

The Causes of Death in below Five Years Children with Severe Acute Malnutrition (SAM) at the University Teaching Children's Hospital in Lusaka, Zambia

R. Sakthivel¹, A. Ananda Kumar²

¹Principal, DMI-St. Eugene University, Lusaka, Zambia.

²Research & Development-Head, DMI-St. Eugene University, Lusaka, Zambia.

Abstract

This study was aimed at finding the leading causes of death in these malnourished patients as mortality of children under five years of age with severe acute malnutrition (SAM) in-patient set-ups in the sub-Saharan Africa still remains high. This was conducted on the inpatients with severe acute malnutrition. Both the complicated and uncomplicated ones were assessed without any exception and there was no exclusion. The patients aged 0 to 59 months were under study from the Malnutrition ward A07 at the University Teaching Children's Hospital which occupies about 59 bed spaces. Data was collected from a sample of 50 respondents and was analyzed to produce results in relation to the objectives of the study. The tools used in the collection of data were questionnaires and observations. The SPSS was used for the analysis of the data in order to obtain the necessary information for the study and present the findings.

Keywords: Children, Death, Hospital, Patients.

Introduction

Here an overview of the “causes of death” in severely undernourished patients is provided, in order to present the general understanding of the topic of study. It also gives the demographics of the nation on the mortality and morbidity rates of children under the age of five years with severe acute malnutrition. Severe acute malnutrition is classified according to the acute malnutrition degree of wasting and the presence of edema. Malnutrition is still of great concern in resource-poor countries, and it accounts for about 60% of under five-year mortality; this amounts to about 3.2 million deaths/annum (WHO, 2019).

It is severe acute malnutrition (SAM) if the wasting is severe (in children, MUAC <115mm or WHZ < -3 Z-score WHO growth standards) or there is bilateral pitting edema. Severely wasted children have a nine times greater mortality risk than their well nourished counterparts. Overall, 6 percent of children are wasted. Analysis by age group shows that

wasting ranges from 5 percent among children aged 24-59 months to 10 percent among those aged 9-11 months (Food and Nutrition Technical Assistance III Project (FANTA, 2017).

Background of Study

Severe acute malnutrition (SAM) was known as Protein Energy Malnutrition (PEM) in most medical books and practice. This was so, due to the existence of the extreme thinness or the swelling of the face, body, hands, and feet, or the existence of both symptoms (Marasmic-kwarshiokor).

This theory has been proved wrong because the treatment that was considered to be correct was specialized on giving more energy and protein foods to the patients omitting the micronutrients, electrolyte imbalance, and infectious diseases associated with severe malnutrition which led to lives being lost due to the nutrition overloads and severe infections. Over the past 50 years, in most resource poor settings, case fatality rates for SAM treated in health care facilities have remained at 20–30% for marasmus (wasting malnutrition) and 50–60% for kwashiorkor. An estimated 8.8 million deaths of children under five years of age occurred worldwide in 2008, signifying that 35% of the deaths were associated with SAM. A severely wasted child is estimated to have a nine times more mortality risk than a well-nourished one (relative risk of 9.4) (Black et al., 2013).

The risk of mortality in acute malnutrition is directly related to severity: moderate wasting is associated with a mortality rate of 30–148 per 1000 children per year and severe wasting is associated with a mortality rate of 73–187 per 1000 children per year. This equates to over 1.5 million child deaths associated with severe wasting and 3.5 million with moderate wasting every year. These numbers do not include children who die of edematous malnutrition (kwashiorkor), a form of SAM that in some countries is more common than the wasted form, and probably, therefore, underestimate the total number of child deaths directly associated with acute malnutrition. This is according to Felix Masiye et al. (2011). The Zambian prevalence of malnutrition is still really high. Overall, 6 percent of children are wasted. Analysis by age group shows that wasting ranges from 5 percent among children aged 24-59 months to 10 percent among those aged 9-11 months. By province, wasting is highest among children in Luapula (13 percent) and lowest among children in Muchinga, Northern, and Southern (4 percent each).

The prevalence is still highest in the country, this maybe so because of the large population and the in poverty levels in middle and low income households within the urban areas and rural areas too are getting affected even though there is a reduction in the levels of complicated SAM cases.

Literature Review

Herein we have presented previous studies as evidence that this research was necessary and its recommendations must be implemented to reduce mortality of children under the age of 59

months with severe acute malnutrition (SAM). SAM is most common among children under the age of 59 months due to their vulnerability to various forms of acute illnesses such as infections, which can lead to reduced food intake (ZDHS, 2013-14, 2015).

Hypoglycemia is a condition implying reduced levels of blood glucose in the body. This condition is characterized by weakness, shakiness, nervousness, anxiety, and increasing episodes of fainting. This condition is present in severely malnourished patients since they undergo the process of reducing adaptation, which shuts down the body functions in order to preserve energy for the body and brain to stay alive. It is a result of reduced intake of carbohydrates and other energy yielding foods for the generation of energy. It is common for children with SAM to die of hypoglycemia because of the severe wasting of fat and muscle, which the body breaks down for generation of energy, leaving merely the skin and bones (World Health Organization et al., 2000).

Due to the depletion of subcutaneous fat below the skin in the body and near the skin which protects the body from extreme cold through the alignment of fat and stored energy, when the body is getting wasted, it uses the fat and converts it to energy by a process called gluconeogenesis for the body's metabolic reactions, thereby exposing the body to extreme cold. This happens in severely malnourished patients, resulting in the inability of victims to keep them warm. This is hypothermia (WHO, 2013).

Under the current standard management approach, diarrhea in children with SAM was found to increase their odds of death substantially irrespective of other factors (Irena et al., 2011). Diarrhea is always present in patients with complicated SAM. It is usually caused by infections found in complicated severe malnutrition patients. Such patients are unable to tolerate the feeds given, analogous to a lactose intolerant patient. Two underlying factors, HIV/AIDS and diarrhea, have been documented to substantially increase the mortality rate of children with SAM receiving treatment in inpatient units (Irena et al., 2011).

Significant water losses from diarrhea can lead to dehydration, electrolyte imbalance, shock, decreased mental status, and ultimately death. Episodes of prolonged diarrhea are also associated with increased morbidity and mortality (Emmanuel Ademola Anigilaje, 2018).

When given in correct amount and proportion, amoxicillin led to quick recovery and lowered the mortality rates in patients with SAM. On the other hand, incorrect dosing would have had disastrous consequences. (Bachou et al., 2008).

Statement of the Problem

The (12) months from December 2018 to May 2019 is the relative death rate of SAM patients who are under five years of age in the past Seven high at 45 percent at University Teaching Hospital, Pediatric Hospital.

The case fatality is really high which makes it a problem that must be dealt with immediate effect.

This study will identify the obstacles in the process and highlight measures needed to ameliorate this problem of malnourishment and concurrent reduction of under five mortality rate in different communities of Zambia.

Objectives of the Study

General Objectives

- To identify the main causes of death in under five children with severe acute malnutrition in University Teaching Hospital-Children's Hospital.

Specific Objectives

- To identify the common causes of death in severely malnourished children
- To determine which age group is affected the most
- To establish the level of care given to patients during their treatment
- To identify the challenges faced in preventing under five mortality
- To determine the measures to be put in place to address the under five deaths.

Restating the Research Questions

- What are the common causes of death in severely malnourished children?
- Which age group is affected the most?
- Is the level of care given to patients during treatment in accordance with the World Health Organization guidelines?
- What are the measures that should be put in place to address the under five deaths?

Research Methodology

Study Site

The study was conducted in Lusaka province, Lusaka District at the University Teaching Children's hospital A07 ward with a bed capacity of 59.

Research Design

A systematic study design method was used to show how all the major parts of the research project work together to try to address the central research questions. In other words, it was the scheme, outline or plan that was used to generate answers to research problems. For the study at hand, a descriptive research design was adopted by the researcher.

Population and Sampling Design

This represents the total number of individuals or the group of people from whom the information was required. This population comprised of individuals with common conditions and those belonging to a similar kind of environment as specifically desired by the researcher.

➤ Target Population

The target population is the population from which the researcher seeks information. In this research, the population was the patients below the age of five years, who were diagnosed with SAM, and were on treatment. All children aged 0-59 months admitted to the in-patient unit in the SAM Ward were qualified for the study. In this research, the data was collected from medical personnel such as nurses, doctors, and nutritionists.

➤ Sampling Design

Qualitative and quantitative research method was used during the study. The questionnaires and observations were used to collect information on the common causes of death in children below five years of age with SAM in order to determine qualitative results. The sampling design method is a framework or a blueprint, through which the sample is selected. Random (probability) sampling method was used to determine the selection of each object in the population giving each object an equal chance of getting picked.

Sample Size

The sample size was 50 respondents that included health providers and inpatients at the University Teaching Children Hospital A07 ward which had 59 bed spaces.

Data Collection Methods

Data was collected using questionnaires and observation.

➤ Primary Data

This was first hand information obtained by the researcher. It was an original work done with an effort to get important data. It involved the use of data collection tools that helped to discover the information through interactions with respondents in the areas under study to find the original data in a precise manner. This comprised of observations, questionnaires and researcher participations.

➤ Secondary Data

This was the second hand data collected through the use of published materials of various researches conducted by other researchers. This data can be found in books, articles, record sheets, and unpublished materials.

This can be done through literature review. This will help in understanding the studies already conducted by other authors in this field.

Data Collection Tools

Questionnaires and observations are the tools used during the research to collect data. Instruments of this kind are important in the study to collect original first-hand information needed for the research to be considered reliable.

➤ Questionnaires

These are the forms containing a set of questions used to collect data in a survey in a given population. In this research, multiple copies of such questionnaires were distributed among nurses, nutritionists, and doctors, and their responses were recorded.

➤ Observations

This is a data collection tool which was used by the researcher in the collection of data through observation.

Data Analysis Tools

Data analysis entails categorizing, ordering and summarizing the data and describing them in meaningful terms. The type of analytical method to be used depends on the research design and the method by which the data will be collected or measured. For the purpose of this research, both qualitative and quantitative data were needed as the researcher aimed at getting both statistical data and individual perceptions as an outcome of the study.

Results and Data Analysis

Respondents' Profession

Out of the 50 respondents, 25 (50%) were nurses, 15 (30%) were doctors, and the remaining 10 (20%) were nutritionists.

Respondents' Views regarding which Gender has the highest number of Deaths

The findings were that the male gender had the highest number of deaths (56%), compared to the females (44%), and although the difference is just 12%, it is still high.

Distribution of Respondents' Views concerning which Age group has the highest number of Deaths

As per the responses, 0 to 6 months was at 10% with 5 responses, 6 to 12 months had 40% with 20 responses, 12 to 24 months had 42% with 21 responses, and 24 to 59 months was at

8% with 4 responses. Therefore, the age group with the highest deaths was 12 to 24 months (1 to 2 years), which was the opinion of 42% of the respondents.

Distribution of Respondents' Views regarding Daily Admissions of patients at Children's Hospital A07 ward

80% of the respondents indicated that at most 5 patients were admitted daily in a normal day, and the remaining 20% respondents opined that 5 patients per day was usually the admission rate, except on weekends, when it was 3 patients a day, though during certain seasons, the admission rate of patients on a daily basis did exceed the above rates.

Responses regarding the Number of patients who die on a daily basis in the Malnutrition ward at the Children's Hospital A07 ward

86% (43) respondents indicated that 2 patients died in most cases, and the remaining 14% (7) respondents stated that the daily mortality was 3 patients only in critical conditions. But none of the respondents indicated that the daily mortality exceeded 4 patients, thus the other segments which showed 5 and 7 patients, remained at 0.

Respondents' Views regarding the Causes of death in patients with SAM at the Children's Hospital A07 ward

The question being an open-ended one, the responses were quite precise and straight forward. The total numbers of questionnaires were 50, and they all gave their answers.

The total number of respondents who indicated dehydration to be the cause of death in patients with SAM were 30, and those that wrote infections were 28. High fever was indicated by 31 respondents and 4 wrote certain other related causes, such as pneumonia and septicemia. Thus, as per the respondents, the most common causes of death in patients with SAM were dehydration, infections and high fever.

Distribution of Responses to whether most Patients come with Medical Complications before admission at the Children's Hospital A07 ward

94% of the respondents indicated yes, meaning that most of the patients were admitted with medical complication, whereas the remaining 6% indicated no in response to the question posed to them. This showed that most patients were admitted with medical complications.

Respondents' Views on the Most Common Medical Complications associated with SAM at the Children's Hospital A07 ward

38 respondents indicated the presence of anorexia and poor appetite, 29 indicated intractable vomiting, 19 respondents ticked hypoglycemia, and 26 respondents indicated severe dehydration. High fever had 19 responses and hypothermia had 22 responses.

Risk factors that led to the Death of patients during Treatment at the Children's Hospital A07 ward

It can be noted that 17 respondents indicated impaired immunity to be a major risk factor that led to the death of patients during treatment, 10 indicated bronchopneumonia, 9 indicated acute diarrhea, 8 indicated clinical septicemia, and lastly 6 respondents indicated hypothermia. It can therefore be noted that the risk factors indicated by the respondents were impaired immunity, bronchopneumonia, acute diarrhea, clinical septicemia and hypothermia respectively.

Distribution of Responses on the Period with the highest number of Deaths at the Children's Hospital A07 ward

The period with the highest number of deaths (82%) happened within the first 48 hours of admission, 12% occurred within 3 to 7 days after treatment, and the remaining 6% occurred within 24 hours of admission, and no death (0%) was recorded to happen during the rehabilitation phase.

Presence of Heaters in the Ward at the Children's Hospital A07 ward

Regarding whether the ward had heaters or not, 100% respondents said yes, and 0% (none) said that they did not have heaters in the ward. This clearly shows that the ward had heaters to keep the children warm.

Number of Heaters in the Ward with 59 Bed capacities at the Children's Hospital A07 ward

All the respondents (100%) indicated that the ward only had 7 heaters and none of them indicated otherwise. The ward has adequate number of heaters which were necessary for the prevention of hypothermia in these patients with 59 bed capacity.

Presence of Hypoglycemia and Hypothermia in all the Patients at the time of Admission at the Children's Hospital A07 ward

82% of the respondents said yes, and the remaining 18% indicated otherwise (no). This indicated a major chance of presence of hypoglycemia and hypothermia in these patients.

Correction of Hypoglycemia and Hypothermia at Children's Hospital A07 ward

For this purpose, 2% of the people used sugar solution and heaters, 72% used F-75 milk and heaters, and 26% used dextrose and warm blankets. This clearly means that F-75 milk and heaters were predominantly used to treat hypoglycemia and hypothermia respectively, but mostly, dextrose is used to treat hypoglycemia alone when a patient is critically hypoglycemic and needs sugar urgently.

Administration Frequency of the Therapeutic Feeding of F-75 Milk to the Patients at Children's Hospital A07 ward

Out of the 50 patients who were on F-75 milk, 43 (86%) were on 3 hourly feeding, which is the normal routine, and 7 (14%) were on 2 hourly feeding because they had some complications such as vomiting and persistent diarrhea.

Ways of Storing Milk by the Caregivers after it was collected from the kitchen at Children's Hospital A07 ward

50 caregivers were observed as they went to the kitchen to collect the milk. It was observed that 41 carried cups, 7 carried feeding bottles and 2 carried jars. Then afterwards 82% of the care-givers kept the milk in the cups covered, 14% kept the milk in the feeding bottles, while the remaining 4% kept the milk in the jars.

Milk Storage Conditions (according to the hospital standards)

82% respondents indicated that milk is kept in good condition, whereas the remaining 18% stated the opposite.

Availability of Counseling for the Caregivers during their stay in the hospital at Children's Hospital A07 ward

100% caregivers are provided counseling.

Number of Relapse Cases the ward receives in a Month at Children's Hospital A07 ward

90% of the respondents were of the opinion that the ward received 2 relapse cases in a month, and the remaining 10% of the respondents indicated that it was 1 case per month.

Feedback being provided to the Medical care staff from the Caregivers after being referred to their respective clinics after discharge at Children's Hospital A07 ward

100% of the medical care staff received feedback from the caregivers after they were discharged and referred back to their respective local clinics.

Discussion of the Findings

The first objective was identifying the common causes of death in severely malnourished children. The study found out that dehydration, infections and high fever were the three common causes of death in these children at the University Teaching Hospitals. The study revealed that 31 respondents believed that high fever was responsible for most of the deaths in the ward, 30 respondents indicated dehydration and 28 indicated infections. Since the

question was an open-ended one, the respondents were not bound by any limitation so they had the liberty to indicate more than two answers so that the findings may not be limited. These three were the leading responses, so they were considered to be the most common causes of deaths in SAM patients below five years of age.

The objective number two was to find the most affected age group in these patients, the age groups being: 0 to 6 months, 6 to 12 months, 12 to 24 months, and 24 to 59 months. The results showed that 0 to 6 months received 5 responses (10%), 6 to 12 months received 20 responses (40%), 12 to 24 months received 21 responses (42%), and 24 to 59 months received 4 responses (8%). Therefore, the age group with the highest deaths was concluded to be 12 to 24 months (1 to 2 years) which got 42% responses.

The patients aged 12 to 24 months are susceptible to conditions like severe acute malnutrition; it is so because this is the age when the child stops breast feeding at the will of the mother (in most cases) or at their own will. In most situations, mothers stop breastfeeding their children at the age of 6 months either due to economic factors like mother being unable to provide food for herself (to ensure that her increased diet in order to breast feed the child). In certain scenarios, when a mother gets pregnant while her child is still 8 to 12 months old, she stops breastfeeding her child because of the myth that he/she will feed on the milk of the child which is still growing in her womb. So the child ends up being abandoned by the mother and her attention turns towards the growing fetus.

Another factor is failure to provide adequate food to the child who has stopped breastfeeding. Most mothers in Zambia stop breastfeeding when the child reaches the age of 12 months. Thus when the child doesn't have enough food to eat, and is also not breast feeding, he/she becomes severely malnourished. An additional factor is giving unsafe formula milk to the child without consulting a professional doctor or nutritionist on the matter, which can lead to the child getting infected with certain conditions like developing diarrhea, thereby resulting in the child getting wasted.

Conclusion

In conclusion, there is a definite need to do a more complex research in this area of study and find long lasting ways to combat malnutrition and eliminate this problem. The study revealed that the leading causes of death in children under-five years of age with severe acute malnutrition at the University Teaching Hospital - Children's Hospital in Lusaka have been found to be dehydration, infections and high fever. It has also uncovered that the risk factors that increase the chances of mortality in these patients are impaired immunity, bronchopneumonia, acute (osmotic) diarrhea, clinical septicemia and hypothermia. These are the highest contributing factors that encourage dehydration, infection, and high fever. The most affected age group with high incidences of SAM has been found to be the age group of 12 to 24 months, and the second in place being 06 to 12 months. This is due to the lack of exclusive breastfeeding of these children, which increases the chances of them getting

malnourished. The in-patient care level of these patients is of high quality with no patient being compromised. The study also discovered the challenges the hospital faces when it comes to preventing under-five mortality. This includes reduced community participation in conducting programs to educate parents on how to improve household food security, and reduction of community outreach programs. The measures to be put in place to combat this problem are also being discussed which include improvement of government participation in providing the RUTF for both in-patient and out-patient health care centers to help reduce the number of relapse cases in the country.

Recommendation

The Zambian Government through the Ministry of Health, needs to provide all the local health care centers, first level hospitals and the major referral hospitals with adequate supply of RUTF so that those children who are severely or moderately malnourished or are suspected to be so, are adequately treated, and given the necessary feed at an appropriate time at out-patient level, before their condition worsens, thus obviating the need of referral to tertiary care hospitals. This will reduce the dependence on international donors like UNICEF and WHO, and other donors like Hope-SAM to provide RUTF to the centers (i.e. the crisis that occurred in the country in July where there was less supply of RUTF which led to more relapse cases in the country). This will ensure a decrease in under-five patients' mortality.

The local medical schools need to train a large number of nutrition practitioners and demonstrators who can then make home-made RUTF for the local patients who need the feed instead of depending too much on the donors to supply the feed to us.

There is a great need for the government to provide a source of clean water to be supplied to all the shanty compounds where there is no clean water for the residents. This will reduce the number of diarrhea cases which has also been found to be one of the causes of malnutrition.

The Ministry of Health needs to deploy a large number of nutritionists to all communities, local health centers and clinics, to deal with SAM, so that in-time admissions of these children is ensured, which will gradually reduce the mortality of these patients.

References

1. Bachou, H., Tumwine, J. K., Mwadime, R. K., Ahmed, T., & Tylleskar, T. (2008). Reduction of unnecessary transfusion and intravenous fluids in severely malnourished children is not enough to reduce mortality. *Ann Trop Paediatr*, Mar, 28(1), 23-33.
2. Black, R. E., Victora, C. G., Walker S. P., Bhutta, Z. A., Christian, P., Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., Uauy, R. (2013). Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries. *The Lancet*, 382(9890), 427–51.
3. Anigilaje, E. A. (2018). Management of Diarrhoeal Dehydration in Childhood: A Review for Clinicians in Developing Countries. *Front Pediatr*, 6, 28.

4. Masiye, F., Chama, C., Chitah, B., & Jonsson, D. (2011). Determinants of Child Nutritional Status in Zambia: An Analysis of a National Survey. *Zambia Social Science Journal*, 1(1).
5. Food and Nutrition Technical Assistance III Project (FANTA). (2017). Reducing Malnutrition in Zambia: Estimates to Support Nutrition Advocacy. Zambia Nutrition Profiles 2017. Food and Nutrition Technical Assistance III Project (FANTA), FHI 360, p. 1-55.
6. Irena, A. H., Mwambazi, M., & Mulenga, V. (2011). Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set-up in Lusaka, Zambia. *Nutr J*, Oct 11, 10, 110.
7. WHO (2013). *Updates on the management of severe acute malnutrition in infants and children*. World Health Organization, p. 1-111.
8. WHO (2019). *World Health Statistics 2019: Monitoring Health for the SDGs sustainable development goals*. Switzerland, p.1-28.
9. World Health Organization, United Nations High Commissioner for Refugees, International Federation of Red Cross, World Food Programme (2000). *The management of nutrition in major emergencies*. World Health Organization, p. 1-286.
10. Zambia Demographic and Health Survey 2013-14. (2015). Central Statistical Office Lusaka, Zambia Ministry of Health Lusaka, Zambia University of Zambia Teaching Hospital, Virology Laboratory Lusaka, Zambia University of Zambia Department of Population Studies Lusaka, Zambia Tropical Diseases Research Centre Ndola, Zambia, p. 1-518.