

Research Article

Outcome of Severe Acute Malnutrition in Children Aged 6-59 Months Before and After the Institution of the Malnutrition Treatment Centre in the Regional Hospital Limbe, Southwest Region of Cameroon

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Abstract

Background: Malnutrition occurs when nutrient and energy intake do not meet, or exceed an individual's requirements to maintain growth, immunity, and organ function. In 2020, among children 0-59 months worldwide, 21.3% (144 million) were stunted and 6.9% (47 million) were wasted. The Malnutrition Treatment Centre's (MTC) establishment in the Regional Hospital Limbe in 2019 brought major changes in management such as free and continuous supply of therapeutic food and basic drugs, the expertise of a nutritionist and closer follow up of patients after discharge. The aim of this research was to evaluate the outcome of children with severe acute malnutrition aged 6-59 months treated at the MTC differed from those treated before the MTC's creation.

Methodology: An analytic cross sectional retrospective study was conducted from February to March 2022. The study period was from March 2016 to February 2019 (before the MTC) and March 2019 to February 2022 (after the MTC). A predesigned data extraction form was used to obtain sociodemographic data of the children and their parents, clinical findings on admission and hospital outcome. The data was entered into CDC Epi info 2.4 and analysed using SPSS. A p-value of <0.05 was considered statistically significant.

Results: Out of 129 files included in the study, 35 were pre-MTC and 94 after its creation. The hospital prevalence of SAM increased from 4% to 7% after the MTC's creation. The mean MUAC (mid-upper arm circumference) was 11.1 ± 0.98 cm. Marasmus was the most common form of SAM (90.7%). The most common admission symptoms were fever (74.4%), diarrhoea (47.2%) and vomiting (32.6%). The most common comorbidities were malaria (29.5%), gastrointestinal infection (20.9%), sepsis (18.6%) and pulmonary infection (14%). There was an increase in the recovery rate (from 71.4% to 76.6%) and the rate of weight gain (from 3.5 g/kg/day to 8.7 g/kg/day). There was also a reduction in the death rate (from 14.3% to 9.6%)

and length of in-hospital admission (from 10.24 ± 5.4 days to 7.3 ± 3.6 days)

Conclusion: The MTC led to an increase in the influx of patients with SAM at the RHL, marasmus was the most common form of SAM. There was an increase in the rate of weight gain, a decreased mortality rate and decreased length of hospital stay, thus revealing the pertinent relevance of the MTC in the management of SAM.

Keywords: Severe Acute Malnutrition; Malnutrition Treatment Centre; Regional Hospital Limbe

Introduction

Malnutrition occurs when nutrient and energy intake does not meet, or exceeds an individual's requirements to maintain growth, immunity and organ function [1]. Though there has been a steady decline over the years, the current burden of malnutrition remains unacceptably high. This makes malnutrition a major worldwide public health concern, especially in the paediatric population. In 2020, among children 0-59 months worldwide, 21.3% (144 million) were stunted and 6.9% (47 million) were wasted [2]. Nearly half of all deaths in children under 5 are attributable to undernutrition; undernutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and delays recovery [2]. From the Millennium Development Goals in 2000 to the Sustainable Development Goals in 2015, mention has always been made of ending poverty and hunger (both closely related to malnutrition). Although in effect progress is being made in that direction, the burden of malnutrition in Sub-Saharan Africa and in Cameroon is still heavy. In Cameroon, according to World Food Program (WFP), in 2020, 29% of children under 5 are still stunted, and 4.3% suffer from wasting [3]. In Cameroon, in 2015, 8 out of 10 cases of malnutrition came from the North and Far North regions of Cameroon with more than half of the remainder coming from the East region of the country [4,5]. According to WHO (World Health Organization), Severe Acute Malnutrition (SAM) can be diagnosed in children 6 months-5 years presenting with one or more of these criteria; Weight for-Height (W/H) z-score less than or equal to 3, Mid Upper Arm Circumference (MUAC) <115mm and the presence of clinical signs of bilateral oedema of nutritional origin [6]. SAM arises because of a sudden period of food shortage and is associated with loss of body fat and wasting of skeletal muscle [5]. The form of SAM that presents with severe wasting is called marasmus. When it presents with oedema, it is called kwashiorkor. Marasmickwashiorkor is when there is oedema superimposed on severe wasting [1]. Before the institution of the Malnutrition Treatment Centre (MTC) in the Regional Hospital Limbe (RHL), children with SAM were all treated as inpatients. Though the WHO ten steps for the treatment of SAM were followed, the food of patients was locally prepared at the expense of the parents. In a bid to improve the outcome of children with SAM, the MTC was established in the RHL in 2019 by UNICEF (United Nations Children's Fund) through the regional delegation of public health after observing evidence of SAM and local means of management at the given hospital. The MTC came with not only a more scrupulous implementation of the WHO ten steps, but also provided the children with WHO therapeutic food for SAM and basic drugs to ease treatment. Thus, reducing the financial burden on parents who already had malnourished children. Though there are previous studies on the prevalence of malnutrition in Cameroon and in the South-West Region, no research has been conducted to investigate how effective the MTC has been in accomplishing its objective [7]. As such, the aim of this research was to find out how effective the MTC has been in improving the outcome of children with SAM. The information obtained will be helpful to determine if such centre will be worth implanting in other parts of the country where it's not yet there. It will permit the centre identify its weaknesses and orientate on steps that may be taken towards improvement.

Methodology

The study was an analytic cross sectional retrospective study carried out from February to March 2022 including hospital records from March 2016- February 2019 before the MTC and from March 2019-February 2022 after the creation of the MTC. This research was conducted in the Regional Hospital Limbe. Limbe is found in the South-west region of Cameroon. The RHL is within the Limbe Health Area. It is one of the major referral hospitals of the South-west region. The RHL has 200 beds and has the following facilities: an emergency unit, obstetrics and gynaecology unit, paediatrics and neonatology unit, internal medicine unit, an imaging centre, a dentistry unit, an ophthalmologic unit, HIV centre, physiotherapy centre, 2 theatres, a surgical unit, and an infant welfare clinic where a lot of the SAM children are identified. The paediatric unit is headed by a paediatrician and consists of four hospitalization rooms each having four beds (total of sixteen beds). One room is being reserved for SAM children. The MTC is operated by two nutritionists who handle stockings and basic commodities. The nutritionist follow-up both hospitalized and non-hospitalized children with malnutrition and are assisted by the paediatrician, a general practitioner, and nurses. Children from the emergency who are diagnosed of malnutrition are registered at the MTC and according to their clinical presentation are either hospitalized or not. Inpatients after proper treatment are discharged after attaining a W/H z-score of at least -1.5. The nutritionists also educate mothers and other care givers of malnourished children on proper feeding habits to avoid relapse.

Children admitted to the RHL within March 2016 to February 2022 with a diagnosis of SAM, aged 6-59 months were included in the study and incomplete files were excluded. A consecutive sampling method was used to recruit participants, admission registers in the paediatric ward were initially reviewed, then files fulfilling the inclusion criteria were reviewed and using a data extraction form the following data was extracted; Patients' demographic data (age, sex), Parents' sociodemographic data (age,

level of education, occupation), Anthropometric measurements on admission (weight, height, MUAC), Presenting symptoms, Associated diagnosis (comorbidity), Rate of weight gain (g/kg/day), Number of days of hospitalization, Anthropometric measurement on discharge, Report of discharge against medical advice and death. The data was entered in Epi info version 2.4. and exported in Microsoft Excel 2013. Then data was checked, cleaned, coded, and exported to Statistical Package for the Social Sciences (SPSS) version 25. Statistical analysis were performed using IBM SPSS version 25. Descriptive analysis were computed to compare the sociodemographic characteristics of the children and parents. The mean and standard deviation were reported for normally distributed variables, median and range for non-normally distributed variables and frequencies and percentages for categorical variables. Chi-square test or Fisher's exact test was used to test the dependence of 2 categorical variable depending on whether conditions were fulfilled for the former or the latter. T- test was used to determine the significance of the proportion or percentages of categorical variables. P-values < 0.05 were considered statically significant. Ethical clearance was obtained from the University of Buea Institutional Review Board (IRB), and administrative clearance from the Regional Delegation of Public Health, South-west Region and authorization was also obtained from the director of RHL to review data at the hospital.

Results

A total of 4,304 admissions were recorded within our study period and 2,807 children were within the 6-59 months age. 1,231 children were hospitalized before the MTC creation with 53 SAM cases, 18 missing/ incomplete files so 35 complete files used while 1,576 children were hospitalized after the MTC creation with 121 SAM cases, 27 missing/ incomplete files giving 94 complete files used for the study. Out of 2,807 children aged 6 to 59 months admitted at the paediatric ward of the RHL within our study period, 174 had SAM, thus a global prevalence of 6%.

Before the creation of the MTC, out of 1,231 admissions, 53 were SAM cases. This gave us a prevalence of 4%. After the creation of the MTC, out of 1,576 admissions, 121 were SAM cases. This gave us a prevalence of 7% (Fig. 1). Of the children included in the study, more than half, 75 (58.1%) were females. Most children, 118 (91.5%) were within the age group 6 to 24 months and the median age was 12 months. Majority of the children, 86 (67.7%) were exclusively breastfed for less than 6 months (Table 1).

Regarding the parents of the children, the median age of the mothers was 28 years while for the fathers it was 36 years. Most of the mothers, 27 (58.7%) were unemployed while almost all the fathers, 38 (97.4%) were employed. The educational level of both group of parents were similar, with a majority having attained secondary school, 25 (56.8%) and 23 (60.5%) for mothers and fathers, respectively.

The mean MUAC on admission was 11.1 ± 0.98 cm. Regarding the types of SAM, 117 (90.7%) had marasmus while 12 (9.3%) had kwashiorkor. Before or after the MTC, the type of SAM predominantly remained marasmus (Table 2). The Fisher's exact test reveals that the type of SAM treated at the health facility is independent of whether it was before or after creation of the MTC ($p = 0.212$). Majority, 96 (74.4%) of the children had fever on admission, followed by vomiting 42 (33.6%), cough 40 (31%) and anorexia 29 (22.5%). Regarding associated diagnosis upon admission, a large proportion of children 38 (29.5%) had malaria, 27 (20.9%) had gastrointestinal infections, and 24 (18.6%) had sepsis. Analysis on the trend of hospitalization shows that across all the years (before and after institution of the MTC), the rate of hospitalization was higher in the months of February to April, and again in the months of November and December. We also notice an increase in the number of hospitalizations from 2019, after the creation of the MTC as seen in Fig. 2.

The mean number of days spent in the treatment centre was 8.0 ± 4.3 days. When the data was stratified by MTC establishment status (before and after creation of the MTC in 2019), the mean days of hospitalization before and after was 10.24 ± 5.4 and 7.3 ± 3.6 days, respectively. Hence, the length of hospitalization was 3.0 days shorter after the creation of the MTC. The independent student t-test reveals a significant difference in the number of days of hospitalization before and after institution of the MTC (t-statistic = 2.6, degree of freedom (df) = 32.0, $p = 0.014$). The average weight gain after the MTC's institution (5.238 g/kg/day) was higher than before it's institution (3.465 g/kg/day) and based on the independent Student t-test the difference was found insignificant ($p = 0.182$). Most the children were properly discharged after recovery (71.4% and 76.6% before and after the institution of the MTC, respectively). However, the increased in proportion of SAM children discharged was not significant (Chi-squared, $X^2 = 0.367$, $p = 0.545$). The proportion of children discharged against medical advice was 0.5% lesser after establishment of the MTC, although this difference was not significant (14.3% vs 13.8%, $X^2 = 0.005$, $p = 0.942$). The mortality rate prior to establishment of MTC was 14.3%, which reduced by 4.7% to 9.6%, yet the difference was statistically not significant ($X^2 = 0.577$,

$p = 0.448$) as seen in Fig. 3. The crude death rate was 14/129 (10.9%). The mean time to death was 7.8 ± 7.6 days. The most common cause of death was respiratory distress.

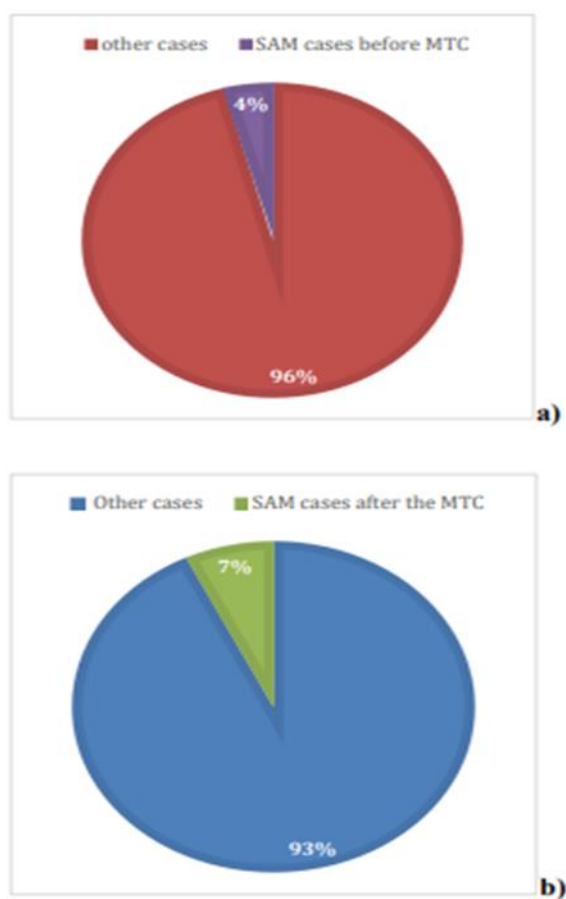


Figure 1: Prevalence of SAM a) Before the MTC b) After the MTC.

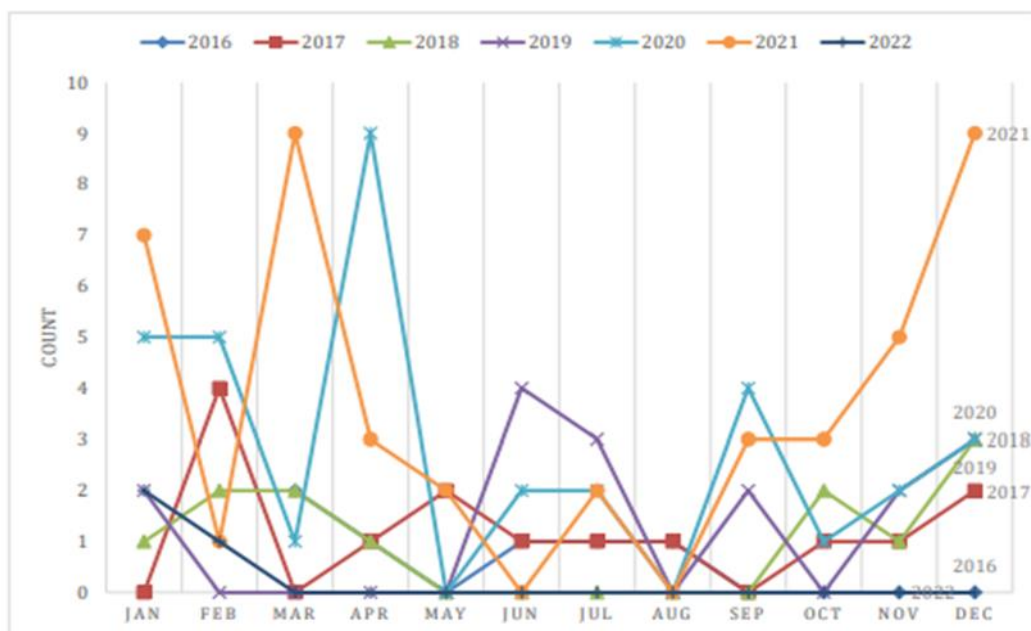


Figure 2: Hospitalization trend from 2016 to 2021.

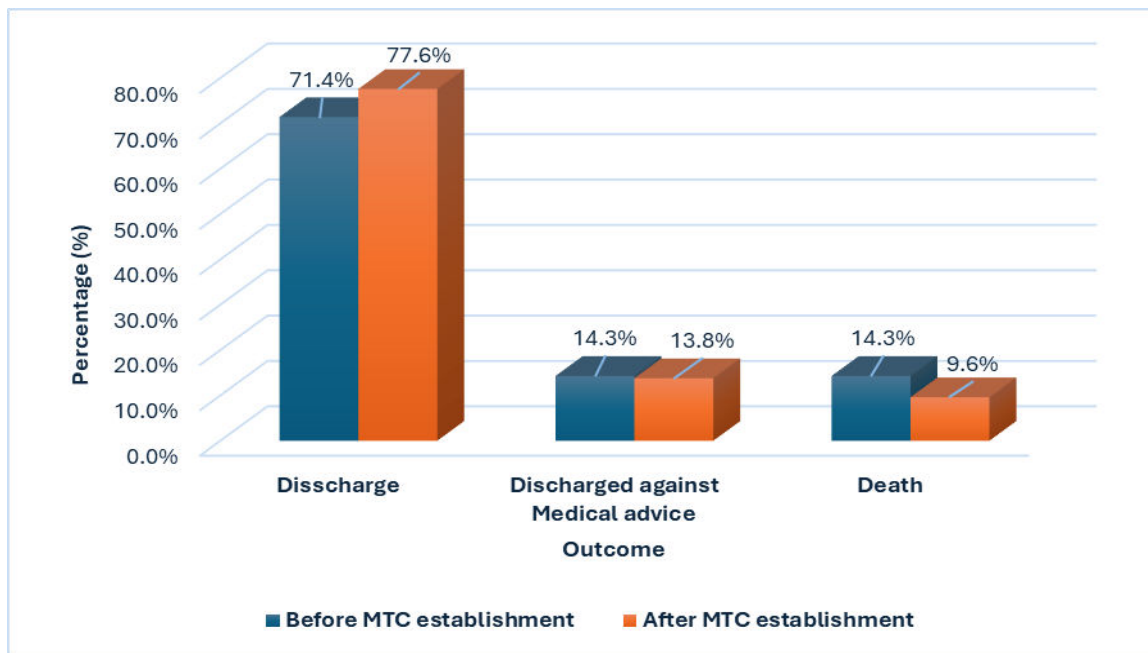


Figure 3: Outcome of SAM before and after creation of the MTC at Regional Hospital Limbe.

Variable	Category	Frequency (n)	Percent (%)
Gender	Female	75	58.1
	Male	54	41.9
Age (months)	Median (range):	12.0 (6 – 60)	
	6 - 24 months	118	91.5
	24 - 48 months	9	7.0
	≥ 48 months	2	1.6
Exclusive breastfeeding (n = 127)	Never	9	7.1
	<6 months	86	67.7
	≥6months	32	25.2

Table 1: Socio-demographic characteristics of children with SAM.

Malnutrition status	MTC establishment status		Total
	Before MTC establishment	After MTC establishment	
Kwashiorkor	5 (14.3%)	7 (7.4%)	12 (9.3%)
Marasmus	30 (85.7%)	87 (92.6%)	117 (90.7%)
Total	35 (100.0%)	94(100.0%)	129 (100.0%)

Table 2: Cross tabulation of types of SAM, before and after MTC creation.

Discussion

This research therefore was set out to investigate the impact the creation of the MTC in the RHL has had on the outcome of SAM. Our objectives were generally to evaluate the outcome of SAM in children aged 6-59 months treated at the MTC of the RHL as compared to those treated before the creation of the MTC. Specifically, to determine the prevalence of SAM, to determine if marasmus or kwashiorkor was more common among hospitalized children with SAM before and after creation of the MTC and to evaluate the mortality rate, the rate of weight gain and length of admission of children of SAM before and after the institution of the MTC.

We had an overall prevalence of 6%. This was similar to 6.5% obtained by Kanan, et al., in Sudan [8]. It was lower than 14.6% obtained by Aliyu, et al., in Nigeria and higher than 2.72% obtained by Chiabi, et al., in Yaounde [9,10]. The differences in prevalence could be due to different socio-economic conditions of the different study areas. There was an increase in the hospital prevalence of SAM at the RHL from 4% to 7%. After its creation, the centre became a major referral centre for malnutrition, hence this could account for the increased prevalence.

Among 129 children, there was a male to female ratio of 1:1.3. This was similar to what was found in a study in Nigeria by Aliyu, et al., [9]. In contrast to our study, Ahmed, et al., had 47% of females in Bangladesh and in Sudan, Kanan, et al., had an almost equal male female ratio of 1:0.9 [8,11]. Our median age was 12 months with the most represented age range being 6-24 months. This is similar to the results of Chane, et al., whose median age was 13 months and had 2/3rd of their sample population within the 6-23 months age range [12]. Gavhi, et al., in South Africa had a median age of 13 months as well with most represented age range being 7-24 months [13]. Nduhukire, et al., had a higher median age of 15 months [14]. By 6-24 months, most children have already been weaned and introduced to adult food. When this is not properly done and the nutritional needs of the child are not met, it can easily lead to malnutrition. This would explain why this age range is often the most represented in our study and other studies.

The most common form of SAM identified in our study was marasmus (90.7%). Aliyu, et al., with 56.9%, Kanan, et al., with 68.2% and Ndzo, et al., in Garoua with 72.4% [15] also had marasmus as the predominant form of SAM [8,9,15]. In contrast, in Zambia, Munthali, et al., observed kwashiorkor as the most common form of SAM (62%) followed by marasmus that accounted for 21.6% while Marasmic-kwashiorkor had 16.4% [16]. Our finding of marasmus as the most common form of SAM is not surprising. However, the comparatively low levels of kwashiorkor and complete absence of marasmic-kwashiorkor could point out to the fact that foods commonly eaten in our study area may be rich in proteins.

The most common presenting complains on admission were fever followed by diarrhoea, vomiting and cough. Weight loss and anorexia were the least common symptoms. In India, Choudhary, et al., had similar results; Fever, followed by vomiting, loose motion, cough and loss of appetite or weight loss [17]. For Chiabi, et al., in Yaounde, the most frequent symptoms on admission were: wasting and fever [10]. This shows most consultations were not prompted by the physical changes often present in malnutrition but rather alarming symptoms such as fever. This often results from poverty (one of the main cause of malnutrition) where the parents delay hospital consultation as much as they can until the child becomes severely ill. Also, parents may not perceive a health challenge in the leanness of the child when they themselves are lean, thinking it's a family trait meanwhile the child is malnourished as they themselves are.

The most common comorbidities were malaria, gastrointestinal infection, sepsis and pulmonary infection. Chiabi, et al., had different results in Yaounde with respiratory tract infections being the dominant comorbidity followed by malaria and sepsis [10]. Choudhary, et al., had gastrointestinal tract infections as the dominant comorbidity, followed by respiratory tract infection, urinary tract infection [17]. The discrepancies in the dominant comorbidities in these studies could be due to factors particular to each study area. However, one thing common in all these studies is that the comorbidities were mostly infectious. Even though the disease burden in developing countries is mostly infectious, the dominance of infections as comorbidities could also be since children with SAM have a weakened immunity and thus have higher risk to get infections as well as longer recovery time. Observing the Hospitalization trend, we see a rise in hospitalization after the creation of the MTC. The increased influx of patients should probably be due to the free malnutrition food and drugs provided by the MTC. The centre also attracted more referral of malnutrition cases. Also, the presence of the nutritionist could have led to greater awareness and diagnosis of malnutrition. From the same graph, highest admissions were seen in the months of February to April. Mathur, et al., in India, observed increased

admissions from the months of May to October [18]. Hossain, et al., in Bangladesh also observed seasonal variations in admission of children with SAM, recording the highest admission in September and October [19]. In our case, the seasonal variation could be related to the transition from dry to rainy season. The rain comes with water puddles which is a breeding ground for female anopheles mosquitoes. Considering that 74.4% of the children presented with fever and 29.5% had a confirmed diagnosis of malaria, this could explain the increased admission in February, March, and April.

The overall number of days of admission were 8.0 ± 4.3 days. After stratifying the data into before and after creation of the MTC, we noticed the average numbers of days of admission decreased by 3 days after the MTC, moving from 10.24 ± 5.4 days to 7.3 ± 3.6 days. Our mean days of admission is similar to 8.25 ± 5.6 days observed by Chiabi, et al., [10]. Ahmed, et al., had a higher average hospital stay of 14.2 ± 9.9 days [11]. The shorter days of admission could be linked to the faster rate of weight gain hence faster recovery. It could also be that the increased influx of patients created a pressure for beds which caused a faster discharge of patients to be followed as outpatients once complications had been managed.

The rate of weight gain increased from by 5.238g/kg/day, rising from 3.465 g/kg/day before the MTC to 8.703g/kg/day after (though not statically significant). This was higher than Hossain, et al., who had 7.73 g/kg [19] and lower than 10.18 (± 7.05) g/kg/d obtained by Savadogo, et al., in Burkina Faso and 12.7 (± 8.9) g/kg/days obtained by Fikrie, et al., [20,21]. The rate of weight gain achieved after the creation of the MTC falls in line with the standard of the >8 g per kg/day specified in the Sphere standards and UNHCR/WFP guidelines [22]. This may signify the supply and constant availability of WHO approved therapeutic food could be more effective than locally prepared malnutrition food in causing weight gain in malnourished children.

The outcomes we evaluated in this work were discharge after recovery, discharge against medical advice and death. The discharge (recovery) rate was higher after the creation of the MTC; from 71.4% to 76.6% (though this was not statically significant). The later recovery rate is similar to 78% observed by Kabeta, et al., [23]. Higher recovery rate of 82% was observed in Northern Ethiopia by Guesh, et al., [24]. Asres, et al., still in Ethiopia had a lower recovery rate of 51.9% [25]. With 76.6% we are in line with international standards of 75% recovery rate [22].

The death rates dropped from 14.3% to 9.6% (though not statically significant). The later death rate was similar to 9.3%. observed by Kanan, et al., in Sudan [8]. It was lower than 10.8% in Southern Ethiopia reported by Fikrie, et al., and 16.2% reported by Kabeta, et al., [21,23]. Yet, higher than 7.5% observed by Kambale, et al., in Congo and 3.8% observed by Guesh, et al., [24,26]. This improved death rate is also in line with international standards of $<10\%$ death rate [22].

The improved recovery rate and death rate most likely is the reflection of the boost the MTC brought not only to the management but to the managing team as well. Surprisingly, the rate of discharge against medical advice (defaulters) did not change much (14.3% before to 13.8% after creation of the MTC). This defaulter rate was similar to 13.85% found by Yebyo, et al., in Northern Ethiopia [27]. higher than 8.5 % in Burkina Faso as demonstrated by Savadogo, et al., and 6.65% in Northern Ethiopia found by Guesh, et al., [20,24]. Yet it was lower than 20.7% Chiabi, et al., noticed in Yaounde [10]. This could be because some expenses were covered by the MTC, some parents were still not able to meet up with, which included bed fee and laboratory investigations. Also, mothers, which most often are the ones in the hospital with the children will express the need to go back and take care of other children at home. Lastly, it could also be that guardians who brought their children for consultation mainly due to alarming symptoms such as fever or diarrhoea, are in a haste to go back home once those symptoms recede, disregarding any other health challenge the doctors may point out. Though our defaulter rate is high, we are within international standards of less than 15% defaulter rate [22].

Conclusion

After the centre's creation, there was an increase in the influx of children with SAM at the RHL and the most common form of SAM was marasmus. There was also an increase in the rate of weight gain, a decreased death rate and a decreased length of hospital stay. This evidence strongly advocates for bigger MTC center which can carry out both hospital and community follow up.

Conflict of Interest

The author has no conflict of interest to declare.

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Authors' Contributions

NM conceived the study and drafted the initial manuscript. CF and TE participated in data extraction and analysis. VV reviewed and corrected manuscript.

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