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Original Research Article

THE STUDY OF DETERMINANTS OF NON-RESPONDERS AMONG CHILDREN ADMITTED IN SEVERE MALNUTRITION TREATMENT UNIT (SMTU)

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ABSTRACT

Background: Severe acute malnutrition (SAM) remains a major contributor to under-five morbidity and mortality. Despite standardized treatment protocols, a significant proportion of children fail to respond adequately, leading to poor outcomes. This study aimed to identify and analyze the determinants of early and late non-response among children with SAM admitted to a tertiary care SMTU. **Materials and Methods:** This hospital-based cross-sectional observational study was conducted among 110 children with SAM admitted to a tertiary care Severe Malnutrition Treatment Unit (SMTU). Children were categorized as early or late non-responders based on treatment response. Data on demographic, clinical, nutritional, and laboratory parameters were collected and analyzed using appropriate statistical methods. **Results:** The majority of children were aged 6–12 months (36.4%) with male predominance (56.4%). Most belonged to lower socioeconomic class (61.5%). Early non-responders constituted 47.3%, followed by late (34.5%) and combined (18.2%) non-response. Maternal anemia (61.5%), low BMI, inadequate breastfeeding (69.2%), and poor feeding knowledge (65.4%) were more common among early and combined non-responders. Complications such as pneumonia (38.2%), severe anemia (33.6%), and dehydration (26.4%) were frequent. Significant biochemical abnormalities included hypoalbuminemia ($p<0.001$), electrolyte imbalance, and micronutrient deficiencies. Persistent edema ($p<0.001$), severe anemia ($p=0.042$), and dehydration ($p=0.033$) were significantly associated with early non-response. Hospital stay was longest in combined non-responders (26.8±7.4 days). **Conclusion:** Treatment non-response in SAM is multifactorial, influenced by clinical severity, nutritional deficits, and socio-demographic factors. Early identification, prompt management of complications, and strengthening caregiver education are essential to improve outcomes.

INTRODUCTION

Severe acute malnutrition (SAM) remains a pressing global health concern, particularly among children under five years of age, where it continues to contribute significantly to morbidity, mortality, and long-term developmental impairment. It not only compromises physical growth but also adversely affects cognitive development and future productivity. According to estimates by the World Health Organization, nearly 45 million children worldwide suffer from wasting, with the highest burden concentrated in low- and middle-income countries, especially in South Asia and Sub-Saharan Africa.[1] India, in particular, bears a disproportionate share of this burden, driven by a complex interplay of poverty, food insecurity, recurrent infections, inadequate infant and young child feeding practices, and gaps in healthcare access and utilization.[2] Clinically, SAM is defined by severe wasting, bilateral pitting edema, or a weight-for-height/length Z-score below −3 standard deviations, and is associated with a markedly increased risk of mortality if not promptly and effectively managed.[1]

Over the years, structured protocols have been developed to address SAM, with a dual focus on community-based management for uncomplicated cases and facility-based care for children with complications. Severe Malnutrition Treatment Units (SMTUs), typically located within tertiary care hospitals, serve as critical centers for the management of complicated SAM. These units operate through a phased approach comprising stabilization, transition, and rehabilitation, integrating medical management, therapeutic nutrition, micronutrient supplementation, and close clinical monitoring.[1,3] Despite the availability of such standardized guidelines, variability in treatment outcomes persists, with a significant proportion of children demonstrating suboptimal response to therapy.

Treatment non-response, characterized by failure to regain appetite, persistent edema, or inadequate weight gain, represents a major clinical and public health challenge. Children who fail to respond are more likely to experience prolonged hospitalization, higher complication rates, increased risk of relapse, and mortality, thereby undermining the overall success of SAM management programs.[4,5] Evidence suggests that this non-response is multifactorial, arising from a combination of clinical factors such as persistent infections, metabolic and micronutrient imbalances, as well as socio-demographic determinants including low socioeconomic status, poor caregiver awareness, and inappropriate feeding practices.[6-9] Furthermore, distinguishing between early and late non-responders is clinically relevant, as these groups often differ in underlying mechanisms and therapeutic needs.[4,7]

In the Indian setting, particularly in central India, there remains a relative paucity of data focusing on determinants of treatment non-response in SMTUs. Given the regional diversity in socio-cultural practices, nutritional patterns, and disease burden, context-specific insights are essential to optimize management strategies and improve outcomes.

Against this background, the present study was undertaken with the aim of evaluating the factors associated with early and late non-responders among children admitted to a Severe Malnutrition Treatment Unit in a tertiary care centre. The objectives were to identify determinants associated with early non-response and to analyze factors contributing to late non-response, thereby facilitating early risk stratification and targeted interventions to enhance recovery outcomes.

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethics Committee, this hospital-based cross-sectional observational study was conducted among children with Severe Acute Malnutrition (SAM) admitted to the Severe Malnutrition Treatment Unit (SMTU) in the Department of Paediatrics at M.G.M. Medical College and associated hospitals, Indore, over a period of one year. Written informed consent was obtained from parents or guardians prior to enrolment. Confidentiality of participant data and voluntary participation were strictly ensured throughout the study.

The sample size was calculated using G*Power software for multiple regression analysis, assuming an effect size of 0.7, power of 90%, and alpha error of 0.05, yielding a minimum required sample size of 88 participants. To enhance statistical validity and account for potential dropouts, a total of 110 children were included using consecutive sampling.

Inclusion Criteria

- Children aged less than 60 months admitted to SMTU and diagnosed with Severe Acute Malnutrition as per WHO criteria, and identified as early or late non-responders during the course of treatment, were included in the study.

Exclusion Criteria

- Children who were discharged against medical advice (LAMA), expired during treatment, or had a duration of hospital stay less than 10 days were excluded.

Methodology

After obtaining informed consent, eligible children were enrolled consecutively at the time of admission. A detailed history was recorded using a predesigned semi-structured proforma, including demographic profile (age, sex, birth order), socioeconomic status (Modified Kuppuswamy Scale), feeding practices, and maternal factors such as maternal age, nutritional status, and education.

A thorough clinical examination was conducted for each child, documenting general condition, appetite status, presence and degree of oedema, vital parameters, and associated comorbidities such as diarrhoea, pneumonia, tuberculosis, or other infections. Anthropometric measurements including weight, mid-upper arm circumference (MUAC), and weight-for-height/length Z-score were recorded at admission and monitored regularly.

All children underwent relevant laboratory investigations including complete blood count, serum electrolytes, blood glucose levels, and screening for infections. Additional investigations such as HIV, HBsAg, and HCV were performed after appropriate counselling and consent.

An appetite test was conducted as per SMTU protocol using therapeutic feeds to assess feeding ability. Based on treatment response, children were classified as early non-responders (failure to regain appetite or resolve oedema during early admission period) and late non-responders (failure to achieve adequate weight gain or deterioration during follow-up).

All patients were managed according to standard SMTU protocols, including therapeutic feeding (F-75, F-100), antibiotic therapy, micronutrient supplementation, and management of associated complications. Daily monitoring of weight, appetite, and clinical status was performed.

Outcome Assessment

Children were followed up throughout their hospital stay and subsequently at scheduled intervals of 15 days, 1 month, and 2 months post-discharge. Outcomes assessed included response to treatment, weight gain, resolution of oedema, and persistence or development of non-response. Early and late non-response patterns were identified based on predefined criteria. Any complications or readmissions during follow-up were also documented.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS software version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analysis between early and late non-responders was performed using appropriate statistical tests such as the Chi-square test for categorical variables and unpaired t-test for continuous variables. Multivariate regression analysis was applied to identify independent predictors of treatment non-response. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The present study included 110 children with severe acute malnutrition (SAM) who were identified as treatment non-responders in the Severe Malnutrition Treatment Unit (SMTU). The majority of children belonged to the 6–12 months age group (36.4%), followed by 12–36 months (30.9%). There was a male predominance (56.4%). Most children belonged to the lower socioeconomic class (61.5%), followed by middle class (34.6%), indicating a higher burden of malnutrition among socioeconomically disadvantaged populations. [Table 1]

Table 1: Demographic Profile of Study Population (N = 110)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	<6 months	14	12.7
	6–12 months	40	36.4
	12–36 months	34	30.9
	>36 months	22	20.0
Gender	Male	62	56.4
	Female	48	43.6
Socioeconomic Status	Upper	4	3.6
	Middle	38	34.6
	Lower	68	61.5

Maternal and early-life factors revealed that a considerable proportion of mothers had anemia (58.2%) and low BMI (<18.5) (42.7%), indicating poor maternal nutritional status. Prematurity was observed in 38.2% of children, and low birth weight (<2.5 kg) was present in 49.1%, reflecting significant perinatal risk factors contributing to malnutrition. Inadequate breastfeeding (65.5%) and poor feeding knowledge among caregivers (61.0%) were also highly prevalent. [Table 2]

Table 2: Maternal, Perinatal and Feeding Risk Factors (N = 110)

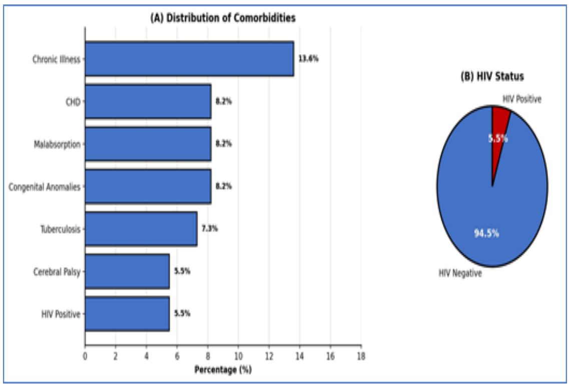
Variable	Category	Frequency (n)	Percentage (%)
Maternal BMI	<18.5	47	42.7
	≥18.5	63	57.3
Maternal Anemia	Present	64	58.2
	Absent	46	41.8
Maternal Education	Illiterate	52	47.3
	Literate	58	52.7
Prematurity	Yes	42	38.2
	No	68	61.8
Birth Weight	<2.5 kg	54	49.1
	≥2.5 kg	56	50.9
Inadequate Breastfeeding	Yes	72	65.5
	No	38	34.5
Lack of Feeding Knowledge	Yes	67	61.0
	No	43	39.0
Adequate Complementary Feeding	Yes	35	31.8
	No	75	68.2

Clinically, children presented with severe forms of malnutrition, with 69.1% having weight-for-height <−3 SD and 30.9% having <−4 SD. MUAC values indicated moderate to severe malnutrition, with 16.4% having MUAC <7 cm. Bilateral pedal edema was present in 25.5% of children. Among complications, pneumonia (38.2%), severe anemia (33.6%), and dehydration (26.4%) were most common. A total of 16.4% required PICU admission, indicating severe clinical compromise. [Table 3]

Table 3: Anthropometric and Clinical Profile at Admission (N = 110)

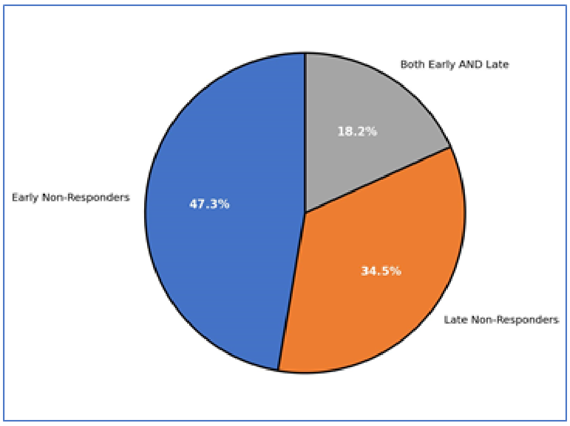
Variable	Category	Frequency (n)	Percentage (%)
Weight-for-Height	<−3 SD	76	69.1
	<−4 SD	34	30.9
MUAC	<7 cm	18	16.4
	7.5–9 cm	52	47.3
	9–11.5 cm	40	36.4
Bilateral Pedal Edema	Present	28	25.5
	Absent	82	74.5
Complications	Pneumonia	42	38.2
	Severe anemia	37	33.6
	Dehydration	29	26.4
	Hypothermia	24	21.8
	Hypoglycaemia	21	19.1
	Shock	18	16.4
	UTI	12	10.9
PICU Admission	Required	18	16.4
	Not required	92	83.6

Comorbidity assessment revealed that chronic illnesses (13.6%), congenital heart disease (8.2%), and malabsorption disorders (8.2%) were the most frequent associated conditions. Tuberculosis was present in 7.3% of cases, while 5.5% were HIV positive. Among specific conditions, celiac disease and ventricular septal defect were the most common in their respective categories. [Graph 1]



Graph 1: Distribution of Comorbidities and HIV Status

Regarding treatment response patterns, early non-responders constituted the largest group (47.3%), followed by late non-responders (34.5%) and those with both early and late non-response (18.2%). [Graph 2]



Graph 2. Distribution of Non-Response Categories

Risk factor analysis revealed that early and combined non-responders had a higher burden of adverse maternal, perinatal, and feeding-related factors compared to late non-responders. Maternal anemia (61.5% and 60.0%) and low maternal BMI (46.2% and 45.0%) were more common in early and combined groups. Perinatal risk factors such as prematurity (42.3%) and low birth weight (53.8%) were also more frequent among early non-responders. Feeding practices showed a strong association, with inadequate breastfeeding (69.2% and 70.0%), poor caregiver feeding knowledge (65.4% and 65.0%), and inadequate complementary feeding (73.1% and 75.0%) predominantly observed in early and combined non-responders. A majority of children belonged to lower socioeconomic class, particularly in early (61.5%) and combined (70.0%) groups. Clinically, complications were markedly higher in early (88.5%) and combined non-responders (90.0%), with slightly higher comorbidity prevalence as well. [Table 4, Graph 3]

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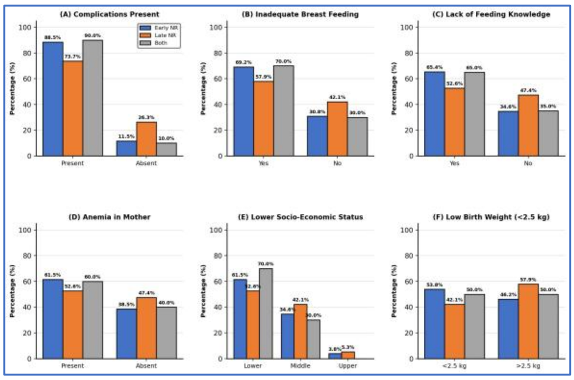
Table 4: Comparison of Maternal, Socio-Demographic and Clinical Factors among Early, Late and Combined Non-Responders

Factor	Category	Early NR (n=52)	Late NR (n=38)	Both NR (n=20)
Maternal Age (years)	<20	18 (34.6%)	10 (26.3%)	6 (30.0%)
	20–40	30 (57.7%)	24 (63.2%)	12 (60.0%)
	>40	4 (7.7%)	4 (10.5%)	2 (10.0%)
Single Parent	Yes	12 (23.1%)	6 (15.8%)	4 (20.0%)
	No	40 (76.9%)	32 (84.2%)	16 (80.0%)
Broken Family	Yes	14 (26.9%)	8 (21.1%)	5 (25.0%)
	No	38 (73.1%)	30 (78.9%)	15 (75.0%)
Number of Children	<2	16 (30.8%)	14 (36.8%)	8 (40.0%)
	2–5	28 (53.8%)	20 (52.6%)	10 (50.0%)
	>5	8 (15.4%)	4 (10.5%)	2 (10.0%)
BMI of Mother	<18	24 (46.2%)	14 (36.8%)	9 (45.0%)
	18.5–29.9	26 (50.0%)	22 (57.9%)	10 (50.0%)
	>30	2 (3.8%)	2 (5.3%)	1 (5.0%)
Maternal Anemia	Present	32 (61.5%)	20 (52.6%)	12 (60.0%)
	Absent	20 (38.5%)	18 (47.4%)	8 (40.0%)
Maternal Education	Literate	26 (50.0%)	22 (57.9%)	10 (50.0%)
	Illiterate	26 (50.0%)	16 (42.1%)	10 (50.0%)
Birth Order	<2	20 (38.5%)	18 (47.4%)	10 (50.0%)
	2–5	28 (53.8%)	18 (47.4%)	9 (45.0%)
	>5	4 (7.7%)	2 (5.3%)	1 (5.0%)
Socio-Economic Status	Upper	2 (3.8%)	2 (5.3%)	0 (0%)
	Middle	18 (34.6%)	16 (42.1%)	6 (30.0%)
	Lower	32 (61.5%)	20 (52.6%)	14 (70.0%)
Prematurity	Yes	22 (42.3%)	12 (31.6%)	8 (40.0%)
	No	30 (57.7%)	26 (68.4%)	12 (60.0%)
Birth Weight	<2.5 kg	28 (53.8%)	16 (42.1%)	10 (50.0%)
	>2.5 kg	24 (46.2%)	22 (57.9%)	10 (50.0%)
Inadequate Breastfeeding	Yes	36 (69.2%)	22 (57.9%)	14 (70.0%)
	No	16 (30.8%)	16 (42.1%)	6 (30.0%)
Lack of Feeding Knowledge	Yes	34 (65.4%)	20 (52.6%)	13 (65.0%)
	No	18 (34.6%)	18 (47.4%)	7 (35.0%)
Adequate Complementary Feeding	Yes	14 (26.9%)	16 (42.1%)	5 (25.0%)
	No	38 (73.1%)	22 (57.9%)	15 (75.0%)
Complications	Present	46 (88.5%)	28 (73.7%)	18 (90.0%)
	Absent	6 (11.5%)	10 (26.3%)	2 (10.0%)
Comorbidities	Present	28 (53.8%)	18 (47.4%)	11 (55.0%)
	Absent	24 (46.2%)	20 (52.6%)	9 (45.0%)



Graph 3: Key Factors Associated with Non-Response Patterns

Laboratory analysis demonstrated significant biochemical derangements across non-response categories. Serum albumin showed highly significant differences across all age groups ($p < 0.001$), with the lowest levels observed among combined non-responders. Late non-responders consistently demonstrated relatively better nutritional and biochemical profiles, including higher hemoglobin, electrolytes, iron, and vitamin D levels. [Table 5]

Table 5: Laboratory Parameters Across Non-Response Categories

Age Group	Parameter	Early NR (Mean ± SD)	Late NR (Mean ± SD)	Both NR (Mean ± SD)	p-value
6–12 months	Hemoglobin (gm%)	7.2 ± 1.5	7.8 ± 1.4	6.9 ± 1.6	0.042*
	Serum Albumin (g/dL)	2.3 ± 0.5	2.8 ± 0.6	2.1 ± 0.4	<0.001**
	Serum Sodium (mEq/L)	132.4 ± 8.2	136.5 ± 6.8	130.2 ± 9.1	0.012*
	Serum Potassium (mEq/L)	3.2 ± 0.6	3.6 ± 0.5	3.0 ± 0.7	0.003**

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	Serum Calcium (mg/dL)	7.8 ± 1.2	8.4 ± 1.0	7.5 ± 1.3	0.023*
	Serum Iron (µg/dL)	32.4 ± 12.5	38.6 ± 14.2	28.3 ± 11.8	0.007**
	Serum Vitamin D3 (ng/mL)	12.5 ± 6.8	16.2 ± 7.5	10.8 ± 6.2	0.011*
12–36 months	Hemoglobin (gm%)	7.5 ± 1.6	8.1 ± 1.5	7.2 ± 1.7	0.061
	Serum Albumin (g/dL)	2.5 ± 0.6	3.0 ± 0.7	2.3 ± 0.5	<0.001**
	Serum Sodium (mEq/L)	134.2 ± 7.5	137.8 ± 6.2	132.5 ± 8.4	0.032*
	Serum Potassium (mEq/L)	3.4 ± 0.5	3.7 ± 0.4	3.2 ± 0.6	0.008**
	Serum Calcium (mg/dL)	8.1 ± 1.1	8.6 ± 0.9	7.8 ± 1.2	0.043*
	Serum Iron (µg/dL)	35.6 ± 13.2	42.3 ± 15.6	31.5 ± 12.4	0.013*
	Serum Vitamin D3 (ng/mL)	14.2 ± 7.2	18.5 ± 8.1	12.3 ± 6.8	0.007**
>36 months	Hemoglobin (gm%)	7.8 ± 1.7	8.4 ± 1.6	7.5 ± 1.8	0.091
	Serum Albumin (g/dL)	2.7 ± 0.7	3.2 ± 0.8	2.5 ± 0.6	<0.001**
	Serum Sodium (mEq/L)	135.6 ± 6.8	138.4 ± 5.9	133.8 ± 7.6	0.048*
	Serum Potassium (mEq/L)	3.5 ± 0.4	3.8 ± 0.3	3.3 ± 0.5	0.013*
	Serum Calcium (mg/dL)	8.3 ± 1.0	8.8 ± 0.8	8.0 ± 1.1	0.060
	Serum Iron (µg/dL)	38.2 ± 14.6	45.8 ± 16.8	34.5 ± 13.2	0.017*
	Serum Vitamin D3 (ng/mL)	15.8 ± 7.8	20.2 ± 8.9	13.5 ± 7.2	0.009**

p < 0.05 (Significant), ** p < 0.001 (Highly significant)

Finally, clinical associations revealed that persistent bilateral pedal edema was strongly associated with early non-response (p < 0.001). Severe anemia and dehydration were also significantly associated with early treatment failure. Hospital stay duration showed a highly significant difference (p < 0.001), with the longest duration observed in children with both early and late non-response (mean 26.8 days), followed by late and early non-responders. [Table 6, Graph 4]

Table 6: Clinical Associations and Hospital Stay Outcomes Across Non-Response Patterns (n = 110)

Factor	Category	Early NR (n=52)	Late NR (n=38)	Both NR (n=20)	Chi-square	p-value
Bilateral Pedal Edema (Day 4)	Present	26 (50.0%)	2 (5.3%)	—	22.456	<0.001**
	Resolved	10 (19.2%)	8 (21.1%)	—		
	Never Present	16 (30.8%)	28 (73.7%)	—		
Pneumonia	Present	26 (50.0%)	12 (31.6%)	4 (20.0%)	3.234	0.072
Severe Anemia	Present	24 (46.2%)	10 (26.3%)	3 (15.0%)	4.123	0.042*
Dehydration	Present	20 (38.5%)	7 (18.4%)	2 (10.0%)	4.567	0.033*
Hypothermia	Present	16 (30.8%)	6 (15.8%)	2 (10.0%)	2.891	0.089
Hypoglycaemia	Present	14 (26.9%)	5 (13.2%)	2 (10.0%)	2.456	0.117
Shock	Present	12 (23.1%)	4 (10.5%)	2 (10.0%)	2.567	0.109
UTI	Present	8 (15.4%)	3 (7.9%)	1 (5.0%)	1.234	0.267
Congenital Anomalies	Present	6 (11.5%)	2 (5.3%)	1 (5.0%)	1.234	0.267
PICU Admission	Required	12 (23.1%)	4 (10.5%)	2 (10.0%)	2.891	0.089
Comorbidities	CHD	6 (11.5%)	2 (5.3%)	1 (5.0%)	1.187	0.276
	Malabsorption	6 (11.5%)	2 (5.3%)	1 (5.0%)	1.187	0.276
	Tuberculosis	5 (9.6%)	2 (5.3%)	1 (5.0%)	0.673	0.412
	Cerebral Palsy	4 (7.7%)	1 (2.6%)	1 (5.0%)	1.145	0.285
	Chronic Illness	9 (17.3%)	4 (10.5%)	2 (10.0%)	0.891	0.345
HIV Status	Positive	4 (7.7%)	1 (2.6%)	1 (5.0%)	1.234	0.267
	Negative	48 (92.3%)	37 (97.4%)	19 (95.0%)		
Hospital Stay (days)	Mean ± SD	18.6 ± 5.8	21.4 ± 6.2	26.8 ± 7.4	—	<0.001**
	Median	18	21	26		
	Range	10–32	14–35	16–42		

p < 0.05 (Significant), ** p < 0.001 (Highly significant)

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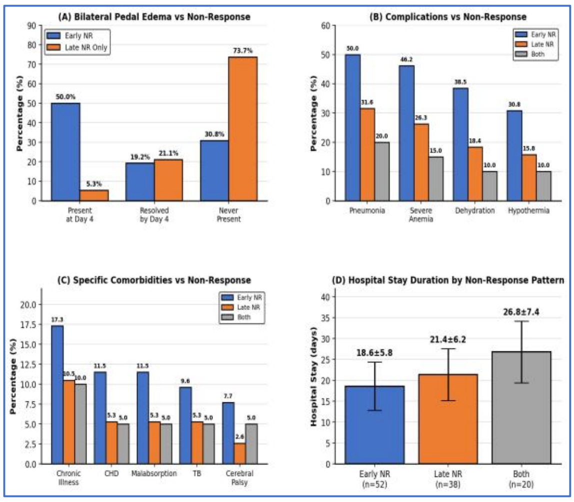

Graph 4: Clinical Associations and Hospital Stay Outcomes

DISCUSSION

The present study evaluated determinants and patterns of treatment non-response among children with severe acute malnutrition (SAM) admitted to a tertiary care SMTU. By classifying children into early, late, and combined non-responders, the study highlights how clinical severity, nutritional status, and socio-environmental factors interact across different phases of treatment.

The majority of non-responders were infants aged 6–12 months, identifying infancy as a high-risk period. Although males were slightly predominant, age and sex were not significantly associated with non-response, consistent with findings by Nyeko et al,[10] and Mena et al,[11] where clinical factors outweighed demographic influences. Daures et al,[12] similarly reported higher risk of non-response in children <12 months (aHR=4.23), likely due to immature immunity and feeding dependence.

Anthropometric assessment revealed severe baseline malnutrition, with a substantial proportion having weight-for-height below −4 SD. This aligns with Daures et al,[12] who showed that severe wasting (MUAC <115 mm) strongly predicts non-response (aHR=11.1). Additionally, 25.5% of children had edema, reflecting oedematous malnutrition. Nyeko et al,[13] reported higher complication rates in such children, emphasizing metabolic instability and feeding intolerance.

A high burden of complications was observed, with pneumonia, severe anemia, and dehydration being most common. These findings are consistent with Mena et al,[11] where absence of pneumonia improved recovery (AOR=7.82), and Nyeko et al,[14] who identified hypothermia as a predictor of poor outcomes. Nalwanga et al,[12] further demonstrated that systemic infections significantly increase mortality risk (AHR=9.0), underscoring that infections and metabolic disturbances are central drivers of treatment failure.

Comorbidities such as chronic illness, congenital heart disease, malabsorption disorders, tuberculosis, and HIV were present in a significant proportion of children. These conditions impair nutrient absorption, increase metabolic demand, and predispose to infections. Similar findings were reported by Abdi et al,[15] where tuberculosis increased poor outcomes (AHR=2.862), and Desyibelew et al,[16] who identified HIV (AHR=3.82) and cardiac disease as predictors of mortality. Although not independently significant, their cumulative impact remains clinically relevant.

Early non-response was the most common pattern (47.3%), followed by late (34.5%) and combined (18.2%), indicating that failure during the stabilization phase is a major challenge. Comparable trends were noted by Ahmed et al,[17] and Daures et al,[12] suggesting that treatment failure persists despite standardized protocols.

Risk factor analysis showed that early and combined non-responders had higher prevalence of maternal anemia, low maternal BMI, inadequate breastfeeding, poor feeding knowledge, and lower socioeconomic status. These findings are supported by Debie et al,[18] and Hassen et al,[19] emphasizing the role of modifiable maternal and feeding-related factors in influencing outcomes.

Biochemical analysis revealed significant derangements, including hypoalbuminemia, anemia, electrolyte imbalance, and micronutrient deficiencies, particularly among early and combined non-responders. Serum albumin showed consistent significance ($p<0.001$), indicating its role as a key marker of severity, consistent with previous studies.[11,14]

A strong association was observed between persistent edema and early non-response ($p<0.001$), along with significant associations of severe anemia and dehydration, reinforcing their role as early predictors of treatment failure. These findings are consistent with earlier literature highlighting the importance of clinical stability in recovery.[11,13]

Hospital stay duration was significantly longer among children with combined non-response, reflecting greater disease severity and delayed recovery, consistent with previous studies.[82,90] However, interpretation of these findings should consider certain constraints, including the single-centre design, purposive sampling, relatively small sample size, short follow-up duration, and potential recall bias in caregiver-reported feeding practices, which may influence generalizability and strength of associations.

In summary, the present study demonstrates that treatment non-response in SAM is multifactorial, with early non-response driven primarily by acute clinical severity and metabolic disturbances, and late non-response influenced by persistent socio-nutritional factors. Early identification of high-risk children, prompt management of complications, and strengthening of feeding practices are essential to improve outcomes and reduce non-response.

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However, the findings should be interpreted cautiously due to certain limitations, including the single-centre design, use of purposive sampling, relatively small sample size, and short follow-up duration. Additionally, reliance on caregiver-reported feeding practices may introduce recall bias, potentially affecting the accuracy of some observed associations.

CONCLUSION

Treatment non-response in severe acute malnutrition is a multifactorial process involving clinical severity, metabolic instability, and socio-nutritional determinants. Early non-response is mainly driven by acute complications and biochemical derangements, whereas late and persistent non-response is influenced by inadequate feeding practices, poor caregiver awareness, and socioeconomic constraints. These findings highlight the importance of early risk identification, timely management of complications, and strengthening of maternal and caregiver education. A comprehensive, multidisciplinary approach integrating clinical care, nutritional rehabilitation, and community-based follow-up is essential to improve recovery rates, reduce non-response, and enhance overall outcomes among children with severe acute malnutrition.

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