



Outcome of Severe Acute Malnutrition Management at a Tertiary Care Nutrition Rehabilitation Centre

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Abstract

Background: Globally, 35.0% of the 7.6 million deaths among children under 5 can be attributed to nutrition-related factors and 4.4% to severe wasting. NFHS-4 India (2015-2016) show that the national prevalence of severe acute malnutrition (SAM) is 7.5 % in children below 5 years with 100 focus districts having high prevalence of malnutrition being situated in 6 states: Bihar, Jharkhand, Madhya Pradesh, Rajasthan, Odisha and Uttar Pradesh.

Objective: To evaluate the clinical and epidemiological profile of SAM children admitted to the NRC of VSSIMSAR, Burla.

Methodology: An observational analytical cross sectional hospital based study was conducted in the Nutritional Rehabilitation Centre (NRC) in Dept. of Pediatrics, VSSIMSAR, Burla from Jan 2016 to August 2018 after institutional ethics committee approval. Continuous data were analyzed in terms of mean or median and categorical data were analyzed by Fischer exact test. For all statistical purpose $p < 0.05$ was taken as significant. All the tests were done with SPSS v 23 (IBM, New York).

Result: Out of the 239 children, 189(79.1%) were discharged after variable durations of hospitalization, 8(3.3%) died and 42(17.5%) got defaulted. The mean age was 23.1 ± 14.5 months with sex ratio= 0.97. Majority of families belonged to lower socio-economic status. The mean age of starting complementary feeding was 6.602 ± 0.909 months. Children with exclusive breast feed till 6 months of age ($\chi^2 = 10.275$, $p = 0.002$) and with anorexia ($\chi^2 = 6.691$, $p < 0.011$) during presentation are more likely to recover. Pneumonia was the most prevalent disease complicating SAM followed closely by anorexia. The average duration of hospitalization was 15.75 ± 5.53 days. No statistically significant difference was observed among the different age groups with respect to duration of stay at the centers ($F = 2.190$, $p = 0.140$). The mean MUAC at admission and discharged was observed to be statistically significant ($t = 10.930$, $p < 0.001$). Dropout rates of 9.89%, 23.07%, and 61.76% were obtained for the three follow-up visits conducted 15 days, 1 month and 2months from the day of discharge as per recommended guidelines.

Conclusion: NRC is extremely vital and is providing life-saving care for children as demonstrated by the high cure rates.

Keywords: Severe acute malnutrition, Nutrition rehabilitation centre.

Introduction

Severe acute malnutrition (SAM) affects nearly 20 million children under five and contributes to one

million child deaths yearly.¹ According to Bhatnagar S et al (2007)², although the minimum international standard set for management of

severe acute malnutrition is cure rate of 75% and death rate of less than 10%, yet the outcome of severely malnourished children treated in different hospitals in developing countries remain poor². According to the World Bank Report(2009)³ the prevalence of underweight children in India is among the highest in the world, and is nearly double that of the Sub Saharan Africa with dire consequence for morbidity, mortality, productivity and economic growth.³ According to United Nations Organization, SAM has been a major obstacle to the achievement of the fourth Millennium Development Goal (MDG).⁴ According to NFHS-4⁵, there exist regional variations of malnutrition in Indian states, with some of the poorest indicators found in the western parts of the country. How apathetic was the State in establishing NRCs is evidenced by fact that when a non-high focus State like Gujarat had a total of 124 NRCs in 2015-16, Odisha being a high-focus State had a mere 45. In comparison, high-focus States like MP, Chhattisgarh and Jharkhand have 315, 62 and 68 NRCs, respectively. Besides, Odisha could add up a mere four NRCs during the period 2013-16 to reach 44. Only around 16 NRCs are functional in as many as nine high-burden western Odisha districts. In poor developing nations, malnutrition is usually caused by food shortages, food prices and distribution, and inadequate breastfeeding.^{6,7} United Nations International Children's Emergency Fund (UNICEF)⁸ estimated malnutrition (45%) to be the most common cause of under-five mortality, with India and Nigeria accounting for more than one third of the deaths.⁹ According to National Family Health Survey (NFHS)-4, 2015-16 in India the prevalence of SAM is 7.5% in children below 5 years.⁵ According to the HUNGaMA survey report the 100 focus districts having high prevalence of malnutrition being situated in 6 states: Bihar, Jharkhand, Madhya Pradesh, Rajasthan, Odisha and Uttar Pradesh.¹⁰ For proper utilization of funds and manpower, there is a phase wise implementation of NRC in the areas by UNICEF.

It's important to analyze the effects of these centers.

According to the study by Garg A et al (2013)¹¹ and NFHS-4 recovery rates in inpatient facilities to treat SAM children varied from state to state ranging from 37.1% to 65%.^{5,11} No study has been done on management outcome of severe acute malnutrition in our NRC which serves 12 districts of western Odisha ,since its establishment in VSSIMSAR, Burla in the year 2013. This study has been designed to assess the beneficiary profile and outcome of the SAM children admitted to our NRC for better formulation of intervention strategies.

Materials and Methods

An observational analytical cross sectional hospital base study was conducted in the nutritional rehabilitation centre (NRC) under the establishment of department of pediatrics, VSSIMSAR, Burla from January 2016 to august 2018 after institutional ethics committee approval. All the children under-5 with predefined inclusion and exclusion criteria were enrolled for the study after written informed consent taken from the parents and/or legal hare.

Inclusion and exclusion criteria

Inclusion criteria

1. All the children admitted to the nutritional rehabilitation centre during the study period.
2. Children of 1 month to 5 years of age with severe acute malnutrition as per WHO criteria⁷
 - a) For children >6 months
 - Weight for height less than -3 SD and/or
 - Mid upper arm circumference <11.5 cm and/or
 - Nutritional edema of both feet
 - b) For infants <6 months of age
 - Weight for length less than -3 SD and/or
 - Nutritional edema of feet

Exclusion criteria

1. Milder forms of acute malnutrition

2. Secondary PEM (Protein Energy Malnutrition)⁴
3. Those whose parents/guardians declined to consent to their child's participation in the study

Study procedure: Detailed history including dietary, immunization and socioeconomic history will be obtained. Thorough clinical examination, anthropometry (i.e., weight, height, mid arm circumference) at time of admission and discharge will be taken according to standardized methodology. Every case admitted will be evaluated in terms of admission nutritional status. At the NRC, a physician conducted a clinical examination to detect the presence/absence of medical complications using the criteria for the Integrated Management of Neonatal and Childhood Illnesses. Detailed examination and investigation will be carried out as per protocol. Upon arrival the patients were screened for hypoglycemia, hypothermia, or signs of dehydration or shock. Blood glucose was tested by a glucometer and the temperature was measured by a low reading thermometer. Patient's hydration status in terms of examining skin turgor oral mucosa, pulse volume, blood pressure, urine output (on history) and sensorium was assessed. The patient's status of anemia was clinically assessed and signs of failure looked for in case of severe anemia. All patients were started on nutritional supplementation as soon as possible after arrival. All morbidities were managed according to WHO guidelines. WHO protocol for the management of these SAM children were strictly adhered. Very sick children were initially managed in the PICU and once stabilized were shifted to the NRC. The diet F-75 and F-100 given to these children were prepared in the NRC kitchen. Once stabilized, home based food was started. All the patient were then started on tube feeding with starter formula, antibiotics, electrolytes and micronutrients (vitamin A, multivitamins, potassium, zinc, folic acid magnesium) were supplemented to all routinely as per the WHO guidelines. Regular eye and skin

care were provided. Those with knuckle pigmentation and glossitis, stomatitis were taken as signs of vitamin B12 deficiency clinically. Iron was started when the patient was free of infection and has entered the catch up phase. Vitamin C and vitamin D deficiency was taken on the clinical and on radiological background. In case of detection of a secondary cause, that case will be dropped from the study.

All the data were analyzed to know the quantitative indicators of the NRC. The quantitative indicators of the NRC are recovery rate, death rate, defaulter rate, weight gain and length of stay. These indicators are also indicative of the outcome of these children admitted to NRC. The nutritional requirement of the patient was calculated on the basis of the presentation or rehydrated weight and continued in the same amount during the stabilization phase. The patients without edema were given 130 ml/kg tube feeding with F-75 formula and with edema 100 ml/kg tube feeding given. After 3-5 days of F-75 when appetite improves then shifted to F-100 gradually. Breast feeding was encouraged in between the feeds. Patients were weighed daily on the same weighing scale and provided sensory stimulation and tender loving care. The patients were watched for signs of recovery viz return of smile, appetite, they were entered the phase of transition and rehabilitation consecutively when fed high calorie and protein in the form of culturally acceptable food items. The mothers were educated about the importance of immunization, breast feeding and healthy weaning practices, maintenance of hygiene and prevention of infections, use of oral rehydration therapy, family planning, female literacy etc.

Monitoring will be done on daily basis in terms of weight, appetite, generalized condition, complications, feed tolerated, feeding offered, edema, etc. Patient will be discharged on fulfilling the discharging criteria. Every case will be followed up from date of discharge for next 6 months as per schedule below:

1st follow up at 2 weeks

2nd follow up at 4 weeks

3rd follow up at 8 weeks

Each case is called to report as per the date and evaluated as per weight, height, mid-arm circumference. Case who failed to report will be contacted telephonically and the same data is gathered as far as practicable.

Data compilation

The following data were collected for the analysis like age, sex, criteria for admission, associated medical complications, type of feeding, immunization status, response to the treatment, duration of stay in the hospital, extent of weight gain, or weight loss, discharges, discharges against medical advice, readmissions, referrals and death. All these relevant data gathered were compiled systematically in Microsoft Excel sheet (2010 review).

Statistical Analysis: A retrospective analysis of all routinely collected program data were conducted with SPSS version 23 statistical software (IBM) in

terms of mean, SD and percentage. A multivariate logistic regression model was also developed to determine risk factors significantly ($P < 0.05$) associated with recovery and defaulters on the bivariate analysis.

Results

A total of two hundred and thirty nine (239) children with severe acute malnutrition were included in the study. Key informant interview were conducted with a nutritionists, a nurse and 3 auxillary nurse midwife. The results are presented in tables and graphs.

1. Trend in Admission at NRC

The cumulative monthly distribution of SAM cases from January 2016 to 2017 (fig 1) revealed that the number of cases were relatively higher in month of August and September in 2016, highest in the month of January 2017. In 2018 the no. of admission didn't vary much.

Trend in admission at NRC

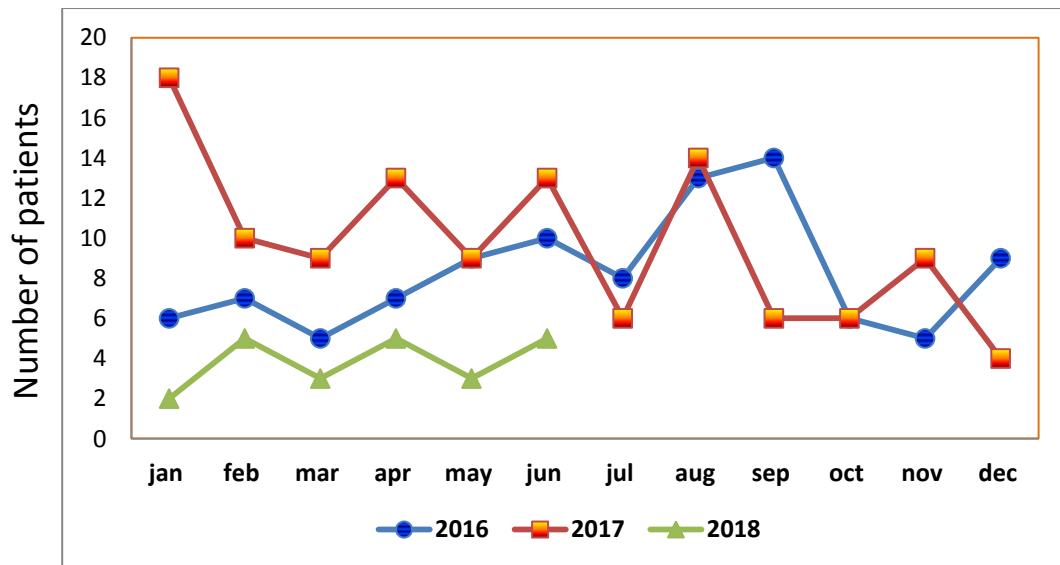


Figure 1: Annual and Seasonal trend in admission of children with SAM at NRC

2. Socio-Demographic Factors

Table 1 shows the socio-demographic factors of the children admitted to NRC in terms of gender, age, type of malnutrition, MUAC and admission profile, VSSIMSAR, Burla from January 2016 to June 2018.

Table 1: Socio-demographic factors of children admitted to NRC.

Category	Value	(%)
1.Gender profile		
Boys	118	(49.3)
Girls	121	(50.6)
2.Age group		
0-5 mo old	15	(6.2)
6-11 mo old	35	(14.6)
12-23 mo old	94	(39.3)
24-35 mo old	47	(19.6)
36-47 mo old	25	(10.4)
48- 59 mo old	23	(9.6)
3.Type of malnutrition		
Edematous ¹	32	(13.3)
Non edematous ²	207	(86.6)
4.MUAC on admission		
MUAC severe (<11.5cm)	124	(51.9)
MUAC moderate (11.5-<12.5 cm)	74	(31)
MUAC normal (at least 12.5 cm)	41	(17.2)
5.Referral practices		
Admission direct from community	43	(18)
Referred from health centre	31	(13)
Referred from inpatient care	100	(41.8)
RBSK	52	(21.8)
VHND	2	(0.8)

¹edematous , SAM children had edema on presentation. It was graded on a scale from + to +++

²MUAC, mid upper arm circumference on admission.

The mean ages of SAM patients were 23.1 ± 14.5 months. In our study Maximum no. of children were within 12 to 23 months of age, 94 (39.33%).15(6.27%) were <6months, 35(14.64%) 6-11months, 94 (39.33%) 12months-23months and 95(39.74%) were >2 years. There is no variation in sex both males and females being equally distributed. Females were slightly more than males with sex ratio= 118:121= 0.97. Males were 118(49.3%) and females were 121(50.62%). Among 239 cases of SAM, majority were non edematous SAM (Marasmus) 207 (86.6%) and rest 32 (13.3%) belonged to edematous SAM (Kwashiorkor). 9 children presented with mild(+) edema, 9 presented with moderate (++)edema and 14 children had severe (+++) edema on admission.

Overall 51.9% (124) of cases met the criteria for MUAC <11.5 cm. The mean MUAC at admission was 11.24 ± 1.45 cm and at discharge it was 11.84 ± 1.47 cm. The difference was observed to be statistically significant ($t=10.930, P<0.001$). The mean MUAC for the boys at admission was 11.38 ± 1.54 cm and at discharge it was 11.88 ± 1.51 .Similarly for girls the mean MUAC at admission was 11.30 ± 1.41 cm, at discharge it was 11.79 ± 1.43 cm.

Well over 100 cases (41.8%) admitted to the NRC were referred from the inpatient care of the same hospital. Rest were directly admitted from the community or were referred from health centres.

3. Source Districts and their Outcome

More than half of the patients were from Sambalpur 123 (51.4%) district. 46(19.2%) were

from Bargarh and 9(3.7%) were from Bolangir district of Odisha. Only 5(2%) were from neighbouring state Chattisgarh. There were no defaulters from Jharsuguda, Angul and Chattisgarh.

4. Socio-Economic Factors

Table 2 shows the socio-economic status, mother's literacy and familial status of the

admitted children. In our study maternal literacy was enquired for. 60.7 % have studied primary school and 37.7 % have studied post primary. In the enrolled patients, 97.9% patients belonged to lower socio economic strata (kuppuswamy scale III,IV,V).

Table 2: Socio-economic characteristics of study sample

Socio-economic factors	Value	(%)
1.Socio-economic class¹		
Upper (I)	0	(0)
Upper middle (II)	4	(1.6)
Middle (III)	93	(38.9)
Upper lower (IV)	78	(32.6)
Lower (V)	63	(26.3)
2.Maternal education		
Illiterate	2	(0.8)
Primary	145	(60.7)
Secondary	90	(37.7)
Post secondary	1	(0.4)
3.Familial status		
Joint	86	(34.7)
Nuclear	153	(64)

¹socio-economic class, according to the modified kuppuswamy scale 2017(Annexure 4)

Table 3: showing socio-cultural characteristics of study sample

Socio-cultural factors	No.of pts.	(%)
1.Duration of exclusive breast feeding		
Upto 6 months	165	(69)
Less than 6 months	74	(30.9)
2.Age of weaning		
<6 months	17	(7.1)
6-9 months	198	(82.8)
9-12 months	3	(1.2)
>12 months	0	
3.Feeding practices		
Prelacteal feeds	82	(34.3)
Bottle feed	138	(57.7)
Adequacy of complementary feeds ¹	88	(36.8)
4.Immunization		
Complete	208	(87)
Incomplete	31	(13)

¹According to IMNCI guidelines, adequate complementary feeds mean semi-solid/ solid/soft food-one 'katori' serving 3 times/day if breastfed and 5 times/day if not breastfed among 6-12 months children, and one and half 'katori' serving 5 times/day among >12 months children.

As shown in table 3, absence of exclusive breast feeding up to 6 months of age (30.9%), Delayed introduction of complimentary feeding beyond 6

months with inadequate quantity and improper dilution (36.8%), incomplete immunization (13%) were major risk factors for SAM. Only 165 (69%)

patients had exclusive breast feeding up-to 6 months of age. Mean duration of exclusive breast feeding was 2.6 ± 1.5 months. Thereafter, they were started on mixed feeds. The mean weight of children who were exclusively breastfed for 6 months was 7.25 ± 1.88 kg as compared to 6.1 ± 2.59 kg for those who were not exclusively breastfed for 6 months. The mean age of starting complementary feeding was 6.602 ± 0.909 months. 34.3% have given pre lacteal feed to their child in form of sugar water, diluted honey, formula milk etc. 57.7% have feed their child with bottle.

The overall mean weight of admission for these children was 6.91 ± 2.18 kg; for boys 6.88 ± 2.16 kg and for girls 6.93 ± 2.26 kg. The mean weight at discharge for the study group was 7.16 ± 2.45 kg; for boys 7.69 ± 2.48 kg and for girls 7.63 ± 2.44 kg [table 7]. A statistically significant difference was observed between the mean weight at discharge and the mean weight at admission for the study group ($t=17.784, P<0.001$).

6. Medical complications associated with SAM

As per table 4 Pneumonia was the most prevalent disease complicating severe acute malnutrition

followed closely by loss of appetite. Of the 239 children enrolled 75(31.3%) had pneumonia, 47(19.6%) had loss of appetite and 33(13.8%) had diarrhea.

Table 4: Medical complications other than edema

Complications	Total No.Of Pts. (%)
Severe pneumonia	75(31.3)
Diarrhea (AGE)	33(13.8)
Jaundice	0
Hyperthermia	28(11.7)
skin lesions ¹	20(8.3)
Anorexia	47(19.6)
Dehydration	2(0.8)
Severe anemia	13(5.4)
Persistent vomiting	9(3.7)
Others ²	12(5.0)

¹skin lesion-extensive superficial infection requiring IM medication

²others-any other general sign that the clinician thinks require admission for further assessment or care.

7. Program effectiveness

Table 5 showing, Out of 239 children, 189(79.1%) recovered and were discharged after they have reached the discharged criteria. Defaulters 42(17.5%) are and 8 (3.3%) died.

Table 5: Treatment outcome of SAM at our NRC in relation to Indian health ministry recommendation

Outcome variable	Results	Acceptable	Alarming
Discharge ¹	189(79.1%)	>75%	<50%
Defaulter ²	42(17.5%)	<15%	>25%
Death	8 (3.3%)	<5%	>15%
Mean daily wt gain(\pm SD)	10.12 ± 5.63 kg	≥ 8	<8
Mean length of stay (\pm SD)	15.75 ± 5.53 days	<4 wks	<1 and >6 wks

¹Discharge indicates the number of beneficiaries that have reached discharge criteria. ² Defaulters indicate a SAM child admitted to the ward but absent from the ward for 3 consecutive days, without being discharged.

We can see that the average weight gain for the study group during their stay at the centers was 10.12 ± 5.63 g/kg/day; for boys the average weight gain being 10.47 ± 6.24 g/kg/day and for girls 9.77 ± 4.94 g/kg/day. An average weight gain of at least 8 g/kg/day is considered to be adequate for a child during stay at the NRC. 147 children (74 boys and 73 girls) had an average weight gain of >8 g/kg/day, while 84 (44 boys and 40 girls) had a weight gain of <8 g/kg/day.

The average duration of stay at the NRCs was 15.75 ± 5.53 days, for boys it was 15.22 ± 4.89 days and for girls it was 16.28 ± 6.07 days. 153 (64.01%) of the children, 80 girls and 73 boys in the study group had stayed at the NRC at the centers for at least 14 days. No statistically significant difference was observed among the different age groups with respect to duration of stay at the centers ($F=2.190, P=0.140$).

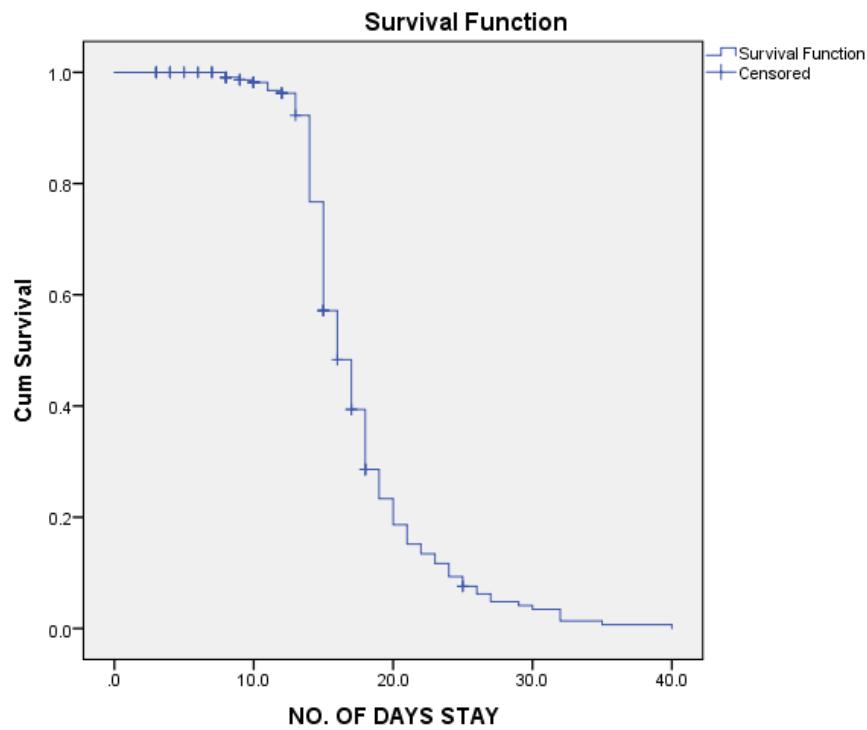


Fig 2: K-M estimates of survival experiences of SAM children.

As shown in figure 2, by 10th day, around 20% of the patients got discharged. By 20th day, more than 80% of the patients got discharged. It has got

no significance association with the child mortality.

8. Factors associated with recovery rate and defaulters

Table 6 : Predictors of recovery from SAM

Factors	No.	Recovered (%)	Chi-square (df)	p value
Pre lacteal feed	82	62(75.6)	0.466(2)	0.792
Exclusive breast feeding	165	139(84.2)	10.275(1)	0.002
Bottle feed	138	104(75.3)	2.009(1)	0.200
Edema	32	23(71.8)	0.880(1)	0.361
Severe Pneumonia	74	58(78.3)	0.001(1)	1.000
Diarrhea	33	25(75.7)	0.139(1)	0.657
Anorexia	49	45(91.8)	6.691(1)	0.011
Fever	28	20(71.4)	0.865(1)	0.339
Skin lesions	20	15(75)	0.135(1)	0.777
Dehydration	2	2(100)	0.561(1)	1.000
Severe Anemia	13	8(61.5)	2.253(1)	0.164
Persistent vomiting	9	6(66.6)	0.736(1)	0.413

The various predictors of outcome in SAM in our study population were found by descriptive statistical analysis. Bivariate and logistic analysis was performed to identify factors that independently predict recovery from SAM (table 6). Various clinical manifestations having

significant relationship with outcome in this study population are fever ($p=0.339$) diarrhea ($p=0.657$), edema ($p=0.361$), severe pneumonia ($p=1.000$), skin lesion ($p=0.777$) loss of appetite ($p=0.011$). No significant difference in recovery rate was observed with respect to pre lacteal feed given,

bottle feed, presence of edema, cough related respiratory tract infection, diarrhea, fever and skin changes. Among various socio-cultural factors, only exclusive breast feeding is having significant association with outcome. ($\chi^2=10.275$, $p= 0.002$) and with loss of appetite during presentation are more likely to recover ($\chi^2=6.691$, $p<0.011$).

On bivariate analysis (table 7), children with exclusive breast feeding ($\chi^2=12.308$, $p= 0.001$) were significantly associated with defaulters. Other variables like pre lacteal feed, bottle feed, complications like edema, pneumonia, loss of appetite, fever and skin lesions had no significant association with the defaulters.

Table 7: Risk factors associated with default rate

Factor	No.	Defaulter (%)	Chi-square (df)	p value
Pre lacteal feed	82	18(21.9)	1.989(1)	0.370
Exclusive breast feeding	165	19(11.5)	12.308(1)	0.001
Bottle feed	138	28(73.6)	2.161(1)	0.166
Edema	32	5(15.6)	0.097(1)	1.000
Severe pneumonia	74	12(16.2)	0.136(1)	0.854
Diarrhea	33	8(25)	1.176(1)	0.323
Anorexia	49	4(8.1)	3.768(1)	0.059
Fever	28	5(17.8)	0.002(1)	1.000
Skin lesions	20	3(15)	0.100(1)	1.000
Dehydration	2	0	0.430(1)	1.000
Severe anaemia	13	4(30.7)	1.653(1)	0.252
Persistent vomiting	9	3(33.3)	1.604(1)	0.197

9. Follow up details

As shown in table 8, of a total of 239 children available for analysis for the first two follow-up visits, 115 children reported for the first follow-up visit and 70 for the second. Similarly of the 68 children available for analysis for the third follow-up visits, 40 children reported for the visit. Dropout rates of 9.89%, 23.07%, and 61.76%

were obtained for the three follow-up visits conducted 15 days, 1 month and 2months from the day of discharge as per recommended guidelines. This dropout rate at each follow-up visit was found to be statistically significant ($\chi^2=61.106$, $P<0.001$). If calculated from the baseline data of 100 children, the dropout rates would be 18%, 30% and 74% for the three follow-ups.

Table 8: Age and Sex wise distribution of children at different follow-ups

Age in months	Boys ¹	Girls ¹	Total ¹	Boys ²	Girls ²	Total ²	Boys ³	Girls ³	Total ³
0-5	2	2	4	1	1	2	1	0	1
6-11	10	8	18	7	4	11	4	2	6
12-23	20	26	46	14	16	30	8	10	18
24-35	11	12	23	6	9	15	3	6	9
36-47	4	8	12	4	4	8	2	2	4
48-60	4	8	12	1	3	4	0	2	2
Total	51	64	115	33	37	70	18	22	40
Dropout No. (%)			74 (39.1)			119 (62.9)			149 (78.8)

¹children came for 1st follow up visit,

²-children came for 2nd follow up visit

³-children came for 3rd follow up visit

Discussions

The trend analysis was carried out to help assess if severe malnutrition cases are increasing or declining over time. No significant decrease in the trend of admission of malnutrition was observed in year 2016 and 2017. In 2018, the rate of admissions have decreased possibly because of establishment of a new NRC at Sambalpur district Headquarter.

In our study, the mean age of admitted patients was 23.1 ± 14.5 months. Maximum number of children were within 12-23 months of age followed by 6-11 months. However in certain studies Dhanalakshmi K, Shah RH, Das K higher prevalence is reported in the age group of 6 months to 1 years.^{12,13,14} The sex ratio was 0.97 which indicates a virtual equality between the sexes with a slight female predominance. There is no variation in sex, both males and females being equally distributed which is similar to the study conducted by Das K et al, Taneja G and Dhanalaxmi K.^{12,14,15} Therefore, programs for children with SAM in Odisha need to give priority to children younger than 2 y—particularly girls—from socioeconomically disadvantaged groups. Strikingly similar values have been reported in other states of India. In present study, non-edematous malnutrition 207(86.6%) was more common than oedematous malnutrition 32(13.8%), this finding was similar to studies by Shah RH showing 86.65% & 5% study population formed by marasmus & kwashiorkor respectively¹³, and Das K showing (Marasmus) (77%) and rest were oedematous (Kwashiorkor)¹⁴.

1. Source districts

Most of the patients belonged to Sambalpur and Bargarh districts and so the defaulters were more from these districts. Those children belonging to farther districts had less or no defaulters. Majority of families belonged to lower socio-economic status similar to many of the studies. Das S et al.¹⁶ and Choudhary M et al.¹⁷ in their studies reported that majority of malnourished children belonged to lower socioeconomic status (IV and V) i.e. 72.8% and 90% respectively. Likewise, Taneja G

et al¹⁵, and Dhanalaxmi K et al.¹² also reported that malnutrition is related to per capita income and socioeconomic condition. They have unavailability of food, poor purchasing power that adds to the risk factors. However 4 children were from upper socio-economic status. Reason may be inadequate quality of food. People may not have access to the variety of foods that will provide all the necessary vitamins and minerals in their diet. People may also lack the knowledge needed to make sound choices about the food they eat or provide to their children

Breast milk is the best available food for infant and those who have been deprived of this, are expected to show a greater prevalence of malnutrition. The mean weight of children who were exclusively breastfed for 6 months was 7.25 ± 1.88 kg as compared to 6.1 ± 2.59 kg for those who were not exclusively breastfed for 6 months. Likewise, Das S et al.¹⁶ reported in their study mean duration of exclusive breastfeeding was 3.1 ± 1.8 months and mean age of starting semi-solid complementary food was 8.5 ± 2.5 months. Similarly, Choudhary M et al¹⁷ also reported Mean duration of exclusive breast feeding was 2.6 ± 1.5 months and mean age of weaning was 8.4 ± 3.9 months. This could be explained as breast milk is a complete source of all vitamins, proteins, fat and carbohydrate for the growing child and also decreases chances of infections in exclusively breast feed infants in the initial six month of age. As depicted in figure 20, 31.3% had acute respiratory tract infection, 19.6% had loss of appetite and 13.8 % had diarrhea. Similar proportion of diarrhea and acute respiratory tract infection as a comorbidity also reported by other studies by Dhanalaxmi K¹² and Shah RH¹³, however in some other studies larger proportion of gastrointestinal (60%) followed by respiratory tract infection (52%) by Choudhary M¹⁷, Das S¹⁶.

2. Program effectiveness:

Out of the 239 children who participated in this study 189(79.1%) were discharged after variable durations of hospitalization, 8(3.3%) died and 42(17.5%) got defaulted. As previously no study

has been done on management outcome of severe acute malnutrition in our NRC since its establishment in VSSIMSAR, these outcome

variables were compared with similar studies conducted in different states of India.

Table 9: Comparing the outcome our study with other studies

Study	Cure(%)	Defaulter (%)	Death (%)	Avg .wt. Gain (g/kg/day)	Avg.length of stay (days)
Index study	79.1	17.5	3.3	10.12±5.63	15.75±5.53
DhanalakshmiK ¹²	81	12.09	6.52	4.4	8.4
Shah RH ¹³	78.33	8.33	5	9.3	15.6
Nagar RP ¹⁹	84	16	1.3	14.13±9.1	12.12±7.67
Das S ¹⁶	75.24	13.65	0.63		
Burza S ¹⁸	57.4	36.2	0.8	8.7±6.1	7.3±5.6

In our NRC, the cure, defaulter and death rates, acceptable weight gain were all within the acceptable rates as per Indian Health Ministry recommendations.

3. Follow up details:

Of a total of 239 children available for analysis for the first two follow-up visits, 115 children reported for the first follow-up visit and 70 for the second. Similarly of the 68 children available for analysis for the third follow-up visits, 40 children reported for the visit. Dropout rates of 9.89%, 23.07%, and 61.76% were obtained for the three follow-up visits conducted 15 days, 1 month and 2months from the day of discharge as per recommended guidelines. Caregivers defaulted on their follow-up visit to NRC due to low awareness about the need for re-visits and non availability of family members or acquaintance to accompany caregivers to NRC. The low attendance rate for follow-up visits was similar to a study in Jharkhand where 62.4% of the 2770 discharge children did not return for any follow-up visits, and only 14.9% children completed the three follow-up visits. Also similar to other studies Das K et al, Taneja G and Dhanalaxmi K.^{14,15,12} Caregiver's awareness about the services and their opportunity cost are important factors as they may influence the health seeking behavior. There is poor compliance with the prescribed three follow-ups. While most of the discharged children come to the NRC for first follow-up, the proportion coming for the second follow-up is lower, and is

further reduced for the third follow-up. The main issues confronting mothers to bring their child for the three follow up visits are: unavailability of a convenient mode of transportation; unavailability of the ASHA due to her other engagement; belief that the child is well and does not require follow-up; and opportunity cost for the daily wage work by mothers, lack of motivation among ASHAs to ensure three visits. ASHAs feel that the incentive for follow-up i.e. Rs.100 lump sum to accompany the mother for 3 follow-up visits is insufficient as they have to travel 3 times to the NRC. Further, this payment only becomes available after the completion of 3 follow-up visits, which often do not take place as it is difficult to convince them others to come for 3 follow-up visits. There is poor coordination between staff of two involved departments. The AWWs feel that the ASHA is responsible to ensure the follow-up of discharged children and vice versa. There is gap in the line of communication at the district level even within the health departments, as the case information must be transferred between the medical and health wings of the health system. Systematic communication on follow-up visits by field staff of DoHFW and DWCD is not transferred to the relevant authorities.

Study limitations

A major strength of this study was the data that were maintained throughout the program with relatively few missing data points for the final

analysis. Limitation of our study was inadequate follow up. Many children defaulted from the program and, therefore, were lost to follow-up. Although data were used from defaulting children to identify risk factors for default, not knowing the eventual outcome of this group of children could have created a potential bias in presenting overall outcomes of the program.

Conclusion

There is need to curb the default rate and it can be done by focus group discussions with care takers to come up with the strategies that may help to reduce the default rate and improve on recovery rate. Simple measures like educating mothers about health care, hygiene, feeding habits, seeking treatment at right time will help. Weaning should start appropriately with balanced complementary diet according to the age can help to improve the nutritional status of the children.

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