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Original Article

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The burden of HIV infected severely acute malnourished children in four health facilities in the Bamenda municipality, Cameroon

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Abstract

Introduction: Severe acute malnutrition (SAM) remains a major cause of morbidity and mortality among children, particularly in developing countries. The presence of HIV worsens this condition, creating a vicious cycle that increases morbidity and mortality. This study aims to assess the profile of children with SAM infected with HIV across four hospitals in Bamenda municipality.

Materials and Methods: This retrospective longitudinal study included children aged 6 weeks to 15 years hospitalized for SAM between January 1st, 2020, and December 31st, 2024, in Bamenda Regional Hospital, Nkwen District Hospital, Saint Blaise Catholic Hospital, and Saint Mary Soledad Catholic Hospital. The sociodemographic information, type of malnutrition, clinical presentation, HIV status and hospital outcome were collected using a pretested study-specific questionnaire, entered into Microsoft Excel, and analyzed with SPSS version 27.

Results: Out of the 217 children with SAM, 54 were HIV-infected, giving a prevalence of 24.9%. The mean age of HIV-infected children was 22.4 months, with a female predominance (sex ratio 1.7). Marasmic kwashiorkor was the clinical form most strongly associated with HIV (aOR=5.05; 95% CI: 1.36–18.68; p=0.015). Dyspnea was the symptom significantly associated with HIV (aOR=5.41; 95% CI: 2.67–10.96; p<0.001), while lymphadenopathy and mouth ulcers were the clinical signs most associated with HIV (aOR=5.19; 95% CI: 1.40–19.80; p=0.013). Purulent otitis (aOR=12.11; 95% CI: 3.12–47.08; p<0.001) and tuberculosis (aOR=12.80; 95% CI: 1.23–133.05; p=0.032) were the pathologies significantly associated with HIV infection. The mean hospitalization duration was longer among HIV-positive children (11.8 days) compared to HIV-negative peers (9.9 days).

Conclusion: HIV prevalence among children with SAM was 24.9%. Marasmic kwashiorkor, dyspnea, lymphadenopathy, mouth ulcers, purulent otitis, and tuberculosis were significantly associated with HIV in SAM cases. Hospital stay was longer among HIV-infected children.

Keywords: severe acute malnutrition, HIV, children

Résumé

Le fardeau des enfants souffrant de malnutrition aiguë sévère infectés par le virus de l'immunodéficience humaine dans quatre formations sanitaires dans la municipalité de Bamenda, Cameroun.

Introduction: La malnutrition aiguë sévère (MAS) demeure une cause majeure de morbidité et de mortalité chez les enfants, en particulier dans les pays en développement. La présence du VIH aggrave cette condition, créant un cercle vicieux qui accroît la morbidité et la mortalité. Cette étude visait à évaluer le profil des enfants atteints de MAS infectés par le VIH dans quatre hôpitaux de la municipalité de Bamenda.

Matériels et Méthodes : Il s'agit d'une étude de cohorte rétrospective incluant des enfants âgés de 6 semaines à 15 ans hospitalisés pour MAS entre le 1er janvier 2020 et le 31 décembre 2024 à l'Hôpital Régional de Bamenda, l'Hôpital de District de Nkwen, l'Hôpital Catholique Saint Blaise et l'Hôpital Catholique Sainte Marie Soledad. Les données ont été recueillies à l'aide d'un questionnaire prétesté spécifique à l'étude, saisies dans Microsoft Excel et analysées avec SPSS version 27.

Résultats : Sur 217 enfants atteints de MAS, 54 étaient infectés par le VIH, soit une prévalence de 24,9 %. L'âge moyen des enfants infectés était de 22,4 mois, avec une prédominance féminine (sex-ratio 1,7). Le kwashiorkor marasmique était la forme clinique la plus fortement associée au VIH (aOR=5,05 ; IC95% : 1,36–18,68 ; p=0,015). La dyspnée était le symptôme significativement associé au VIH (aOR=5,41 ; IC95% : 2,67–10,96 ; p<0,001), tandis que l'adénopathie et les ulcères buccaux constituaient les signes cliniques les plus associés (aOR=5,19 ; IC95% : 1,40–19,80 ; p=0,013). L'otite purulente (aOR=12,11 ; IC95% : 3,12–47,08 ; p<0,001) et la tuberculose (aOR=12,80 ; IC95% : 1,23–133,05 ; p=0,032) étaient les pathologies significativement liées à l'infection par le VIH. La durée moyenne d'hospitalisation était significativement plus longue chez les enfants séropositifs au VIH (11,8 jours) comparativement à leurs pairs séronégatifs (9,9 jours).

Conclusion : La prévalence du VIH chez les enfants atteints de MAS était de 24,9 %. Le kwashiorkor marasmique, la dyspnée, l'adénopathie, les ulcères buccaux, l'otite purulente et la tuberculose étaient significativement associés au VIH dans les cas de MAS. La durée d'hospitalisation était plus longue chez les enfants infectés par le VIH.

Mots clés : malnutrition aiguë sévère, VIH, enfants

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What is known on this topic

- Severe acute malnutrition (SAM) and HIV reinforce each other, increasing morbidity, mortality, and hospital stay in children.
- Reported HIV prevalence among SAM children in sub-Saharan Africa ranges from 8% to 33%.
- No previous study has examined the profile of HIV in severely malnourished children in Bamenda.

What this study adds

- This study affirms existing information on the high burden of HIV infection in hospitalised malnourished children in Bamenda.
- Marasmic kwashiorkor was the commonest form of SAM in our setting unlike most studies who reported marasmus.
- Tuberculosis and purulent otitis were strongly associated with HIV infection in malnourished children.

1 | INTRODUCTION

Although global progress has been made in reducing child malnutrition and HIV-related mortality, both conditions remain major public health challenges, especially in low- and middle-income countries. Severe acute malnutrition (SAM) is one of the leading causes of morbidity and mortality among children under five, accounting for approximately 45 million cases worldwide in 2022, with the highest burden in sub-Saharan Africa and South Asia [1-7]. In Africa alone, an estimated 12 million children are affected by SAM annually, contributing significantly to child mortality [8-12].

HIV infection further exacerbates malnutrition by impairing immunity, reducing appetite, and increasing vulnerability to opportunistic infections. Conversely, malnutrition accelerates HIV progression by weakening host defences and worsening clinical outcomes, thus creating a vicious cycle that disproportionately affects children [13- 15]. Studies have consistently shown that HIV- positive children with SAM experience higher rates of morbidity, prolonged hospital stay, and increased mortality compared to their HIV- negative counterparts [16-17].

Despite these challenges, data on the interaction between HIV and SAM remain limited in many parts of Africa, including Cameroon. Previous studies from Yaoundé reported HIV prevalence rates ranging between 26.7% and 32.9% among children admitted with SAM, with HIV strongly associated with opportunistic infections and poor nutritional recovery [18-19]. However, no study to date has examined this issue in Bamenda municipality, despite the high burden of paediatric HIV and malnutrition. This study therefore aims to assess the profile of severely malnourished children infected with HIV in four major hospitals in Bamenda, Cameroon.

2 | MATERIALS AND METHODS

Study design

We conducted a five-year retrospective longitudinal study using hospital files/records of children admitted with severe acute malnutrition (SAM) between 1st January 2020 to 31st December 2024.

Study setting

The study was carried out in four health facilities within Bamenda municipality, North West Region of Cameroon: Bamenda Regional Hospital, Nkwen District Hospital, Saint Mary Soledad Catholic Hospital, and Saint Blaise Catholic Hospital. These hospitals serve urban and semi-urban populations and are the main referral centres for paediatric care in the municipality. Each paediatric unit is staffed with medical doctors, nurses, and equipped with basic emergency and monitoring facilities.

Study population

The study included children aged 6 weeks to 15 years who were hospitalized for SAM during the study period. SAM was defined according to WHO criteria (weight-for-height/length Z-score < –3, or mid-upper arm circumference <11.5 cm, or the presence of bilateral pitting oedema). Children with incomplete records or missing HIV results were excluded.

Sample size and sampling

All eligible cases of SAM admitted during the study period and meeting inclusion criteria were consecutively enrolled.

The minimum sample size for the statistical significance of our study was calculated using Cochran's formula[20].

$$n = \frac{Z^2 . (P.(1-P)}{e^2}$$

n =Sample size

z =Z-score corresponding to the desired confidence level = 1.96

p =Estimated proportion of the population with the characteristic of interest which was calculated using the prevalence of HIV infected malnourished children in the study of Mandjo et al is 26,6%[19]. Hence p=0,266 e =7% (0.007). This gave a minimum sample size of 153 participants

Data collection

Data were extracted from hospital records using a structured and pretested questionnaire designed for the study. Variables collected included socio-demographic characteristics (age, sex, residence, parental occupation, education), clinical present - ation (symptoms, signs, type of malnutrition), comorbidities, HIV status, duration of hospitaliz - ation, and outcomes.

Data management and analysis

Data were entered into Microsoft Excel, cleaned, and analysed using SPSS version 27. Descriptive statistics (means, medians, proportions) were computed. Associations between HIV status and categorical variables were assessed using Chi-square or Fisher's exact tests where appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Logistic regression was used to identify independent associations. A p-value <0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of the Faculty of Health Sciences (2025/0017H/Uba/IRB), University of Bamenda. Administrative authorization was also granted by the Regional Delegation of Public Health and the directors of the participating hospitals.

3| RESULTS

Throughout our study, a total of 217 participants with SAM were recruited, with 54 being HIV infected, giving a prevalence of 24.9%.

Sociodemographic characteristics of the children

In the HIV infected children, the age range spanned from 4 months to 12 years and the most represented age group were those aged 12 to 24 months (23.9%). The mean age of the infected children was 22.4 months. We had more females than males giving a sex ratio of 1.7 and most of the infected children resided in urban areas (72.2%).

In the non-infected children, the age range spanned from 2 months to 14years and the most represented age group were those aged 12 to 24months (76.1%). The mean age of the non-infected children was 18 months. We also had more females than males giving a sex ratio of 1.32 and most of the non-infected children lived in urban areas (75.8%) (Table I)

Table I. Sociodemographic characteristics of the children (N=217)

Variables	Total (n=217)	HIV+ (n=54)	HIV - (n=163)
	N	N	N
Age(months)			
≤6	11(5.1)	6(54,5)	5(45.5)
]6-12]	79(36.4)	15(19.0)	64(81.0)
]12 -24]	92(42.4)	22(23.9)	70(76.1)
]24 -36]	8(3.7)	0(0)	8(100)
]36 -48]	10(4.6)	2(20.0)	8(80.0)
]48 -60]	2(0.9)	1(50.0)	1(50.0)
>60	15(6.9)	8(53.3)	7(46.7)
Sex			
Male	90(41.5)	20(22.2)	70(77.8)
Female	127(58.5)	34(26.8)	93(73.2)
Residence			
Urban	161(74.2)	39(24.2)	122(75.8)
Rural	56(25.8)	15(26.8)	41(73.2)

In HIV infected children, the mothers age ranged from 19 to 42years with more than half of the mothers aged between 20 and 30 years (48.1%). The mean age for the mothers of infected children was 32.3 years. The mothers of 6 (11.5%) of the children who were both malnourished and HIV-infected had died. The HIV status of most of these mothers were positive (74.0%) and half of them had a liberal profession (50%).

In the non-infected children, the mothers were aged 17 to 43years with most of the mothers aged between 20 to 30years (64.4%). The mean age for the mothers of non-infected children was 29.9 years. Most of their mothers were also alive (95.0%) and most had a negative serological status (54.7%). Regarding their occupation, most of them had a liberal profession (62.0%) (Table II).

Table II. Sociodemographic characteristics of the mothers (N=217)

Variables	Total (n=217)	HIV+ (n=54)	HIV- (n=163)
	N%	N%	N%
Age (years)			
<20	4(1.8)	1(1.9)	3(1.8)
[20-30[	131(60.4)	26(48.1)	105(64.4)
>30	82(37.8)	27(50)	55(33.8)
Living status			
Alive	203(93.5)	48(88.9)	155(95.0)
Dead	14(6.5)	6(11.1)	8(5.0)
Serological status			
Unknown	84(38.7)	13(24.0)	71(43.5)
Positive	43(19.8)	40(74.0)	3(1.8)
Negative	90(41.5)	1(2.0)	89(54.7)
Profession			
Unemployed	26(12.0)	8(14.8)	18(11.0)
Liberal*	128(59.0)	27(50.0)	101(62.0)
Non-liberal**	63(29.0)	19(35.2)	44(27.0)

*Liberal: Seamstress, hair dresser, farmer, business, driver.
**Non liberal: Teacher, civil servants, accountant, cashier.

Nutritional status of the study population

Marasmus was the most common clinical form of SAM in our study population (88.5%). Marasmic kwashiorkor was significantly associated with HIV infection (aOR= 5.05; CI95% (1.36-18.68); p=0.015). (Table III)

Table III: Nutritional status of the study population (N=217)

Variable	Total N(%) (n=217)	HIV+ N(%) (n=54)	HIV- N(%) (n=163)	OR(95%CI)	P-value	aOR(95%CI)	P-value
MUAC (cm)							
<11.5	127(58.6)	38(29.9)	89(70.1)	1.49 (0.69–3.46)	0.324		
11.5<MUAC<12.5	45(20.7)	6(13.3)	39(86.7)	0.54 (0.17–1.6)	0.274		
>12.5	45(20.7)	10(22.2)	35(77.8)				
Z-score W/H							
<-3	205(94.5)	50(24.4)	155(75.6)				
-3< Z-score <-2	12(4.5)	4(33.3)	8(66.7)	1.55 (0.33–6.07)	0.498		
>-2	0(0)	0(0)	0(0)				
Z-score W/A							
<-3	180(83.0)	44(24.4)	136(75.6)	0.86 (0.20–5.27)	0.733		
-3< Z-score <-2	26(12.0)	7(26.9)	19(73.1)	0.98 (0.16–7.39)	0.958		
>-2	11(5.0)	3(27.2)	8(72.2)				
Z-score H/A							
<-3	135(62.2)	36(26.7)	99(73.3)	1.4 (0.53 – 4.15)	0.517		
-3< Z-score <-2	48(22.1)	11(22.9)	37(77.1)	1.14 (0.35–3.97)	0.952		
>-2	34(15.7)	7(20.6)	27(79.4)				
Clinical Form							
Marasmus	192(88.5)	44(22.9)	148(77.1)				
Kwashiorkor	14(6.5)	4(28.6)	10(71.4)	1.34 (0.29–4.95)	0.743		
Marasmic Kwashiorkor	11(5.0)	6(54.5)	5(45.5)	**4 (0.97 – 17.42)**	**0.028**	**5.05 (1.36 – 18.68)**	**0.015**

Symptoms at admission of the study population

Loss of appetite and Asthenia were the most common symptoms on admission of children diagnosed with SAM (96.3% and 96.8% respectively). They were also the most common symptoms in infected children with SAM upon admission. Dyspnoea was significantly associated with HIV infection (OR= 5.41; CI95% (2.67-10.96); p=<0.001). (Table IV).

Table IV. Symptoms at admission of the study population (N=217)

Symptoms	Total N(%) (n=217)	HIV+ N(%) (n=54)	HIV- N(%) (n=163)	OR(95%CI)	P-value	aOR(95%CI)	P-value
Loss of appetite							
Yes	209(96.3)	53(25.4)	156(74.6)	2.37 (0.29–109.13)	0.682		
No	8(3.7)	1(12.5)	7(87.5)				
Asthenia							
Yes	210(96.8)	54(25.7)	156(74.3)				
N2o	7(3.2)	0(0)	7(100.0)				
Fever							
Yes	173(79.7)	48(27.7)	125(72.3)	2.42 (0.93–7.47)	0.077		
No	44(20.3)	6(13.6)	38(86.4)				
Convulsion							
Yes	12(5.5)	5(41.7)	7(58.3)	2.26 (0.54–8.72)	0.178		
No	205(94.5)	49(23.9)	156(76.1)				
Diarrhoea							
Yes	162(74.7)	43(26.5)	119(73.5)	1.44 (0.66–3.39)	0.371		
No	55(25.3)	11(20.0)	44(80.0)				
Vomiting							
Yes	181(83.8)	45(24.9)	136(75.1)	0.96 (0.4–2.5)	>0.999		
No	36(16.2)	9(25.0)	27(75.0)				
Cough							
Yes	70(32.3)	23(32.9)	47(67.1)	1.83 (0.92–3.62)	0.066		
No	147(67.7)	31(21.0)	116(79.0)				
Dyspnoea							
Yes	45(20.7)	24(53.3)	21(46.7)	**5.36 (2.51–11.62)**	**0.001**	**5.41 (2.67–10.96)**	**0.001**
No	172(79.3)	30(17.4)	142(82.6)				

Clinical signs at admission of the study population

Oedema (11.5%), lymphadenopathy (5.1%) and Mouth ulcers (5.1%) were the most common clinical signs at admission of children with SAM. They were also the most common clinical signs among the infected children upon admission. Lymphadenopathy and mouth ulcers were significantly associated with HIV infection (OR= 5.19; $CI_{95\%(1.40\text{-}19.80)}$; *p=<0.013*) (Table V)

Table V. Clinical signs at admission of the study population

Sign	Total N(%) (n=217)	HIV+ N(%) (n=54)	HIV- N(%) (n=163)	OR(95%CI)	P-value	aOR(95%CI)	P-value
Lymphadenopathy							
Yes	11(5.1)	7(63.6)	4(36.4)	**5.86 (1.42–28.52)**	**0.006**	**5.19 (1.40–19.80)**	**0.013**
No	206(94.9)	47(22.8)	159(77.2)				
Mouth Ulcer							
Yes	11(5.1)	7(63.6)	4(36.4)	**5.86 (1.42–28.52)**	**0.006**	**5.19 (1.40–19.80)**	**0.013**
No	206(94.9)	47(22.8)	159(77.2)				
Hepatomegaly							
Yes	6(2.8)	2(33.3)	4(66.7)	1.53 (0.13–11)	0.640		
No	211(97.2)	52(24.6)	159(75.4)				
Splenomegaly							
Yes	5(2.3)	1(20.0)	4(80.0)	0.75 (0.01–7.81)	>0.999		
No	212(97.7)	53(25.0)	159(75)				
Skin Lesion							
Yes	5(2.3)	2(40.0)	3(60.0)	2.04 (0.17–18.34)	0.600		
No	212(97.7)	52(24.5)	160(75.5)				
Oedema							
Yes	25(11.5)	10(40.0)	15(60.0)	2.19 (0.86–5.4)	0.065		
No	192(88.5)	44(22.9)	148(77.1)				

Table VI. Pathologies associated with SAM in the study population

Pathologies	Total N(%) (n=217)	HIV+ N(%) (n=54)	HIV- N(%) (n=163)	OR(95%CI)	P-value	aOR(95%CI)	P-value
Malaria							
Yes	79(37.3)	22(29.6)	57(70.4)	1.48 (0.75–2.91)	0.256		
No	138(62.7)	32(23.2)	106(76.8)				
Urinary tract infection							
Yes	20(9.2)	6(30.0)	14(70.0)	1.33 (0.4–3.94)	0.591		
No	197(90.8)	48(24.4)	149(75.6)				
Purulent Otitis							
Yes	14(6.5)	11(78.6)	3(21.4)	13.43 (3.35–78.24)	<0.001	12.11 (3.12–47.08)	<0.001
No	203(93.5)	43(21.2)	160(78.8)				
Pneumonia							
Yes	66(30.4)	24(36.4)	42(63.5)	2.3 (1.15–4.58)	0.016	1.97 (0.97–3.98)	0.059
No	151(69.6)	30(19.9)	121(80.1)				
Dysentery							
Yes	9(4.1)	0(0)	9(100)				
No	208(95.9)	54(26.0)	154(74.0)				
Unknown infection							
Yes	3(1.4)	2(66.7)	1(33.3)	6.17 (0.32–368.88)	0.153		
No	214(98.6)	52(24.3)	162(75.7)				
Tuberculosis							
Yes	5(2.3)	4(80.0)	1(20.0)	12.77 (1.23–639.64)	0.014	12.80 (1.23–133.05)	0.032
No	212(97.6)	50(23.6)	162(76.4)				
Meningitis							
Yes	11(5.1)	6(54.5)	5(45.5)	3.92 (0.95–16.99)	0.029	3.32 (0.86–12.82)	0.081
No	206(94.8)	48(23.3)	158(76.7)				

Malaria and pneumonia were the most common pathologies co-existed with SAM in the study population (37 . 3 % & 30 . 4 % respectively). They were also the most common associated pathologies among the infected children. Purulent otitis (OR= 12.11; CI 95% (3.12-47.08); *p=<0.001*) and Tuberculosis (OR= 12.80; CI 95% (1.23-133.05); *p=<0.032*) were the pathologies significantly associated with HIV infection, (Table VI).

Duration of hospitalisation of the study population

Most participants spent between more than 7 days in the hospital (82%). The mean duration of hospitalisation for HIV+ children was 11.8days as compared to 9.9days for the HIV- children. There was significant association between HIV status and duration of hospitalisation.

Also, most of the participants were discharged alive (81.5%). Six of the participants died giving a total mortality rate of 2.8% with 4(66.7%) of these participants being HIV infected.

4| DISCUSSION

In the HIV infected children, the mean age was 22.4 months while in the non-infected children, the mean age was 18 months. This differs slightly from reports by Mandjo et al in Cameroon where the mean ages of infected and non-infected children were 17 months and 12 months respectively [19]. This is because between 12–24 months, many children transition from complementary feeding to exclusively family foods. and nutrients supplied may be inadequate to meet daily needs. Inadequate or inappropriate complementary feeding practices can lead to nutritional deficiencies and increase the risk of SAM. In the HIV infected children, we had more females than males giving a sex ratio of 1.7. Similarly, in the non-infected children, we also had more females than males giving a sex ratio of 1.32. This differs from reports by Mandjo et al in Cameroon and Musiime et al in Uganda where most of the children with SAM were males and HIV in SAM was also more common in males as compared to females suggesting that sex may not significantly influence the risk of HIV transmission.[16,19].

The prevalence of HIV infection among children with severe acute malnutrition (SAM) in our study was 24.9%. This is comparable to findings by Mandjo et al. in Cameroon (26.7%) and Asafo-Agyei et al. in Ghana (27.2%)[19,21]. However, it is lower than the prevalence reported by Nguefack et al. in Cameroon (32.9%) and significantly higher than that reported by Musiime et al. in Uganda (9.5%) and Madec et al. in Niger (8.6%) [16-18]. These variations may reflect differences in HIV burden across regions, access to preventive services, and differences in study settings or population characteristics.

Children with HIV were found to have higher chances of developing marasmic kwashiorkor compared to their HIV-negative counterparts. These findings are consistent with those reported by Mandjo et al. and Nguefack et al. in Cameroon, as well as by Madec et al. in Niger, where marasmus was similarly identified as the predominant clinical form of SAM both in the general study population and among HIV-infected children [17,19]. This could be because HIV frequently causes enteropathy and chronic diarrhoea, leading to poor absorption of both energy and protein. This disproportionately affects caloric balance, which is more consistent with marasmus than with oedematous forms like kwashiorkor.

HIV-infected children with SAM had higher chances of presenting with dyspnoea compared to their HIV-negative counterparts. This contrasts with findings from Mandjo et al., where weight loss and fever were the most commonly reported presenting symptoms, and from Nguefack et al., who reported weight loss and watery stools as the predominant symptoms among HIV-infected children with SAM [18-19]. HIV infection predisposes children to a wide range of opportunistic pulmonary infections such as pneumocystis pneumonia (PCP) , bacterial pneumonia, and tuberculosis, all of which frequently present with respiratory distress and dyspnoea. HIV-infected children had higher chances of presenting with lymphadenopathy as compared to non-infected children. These findings differs from those reported by Mandjo et al. in Cameroon and Asafo-Agyei et al. in Ghana, where oral thrush and hepatomegaly were the most common clinical signs in children with SAM, including those infected with HIV [19-21]. The significantly higher odds of lymphadenopathy among HIV-infected children can be attributed to the profound immune system alterations caused by HIV infection. HIV targets and depletes CD4+ T lymphocytes, leading to chronic immune activation and opportunistic infections, both of which can cause generalized or localized lymph node enlargement. HIV-infected children also had had higher chances of presenting with mouth ulcers as compared to non-infected children. These findings also differ from those reported by Mandjo et al. in Cameroon and Asafo-Agyei et al. in Ghana, where oral thrush and hepatomegaly were the most common clinical signs in children with SAM, including those infected with HIV[19,21]. The significantly higher odds of mouth ulcers in HIV-infected children can be explained by the immunosuppressive effects of HIV, which impair the body's ability to control oral infections and maintain mucosal integrity. Children with SAM who were HIV-positive had had higher chances of presenting with purulent otitis compared to their HIV-negative counterparts. These findings are consistent with those reported by Mandjo et al. in Cameroon and Madec et al. in Niger, where purulent otitis was also was also reported to be significantly associated with HIV in severe acute malnutrition[17,19].

The markedly higher odds of purulent otitis

observed in HIV-positive children with Severe Acute Malnutrition (SAM) can be attributed to the combined effects of immunosuppression and poor nutritional status, both of which severely compromise the body's defence mechanisms against infections. HIV infection leads to the depletion of CD4+ T cells and disrupts mucosal immunity, rendering the middle ear more susceptible to bacterial infections such as those caused by Streptococcus pneumoniae, Haemophilus influenzae, and Pseudomonas aeruginosa.

Also, children with SAM who were HIV-positive had higher chances of presenting with tuberculosis compared to their HIV-negative counterparts. These findings are consistent with those reported by Mandjo et al. in Cameroon and Madec et al. in Niger, where tuberculosis was also was also reported to be significantly associated with HIV in severe acute malnutrition[17,19]. The significantly higher odds of tuberculosis (TB) in HIV-positive children with Severe Acute Malnutrition (SAM) reflect the compounded vulnerability created by both HIV infection and malnutrition, which severely weaken the immune system. HIV compromises cell-mediated immunity, particularly by depleting CD4+ T lymphocytes, which play a crucial role in controlling Mycobacterium tuberculosis infection. The mean duration of hospitalization among HIV-positive children was 11.8 days, notably longer than the 9.9 days recorded for HIV-negative counterparts. This suggests that HIV infection may be associated with a more complicated clinical course, characterized by increased susceptibility to opportunistic infections, slower nutritional recovery, impaired immune response, and a greater likelihood of developing comorbidities. The majority of participants (81.5%) were discharged alive, reflecting overall effective inpatient management despite the challenges posed by SAM and HIV co-infection. However, the study recorded six deaths during hospitalization, corresponding to an overall mortality rate of 2.8%. Notably, four of the six deaths (66.7%) occurred among HIV-infected children, indicating a higher mortality burden within this subgroup.

► Abbreviations

HIV- Human Immunodeficiency Virus.
SPSS - Statistical Package for Social Sciences;
SAM – Severe Acute Malnutrition

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► Competing interests

The authors declare no competing interests.

References

1. Viana RS, De Araújo-Moura K, De Moraes ACF. Worldwide prevalence of the double burden of malnutrition in children and adolescents at the individual level: systematic review and meta-regression. J Pediatr. 2025 Mar;101(2):158–66.
2. Tchuente BRT, Nguedjo MW, Ngoumen DJN, De Wandji GCF, Tene Mouafo H, Tambe BA, et al. Prevalence and associated factors of coexisting forms of malnutrition in children under 5 years age in a rural area of Cameroon. PLoS ONE. 2024 Jun 10;19(6):e0303611.
3. Ara G, Fawad B, Shabbir S. Malnutrition in children under five years in a squatter settlement of Karachi: a case-control study. BMC Public Health. 2024 Mar 19;24(1):848.
4. Govender I, Rangiah S, Kaswa R, Nzaumvila D. Malnutrition in children under the age of 5 years in a primary health care setting. S Afr Fam Pract. 2021 Sep 7;63(1):a5337.
5. Mathosi MM, Cele LP, Mathibe M, Modjadji P. Acute malnutrition in under-five children in KwaZulu-Natal, South Africa: Risk factors and implications for dietary quality. Nutrients. 2025 Jun 18;17(12):2038.
6. Bain LE, Awah PK, Geraldine N, Kindong NP, Sigal Y, Bernard N, et al. Malnutrition in sub-Saharan Africa: burden, causes and prospects. Pan Afr Med J. 2013;15:120.
7. Saidu SF, Danielson RA. Social determinants of health associated with increased prevalence of childhood malnutrition in Africa. Front Nutr. 2024

Nov 1;11:1456089.

8. Takyi A, Tette E, Goka B, Insaidoo G, Alhassan Y, Nyarko MY, et al. Treatment outcomes among children treated for uncomplicated severe acute malnutrition: a retrospective study in Accra, Ghana. Public Health Nutr. 2021 Aug;24(12): 3685–97.
9. Sturgeon JP, Mufukari W, Tome J, Dumbura C, Majo FD, Ngosa D, et al. Risk factors for inpatient mortality among children with severe acute malnutrition in Zimbabwe and Zambia. Eur J Clin Nutr. 2023 Sept;77(9): 895–904.
10. Karunaratne R, Sturgeon JP, Patel R, Prendergast AJ. Predictors of inpatient mortality among children hospitalized for severe acute malnutrition: a systematic review and meta-analysis. Am J Clin Nutr. 2020 Oct;112(4) :1069–79.
11. Nalwanga D, Musiime V, Kizito S, Kiggundu JB, Batte A, Musoke P, et al. Mortality among children under five malnutrition: a prospective cohort study from Kampala, Uganda. BMC Pediatr. 2020 Dec;20(1):182.
12. Madewell ZJ, Keita AM, Das PMG, Mehta A, Akelo V, Oluoch OB, et al. Contribution of malnutrition to infant and child deaths in sub-Saharan Africa and South Asia. BMJ Glob Health. 2024 Dec;9(12):e017262.
13. Torres AM, Peterson KE, Chen LC. Association of diarrhoea and upper respiratory infections with weight and height gains in Bangladeshi children aged 5 to 11 years. Bull World Health Organ. 2000;78(11):1316–23.
14. Sunguya BF, Poudel KC, Mlunde LB, Urassa DP, Yasuoka J, Jimba M. Poor nutrition status and associated feeding practices among HIV-positive children in a food secure region in for tailored nutrition training. PLoS ONE. 2014 May 20;9(5):e98308.
15. Walson JL, Berkley JA. The impact of malnutrition on childhood infections. Curr Opin Infect Dis. 2018 June;31(3):231–6.
16. Musiime V, Rujumba J, Kakooza L, Namisanvu H, Atuhaire L, Naguti E, et al. HIV prevalence among children admitted with severe acute malnu trition and associated factors with mother-to-child HIV transmission at Mulago Hospital, Uganda: A mixed methods study. PLoS ONE. 2024 Apr 16;19(4):e0301887.
17. Madec Y, Germanaud D, Moya-Alvarez V, Alkassoum W, Issa A, Amadou M, et al. HIV Prevalence and impact on renutrition in children hospitalized for severe malnutrition in Niger: An argument for more systematic screening. PLoS ONE. 2011 July 28;6(7): e22787.
18. Nguefack F, Ehouzou MN, Kamgaing N, Chiabi A, Eloundou OE, Dongmo R, et al. Caractéristiques cliniques et évolutives de la malnutrition aiguë sévère chez les enfants infectés par le VIH: étude rétrospective sur 5 ans. J Pediatr Pueric. 2015 Nov;28 (5) : 223–32.
19. Mandjo W. Profil clinique et évolutif des enfants atteints de malnutrition aiguë sévère et infectés par le VIH à l'Hôpital Gynéco-Obstétrique et Pédiatrique de Yaoundé. Faculty of Medicine and Biomedical Sciences, University of I;2020.
20. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian J Psychol Med. 2013 Apr;35(2):121–6.
21. Asafo-Agyei SB, Antwi S, Nguah SB. HIV infection in severely malnourished children in Kumasi, Ghana: a cross-sectional prospective study. BMC Pediatr. 2013 Dec;13(1):181.