

Co-morbidities in Hospitalized Children with Severe Acute Malnutrition: A Descriptive Study from a Tertiary Care Hospital in North India

Annpurna Adarsh¹, Anjali Kumari², Mani Shankar³, Rizwan Haider⁴, Shiwali Singh⁵, Yogesh Chandra⁶, Farhan Abdul Hai⁷, Abhishek Kumar⁸

^{1,2,5,6,7,8}Junior Resident (Academic), Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

³Associate Professor, Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

⁴Professor & H.O.D., Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

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Corresponding author: Dr. Annpurna Adarsh

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Abstract

Background: Severe acute malnutrition (SAM) remains a major cause of childhood morbidity and mortality in low- and middle-income countries, and co-morbid infections and metabolic complications substantially influence survival. Understanding the local pattern of co-morbidities and outcome determinants is essential for planning hospital-based management.

Methods: This descriptive hospital-based study enrolled 100 children aged 6–59 months admitted with SAM defined by WHO criteria (weight-for-height z-score <3 SD, mid-upper arm circumference <115 mm, or nutritional edema) at a tertiary care hospital over two years. Detailed demographic, feeding, immunization, anthropometric, and clinical data were recorded; hemoglobin and blood glucose were measured, and co-morbidities were documented by clinical assessment and investigations. Data were analyzed using SPSS; chi-square tests, t-tests, Pearson correlation, and multivariable logistic regression were applied, with $p < 0.05$ considered significant.

Results: The mean age was 27.59 ± 15.78 months, with the highest proportion (29%) in the 13–24 month group. Females comprised 53%. Most children belonged to lower (38%) or upper-lower (35%) socioeconomic classes, and 55% were from urban slums. Only 41% reported exclusive breastfeeding for six months. All children had MUAC <11.5 cm, 67% had weight-for-height <−3 SD, and 51% had edema. Nutritional anemia (72%), acute respiratory infection (57%), diarrhea (47%), sepsis (44%), and urinary tract infection (39%) were the leading co-morbidities; 98% had at least one co-morbidity. Mean hemoglobin was 9.62 ± 2.11 g/dL and mean blood glucose 73.48 ± 22.43 mg/dL. Developmental delay was present in 36%, and was strongly associated with mortality ($p < 0.001$). Overall, 86% were discharged, 7% died, and 7% left against medical advice; discharged children had the longest mean hospital stay (23.93 ± 2.31 days).

Conclusion: Hospitalized SAM children carry a heavy burden of infectious and nutritional co-morbidities, with anemia, respiratory infection, diarrhea, and sepsis predominating. Integrated management addressing infections, feeding practices, immunization gaps, and developmental surveillance is critical to improving outcomes.

Keywords: Severe Acute Malnutrition; Co-Morbidities; Anemia; Pneumonia; Diarrhea; Sepsis; Mid-Upper Arm Circumference; Child Mortality; India.

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Introduction

Malnutrition remains one of the most pervasive threats to child survival and development. Severe acute malnutrition (SAM) —characterized by severe wasting and/or nutritional edema —affects an estimated tens of millions of children under five years of age, and the great majority live in sub-Saharan Africa and South Asia, where it contributes directly or indirectly to a large fraction

of under-five deaths [1-7]. India carries a substantial share of this burden, and despite national programs and improving wealth indicators, pockets of severe malnutrition persist, particularly among the poorest households and in urban slums [8,9]. The World Health Organization defines SAM using independent diagnostic criteria: a weight-for-height z-score below −3 standard deviations, a mid-

upper arm circumference (MUAC) below 115 mm, or the presence of bilateral nutritional edema. Each criterion identifies children at elevated risk of death, and the indicators are complementary rather than interchangeable, with MUAC showing characteristic geographical variation particularly among children with edema [10,18,53].

The relationship between malnutrition and infection is bidirectional and self-reinforcing: malnutrition impairs immune competence and epithelial integrity, increasing susceptibility to infection, while infections — especially diarrheal disease and respiratory tract infections — worsen nutritional status through reduced intake, malabsorption, and increased nutrient requirements. This vicious cycle is a principal mechanism through which SAM children acquire multiple concurrent co-morbidities [11,12]. Socioeconomic deprivation, food insecurity, suboptimal infant and young child feeding practices, and incomplete immunization further amplify this risk [13-16,21,27-31]. Hospitalized SAM children typically present with a characteristic cluster of co-morbidities — nutritional anemia, acute respiratory infections, diarrhea, sepsis, urinary tract infections, tuberculosis, and measles — together with metabolic complications such as hypoglycemia, which independently predict mortality [26,31,32,39,40,43,45,46]. Beyond acute survival, early childhood malnutrition has lasting consequences for neurodevelopment, cognition, and adult brain function [33-36,62-65].

Understanding the local clinical and laboratory profile of SAM — including co-morbidity patterns and their association with outcomes — informs context-appropriate protocols for stabilization, infection management, feeding support, and follow-up. The present study was therefore undertaken to describe the co-morbidities and factors influencing outcomes among children aged 6–59 months hospitalized with SAM at a tertiary care hospital in North India.

Materials and Methods

Study Design and Setting: This investigation was designed as a descriptive study carried out in the Department of Pediatrics at Darbhanga Medical College and Hospital, Laheriasarai, a tertiary-level hospital serving both urban and surrounding rural populations, over a two-year duration from 2024 to 2026, after institutional ethics approval.

Study Population: Children aged 6 to 59 months admitted to the pediatric department with severe acute malnutrition (SAM) per WHO criteria were enrolled; a total of 100 cases meeting the definition of SAM were included after written informed consent from parents or guardians. SAM was

confirmed when weight-for-height was below 3 SD relative to WHO growth standards, when MUAC was under 115 mm, or when bilateral nutritional edema was clinically evident [24,25].

Exclusion Criteria: Children whose parents or guardians did not consent to participation were excluded.

Sample Size: The sample size was calculated using the formula $n = Z^2 \times p \times q / d^2$, where $Z = 1.96$ at 95% confidence, $p =$ expected prevalence of co-morbidities among SAM children of 0.86, $q = 0.14$, and $d =$ allowable error of 0.07, yielding 100 participants.

Methodology: After admission, we recorded detailed demographic information, including age, sex, socioeconomic background, and locality. Parents or caregivers provided a complete clinical history covering presenting complaints, feeding practices, and immunization status, followed by a thorough physical examination. Anthropometric measurements — weight, height or recumbent length, and mid-upper arm circumference — were obtained using standardized protocols with attention to accuracy and consistency, and children were examined for edema and visible signs of nutritional depletion. Laboratory evaluation included hemoglobin estimation, blood glucose measurement, chest imaging where indicated, and relevant investigations to identify accompanying illnesses such as respiratory tract infections, diarrheal disease, anemia, bloodstream infection, urinary infection, and tuberculosis. Developmental status was assessed and documented for each child.

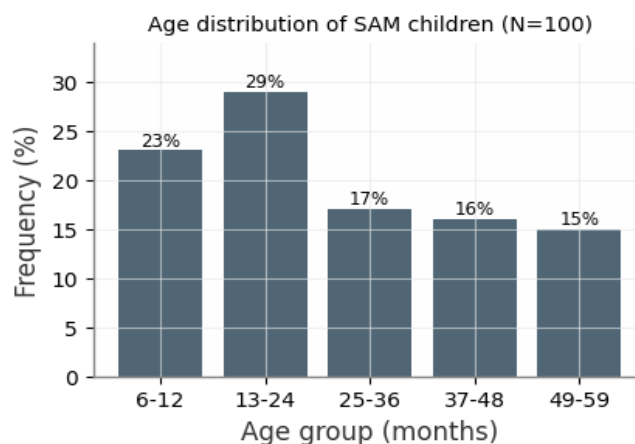
Statistical Analysis: Data were compiled and analyzed in SPSS. Continuous variables were described as mean $\pm$ standard deviation and qualitative variables as counts and percentages. We examined associations between categorical variables using the chi-square test, compared continuous variables between groups using the independent-samples t-test, and assessed correlations using the Pearson correlation coefficient. We used a multivariable logistic model to identify predictors independently associated with death. We considered p-values below 0.05 statistically significant.

Results

Age Distribution: The study enrolled 100 children hospitalized with SAM, aged 6 to 59 months, with a mean age of presentation of 27.59 ± 15.78 months. The 13–24 months group had the highest proportion (29.0%), followed by 6–12 months (23.0%), 25–36 months (17.0%), 37–48 months (16.0%), and 49–59 months (15.0%) (Table 1, Figure 1).

Table 1: Age distribution of SAM children (N=100)

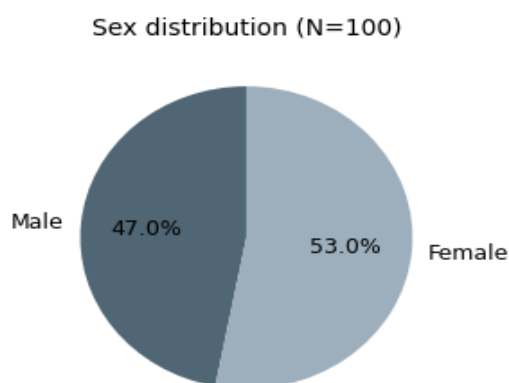
Age group (months)	Frequency (n)	Percentage (%)
06-Dec	23	23
13-24	29	29
25-36	17	17
37-48	16	16
49-59	15	15
Total	100	100
Mean $\pm$ SD		27.59 $\pm$ 15.78

**Figure 1: Age distribution of SAM children**

Sex Distribution and Outcomes by Sex: Female children constituted a slight majority, 53 (53.0%), versus 47 (47.0%) males, a male-to-female ratio of 0.89:1. Clinical outcomes did not differ significantly by sex ($\chi^2=0.672$, $p=0.715$): mortality was 8.51% (4/47) in males versus 5.66% (3/53) in females, with comparable discharge and LAMA (leave against medical advice) rates (Tables 2–3, Figures 2–3).

Table 2: Sex distribution of SAM children (N=100)

Sex	Frequency (n)	Percentage (%)
Female	53	53
Male	47	47
Total	100	100

**Figure 2: Sex distribution****Table 3: Cross-tabulation of sex versus clinical outcome**

Sex	Death		Discharged		LAMA		P-value
	(n)	(%)	(n)	(%)	(n)	(%)	
Female	3	42.86	47	54.65	3	42.86	0.715
Male	4	57.14	39	45.35	4	57.14	
Total	7	100	86	100	7	100	

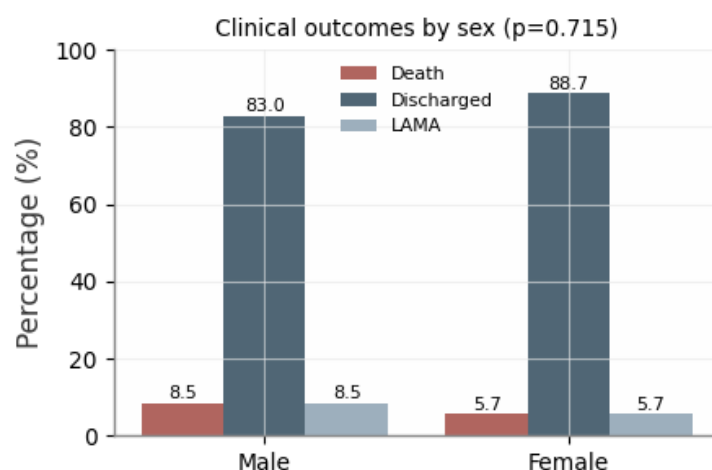


Figure 3: Clinical outcomes by sex

Socioeconomic and Locality Distribution: Most children belonged to the Lower socioeconomic class (38.0%), followed by Upper lower (35.0%) and Lower middle (27.0%), with no children from upper classes. Regarding locality, 55.0% were from urban slum areas and 45.0% from rural settings.

Socioeconomic status was significantly associated with locality ($p=0.022$); children of the Lower class predominantly resided in urban areas (71.1%), while lower middle-class children were more often from rural settings (63.0%) (Table 4, Figures 4–5).

Table 4: Distribution by socioeconomic and locality status

Variable	Category	Frequency (n)	Percentage (%)	P-value
Socioeconomic status	Lower	38	38	<0.05
	Upper lower	35	35	
	Lower middle	27	27	
Locality	Urban	55	55	
	Rural	45	45	

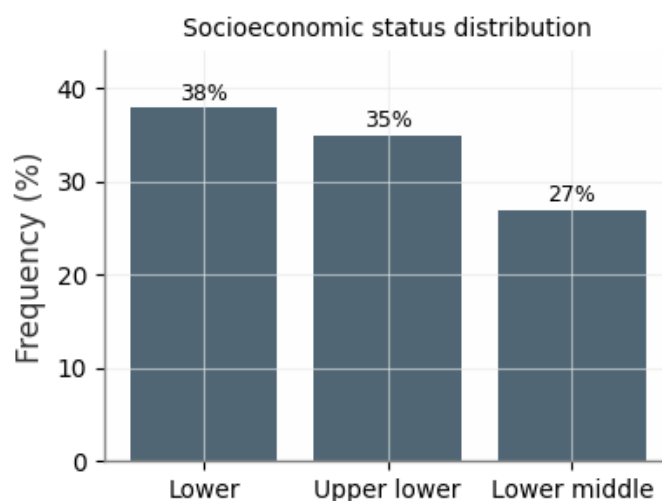
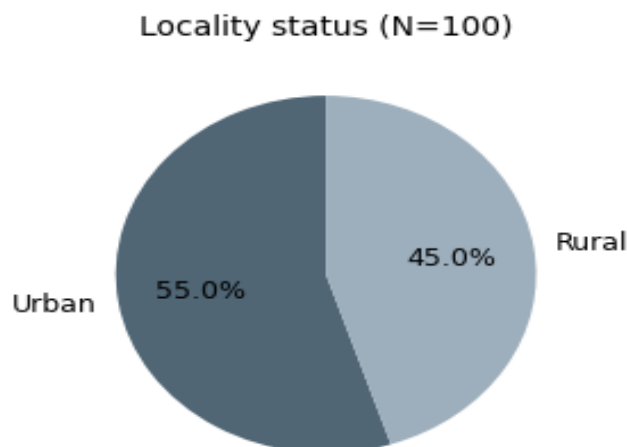


Figure 4: Distribution by socioeconomic status

**Figure 5: Locality status**

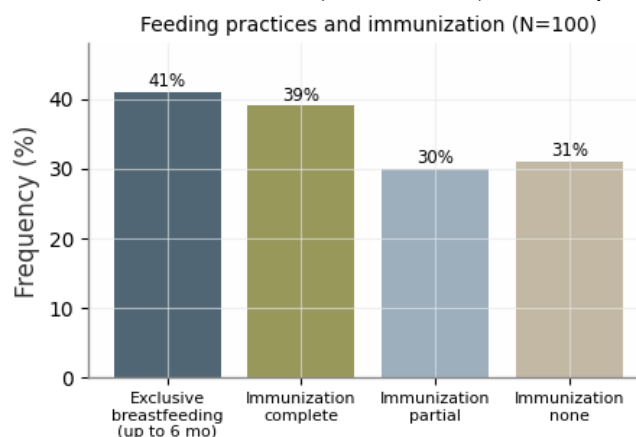
Feeding Practices and Immunization: Only 41.0% of mothers reported exclusive breastfeeding up to six months, while 59.0% had discontinued exclusive breastfeeding early or never initiated it. Complementary feeding was started in 76.0% of

children. Among children with available immunization records, 56.5% had complete immunization appropriate for age; as categorized in Table 5, 39% were fully immunized, 30% partially, and 31% not immunized (Table 5, Figure 6).

Table 5: Distribution of feeding practices and immunization

Variable	Category	n (%)
Exclusive breastfeeding up to 6 months	Yes	41 (41%)
	No	59 (59%)
Immunization	Complete	39 (39%)
	Partial	30 (30%)
	None	31 (31%)

Text and table denominators differ in the source thesis (see discussion); values reproduced as reported.

**Figure 6: Distribution of feeding practices and immunization**

Anthropometric Measurements and SAM Criteria: Mean weight was 8.95 ± 2.65 kg and mean height 86.69 ± 14.19 cm. By WHO SAM criteria, 67 (67.0%) children had severe wasting (weight-for-height < 3 SD), all 100 (100.0%) presented with MUAC < 11.5 cm, and edema was observed in 51 (51.0%) (Table 6, Figure 7).

Table 6: Anthropometric measurements (N=100)

Variable	Category	Mean $\pm$ SD / n (%)
Anthropometry	Weight (kg)	8.95 ± 2.65
	Height (cm)	86.69 ± 14.19
WHO SAM criteria	W/H < -3 SD	67 (67.00%)
	MUAC < 11.5 cm	100 (100.00%)
	Edema	51 (51.00%)

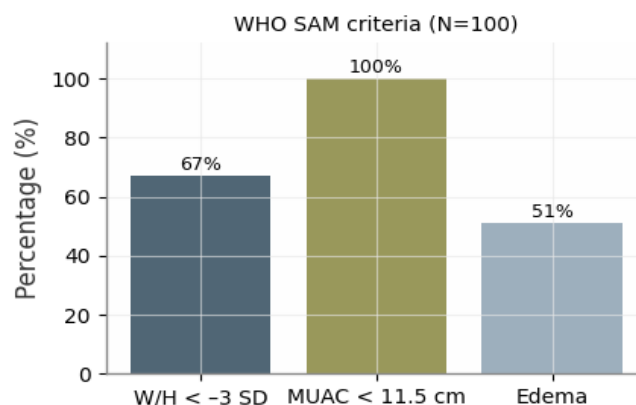


Figure 7: WHO SAM criteria

Frequency and Distribution of Co-morbidities:

Nutritional anemia was the most prevalent co-morbidity, affecting 72 (72.0%), followed by acute respiratory infection in 57 (57.0%), diarrhea in 47 (47.0%), sepsis in 44 (44.0%), and urinary tract infection in 39 (39.0%). Tuberculosis was

identified in 11 (11.0%), meningitis in 8 (8.0%), and measles in 5 (5.0%).

Only 2% of children had no additional co-morbidity, while 33.0% had two, 38.0% had three, and 23.0% had four or more concurrent co-morbidities (Table 7, Figure 8).

Table 7: Frequency of co-morbidities in hospitalized SAM children (N=100)

Co-morbidity	Frequency (n)	Percentage (%)
Nutritional anemia	72	72
Acute respiratory infection (ARI)	57	57
Diarrhoea	47	47
Sepsis	44	44
Urinary tract infection (UTI)	39	39
Tuberculosis	11	11
Meningitis	8	8
Measles	5	5

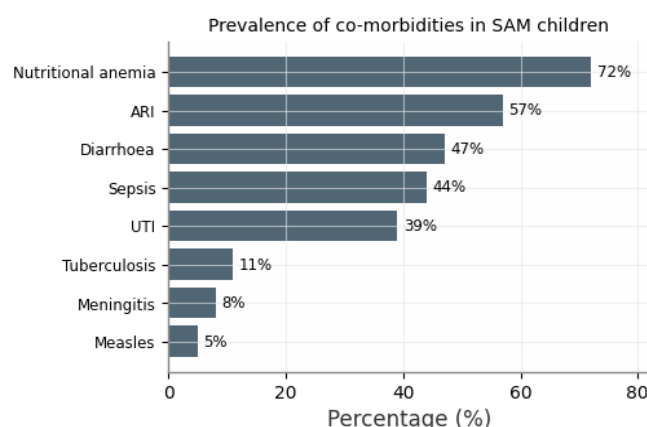


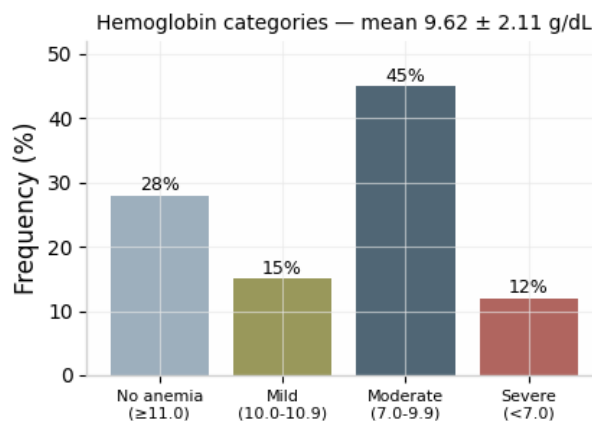
Figure 8: Prevalence of co-morbidities in SAM children

Laboratory Parameters: Mean hemoglobin was 9.62 ± 2.11 g/dL (range 6.0–13.1 g/dL); 72% met criteria for anemia, with moderate anemia (7–9.9 g/dL) in 45.0%, mild (10–10.9 g/dL) in 15.0%, and severe (<7 g/dL) in 12.0% (Table 8, Figure 9). Mean blood glucose was 73.48 ± 22.43 mg/dL (range 45–120 mg/dL); 51.0% had normal levels, 32.0% exhibited hypoglycemia (24% severe <54 mg/dL; 17% mild 54–69 mg/dL), and 8.0% had

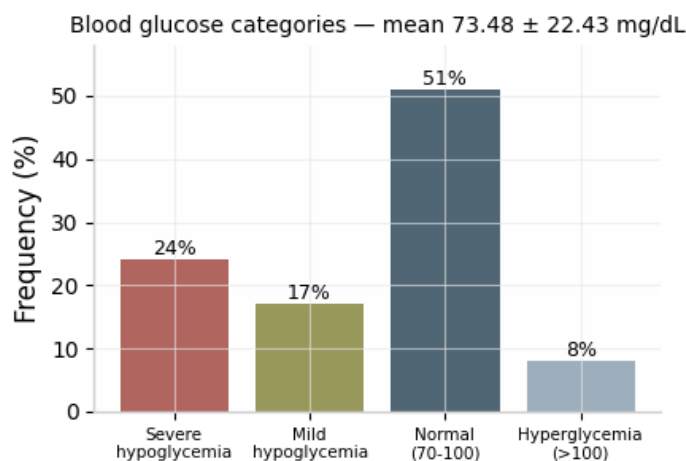
hyperglycemia (>100 mg/dL) (Table 9, Figure 10). Pearson correlation showed no significant association between hemoglobin and age ($r=0.092$, $p=0.361$) or between blood glucose and age ($r=0.031$, $p=0.759$). Mean hemoglobin did not differ significantly between children discharged (9.50 ± 2.13 g/dL) and those who died (10.43 ± 1.91 g/dL; $t=1.116$, $p=0.267$) (Table 10).

Table 8: Hemoglobin level categories (WHO criteria)

Hemoglobin Category	Frequency (n)	Percentage (%)
No anemia (≥ 11.0)	28	28
Mild anemia (10.0-10.9)	15	15
Moderate anemia (7.0-9.9)	45	45
Severe anemia (< 7.0)	12	12
Mean $\pm$ SD (g/dL)	9.62 $\pm$ 2.11	

**Figure 9: Hemoglobin distribution****Table 9: Blood glucose categories**

Glucose category	Frequency (n)	Percentage (%)
Severe hypoglycemia (< 54 mg/dL)	24	24
Mild hypoglycemia (54-69 mg/dL)	17	17
Normal (70-100 mg/dL)	51	51
Hyperglycemia (> 100 mg/dL)	8	8
Mean $\pm$ SD (mg/dL)	73.48 $\pm$ 22.43	

**Figure 10: Blood glucose distribution****Table 10: Descriptive statistics of laboratory parameters**

Parameter	Mean $\pm$ SD	Median	Range	P-value
Hemoglobin (g/dL)	9.62 $\pm$ 2.11	9.55	6.0 - 13.1	0.361
Blood glucose (mg/dL)	80.35 $\pm$ 20.98	81	45.0 - 120.0	0.759

The mean glucose in the source thesis descriptive table (80.35 $\pm$ 20.98 mg/dL) differs from its category table (73.48 $\pm$ 22.43 mg/dL); both are reproduced as reported.

Developmental Status: Age-appropriate development was present in 64.0% of children, while developmental delay affected 36.0% — motor delay 22.0%, speech delay 8.0%, and global developmental delay 6.0%. Developmental status

was strongly associated with clinical outcome ($p < 0.001$).

Children with global developmental delay had the highest mortality (83.3%, 5/6 deaths), while no

deaths occurred among children with normal development or isolated speech delay (Tables 11–12, Figures 11–12).

Table 11: Developmental status distribution

Developmental status	Frequency (n)	Percentage (%)
Normal	64	64
Motor delay	22	22
Speech delay	8	8
Global developmental delay	6	6
Total	100	100

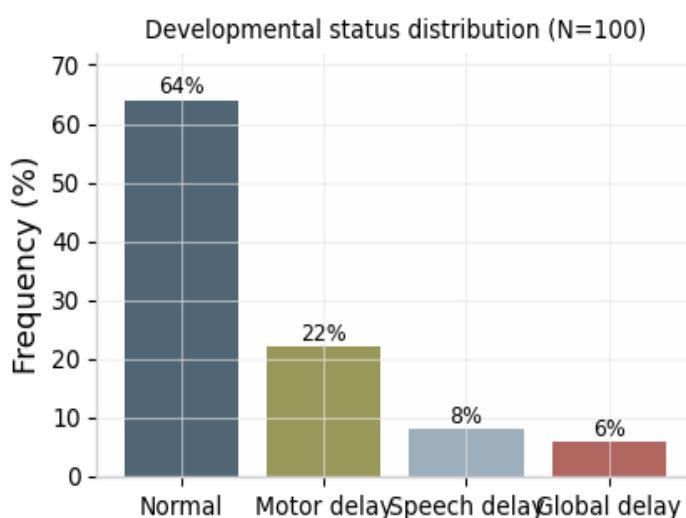


Figure 11: Distribution of developmental status

Table 12: Developmental status versus clinical outcome

Developmental status	Death		Discharged		LAMA		P-value
	(n)	(%)	(n)	(%)	(n)	(%)	
Global developmental delay	5	71.43	0	0	1	14.29	<0.001
Motor delay	2	28.57	17	19.77	3	42.86	
Normal	0	0	64	74.42	0	0	
Speech delay	0	0	5	5.81	3	42.86	
Total	7	100	86	100	7	100	

Clinical Outcomes and Hospital Stay: Overall, 86.0% of hospitalized SAM children were discharged; the case fatality rate was 7.0% (7 deaths), and 7.0% left against medical advice (Table 13, Figure 13). Discharged patients had the longest mean hospitalization (23.93 ± 2.31 days, median 25 days), followed by those who died (10.86 ± 4.18 days, median 8 days) and LAMA cases (9.71 ± 4.15 days, median 9 days); these differences were statistically significant ($p < 0.001$) (Table 14, Figure 14).

Table 13: Clinical outcomes of hospitalized SAM children

Outcome	Frequency (n)	Percentage (%)	Case fatality rate (%)
Discharged	86	86	-
Death	7	7	7
LAMA	7	7	-

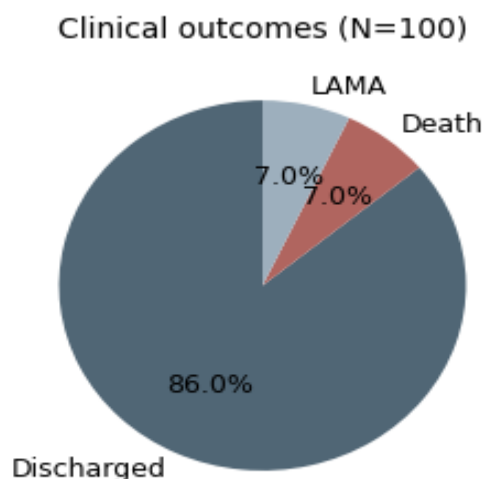


Figure 12: Distribution of clinical outcomes

Table 14: Hospital stay duration by clinical outcome

Outcome	Mean $\pm$ SD (days)	Median (days)	P-value
Death	10.86 $\pm$ 4.18	8	<0.001
Discharged	23.93 $\pm$ 2.31	25	
LAMA	9.71 $\pm$ 4.15	9	

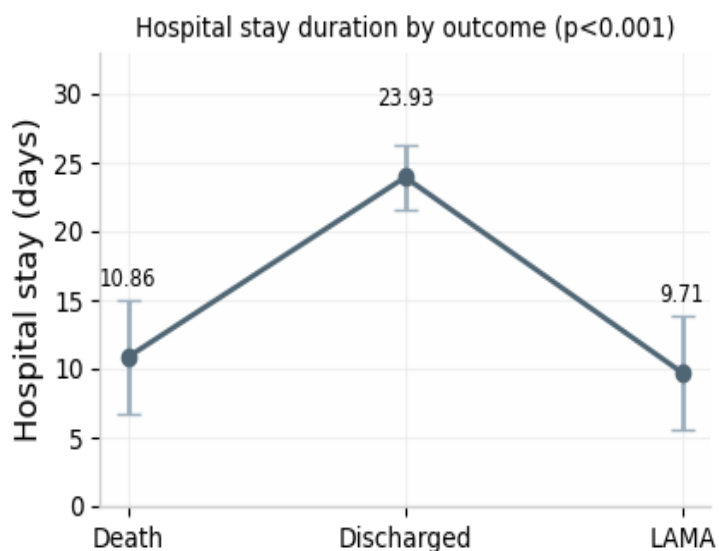


Figure 13: Hospital stay duration by outcome

Correlation Analysis: Three statistically significant associations emerged: a weak positive correlation between weight and height ($r=0.316$, $p<0.001$); a weak negative correlation between hemoglobin and the total number of co-morbidities ($r=0.348$, $p<0.001$); and a weak negative correlation between weight and total co-morbidities ($r=0.216$, $p<0.05$). Age did not correlate

significantly with weight ($r=0.032$, $p=0.749$) or height ($r=0.042$, $p=0.675$).

MUAC correlated significantly with weight ($r=0.078$, $p<0.001$) and hemoglobin ($r=0.403$, $p<0.001$), as reported in the source thesis (Table 15).

Table 15: Pearson correlation matrix of continuous variables (N=100)

Variables	Age (mo)	Weight (kg)	Height (cm)	MUAC (cm)	Hb (g/dL)	Glucose	Stay (d)	Comorbidities
Age (months)	1	0.032	0.042	0.089	0.092	0.031	0.012	0.007
Weight (kg)	0.032	1	0.316	0.682	0.011	0.091	-0.01	-0.218
Height (cm)	0.042	0.316	1	-0.195	-0.111	-0.079	-0.03	0.121
MUAC (cm)	0.089	0.078	-0.195	1	0.032	-0.154	0.034	-0.054
Hemoglobin (g/dL)	0.092	0.011	-0.111	0.403	1	0.018	0.076	-0.239
Blood glucose (mg/dL)	0.031	0.091	-0.079	-0.154	0.018	1	-0.067	-0.047
Hospital stays (days)	0.012	-0.01	-0.03	0.034	0.076	-0.067	1	-0.059
Total co-morbidities	0.007	-0.218	0.121	-0.217	-0.239	-0.047	-0.059	1

Values reproduced exactly as in the source thesis; some entries are inconsistent with the narrative text (e.g., MUAC-weight and hemoglobin-co-morbidity correlations)

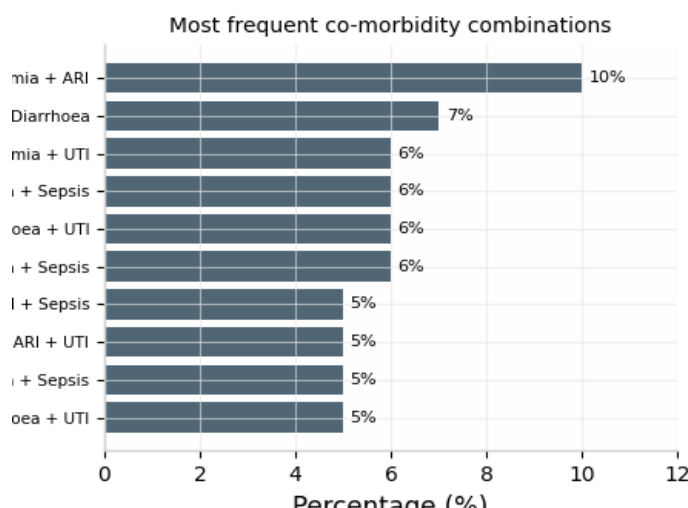
Co-morbidity Pattern Analysis: The most frequent profile was anemia co-existing with acute respiratory infection (10.0%), followed by the triad of anemia, ARI, and diarrhea (7.0%); anemia with

UTI, anemia with sepsis, and the quadruple combination of anemia, ARI, diarrhea, and UTI each accounted for 6.0% (Table 16, Figure 14).

Analysis by SAM type revealed no significant difference in mean co-morbidity burden ($F=1.881$, $p=0.138$): Marasmus 3.03 ± 1.16 , Marasmic-Kwashiorkor 2.97 ± 0.87 , unclassified 2.56 ± 0.73 , and Kwashiorkor 2.41 ± 1.33 .

Table 16: Most frequent co-morbidity combinations

Co-morbidity profile	Frequency (n)	Percentage (%)
Anemia + ARI	10	10
Anemia + ARI + Diarrhoea	7	7
Anemia + UTI	6	6
Anemia + Sepsis	6	6
Anemia + ARI + Diarrhoea + UTI	6	6
Diarrhoea + Sepsis	6	6
Anemia + ARI + Sepsis	5	5
Anemia + ARI + UTI	5	5
Anemia + Diarrhoea + Sepsis	5	5
Anemia + Diarrhoea + UTI	5	5

**Figure 14: Most frequent co-morbidity combinations**

Discussion

This investigation enrolled 100 children hospitalized with severe acute malnutrition and describes their demographic profile, feeding and

immunization practices, co-morbidity burden, and outcomes at a tertiary care hospital in North India.

Age, Sex, and Socioeconomic Profile: The mean age of presentation was 27.59 ± 15.78 months, with the highest burden in the 13–24 month group

(29.0%); notably, 31.0% of cases were older preschool children aged 37–59 months. Hierarchical analyses across low- and middle-income countries confirm that children under 24 months carry the greatest risk of SAM, and community-based data from Vellore similarly show that a substantial proportion of SAM extends beyond infancy, pointing to local factors such as delayed weaning, prolonged food insecurity, and cumulative recurrent infections [47,48].

Females marginally outnumbered males (53% versus 47%), consistent with reports from north-western Nigeria where household feeding behaviors place girls at a nutritional disadvantage, although — as in the present cohort — sex was not a significant determinant of mortality when treatment was provided [49,50]. The concentration of cases in the lower and upper-lower socioeconomic strata, and the significant association between poverty and urban slum residence, underscore socioeconomic deprivation as a fundamental driver of SAM; multivariate analyses identify low socioeconomic status as one of the strongest predictors of SAM [13,14,16,21,27,28,30,38,51]. The urban predominance among the poorest children highlights urban food deserts and disrupted traditional food systems in rapidly urbanizing settings [14,50].

Anthropometry and SAM Classification: All children met the MUAC criterion; about two-thirds had weight-for-height below 3 SD, and roughly half had bilateral pitting edema; the distribution by SAM type was Marasmic-Kwashiorkor 34%, Marasmus 33%, Kwashiorkor 17%, and MUAC-only 16%. MUAC proved a consistent, feasible screening criterion, consistent with evidence that it identifies high-risk children at least as well as weight-for-height in resource-constrained settings, and that children with combined anthropometric deficits fare worse. Those identified by MUAC alone [18,52–55]. Sex did not influence the degree of growth faltering, and SAM type was not significantly associated with outcome ($p=0.873$), consistent with multi-country pooled analyses showing comparable outcomes across SAM types when standardized treatment protocols are followed [55].

Co-morbidity Burden: Nutritional anemia (72%), acute respiratory infection (57%), diarrhea (47%), sepsis (44%), and urinary tract infection (39%) were the leading co-morbidities, and 98% of children had at least one concurrent condition, with 23% carrying four or more. This profile closely mirrors hospital-based studies from India and elsewhere, which repeatedly identify anemia and respiratory and diarrheal infections as the dominant concurrent illnesses in SAM, and reflects the well-established malnutrition–infection vicious cycle [11,12,26,31,32,39,40,43,45,56–58]. The weak negative

correlations of hemoglobin and weight with the total number of co-morbidities further support cumulative infectious burden as a marker of severity.

Feeding, Immunization, and Development:

Exclusive breastfeeding for six months was reported in only 41%, complementary feeding in 76%, and complete immunization in about 56.5% of children with records — substantial gaps that mirror regional data linking suboptimal breastfeeding, inappropriate complementary feeding, and incomplete immunization to malnutrition [59–61]. Developmental delay affected 36% of the cohort and was strongly associated with mortality ($p<0.001$), with global developmental delay carrying an 83.3% case fatality. This finding aligns with systematic evidence that childhood malnutrition impairs neurodevelopment, cognition, and behavior, and with studies demonstrating both the burden of developmental delay in SAM and the potential for partial recovery with nutritional rehabilitation [33–37,62–65].

Laboratory Parameters, Metabolic Risk, and Outcomes:

Mean hemoglobin of 9.62 ± 2.11 g/dL confirmed anemia in 72%, predominantly moderate severity; anemia in this setting arises from iron and micronutrient deficiency compounded by anemia of chronic disease, as suggested by its inverse correlation with co-morbidity count [46,67].

Hypoglycemia affected 32% of children — a recognized, dangerous complication of SAM that demands routine screening during stabilization [66,68]. Overall survival was 86% discharged, 7% died, and 7% left against medical advice; the 7% inpatient case fatality is at the lower end of published inpatient mortality series and systematic reviews, reflecting effective implementation of standardized management protocols [19,20,23,37,41,42,52,68–73]. Discharged children had the longest mean stay (23.93 days), consistent with the time required for nutritional rehabilitation, while shorter stays among deaths and LAMA cases reflect early deterioration or attrition [37,42,54,68]. Finally, antibiotic use and resistance are growing concerns in SAM management, with hospitalized children frequently carrying resistance genes; judicious antimicrobial stewardship remains an integral part of SAM care [44,74].

Strengths and Limitations: Strengths include the systematic application of WHO SAM criteria, comprehensive documentation of co-morbidities with laboratory confirmation, and correlation of clinical, anthropometric, and outcome variables. Limitations include the single-center descriptive design, the absence of longitudinal follow-up after discharge to assess relapse and recovery, incomplete assessment of complementary feeding

adequacy, and the modest sample size, which limits multivariable modeling of mortality predictors. Larger prospective multicenter studies with standardized outcome definitions are needed to refine risk stratification in hospitalized SAM children [4,17,22,29,41,71].

Conclusion

Hospitalized children with severe acute malnutrition at this tertiary care center carried a heavy burden of co-morbid illness: nutritional anemia affected nearly three-quarters, and acute respiratory infection, diarrhea, sepsis, and urinary tract infection each affected a substantial proportion, with almost all children harboring at least one concurrent condition. Hypoglycemia was present in nearly a third; exclusive breastfeeding and complete immunization coverage were suboptimal, and developmental delay — strongly associated with mortality — affected more than a third of the cohort. Outcomes were nevertheless favorable for most children, with 86% discharged alive, supporting the effectiveness of standardized inpatient SAM management. These findings underscore the need for integrated strategies that combine prompt identification using MUAC and weight-for-height criteria, aggressive management of infections and metabolic complications, promotion of optimal infant and young child feeding, catch-up immunization, and developmental surveillance with nutritional rehabilitation to reduce the burden of severe acute malnutrition in this region.

Declarations:

Ethics approval and consent to participate: The Institutional Ethics Committee of Darbhanga Medical College and Hospital approved the study protocol; written informed consent was obtained from parents or guardians. Consent for publication: Not applicable. Availability of data and materials: Available from the corresponding author on reasonable request. Competing interests: The author declares no competing interests. Funding: None. Acknowledgements: The author thanks the faculty and staff of the Department of Pediatrics, Darbhanga Medical College and Hospital, and the participating families.

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