Factors Associated with Mortality Among Children Under Five Hospitalized with Severe Acute Malnutrition in Selected Provinces of Zambia: A Retrospective Review of Hospital Records

Chipwaila Choolwe Chunga (✉ chungachipwaila90@gmail.com)

National Health Research Authority

Victor Chalwe

National Health Research Authority

Kutha Banda

National Health Research Authority

Sandra Chilengi-Sakala

National Health Research Authority

Hiwote Solomon

University of Boston

Colleen Leonard

National Health Research Authority

Justin Nkaama

National Health Research Authority

Mupeta Bobo

Ministry of Health, Zambia

Agness Aongola

Ministry of Health, Zambia

Godfrey Biemba

National Health Research Authority

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Abstract

Background: Malnutrition continues to take the lives of millions of children every year. Children under the age of five years are especially susceptible to high rates of malnutrition and more than half of the deaths in under five children are caused by undernutrition in low- and middle-income countries. Zambia continues to have one of the highest rates of malnutrition in Southern Africa, specifically Severe Acute Malnutrition (SAM). The country's prevalence of under-five malnutrition is above the WHO Public Health threshold which may linked to the observed under-mortality. In this study, we assessed the factors associated with under-5 mortality in children with SAM.

Methods: This was a cross-sectional study assessing the factors associated with under-5 mortality in children hospitalized with severe acute malnutrition. The study used data from a cross-sectional study which was assessing factors associated with SAM in under-5 children in five underperforming provinces of Zambia. In this study, we reviewed hospital records from 2014 to 2016 and recorded length of hospital stay, co-morbidities, and death among under-5 children presenting with SAM to select level-one hospitals. Stata version 13 was used for analysis. We conducted both descriptive and bivariate logistic regression to assess the association between mortality and select key factors.

Results: We found that over half of the records we extracted listed SAM as the main cause of hospital stay. About one-fourth of under-5 children (24%) were recorded as being HIV positive at time of hospital stay. Malnourished under-5 children who were diagnosed as HIV positive were 3.5 times more likely to die than malnourished under-5 children who were HIV negative.

Conclusions: Malnutrition continues to be a problem in Zambia. Undernourished children with existing co-morbidities such as HIV are at greater risk for mortality and poor health outcomes. To combat high rates of SAM, continued efforts are needed to provide adequate nutrition services and care especially in rural areas of Zambia.

Introduction

Malnutrition is one of the most challenging public health problems worldwide. Malnutrition is divided into undernutrition and overweight or obesity. Undernutrition includes stunting, wasting, underweight, and micronutrient deficiencies. Stunting in children is specifically defined as a child being too short for his or her age and results in both cognitive and physical delays. Wasting (or acute malnutrition) in children is defined as a child who is too thin for his or her height. While treatment is possible for wasting, a child who is moderately or severely wasted has an increased risk of death [1,2].

Severe Acute Malnutrition (SAM) is defined as below 3 standard deviations (-3 Z-score) of the median WHO growth standards, visible severe wasting, or the presence of nutritional edema [3]. In 2013, the WHO updated anthropometric diagnostic criteria to include mid- upper- arm circumference (MUAC) as an alternative to weight/height Z-score in children aged 6–59 months. This was expected to improve recognition of SAM [3]. Worldwide, SAM is a major cause of death in children under five and associated

with one to two million child deaths each year [4]. Therefore, the prevention and treatment of SAM is essential for child well-being, survival, and development.

It is well known that SAM is a strong predictor of morbidity, mortality and delayed recovery among children under five years [5]. In Southern Africa, there is a high prevalence of stunting standing at 28.1% while overweight and wasting stand at 11.8% and 5.5%, respectively, for children under five [2]. Zambia has one of the highest rates of malnutrition in Africa; classified as “critical” for stunting, “medium” for wasting,” and “medium” for underweight [5]. Zambia has about 40% of children under-five years who are classified as stunted which gives an indication of chronic malnutrition in the country [6]. In Zambia, the prevalence of under-five malnutrition is above the WHO Public Health threshold standing at 40% for stunting, 15% for underweight, and 6 % for wasting [6]. While the situation requires attention countrywide, the investigation and analysis of the factors associated with SAM is crucial in the five study provinces, considering the high levels of mortality attributed to SAM there. According to Health Management Information System (HMIS) data, between 2014 and 2016 the five provinces recorded an average annual SAM prevalence of between 10.3% and 14.5% [7]. Although the causes of acute malnutrition can be categorized broadly using the UNICEF conceptual framework, they differ from one area to another. It is therefore important to establish, understand, and assess factors associated with acute malnutrition before designing appropriate interventions for specific areas.

The reasons for SAM in Zambia are vast, but include: food insecurity, lack of dietary diversity, and poor water and sanitation [8]. Malnourished children are often unable to effectively defend themselves against infection and therefore, are more likely to become ill, which can sometimes lead to death. For example, children who are malnourished have more difficulty fighting off malaria once infected. In a global study, mildly malnourished children were twice as likely to die from malaria as compared to children who were not undernourished. While, severely malnourished children were nine times more likely to die [9]. Therefore, it is critical to prevent and urgently treat all cases of SAM among children under five.

The Ministry of Health has been implementing a Zambia Health Services Improvement Project (ZHSIP) with support from the World Bank in five provinces to strengthen health systems and improve health service delivery. The five provinces include Luapula, Muchinga, Northern, North-Western, and Western Provinces. The ZHSIP project focuses on Reproductive Health, Maternal, Neonatal, Child and Adolescent Health and Nutrition (RMNCAH&N). The project supports the government’s efforts to accelerate progress towards the maternal and child health Sustainable Development Goals (SDGs) and for it to be better prepared for different emerging health challenges. The project supports strengthening service delivery while focusing on results and reducing inequities. As such, activities are targeted at provinces that are poorer and underserved to scale-up coverage of high impact MNCH and nutrition interventions. This study was conducted in the ZHSIP provinces as outlined above. The five provinces under ZHSIP were selected based on having low performing RMNCH indicators.

This analysis is a component of a study conducted on the ‘Factors Associated with Severe Acute Malnutrition in Under-5 Children in five (5) Provinces in Zambia’. The paper provides an analysis of

factors associated with under-5 mortality of children with SAM.

Methods

Study design and participants

We analysed data from a retrospective review of facility-based health records, including patient files and death records, for all children 0-59 months of age presenting to select first-level hospitals for SAM from January 2014 to December 2016.

Study Site

The study was conducted in five (5) provinces under ZHSIP: Luapula, Muchinga, Northern, North-Western and Western. Five (5) first level hospitals in each province were selected for the study. The five provinces under ZHSIP were selected based on having low performing RMNCH indicators. Methods utilized in selecting hospitals is detailed below.

Study Population

Criteria for admission for severe malnutrition was identified as the presence of bilateral pitting edema and/or weight for height Z-score that is less than 3 standard deviations based on the WHO growth standard charts. The data collection phase was conducted by five survey teams from January to February 2018. All targeted districts and hospitals were covered with the exception of Chama District in Muchinga Province due to safety concerns caused by severe flooding and road blockages.

The following inclusion criteria was applied for this study:

- A child was aged 0-59 months at the time of visit to the hospital
- Child resided in one of the following 5 provinces: Luapula, Muchinga, Northern, North-Western, and Western Provinces
- A child was diagnosed by a health professional to severely malnourished using anthropometric diagnostic criteria (weigh-height Z-scores or mid upper arm circumference (MUAC))

Sample Size Consideration

A simple random sample of health facilities in each province of interest was taken. A complete enumeration of all health facilities in the province was listed and numbered. After the listing, a random number generator using Microsoft Excel was utilized to randomly select each health facility until a sample size of 5 facilities in each district was generated. The sample was restricted to five districts per province due to financial and time constraints.

Data collection and management

The study utilized a structured data extraction tool to collect information from hospital records. The extraction tool was designed to capture the type of data recorded at the health facilities. A pilot study was conducted at two health facilities in Chongwe district to test the design of the survey tools and to identify any areas needing improvement prior to performance of the full-scale research project. These pre-testing facilities were not considered as part of the final sample. All research data were captured using Personal Digital Assistant (PDA) tablets and were sent to a private server each evening and wiped clean to upkeep data integrity and confidentiality. Data verification and consistency checks were also carried out.

Data Analysis

A two-level analyses were employed using STATA version 13.0. Descriptive analysis was done at the first level and second level, we used bivariate analysis using logistic regression to measure the relationship between the dependent and each of the independent variables. During the bivariate analysis, mortality was identified as the outcome variable (Death or Survival) and age, sex, residence, length of stay in hospital, HIV status presence of other co-morbidities as the independent variables.

Ethical statement

Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee.

Results

The study findings are mainly be presented in three major sections with the first showing the background characteristics and levels of SAM. The second section will show findings on co-morbidities and levels of mortality in under-5 children with SAM whilst the last section will have findings on the analysis of factors associated with mortality amongst children with SAM.

Background Characteristics and Levels of SAM in under-five Children.

The study findings in table 1 show that Luapula had the highest levels of SAM recorded for the children under the age of 6 months at 31.86%(n=36). Similarly for age above 6 months but below 2 years Luapula had 38.4%(n=457) for the population aged between 2 and 5 years it was 37.8%(n=493) and overall under-five malnutrition was at 40.6% (n=980) =. On the other hand, North-Western and Northern Province had the lowest level of SAM for the population under 6 months at 7.96%(n=9), and for the age over six months but below 2 years North-Western was the lowest at 9.83%(n=84). North-Western Province still had the lowest levels of malnutrition for the for the ages between 2 to 5 years it was 7.1%(n=93) and 8.4% (n=202) below 5 years].

In terms of trends of SAM by year, study findings show that 2015 has the highest SAM for the at 35.4% (n=40) for the population below six months. For the age above 6 months but below 2 years 2015 had the highest SAM at 32.77%(n=390). For ages 2-5 years old, 2015 had the lowest proportion of 25.9%(n=287)), this was also the case for overall under-5 years which as at 29.1% (n=701).

The SAM distribution was highly skewed towards rural population, with over 99% (n=112 for under 6 months, n=1178 for 7 months to 23 months, n=1104 for 2-5 years and overall n=2394) of SAM in all age categories being in rural areas. In terms of gender for the age below 6 months males were the highest at 58.03%(n=65), similarly for age below 2 years and above 6 months the were the majority at 55.62% (n=653). This trend was observed for the population of two-to 5 years and overall under-five years. Overall, SAM was at 4.68%(n=113) for the population under 6 months, 49.34%(n=1190) for population over six months but below two year, 46%(n=1109) for population between two to five years.

Table 1.0 Sociodemographic Characteristics of under-5 children with SAM in Selected Level-One Hospitals (2014-2016)

	Under 6	7 months-23 Months	2-5 years	0-5 years
	n (%)	n(%)	n (%)	n (%)
Province				
Luapula	36(31.86%)	457(38.4%)	493 (37.84%)	980 (40.6%)
Muchinga	26(23.01%)	304(25.55%)	330 (25.3.%)	591 (24.5%)
North-Western	9(7.96%)	84(9.83%)	93 (7.1%)	202 (8.4%)
Northern	9)7.96%)	118(9.92%)	127 (9.75%)	248 (10.3%)
Western	33(29.2%)	227(19.08%)	260 (19.9%%)	392 (16.2%)
Year				
2014	25(22.21%)	390(32.77%)	400 (36.1%)	815 (33.8%)
2015	40(35.4%)	374(31.43%)	287 (25.9%)	701 (29.1%)
2016	48(42.48%)	426(35.8%)	422 (38.1%)	896 (37.1%)
Residence				
Rural	112(99.12%)	1178(98.99%)	1104 (99.5%)	2394 (99.3%)
Urban	1(0.88%)	12(1.01%)	5 (0.5%)	18 (0.7%)
Gender				
Male	65(58.03%)	653(55.62%)	633 (58%)	1351 (56.8%)
Female	47(41.96%)	521(44.38%)	458 (42%)	1026 (43.2%)
Total	113(4.68%)	1190(49.34%)	1109 (46%)	2412 (100%)

Co-morbidities and Mortality Levels in under-five children with SAM

SAM Common Diagnosis and Comorbidities (excluding HIV/AIDS)

The study findings show that Protein–Energy Malnutrition (PEM)/SAM was the most commonly reported diagnosis in all the age groups (Table 2). In all the provinces, PEM/SAM were reported for 50.4% of children under two years old, 60.5% for those aged between two and five years of age and 55.0% for all children under five. A review of the hospital records disaggregated by types of malnutrition, showed that kwashiorkor and marasmus are the most common types of malnutrition, sometimes occurring simultaneously (Table 2).

In terms of co-morbidities other than HIV/AIDS, the study shows that the most common type reported was malaria presenting in 8.7% of children under 2 years, 12.9% in children aged 2 to 5 years, and 10.6% of all under 5 years. However, it should be noted that 78.1% of under-5 children did not have tuberculosis, pneumonia, anaemia, cough, malaria and diarrheal

as their comorbidity added to their SAM diagnosis.

Table 2.0 Distribution of diagnosis and comorbidity			
Variable	Under 2	2-5 Years	Under 5
Diagnosis	n (%)	n (%)	n (%)
PEM/SAM	656 (50.4%)	671 (60.5%)	1327 (55.0%)
Oedema/Kwashiorkor	229(17.6%)	166(15.0%)	395(16.4%)
Wasting/Marasmus	188(14.4%)	116(10.5%)	304(12.6%)
Kwashiorkor and Marasmus	20 (1.5%)	19 (1.7%)	39 (1.6%)
Other	7 (0.5%)	8 (0.7%)	15 (1.6%)
Not Stated	203 (15.6%)	129 (11.6%)	332 (13.8%)
Total	1100 (100%)	980 (100%)	2080 (100%)
Comorbidity	n (%)	n (%)	n (%)
No Comorbidity	1030 (79%)	853 (76.9%)	1883 (78.1%)
Tuberculosis	5 (0.4%)	7 (0.6%)	12 (0.5%)
Pneumonia	40 (3.1%)	10 (0.9%)	50 (2.1%)
Anemia	27 (2.1%)	37 (3.3%)	64 (2.7%)
Cough	4 (0.3%)	2 (0.2%)	6 (0.2%)
Malaria	113 (8.7%)	143 (12.9%)	256 (10.6%)
Diarrhea	12 (0.9%)	7 (0.6%)	19 (0.8%)
Others	72 (5.5%)	50 (4.5%)	122 (5.1%)
Total	1303 (100%)	1109 (100%)	2412 (100%)

HIV Status amongst SAM Patients

The study findings found that 8.3% of SAM patients in Luapula were HIV-positive in 2014 (Table 3). This increased to 15.8% in 2015 and later reduced to 6.8% in 2016. In Muchinga Province, 25.4% of SAM patients were HIV-positive in 2014, this decreased to 17.1% in 2015 and later to 9.2% in 2016.

North-Western and Northern Provinces had issues of missing data records on the HIV status of SAM patients. In North-Western, 2014 only had one HIV positive case recorded, 13 cases were reported in 2015 with one case classified as HIV-positive, and nine cases in 2016. In Northern Province, a similar trend was observed. In both 2014 and 2015, seven cases of HIV-positive cases were recorded, this increased to 10 cases in 2016. Western Province showed a balance in the percentage of HIV negative and positive cases

recorded in 2014, the percentage of HIV cases reduced to 49.1% in 2015, and reduced to 37.9% in 2016. Overall, the study showed that the percentage of HIV-positive children across all provinces in the three year period of interest was 27.8% in 2014, to 26.8% in 2015 and 18.3% in 2016.

Table 3.0 In-Patient HIV Frequency among SAM patients by Province (2014-2016)

	2014, n (%)		2015, n (%)		2016, n (%)	
	Negative	Positive	Negative	Positive	Negative	Positive
Luapula	88 (91.7%)	8 (8.3%)	123 (84.2%)	23 (15.8%)	96 (93.2%)	7 (6.8%)
Muchinga	44 (74.6%)	15 (25.4%)	87 (82.9%)	18 (17.1%)	119 (90.8%)	12 (9.2%)
North-Western*	0	1 (100%)	12 (92.3%)	1 (7.7%)	8 (88.9%)	1 (11.1%)
Northern*	2 (22.2%)	7 (77.8%)	1 (12.5%)	7 (87.5%)	22 (68.8%)	10 (31.2%)
Western	33 (50%)	33 (50%)	55 (50.9%)	53 (49.1%)	64 (62.1%)	39 (37.9%)
Total	167 (72.3%)	64 (27.8%)	278 (73.2%)	102 (26.8%)	309 (81.7%)	69 (18.3%)
*Missing Records						

The study finding in figure 1 on the HIV status by age shows that overall amongst under five children, 24 percent of the children with SAM were HIV positive. Children under two years had a higher HIV/AIDS prevalence rate (25.4%) compared to those aged two to five years old (22.1%).

Reported cases of Mortality in under-five children with SAM

When looking at the aggregate data for all provinces, we found that the death rate has been stationary over the three study years, hovering at around 18% (Table 4.0). However, when examining by province, there was a general reduction in the proportion of deaths over the three years of interest for each Province, except in North-Western and Luapula Provinces (Figure 2). In Western Province, 25.4% of SAM patients died in 2014, this number reduced to 22% in 2015 and later to 16.2% in 2016. For Northern Province, 14.1% of SAM patients died in 2014, 10% in 2015 and 11.8% in 2016. Hospital records in select level-one hospitals in North-Western Province recorded that 4.3% of SAM patients died in 2014, 19.3% in 2015, and 21.5% in 2016. Muchinga Province recorded 13.6% of SAM patients die in 2014, 14.4% in 2015,

and 9.2% in 2015. Lastly, deaths for SAM patients were relatively the same across the 3-year period in Luapula Province (15.5% in 2014, 15.7% in 2015 and 15% in 2016) .

Table 4.0 Child outcome by year				
Variable	2014	2015	2016	Total
Death	130(17.8%)	118(19.9%)	129(18.9%)	377(18.8%)
Discharged	576(78.8%)	449(75.8%)	513(75.2%)	1538(76.7%)
Absconded	20(2.7%)	22(3.7%)	29(4.3%)	71(3.5%)
Others (Referrals)	5(0.7%)	3(0.5%)	11(1.6%)	19(0.95%)

The study findings as depicted in figure 3 showed that 49% of SAM patients were discharged within seven days of being admitted (Figure 3). Only 6% were discharged after more than 3 weeks (21 days) of being admitted. However, the study found that of those children who were admitted as a case of SAM and died, 71% of them died within 7 days of being admitted, while 4% died after 3 weeks of being in the hospital.

Factors associated with Mortality amongst children with SAM.

The study utilized a logistic regression model to assess the factors associated with mortality in children with SAM. Variables such gender, age, diagnosis, length of stay in the hospital and co-morbidities were assessed (Table 5.0).

From the bivariate analysis, gender, and some co-morbidities were not statistically significant when examining the association with under-5 mortality in children with SAM. However, the study found that children aged between two to five years were 0.73 times less likely to die than those aged below two years (95% CI: 0.58-0.92). By Province, children based in Western province were 1.833 times more likely to die than those in Luapula (95% CI: 1.35-2.50). The study also shows that children who spent two weeks in the hospital were 0.4 times less likely to die compared to those that had only spent a week (95% CI: 0.26-0.55). Similarly, children that spent three and four weeks in the hospital were 0.3 times (95% CI: 0.18-0.56) and 0.5 times (95% CI: 0.29-0.93) respectively less likely to die than those that spent one week. Generally implicating that survival was higher for a longer stay in the hospital. In terms of co-morbidities, all co-morbidities were positively associated with death: tuberculosis (OR: 1.83, 95% CI: 0.35- 9.48), pneumonia (OR: 1.36, 95% CI: 0.69- 2.70), anemia (OR: 2.59, 95% CI: 1.41- 4.77), cough (OR: 1.53, 95% CI: 0.16- 14.71), malaria (OR: 1.14, 95% CI: 0.78- 1.65), diarrhea (OR: 1.06, 95% CI: 0.30- 3.73), other (OR: 2.46, 95% CI: 1.61- 3.76) and HIV-positive (OR: 3.53, 95% CI: 2.38-5.24). Although, only anemia, other, and HIV-positive were statistically significant. HIV-positive children were 3.53 times more likely to die than those who were HIV-negative. Further, the presence of at least one co-morbidity in a child with SAM increased the likelihood of dying by 1.5 times. These results are summarized in table 5.

Table 5.0 Bivariate analysis of factors associated with mortality among under-5 children with SAM

Variable	Prevalence Odds Ratio	p-value	95% Conf. Interval
Gender			
Female	1		
Male	1.803	0.497	0.861-1.361
Age			
Under 2 years			
2-5 years	0.730	0.008*	0.579-0.921
Residence			
Rural	1		
Urban	0.244	0.005	0.079- 0.641
Province			
Luapula	1		
Muchinga	1.018	0.906	0.750-1.384
North-Western	0.906	0.647	0.593-1.383
Northern	1.048	0.825	0.694-1.580
Western	1.833	0.000	1.347-2.497
Length of stay			
1 Week	1		
2 Weeks	0.401	<0.001*	0.256-0.545
3 Weeks	0.314	<0.001*	0.177-0.558
4+ Weeks	0.533	0.004*	0.289-0.936
Specific Comorbidities 1			
None	1		
Tuberculosis	1.830	0.472	0.353-9.482
Pneumonia	1.360	0.380	0.685-2.701
Anemia	2.592	0.002*	1.409-4.769
Cough	1.525	0.715	0.158-14.712
Malaria	1.136	0.504	0.781-1.653

Diarrhea	1.056	0.933	0.299-3.730
Others	2.458	<0.001*	1.605-3.764
HIV/AIDS Status			
Negative	1		
Positive	3.533	<0.001*	2.383-5.240

¹Excluding HIV/AIDS *Statistically significant

Discussion

This study highlighted the factors associated with mortality in children under five years of age with SAM in Zambia. The results show that mortality among children with SAM is related to HIV status, residence, age of child, Anemia (co-morbidity), and length of hospital stay. Children with HIV were found to be 3.5 times more likely to die when hospitalized for SAM than those who were HIV-negative. This is in line with the literature. For example, one study conducted in Zambia found that HIV-infected children had an almost three times higher risk of death compared to HIV-negative children [11]. Another study found that among children with SAM, HIV-infected children were significantly more likely to die than HIV negative children (30.4% versus 8.4%, $P < 0.001$; Relative Risk = 2.81, 95% CI: 2.04 - 3.87) [12]. One explanation for the increased likelihood of death among HIV-positive children with SAM is that HIV reduces the child's immunity and the combined effect of lowered immunity from HIV (especially those with AIDS) and lowered immunity from malnutrition increases the likelihood of death among children with both HIV and SAM [13] [14].

Hospital length of stay was also significantly associated with mortality among children with SAM. Mortality was highest within the first week of stay. By day seven after admission, 71% of all deaths had occurred. At bivariate level, staying two, three and four weeks in the hospital were all statistically significant as children were 0.4, 0.3 and 0.5 times less likely to die than those who stayed only one week. This makes sense as severe acute malnutrition is an acute illness that without proper treatment in a timely manner can result in death. Also, many children with SAM are admitted to the hospital in a critical condition. If a child survives past the first week in the hospital, they are more likely to survive and respond to treatment. Other studies have found that most children recover from SAM after one week of receiving treatment at a hospital [15]. These results imply that particular and extra attention should be paid to children with SAM during the first seven days of admission.

Severe acute malnutrition was most pronounced among the children in the rural areas; this is supported by previous literature [7]. The study also confirms that children in urban areas were 0.24 times less likely to have die in Severe Acute Malnutrition than those in rural areas. This is most likely because rural areas are more prone to food shortages, and lack access to clean water and sanitation. Therefore, rural areas should be targeted to prevent and treat SAM among children under five. In addition, the provinces of Luapula and Muchinga have the highest numbers of SAM cases, over 500 among children under five in

2016. These two provinces should therefore receive the most support when it comes to improving prevention and treatment methods for children with SAM.

Among the children under five who were hospitalized for SAM, most of them were diagnosed with PEM/SAM (55.0%). This indicates that protein is lacking in the diets of these malnourished children. This is most likely because maize, other cereals and starchy roots account for 80% of the energy intake for the average Zambian [16]. “Nshima” or maize meal thick porridge, is a popular maize-based staple food and although it is filling and provides energy, it does not provide a sufficient range of nutrients; certainly not enough protein. In order to prevent PEM, one of the causes of SAM, the Ministry of Health should work with the Ministry of Agriculture to increase awareness of good sources of proteins for families. Oftentimes, low-income families cannot afford meat, but food like groundnuts and eggs can also be good sources of protein. The alternative sources of protein should be promoted and ways to make them more affordable to low-income families should be explored.

When looking at comorbidities, with the exception of HIV, 78.1% of children under five did not have any other comorbidity to their SAM diagnosis. This is advantageous because these children are easier to treat and have less complications than children presenting with multiple illnesses. We found that children with at least one comorbidity were less likely to survive than those with only SAM. All comorbidities were positively associated with death, including: tuberculosis, pneumonia, anemia, cough, malaria, diarrhea, HIV-positive, and other. Although, only anemia, HIV-positive, and other were statistically significant. The most common co-morbidity at 10.6% was malaria. Malnourished children with malaria are at a disadvantage because they are less able to fight off their malaria infection. Therefore, these children are more likely to die due to malaria than children who are not malnourished. This may explain why the most common co-morbidity for hospitalized patients with SAM was malaria. These findings call for not only extra care for these children with SAM and comorbidities but greater collaboration among medical specialties in caring for these children in order to improve survival.

Although, the prevalence of HIV has been decreasing over the years in Zambia, it is still quite high, especially in Northern and Western provinces. According to UNAIDS, the adult HIV prevalence is 11.5% in Zambia [17]. We found a higher HIV prevalence at 18% among all the children in our study in 2016. This is likely because our sample was children hospitalized with SAM, and children with HIV/AIDs often experience loss of appetite and weight loss compared to children without HIV, therefore making them more likely to experience SAM. The high HIV prevalence is important to note because HIV/AIDs can cause severe weight loss, which can lead to malnutrition in the form of wasting [7]. Not only can HIV/AIDs cause malnutrition, but it can make SAM more fatal for a child.

It is encouraging to see that the all-cause death rate among children under five with SAM has decreased from 2014 to 2016 in most provinces; however, it is still too high. In Western Province, 16.2% of all children under five died while in the hospital receiving care in 2016. This is unacceptable and these deaths can be prevented. The most effective way to prevent these deaths is to prevent children from becoming malnourished in the first place. Improving food security and the water and sanitation situation,

can help prevent malnutrition and therefore, prevent child death. Also, trained community health volunteers can help identify children in the community who are malnourished and prevent their malnutrition from turning into SAM. In addition, the fact that the majority (71%) of all deaths among children with SAM occur within the first week in the hospital shows the urgency of the situation. These children need to be attended to and treated with the extra care right away in order to prevent these deaths.

Limitations

We recognise some limitations of the study. We sampled up to five hospitals in each Province without calculating a statistically significant sample. This may pose a potential risk of bias to the measures and the estimates may not fully be representative of the entire country. In addition, an inherent limitation of using routine health data are data quality issues due to missing data. We encountered missing data during our data extraction, especially for the HIV status indicator. We have indicated variables where data were missing in our results. Notwithstanding these limitations, we felt that the study provides important findings as the selected facilities were randomly selected and these results can guide deliberate strategies to intensify the current efforts to address malnutrition among children under five.

Conclusion

The study found that malnutrition continues to be a major problem in Zambia. Undernourished children with existing co-morbidities such as HIV are at greater risk for mortality and poor health outcomes. Furthermore, study also reviewed that length of stay in the hospital increased the chances of survival for children with SAM. To combat high rates of SAM, continued efforts are needed to provide adequate nutrition services and care especially in rural areas of Zambia.

Declarations

Ethics approval and consent to participate

All study was carried out in accordance with Health Research Act of 2013 and the applicable ethical principles and guidelines. Before commencement, we obtained ethical approval from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) and authority to conduct research from the National Health Research Ethics Board. Given the study was based on data from facility records for a five(5) year period prior to the study, no direct consenting was done from participants as there was no direct interaction made with respondents that has accessed health services in the selected facilities. However, permission to access the records was sort and granted by the Ministry of Health at all levels including the target health facilities.

The study did not collect any biological human samples and no identified data was collected from the records.

Consent for publication

The study was based on secondary data from hospital records as for such permission to access the records also indicated our plans to disseminate findings.

Competing interests

No competing interests from the authors.

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Authors' contributions

Chipwaila C. Chunga: Conceptualization, drafting of original article, methodology and data analysis

Prof Victor Chalwe: Conceptualization, support Supervision and analysis.

Kutha Banda: Introduction and methodology

Sandra C. Sakala: Conceptualization, review and edits

Hiwote Solomon: Data analysis and discussion

Colleen Leonard: Discussion and edits

Justin Nkaama: Review and edit

Dr Mupeta Bobo: Conceptualization, review and edits

Dr Agness Aongola: Conceptualization, review and edits

Prof Godfrey Biemba: Review, Editing and overall supervision

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Data availability

The data used for this study are fully available without any restriction upon request to the corresponding author. Data can be request from the author through email on chungachipwaila90@gmail.com

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Figures

Figure 1

HIV status amongst under-5 Children admitted to the hospital for SAM, 2014-2016

Figure 2

Percent Distribution of In-patient Deaths by Province (2014, 2015, 2016)

Figure 3

Percent Distribution of Hospitalization Ending in Death or Discharge