioning and outcome of NRCs in India is scarce. A study of seven NRCs in Madhya Pradesh found a significant increase in body weight from admission to discharge.⁹ However, another study of MTCs in Jharkhand reported that a high proportion of children did not attain the desired weight gain.⁸ The former study reported a higher loss to follow-up after discharge from NRCs compared to the latter. Loss to follow-up has been shown to result in reduced effectiveness of such programmes.^{10,11}

The focus of the past studies has mostly been on the outcome of in-patient care of children at the NRCs, and it remains to be seen how follow-up activities complement these. In addition, past studies in Madhya Pradesh have used relatively small sample sizes and a short follow-up period.

The present study was conducted to examine outcomes among children during community-based follow-up after discharge from in-patient care using a larger sample. The study aimed to determine the extent of sustained nutritional improvement during the follow-up period among children admitted to NRCs in Madhya Pradesh. Specific objectives were to assess 1) the proportion of SAM children who completed in-patient treatment, 2) the extent to which children returned for scheduled follow-up visits after discharge, 3) the

AFFILIATIONS

- 1 Indian Institute of Public Health Delhi, Public Health Foundation of India, New Delhi, India
- 2 Family Health International, Bhopal, India
- 3 International Union Against Tuberculosis and Lung Disease, New Delhi, India
- 4 Medical Department, Operational Research Unit, Operational Centre Brussels, Médecins Sans Frontières, MSF-Luxembourg, Luxembourg
- 5 Indian Institute of Public Health Delhi, Public Health Foundation of India, New Delhi, India
- 6 Government of Madhya Pradesh, Bhopal, India

CORRESPONDENCE

Binay Kumar
Monitoring and Evaluation
Global Alliance for
Vaccines and Immunisation
(GAVI) Alliance
2 Chemin des Mines
Geneva 1202, Switzerland
Tel: (+41) 79 854 3823
Fax: (+41) 22 909 6555
e-mail: binaythapliyal@gmail.com

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extent of sustained weight gain during the follow-up period, and 4) the relation between the patients' demographic characteristics, completion of follow-up visits and sustained weight gain.

METHOD

Design

This was a retrospective record review study involving the review of existing programme records.

Population

All children admitted to two NRCs in the Gwalior District of Madhya Pradesh, India, between 1 January 2011 and 31 July 2012 were included in the study. The NRCs were chosen based on convenience and have been operational for more than 5 years.

Management of children at nutritional rehabilitation centres

The NRCs consist of 10- to 20-bed wards with a kitchen, toilet facility and demonstration room attached to existing public health facilities. Children aged <5 years are referred to the NRC primarily by community-level health workers (see Dutta¹² for defini-

tion). Community-level health workers are also referred by physicians at government health facilities or approached by parents themselves in some cases.

The admission and discharge criteria are laid out in the national guidelines (Table 1). In Madhya Pradesh, the guidelines are adapted to meet the prevailing conditions.⁷ At NRCs, the children are nutritionally rehabilitated with a therapeutic diet made of locally available food for a minimum of 14 days and mandatorily accompanied by the mother or the primary care giver. In addition, the children are medically rehabilitated per the IAP protocol.⁶ Anthropometric measurements, including weight, height and MUAC, are monitored by the NRC staff using standard techniques prescribed in the guidelines. During the stay at the NRC, the mother or primary care giver is counselled and educated on the composition and preparation of therapeutic diets and provided with INR 65 (≈US\$1.25) to compensate for daily wage loss.

Children are discharged from the NRC if the child shows no obvious signs of infection or oedema, has received the stipulated amount of micronutrients and the mother has an improved understanding of correct feeding practices. Following discharge, the children commence 2 months of follow-up, when they attend the NRC on designated dates at 15-day intervals. Children

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TABLE 1 Admission and discharge criteria for children in nutrition rehabilitation centre in India

<p>Admission criteria</p> <p>Children aged 6–59 months</p> <p>Any of the following:</p> <ul style="list-style-type: none"> • MUAC <115 mm with or without any grade of oedema • WFH <−3 SD with or without any grade of oedema • Bilateral pitting oedema <p>WITH</p> <p>Any of the following complications:</p> <ul style="list-style-type: none"> • Anorexia (loss of appetite) • Fever (39°C) or hypothermia (<35°C) • Persistent vomiting • Severe dehydration based on history and clinical examination • Not alert, very weak, apathetic, unconscious, convulsions • Hypoglycaemia • Severe anaemia (severe palmar pallor) • Severe pneumonia • Extensive superficial infection requiring intramuscular medications • Any other general sign that a clinician thinks requires admission for further assessment or care • In addition to above criteria, the child should be admitted if the care giver is unable to take care of the child at home. 	<p>Infants aged <6 months</p> <p>Infant is too weak or feeble to suckle effectively, regardless of WFL</p> <p>OR</p> <p>WFL <−3 SD (in infants >45 cm)</p> <p>OR</p> <p>Visible severe wasting in infants <45 cm</p> <p>OR</p> <p>Presence of oedema in both feet</p>
<p>Discharge criteria for child from nutrition rehabilitation centre</p> <p>Child</p> <ul style="list-style-type: none"> • Oedema has resolved • Child has achieved weight gain of >15% and has satisfactory weight gain for 3 consecutive days (>5 g/kg/day) • Child is eating an adequate amount of nutritious food that the mother can prepare at home • All infections and other medical complications have been treated • Child is provided with micronutrients • Immunisation is updated <p>Where the community-based programme is well functioning, the child can be transferred from facility-based care to community-based care to achieve the target weight gain of 15%, based on the following criteria:</p> <ul style="list-style-type: none"> • Child has completed antibiotic treatment • Has good appetite (eating at least 120–130 calories/kg/day) • Has good weight gain (at least 5 g/kg/day for three consecutive days) on exclusive oral feeding • No oedema • Care givers sensitised to home care and education has been completed • Immunisation is up-to-date • If the child has not recovered in 4 months s/he is classified as a 'non-responder'. 	

MUAC = mid-upper arm circumference; SD = standard deviation; WFH = weight for height; WFL = weight for length.

are discharged from the programme at the end of the follow-up period if they have attained the target weight gain of >15% of admission weight. Routine data are recorded in standardised registers at the NRCs.

Data variables, sources and definitions

Data on age (in months), sex, source of referral, weight, length and MUAC were collected from NRC registers at admission, in-patient discharge and each of the four follow-up visits. A successful outcome was defined as weight gain that was >15% of the admission weight within 60 days from discharge from in-patient care. However, as the study was based on facility records, to assess sustained target weight gain, a >15% weight gain was assessed at the third follow-up visit (45 days) and its retention was assessed at the fourth follow-up visit (60 days). The other outcomes included referral to a higher level health facility, no response to treatment, loss to care (child withdrawn from the NRC against medical advice before 14 days), loss to follow-up (child who did not finish one or more scheduled follow-up visits) and death. Sustained weight gain was defined as no change or an increase in weight at the fourth follow-up visit compared to the third follow-up.

Data management

Data from NRC registers were extracted into an electronic database created in EpiData version 3.1 (EpiData Association, Odense, Denmark) and analysed in STATA® 11 (Stata Corp, College Station, TX, USA). WHZ was calculated to establish the nutritional status of the children at the time of admission, at discharge and at each follow-up visit using WHO standards. The variables were summarised using proportions, means and SDs. Children were subgrouped into those who did and those who did not 1) have a >15% weight gain at the third follow-up visit, 2) attend all follow-up visits, and 3) have sustained weight gain at the fourth follow-up visit. Differences between groups were compared using *t*-tests, odds ratios and 95% confidence intervals (CIs). *P* < 0.05 was considered statistically significant.

Ethics approval

The study met the approval criteria for analysis of routinely collected programme data of the Ethics Review Board of Médecins Sans Frontières (Geneva, Switzerland), and was approved by the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France. The study also obtained approval for the use of routine data from NRCs from the local government authorities in Madhya Pradesh.

RESULTS

Description of the children admitted to the nutrition rehabilitation centres

The characteristics of the children included in the study are summarised in Table 2. Of the 1027 children admitted to the NRCs, 57% were female (mean age 18.4 months, SD 11.6). While most of the children were in the 6–23 months age group (76%), a small proportion (4%) were aged <6 months.

At the time of admission, the mean weight of the children was 5.9 kg (SD 1.6) and mean height was 69.5 cm (SD 8.6). Of all admitted children, 778 (76%) had WHZ < -3SD (Table 2) and 145 (14%) had an MUAC < 115 mm; the admission criteria for the rest of the children (*n* = 104, 10%) could not be ascertained from the data.

The majority of the children (95%) were referred to the NRC by village-level health workers, including *anganwadi* workers

TABLE 2 Characteristics of the children admitted to the selected NRCs, Madhya Pradesh, January 2011–July 2012 (*N* = 1027)

	<i>n</i> (%)
Sex	
Male	438 (42.6)
Female	589 (57.3)
Age group	
<6 months	40 (3.9)
6 months–1 year	386 (37.6)
1–2 years	391 (38.1)
2–4 years	184 (18.0)
4–6 years	26 (2.5)
Source of referral to the NRC	
<i>Anganwadi</i> worker	954 (93.0)
Auxiliary nurse midwife	12 (1.2)
Accredited social health activist	10 (1.0)
Medical doctor of a government health facility	49 (4.8)
Care giver or family member	1 (0.1)
Nutritional status at the time of admission (weight-for-height Z score)	
<-3 SD	778 (75.7)
-3 to -2 SD	172 (16.7)
-2 to -1 SD	27 (2.6)
≥-1 SD	6 (0.6)
Not calculated*	44 (4.3)
Status of child after 14 days at the NRC	
Treatment completed	900 (87.6)
Lost to care	98 (9.5)
Medical transfer to another health facility	27 (2.6)
Death	2 (0.2)

*Z-score not calculated due to missing weight or height or presence of oedema. NRC = nutrition rehabilitation centre; SD = standard deviation.

(93%), auxiliary nurse midwives (1%) and accredited social health activists (1%). Most of the remaining children (5%) were referred to the NRC by physicians working in government health facilities. Only one child was reported to have been brought to the NRC by a family member.

Completion of 14-day in-patient care at the nutrition rehabilitation centre

Table 2 shows the proportion of admitted children who completed the 14-day in-patient care, along with reasons for dropout. A comparison with sex and age groups shown in Table 3 indicates that while there was no statistically significant difference in the odds of completing treatment among boys and girls, children aged >6 months had significantly higher odds of completing the treatment than children aged <6 months.

TABLE 3 Duration of stay of children admitted to two NRCs by sex and age group, Madhya Pradesh, January 2011–July 2012

	<i>n</i>	Stayed for entire 14-day duration	Stayed only for partial duration	Odds ratio	<i>P</i> value	95%CI
Sex						
Male	438	389	49			
Female	589	511	78	1.2	0.32	0.82–1.77
Age						
<6 months	40	25	15			
6 months–1 year	386	337	49	4.13	<0.001	2.04–8.37
1–2 years	391	354	37	5.74	<0.001	2.78–11.84
2–4 years	184	160	24	4.00	<0.001	1.85–8.64
4–6 years	26	24	2	7.20	<0.05	1.49–34.89

NRC = nutrition rehabilitation centre; CI = confidence interval.

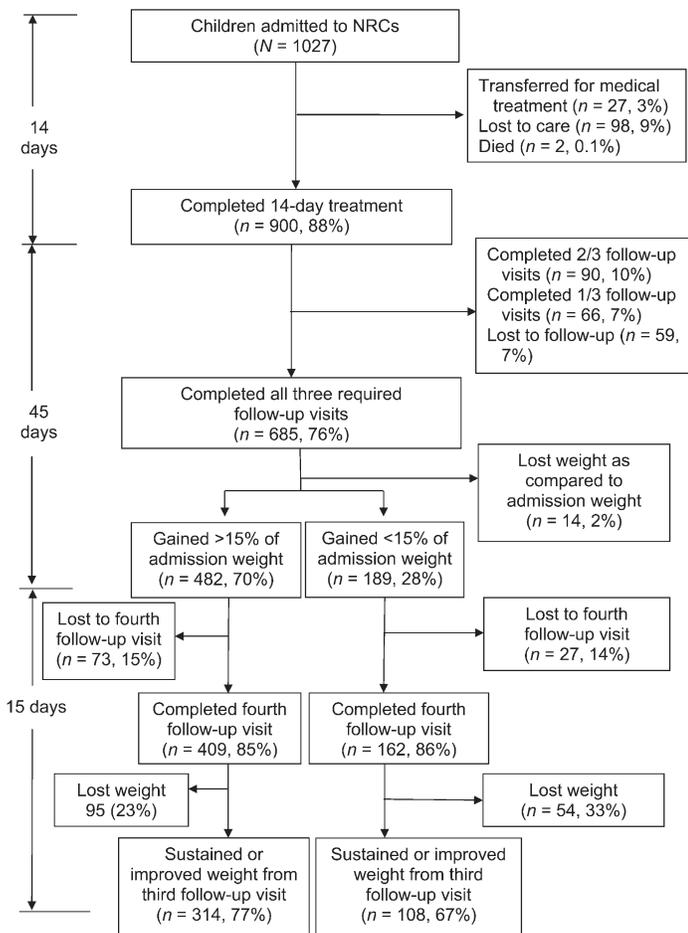


FIGURE Flow diagram representing the progression of the children included in the study from admission to the fourth follow-up visit in terms of number of days from admission. NRC = nutrition rehabilitation centre.

Adherence to the follow-up plan to achieve and sustain target weight gain

The Figure depicts the progression and associated outcomes related to the proportion of children completing the required follow-up visits and weight gain at each stage of the programme.

First three follow-up visits and >15% weight gain

As shown in the Figure, 76% of the children discharged from in-patient care completed all three scheduled follow-up visits. However, no statistically significant difference was detected among the sexes or age groups in terms of completing all three follow-up visits. Of those children (24%) who did not complete all three follow-up visits, 7% did not attend any of the visits.

Of the total number of children who completed the three follow-up visits, the majority (70%) gained >15% of admission weight while 2% lost weight. These children were excluded from further analysis (Figure). No statistically significant difference was detected among the sexes and age groups in gaining target weight.

Fourth follow-up visit and sustained target weight gain

As shown in the Figure, almost equal proportions of children completed the fourth follow-up visit, irrespective of whether they gained the target weight. However, of those who did not gain their target weight by the third follow-up visit, a statistically sig-

nificantly lower proportion had sustained their weight gain compared to those who had gained their target weight ($P < 0.05$, 95%CI 0.02–0.18). Also, a significantly higher proportion of those who did not gain the target weight by the third follow-up visit had lost weight by the fourth follow-up visit. No statistically significant difference was detected in sustained weight gain among the sexes and age groups.

DISCUSSION

This study is one of the few to examine the function of NRCs in India, and adds to our knowledge by evaluating outcomes beyond in-patient care. It suggests that a facility-based management model, combined with a community-based follow-up approach for managing SAM, is effective in ensuring completion of treatment, adherence to follow-up and sustained weight gain.

While the good news was that, similar to other studies, a substantially high proportion of children stay for the entire duration required for the treatment at the NRCs,⁸ the lower odds of completing the stay for children aged <6 months may require further attention and investigation.

Importantly, although the majority of the admitted children were females, there was no significant difference as regards the completion of the four follow-up visits and sustaining weight gain between the sexes, in agreement with the findings of another study from the same state.⁹ This is especially important given the widespread gender discrimination against girl children in Indian households.¹³

While the participation of community-based health workers in identifying and referring children with SAM for in-patient care appeared to be effective in this study setting, the unidentified reasons for admission of up to 10% children in NRC may suggest that there is room for improvement in adherence to or revision of the admission protocol at the health facility level. While such findings may find their roots in data recording at the facility level, a similar concern has also been raised by others.^{14–17}

The results of the study indicate that the programme was on the whole effective in ensuring relatively high levels of adherence to the follow-up visits. The study found a 24% dropout rate by the third follow-up visit, which increased to 35% for the fourth follow-up visit. The proportion of children who dropped out was much lower than reported in previous studies,⁹ indicating that the programme is maturing and evolving, as the current study uses more recent data than previous studies.

However, one of the important indicators of success of such programmes is the role of the follow-up visits in helping children to sustain weight gain. Instead of household data, this study attempted to use health facility data to determine the extent to which weight gain was sustained. Although the 15-day intervals may be considered too small to detect any meaningful change, this study identified real changes in weight between the third and fourth visits. Achieving target weight gain by the third follow-up visit significantly increases the chances of sustaining weight gain until the fourth visit. It may be argued that poor socio-economic background, comorbidities, inadequate attention at home or systemic factors could explain such findings,^{11,18–21} but further investigation and identification of the causes may have a positive impact on the overall effectiveness of the programme.

The limitations of the study were, first, that it was conducted at two nutritional rehabilitation centres and may not be representative of the entire state. Second, as the study was based on a review of existing records, it is limited by the quality of the data recorded. As the functioning of the NRCs was monitored at

various levels, we believe, however, that errors in data recording were minimal.

In conclusion, this study demonstrated that NRCs in Madhya Pradesh were using an effective integrated model of managing SAM that combined facility- and community-based approaches. It also revealed some programmatic issues that could be improved, including the need for better adherence to or revision of the admission protocols, and more robust follow-up mechanisms.

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Contexte : Tous les enfants admis dans deux Centres de Réhabilitation Nutritionnelle (NRC) en 2011–2012 au Madhya Pradesh, Inde.

Objectif : Déterminer 1) l'adhésion aux soins hospitaliers et aux visites de suivi, 2) la réalisation et le maintien du gain de poids visé et 3) l'association avec les caractéristiques démographiques des enfants.

Schéma : Il s'agit d'une revue rétrospective des dossiers. Le programme de 74 jours a comporté 14 jours de soins hospitaliers et ultérieurement des soins au domicile accompagnés de quatre visites au NRC à 15 jours d'intervalle. Les trois premières visites faisaient partie du traitement, alors que la quatrième visait à évaluer la persistance du gain de poids.

Résultats : Sur 1027 enfants admis, 900 (88%) ont achevé les soins intra-hospitaliers. Parmi ceux-ci, 685 (76%) se sont présentés aux

trois premières visites de suivi, dont 482 (70%) ont gagné >15% du poids d'admission. Parmi ceux-ci, 409 (85%) ont achevé les quatre visites et chez 314 d'entre eux (77%), on a observé la persistance du gain de poids. Chez ceux incapables de gagner >15% de poids lors de la troisième visite, la proportion maintenant un gain de poids lors de la quatrième visite est significativement plus faible. L'odds d'achèvement des soins hospitaliers est significativement plus élevé (OR 4,5 ; $P < 0,05$, IC95% 3,1–6,2) chez les enfants âgés de ≥ 6 mois. **Conclusion :** Des soins hospitaliers combinés avec un suivi dans la collectivité s'avèrent efficaces pour l'adhésion aux visites de suivi ; l'objectif qui reste à améliorer est l'obtention du poids-cible et son maintien.

Marco de referencia: Todos los niños que ingresaron a dos Centros de Rehabilitación Nutricional del 2011 al 2012 en Madhya Pradesh, en la India.

Objetivo: Determinar: 1) la aceptación de la atención en el centro y el cumplimiento de las citas de seguimiento; 2) el logro de la ganancia de peso prevista y su mantenimiento; y 3) la asociación de la evolución con las características demográficas de los niños.

Métodos: Fue este un estudio retrospectivo de análisis de las historias clínicas. El programa de 74 días comportaba 14 días de atención con permanencia en el centro, continuados con un cuidado en el hogar y cuatro consultas de seguimiento en el Centro de Rehabilitación

Nutricional con intervalos de 15 días. Las tres primeras citas formaban parte del tratamiento y la cuarta consistía en una evaluación del mantenimiento de la ganancia de peso.

Resultados: De 1027 niños que ingresaron al centro, 900 completaron el tratamiento institucional (88%). De estos, 685 acudieron a las tres primeras consultas de seguimiento (76%) y 482 de ellos (70%) habían ganado más del 15% del peso que presentaban en el momento del ingreso. De estos, 409 niños completaron las cuatro citas de seguimiento (85%) y de ellos, 314 conservaron su ganancia de peso (77%). De los niños que no habían podido ganar más de 15% del peso inicial en la tercera consulta, una proporción significativamente

más baja mantuvo su ganancia de peso en el cuarto control. Fue mucho más probable que los niños de 6 meses de edad y mayores completaran el tratamiento institucional (OR 4,5; $P < 0,05$, IC 95% 3,1 a 6,2).

Conclusión: Un tratamiento que asocia una etapa con el niño in-

terno en una institución y un seguimiento en la comunidad demostró su eficacia con respecto al cumplimiento de las citas de seguimiento; el objetivo de la iniciativa sigue siendo mejorar el logro del peso previsto y su mantenimiento.