Global Scientific JOURNALS

GSJ: Volume 10, Issue 11, November 2022, Online: ISSN 2320-9186

www.globalscientificjournal.com

Factors Associated With Relapse of Acute Malnutrition among Under Five Years Old Children with Acute Malnutrition in Bugesera District, Rwanda

Hakizimana Diogene

Dr Rosemary Okova (Supervisor)

Department of Public Health, Mount Kenya University Rwanda

Email: diogenehakizimana1@gmail.com

Department of Public Health, Mount Kenya University Rwanda

Email: ROkova@mku.ac.ke

1. Introduction

Acute malnutrition is one of the leading causes of morbidity and mortality in children under the age of 5 years in developing countries. Severe acute malnutrition (SAM) remains a major health threat to children, as the mortality rates among children with SAM are nine times higher than those in well-nourished children (Bhadoria, 2017). Acute malnutrition is responsible for almost one third of all deaths in children under five years of age and causes intellectual or cognitive impairment among those who survive. The estimated number of underweight children (weight-for-age Z score < -2) globally is 101 million or 16%. The prevalence of acute malnutrition among under-five children is above the World Health Assembly target of reducing and maintaining prevalence at under 5% by 2025 (Dipasquale, 2020). The global prevalence of acute malnutrition is affected by relapse of recurring episodes of malnutrition that tends to occur after discharge from acute malnutrition treatment (SphereAssociation, 2018).

According to the 2018 global nutrition report, 50.5 million children under five years worldwide suffer from acute malnutrition (WHO, 2018). In Africa, 13.8 million children under five years

are acutely malnourished, and this represents 27% of children fewer than five years on the continent. Acute malnutrition among children has been considered as a global health problem, which endangers the health of one in three children in developing countries. It is also considered a public health challenge as it is associated with more than four million deaths in children under five worldwide (Stephenson, 2019). The immediate consequences of childhood acute malnutrition are life threatening, as a child with severe acute malnutrition is 5 to 20 times more likely to die than a non-malnourished child given that fatality rate among severely malnourished children ranges from 30 to 50%(Ashworth & Schofield, 2003)(Ashworth & Schofield, 2003). On the other hand, about 11% of children under five years old are moderately malnourished, and moderately malnourished children are 3 times at greater risk of death than well-nourished children (Abitew, 2020). In East African Countries, acute malnutrition prevalence varies. According to Buzigi (2018), in Uganda the occurrence of acute malnutrition among under-five children reduced from 38.3% in 1995 to 29% in 2016. The yearly decrease rate of acute malnutrition was 0.45% (Buzigi, 2018). The study of Sunguya (2019) indicates that the occurrence of acutely malnourished children among under-five children dropped by 30% in the spell of 25 years between 1991 and 2016 in Tanzania (Sunguya, 2019). In Rwanda, the Ministry of Health ranked acute malnutrition among ten leading causes of death before the fifth birthday of the children with its consequences contributing to more than 50 percent of under-five children's deaths and childhood stunting rate has remained stubbornly high with a 38% in 2015. Moreover, acute malnutrition is highly distributed in rural areas in Rwanda including Bugesera District (RDHS, 2016).

Under-nutrition results from reductions in food intake or diet quality and is often combined with pathological causes and may be categorized as either chronic or acute malnutrition. Acute malnutrition or wasting is further classified as moderate acute malnutrition (MAM) or severe acute malnutrition (SAM) based on the degree of malnutrition and the presence of edema (Abitew, 2020). According to a 2018 report, globally, over 49 million children under 5 have acute malnutrition and nearly 17 million were classified as severely wasted (WHO, 2018). The magnitude of acute malnutrition nationally was found to be 33% (RDHS, 2016). It is not only the magnitude of undernutrition, but also subsequent health consequences that are important, as children suffering from acute malnutrition have weakened immunity and face an increased risk of death, particularly when wasting is severe. The mortality rate among children with SAM is 5–20 times higher than among well-nourished children (Akparibo, 2017). Globally about 1 million children die every year from SAM (Abitew, 2020) and in Sub-Saharan Africa about 57% of all

under-five deaths are related to malnutrition, of which three-quarters are related to mild to moderate malnutrition. It is also estimated that about 70% of all childhood mortality in developing countries is due to five major conditions, and for these, malnutrition increases the likelihood of mortality up to 56% (Dodos, 2018). Ten high-impact, nutrition-specific interventions have been identified that, if taken as a package up to 90 percent coverage, could reduce wasting by 60 percent. Among these important interventions is the management of SAM and MAM (Ellen, 2020) . Children with uncomplicated SAM (WHZ below -3 SD cut-off and/or with MUAC cut-off below 11.5 cm and/or with bilateral edema) and MAM (WHZ between −2 and −3 or mid-upper arm circumference between 11.5 and 12.5 centimeters) may be treated in primary health care such as community and health centers with special therapeutic foods without requiring admission to a health facility, referred to as Community based Management of Acute Malnutrition (CMAM) program. The most common therapeutic regimens are based on severity and include a short course of basic oral medications to treat infections (Abitew, 2020).

Children diagnosed with SAM are discharged recovered from the program when their weight-for-height/length is ≥ –2 Z-score and they have had no edema for at least 2 weeks or alternatively if their mid-upper-arm circumference is ≥12.5 cm and they have had no edema for at least 2 weeks. In addition, children admitted with only bilateral pitting edema are discharged recovered based on the anthropometric indicator routinely used in local programmes (Dandona, 2019) which in the Ethiopian context, is when their W/L> = 85% or W/H> = 85% on more than one occasion (two days for in-patients, two weeks for out-patients) and they have had no edema for 10 days (as an in-patient) or 14 days (as an out-patient) and/or when target weight gain has been reached and they have had no edema for 10 days (as an in-patient) or 14 days (as an out-patient) as the second option (Abitew, 2020).

In Rwanda, the Ministry of Health ranked acute malnutrition among ten leading causes of death before the fifth birthday of the children with its consequences contributing to more than 50 percent of under-five children’s deaths and childhood stunting rate has remained stubbornly high with a 38% in 2015. Moreover, acute malnutrition is highly distributed in rural areas in Rwanda including Bugesera District (RDHS, 2016). In the post- Millennium Development Goal era, the Government of Rwanda is committed to implementing the 2030 Agenda and addressing the significant challenges that remain and has prioritized achievement of the Sustainable Development Goals (SDGs) as a central element in its development strategies (WFP, 2018). Malnutrition imposes significant cost on Rwandan economy, as it is one of major principal

causes of death for children before their fifth birthday. Concealed or untreated acute malnutrition contributes to more than 50 percent of under-five children's deaths and Children's deaths related to acute malnutrition contribute to the reduction and loss of the financial potential of the country (RDHS, 2016).

However, the prevalence of acute malnutrition is affected by relapse or recurring episodes of acute malnutrition that tends to occur after discharge from acute malnutrition treatment (SphereAssociation, 2018). Studies indicate that relapse of acute malnutrition after discharge from treatment results into recurring cases of acute as well as chronic malnutrition and this results into habitual presence of cases with in the community (Abitew, 2020)

Studies in other countries have investigated the factors specifically associated with relapse of acute malnutrition after discharge upon recovery, but none thus far has emanated from Rwanda as a whole, or Bugesera District in particular. Thus, it was necessary to conduct this study to determine factors associated with relapse of acute malnutrition among children aged under five in Bugesera District. The objectives of the study were:

i. To determine the prevalence of relapse of acute malnutrition among under-five year old children of Bugesera District of Rwanda
ii. To determine the maternal and child related factors associated with relapse of acute malnutrition among under-five year old children of Bugesera District of Rwanda
iii. To identify the socio-economic factors associated with relapse of acute malnutrition among under-five year old children of Bugesera District of Rwanda.

2. Literature review

2.1. Prevalence of relapse of acute malnutrition

The relapse rate of both Severe Acute Malnutrition (SAM) as well as Moderate Acute Malnutrition (MAM) after discharge is still high. In some research findings, the recovery rate has been reported to be above the Sphere Handbook minimum standard of >75% (SphereAssociation, 2018), but the relapse rate of acute malnutrition (both SAM and MAM) after discharge as recovered is reportedly still high. This has been noted as 78% as in Bangladesh where the relapse was 69% among children with MAM and 9% among children with SAM (Banerjee, 2016), and in Southern Ethiopia the relapse of malnutrition was at 72.1% a total of 34.6% SAM and 37.5% MAM (Tadesse, 2018) . In a systematic review that involved 26 articles that assessed the prevalence of acute malnutrition relapse among the children, the proportion of

children who relapsed after SAM treatment varied greatly from 0% to 37% across varying lengths of time following discharge. However in that review the lack of a standard definition of relapse limited comparability even among the few studies that have quantified post-discharge relapse (Stobaugh, 2018). In different studies that were done, relapse of malnutrition tended to occur more frequently during the first 6 months following discharge from treatment. In the 2016 study in India that followed children on a quarterly basis for 18 months after discharge found that children were more likely to relapse in the first 3 months (9.1%) versus 6 months (2.9%), 9 months (2.1%), 12 months (2.8%), and 18 months (Burza, 2016). A 2015 longitudinal study in Ethiopia demonstrated the probability of experiencing a new episode of acute malnutrition (AM) was 26% and 7.5% for 6 and 12 months, respectively (Stobaugh, 2018).

2.2. Maternal and child related factors associated with relapse of acute malnutrition

In past studies maternal and child related factors were associated with the relapse of malnutrition among children. Maternal factors such as poor nutrition of pregnant women, intrauterine growth restriction, low birth weight, poor breastfeeding and inadequate complementary feeding, frequent infectious illnesses were identified as factors that lead to recurring episodes of acute malnutrition (Akparibo, 2017). Another study has also noted that boys' health may be more influenced by environmental stressor and diarrhea (Kumi-Kyereme, 2016). The odds of relapse were higher among children not given Vitamin A in the 6 months preceding the survey than among those who received Vitamin A supplement. Studies also found that children who were given pre-lacteal feeding were more acutely malnourished than those who were not (Abitew, 2020).

Consistently, studies and program evaluations reported that children who were discharged prior to reaching recommended anthropometric discharge criteria (default) had higher risk for relapse (Akparibo, 2017). In Niger, those who defaulted during treatment had 7.1 times higher risk of death and were more likely to relapse at 3 months than those who were discharged as recovered (Stobaugh, 2018). A 2016 study in India observed relapse as high as 52% of children who defaulted from SAM treatment (Burza, 2016). The strongest, most consistent risk factor associated with relapse was having lower anthropometric measurements upon admission to and discharge from treatment of SAM (Tadesse, 2018). Illness was observed at the time of relapse in eight studies (Abitew, 2020). Several authors suggested that children who are discharged as recovered from SAM treatment based on anthropometrics alone may not have experienced full immunologic recovery, leaving them susceptible to infection and subsequent relapse. Although rarely measured, micronutrient deficiencies were not associated with relapse (Stobaugh, 2018).

2.3. Socio-economic factors associated with relapse of acute malnutrition

Primary acute malnutrition in children results from insufficient food supply caused by socioeconomic factors and it is most commonly seen in low and middle-income countries. Responsible factors include household food insecurity, poverty, poor quality of water, hygiene, and others (Koletzko, 2017). Relapse of acute malnutrition is considered more social rather than biomedical in origin, but it is also multifactorial. For instance, poor water quality, sanitation and hygiene practices are increasingly believed to be the cause of a condition called “environmental enteropathy” that contributes to acute malnutrition in childhood. The repetitive exposure to pathogens in the environment causes small intestinal bacterial colonization, with accumulation of inflammatory cells in the small intestinal mucosa, damage of intestinal villi, and consequently, malabsorption of nutrients which results in malnutrition (Dipasquale, 2020).

In some studies, place of residence (district) was associated with relapse of acute malnutrition. This was related to differences in HH food security status, hand washing practices, and access to water source in the districts. Relapse of acute malnutrition after discharge as recovered was also related to HH food security status generally. The odds of relapse among children in food insecure HHs were higher than in food secure HHs (Abitew, 2020). Food insecurity can be linked to inadequate intake of diversified foods and studies have reported consumption of low dietary diversity food as being associated with acute malnutrition (Dodos, 2018). Other studies pointed to the role of low socioeconomic status or monthly income in food insecurity (Wolde, 2016) which directly or indirectly reduces the HH purchasing power, and thus, reduces access to food. Having another family member currently on SAM therapy increased the likelihood of being more acutely malnourished. In one study 1.1% of respondents reported that they shared therapeutic food with other children in the family and 1.2% reported knowing other households which had done so. Sharing therapeutic food could make it more likely that a recovered malnourished child could relapse. The odds of relapse were higher among children whose mother reported not consuming additional food during pregnancy/lactation. International recommendations for pregnant and lactating women include additional daily food consumption to meet extra caloric needs (Abitew, 2020). No regional and local studies were found assessing the relapse of acute malnutrition among under-five years old children.

3. Materials and methods

3.1. Research design

This study is of a quantitative descriptive retrospective study design. It was conducted on children aged under five years who had acute malnutrition in Bugesera District, Rwanda.

3.2. Target population

The research target population was children aged 6 to 59 months who were discharged from acute malnutrition treatment programs 3 to 24 months prior to data collection in Bugesera District. According to Bugesera District Bi-annual Bulletin, 180 under-five children suffered from acute malnutrition (BugeseraDistrict, 2019).

In this study, the sample of 125 malnourished children was obtained by calculation using SOLVIN FORMULA. The formula was selected because it is used to calculate the size of the sample in prevalence studies of population less than 10,000 (Ellen, 2020).

The formula is $\mathbf{n=N/\ [1+N\ (e)^2]}$.

In this formula **n** is sample size, **N** is study population, which is 180, the number of children who suffered from acute malnutrition in Bugesera District in two years prior to the research. **e** is error which is 5%. By substituting the values in the formula, we obtain $n=180/\ [1+180(0.05)^2]$ = 124.7 which is 125 approximately. This sample is large enough to represent the target population. The error of 5% was selected because it gives the desired number to represent the population.

3.3. Sampling technique

Systematic sampling method was used in this study. As malnourished children are treated from health centers across the District, the number of participants at each health center was calculated by multiplying the desired sample of 125 with the total number of discharged children in the records at health center during the time of data collection and dividing the product with 180, the total population. Participants were enrolled according to the time of discharge, starting from those discharged earlier than others.

3.4. Research instruments

A questionnaire was used to collect data. It was developed by the researcher, since there was no standardized tool that could be found meeting all the objectives of this study.

To ensure reliability of the research instrument, a test-retest was conducted on 5 random participants in separate occasions. The instrument is considered reliable and appropriate for use in this research as in all those five different occasions, it could consistently reproduce the same results over all the visits, other variables remaining the same.

For validity, a pretest pilot study was conducted at occasions on random 5 participants from Gahanga Health Center. This Health Center has similarities with Health Centers of Bugesera District since their populations are neighbors and mainly rural in character. In all 5 different occasions the content of the research tool was unchallenged, hence considered.

3.5. Procedures of data collection

A number of 15 Community Health Workers (CHW) were hired and trained on research ethics and the purpose of the research and questionnaire. At time of collecting data, mothers or caregivers of the selected participants were given research explanations by the data collectors and signed a consent form before participating. To identify the relapse, records at health centers during follow up were consulted and on data collection day, each child was measured for anthropometric data and parents or caretakers were interviewed to collect socioeconomic status data. The questionnaire was interviewer-administered.

3.6. Data analysis and presentation

Data was manually checked for completeness. Primary recording and validation was done and data and data entered in SPPS software version 22 for statistical analysis. Descriptive analysis was carried out. Demographic characteristics are statistically represented. Factors associated with relapse of acute malnutrition are represented in tables. Regression and correlation analysis was done to find the correlation between dependent and independent variables. Since this study has more than one independent variable, Multivariate Analysis of Variance was used. The results are represented in tables and figures.

4. Results and discussion

4.1. Demographic characteristics of participants

Table 4. 1. Children's demographics

(n=125)

Variable	Frequency (n)	Percentage (%)

Child's gender		
Male	61	48.8
Female	64	51.2
Child age in months		
6-11	1	0.80
12-23	58	46.40
24-35	32	25.60
36-47	24	19.20
48-60	10	8.00

Source: computed from SPSS, version 22

The research was conducted on 125 children aged 6 to 59 months who had acute malnutrition in the last two years. As shown in Table 1 above, 61 (48.8%) of them were boys and 64 (51.2%) were girls. 1 child (0.80%) of the 125 children was aged 6-11 months, 58 (46.4%) aged 12-23 months, 32 (25.6%) aged 24-35 months, 24 (19.2%) aged 36-47 months and 10 children (8%) aged 48-59 months.

Table 4. 2.Parents' socio- demographic characteristics

(n=125)

Variable	**Frequency (n)**	**Percentage (%)**
Head of family		
Male	85	68
Female	40	32
Household size		
Mean (SD)	5±2.0	
Under five children		
One child	58	46.4
Two children	50	40.0
Three children	16	12.8
Four children	1	0.8
Mother's occupation		
No occupation	18	14.4

Agriculture	71	56.8
Full time Job	1	0.8
Part time job	35	28.0
Father's occupation		
No occupation	17	13.6
Agriculture	64	51.2
Full time Job	7	5.6
Part time job	34	27.2
Other	3	2.4
Religion		
None	9	7.2
Catholic	26	20.9
Protestant	59	47.5
Islam	2	1.6
Other	28	22.5
Mother's marital status		
Single	14	11.2
Married	88	70.9
Separated	16	12.9
Widowed	6	4.8

Source: computed from SPSS, version 22

As per table 2, 85 households (68%) were headed by men, and 40 (32%) headed by women. 58 households (46.4%) had one child aged under five years among the members each, 50 households (40%) had two children aged under five, 16(12.8%) three children aged under five, and 1 household (0.8%) had four children aged under five years among its members. 18 (14.4%) of the mothers who participated in this study had no occupation, 71(56.8%) were engaged in agriculture, 1(0.8%) had a full-time job, while 35(28%) had part-time jobs. Among fathers of children on whom the research was conducted, 17(13.6%) were jobless, 64(51.2%) were farmers, 7(5.6%) had a full-time job, 34(27.2%) part-time jobs and 3(2.4%) reported to be engaged in other various activities. 9(7.2%) of the mothers of these children self-reported not to belong to any religion, 26(20.9%) were catholic, 59(47.5%) protestant, 2(1.6%) Muslims, while 28(22.5%)

belonged to other religions. Single mothers were 14(11.2%), 88(70.9%) were married, 16(12.9%) separated, and 6(4.8) were widows.

Table 4. 3. Socioeconomic characteristics

(n=125)

Variable	Frequency (n)	Percentage (%)
Ubudehe category		
Category 1	28	22.4
Category 2	55	44.0
Category 3	34	27.2
No category	8	6.4

Source: computed from SPSS, version 22

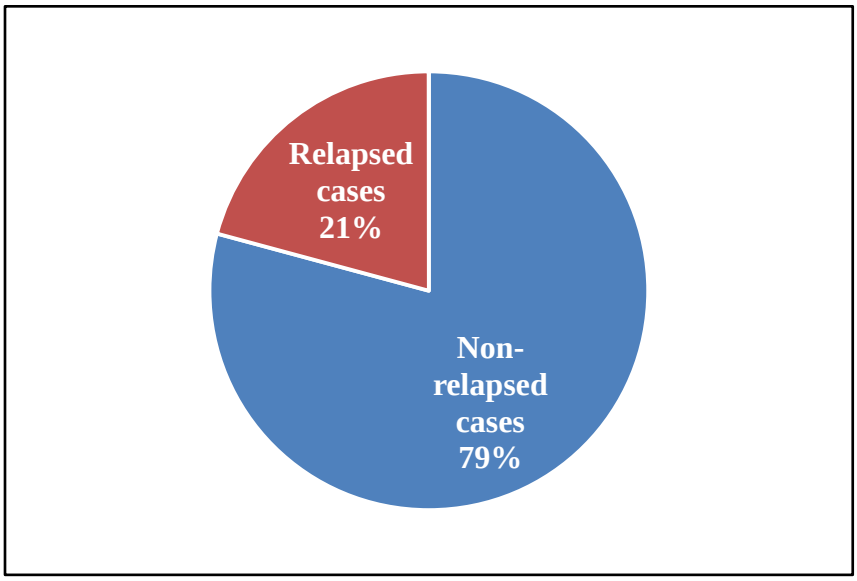
As shows Table 3, among the children on whom the research was conducted, 28(22.4%) came from households under Ubudehe category 1, 55(44%) from households in Ubudehe category 2, 34(27.2%) from Ubudehe category 3, while 8 (6.4%) children were from households which had no Ubudehe category.

4.2. Presentation of findings

4.2.1. Prevalence of relapse of acute malnutrition

The figure below shows the prevalence of relapse of acute malnutrition among under five years old children in Bugesera District who had acute malnutrition in two years prior to the study. To determine the prevalence, every child's caretaker was asked the number of episodes of acute malnutrition their child had had.

Figure 4. 1 Presentation of the prevalence of relapse of acute malnutrition



- Non-relapsed cases 99(79)
- Relapsed cases 26 (21)

Of the 125 children, 26 representing 21%, were found to have had a relapse of acute malnutrition.

4.2.2. Maternal and child related factors associated with relapse of acute malnutrition

Table 4. 4. Relapse cases and breastfeeding practices

The table below shows the relationship between relapse of acute malnutrition among under five years old children and child breastfeeding as a child related factor.

(n=125)

	Relapse Malnutrition			
	Yes	**No**	**Total**	**P-value**
	n (%)	**n (%)**	**n (%)**	
Child is Breastfeed				
Yes	9(7.2)	46(36.8)	55(44)	0.27
No	17(13.6)	53(42.4)	70(56)	

Exclusive breast feeding				
Yes	15(12)	43(34.4)	58(46.4)	0.19
No	11(8.8)	56(44.8)	67(53.6)	
Child given Colostrum				
Yes	19(15.3)	77(62.1)	96(77.4)	0.55
No	7(5.6)	21(16.9)	28(22.5)	

Source: computed from SPSS, version 22

Chi-square test of independence showed no significant association between child being breastfed and relapse of acute malnutrition with $x^2(1, n=125) = 1.9$, p-value=0.27. Chi-square test of independence also showed no significant association between exclusive breastfeeding and relapse of acute malnutrition with $x^2(1, n=125) = 1.6$, p-value=0.19. there was also no significant association between giving a child colostrum and relapse of acute malnutrition with $x^2(1, n=125) = 0.34$, p-value=0.55 as shown by the same test.

Table 4. 5. Health and vaccination status of the child

The table below sheds light on the relationship between relapse of acute malnutrition and the child's MUAC at both admission and discharge, having received all due vaccines according to the age of the child, history of illness in two weeks prior to data collection, having been given deworming tablets in 6 months prior to data collection, and place of birth; as child related factors.

(n=125)

	Relapse Malnutrition			
	Yes	**No**	**Total**	**P-value**
	n (%)	**n (%)**	**n (%)**	
MUAC at admission				
<11.5 cm	11(45.8)	13(54.1)	24(19.2)	-
11.5-12.4 cm	14(14.4)	83(85.5)	97(77.6)	0.00
>12.4 cm	1(25.0)	3(75.0.2)	4(3.2)	0.44

MUAC at discharge				
<12.7 cm	18(30.5)	41(69.4)	59(47.2)	
12.7-12.8 cm	4(9.5)	38(90.4)	42(33.6)	0.00
>12.8 cm	4(16.6)	20(83.3)	24(19.2)	0.44
Vaccination				
Yes	24(20.5)	93(79.4)	117(93.6)	0.67
No	2(25)	6(75)	8(6.4)	
Illness history in 2 weeks				
Yes	12(20.3)	47(79.6)	59(47.2)	0.90
No	14(21.2)	52(78.7)	66(52.8)	
Child given deworming in past 6 months				
Yes	19(18.2)	85(81.7)	104(83.2)	
No	7(33.3)	14(66.67)	21(16.8)	
Place of delivery				
Health facility	20(19.8)	81(80.2)	101(80.8)	0.30
Other places	6(25.0)	18(75.0)	24(19.2)	

Source: computed from SPSS, version 22

Children admitted to treatment programmes with a lower MUAC were more likely to relapse into acute malnutrition than others. For instance, as per table 4.5, 11(45.8%) of children admitted with a MUAC less than 11.5 centimetres relapsed while relapse rate was 14.4% among children admitted with a MUAC of 11.5 to 12.4 centimetres and 25% among those admitted having a MUAC greater than 12.4 centimetres.

Children discharged from treatment programmes having a lower MUAC were more likely to have a relapse of acute malnutrition than children admitted having a higher MUAC, as 18(30.5%) of children discharged having achieved a MUAC less than 12.7 centimetres relapsed; while only 4(9.5%) of children discharged with 12.7 to 12.8 cm MUAC relapsed and 4(16.6%) discharged with a MUAC greater than 12.8 had a relapse of acute malnutrition. Children who were given deworming in the past 6 months were 2 times less likely to have relapse of malnutrition than those who were not given deworming (OR=2). Children who were born at other places had 1.3-time chances to have relapse of acute malnutrition than children who were born in healthcare facilities (OR=1.3)

Table 4. 6. Maternal factors and relapse of acute malnutrition

This table presents frequencies and percentages relating to level of education, marital status and age at delivery as maternal factors that influence relapse of acute malnutrition among children aged under five years.

n=125

	Relapse of Malnutrition		
	Yes	**No**	**Total**
	n (%)	**n (%)**	**n (%)**
Mother's education			
No education	11(22.9)	37(77.0)	48(38.4)
Primary	14(21.5)	51(78.4)	65(52)
Secondary	1(8.3)	11(91.6)	12(9.6)
Mother's marital status			
Single	5(35.7)	9(64.2)	14(11.2)
Married	18(20.4)	70(79.5)	88(70.4)
Separated	1(6.2)	15(93.7)	16(12.8)
Widowed	2(28.5)	5(71.4)	7(5.6)
Mother's age at delivery			
<20	2(16.67)	10(83.3)	12(9.6)
21-25	6(33.3)	12(66.6)	18(14.4)
26-30	5(16.1)	26(83.8)	31(24.8)
>31	13(20.3)	51(79.6)	64(51.2)

Source: SPSS, version 22

Table 4.6 shows that mothers of children that the study was conducted upon, 12(9.6%), reached secondary school, 65(52%) primary school, while 48(38.6%) did not attend school. As per the table, relapse of acute malnutrition varied with the education level of mothers. For instance, children whose mothers had no education were more likely to relapse to acute malnutrition as

11(22.9%) of them relapsed, while 14(21.5%) of children whose mothers attended primary school relapsed and only 1(8.3%) of children whose mothers reached secondary school had a relapse of acute malnutrition.

Also referring to table 4.6, relapse of acute malnutrition was found to be higher among children born from single mothers as 5(35.7%) had a relapse of acute malnutrition while among children born from married mothers, relapse of acute malnutrition occurred to 18(20.4%), and to 1(6.2%) among children of separated mothers and 2(28.5%) of children of widows.

Table 4. 7. Handwashing as a maternal factor of relapse of acute malnutrition

(n=125)

	Relapse of malnutrition			
	Yes	**No**	**Total**	**P-value**
	n (%)	**n (%)**	**n (%)**	
Number of handwashing events				
Less than 2 times	21(84)	4(16)	25(20)	0.001
More than 3 times	5(5)	95(95)	100(80)	

Source: computed from SPSS, version 22

Handwashing habit was found to be strongly associated with relapsing into acute malnutrition. 21(84%) of children whose mothers wash hands less than two critical times or events had a relapse of acute malnutrition while 5(5%) of children whose mothers wash hands at more than three critical times relapsed as shown in table 7.

4.2.3. Socio-economic factors associated with relapse of acute malnutrition

Table 4. 8. Relapse of acute malnutrition and socio-economic factors

The table below indicates relationships between relapse of acute malnutrition and mothers' occupations, fathers' occupations and ubudehe categories as socio-economic factors.

n=125

	Relapse of Malnutrition		
	Yes	**No**	**Total**
	n (%)	**n (%)**	**n (%)**
Mother's occupation			
No occupation	5(27.7)	13(72.2)	18(14.4)

Agriculture	17(24.2)	53(16.9)	71(56.8)
Full time Job	0(0)	1(100)	1(0.8)
Part time job	4(11.4)	31(88.5)	35(28)
Father's occupation			
No occupation	4(25)	12(75)	16(12.8)
Agriculture	11(20)	44(80)	55(44)
Full time Job	6(20.6)	23(79.3)	29(23.2)
Part time job	1(33.3)	2(66.6)	3(2.4)
Ubudehe category			
No category	0(0.0)	8(100)	8(6.4)
Category 1	9(32.1)	19(67.8)	28(22.4)
Category 2	10(18.1)	45(81.8)	55(44)
Category 3	7(20.5)	27(79.4)	34(27.2)

Source: computed from SPSS, version 22

As according to table 4.8, occupations of the mothers were agriculture (56.8%), full-time jobs (0.8%), part-time jobs (28%), while others had no occupations (14.4%). Relapse of acute malnutrition was higher among children whose mothers had no occupation (27.7%) than those whose mothers had occupations: agriculture (24.2%), full-time jobs (0%) and part-time jobs (11.4%). Children whose fathers had part-time jobs were more likely to relapse into acute malnutrition by the fact that 33.3% of children who had fathers doing part-time jobs had a relapse of acute malnutrition while 25% of those whose fathers had no occupations, 20.6% of those whose fathers had full-time jobs and 20% of those whose fathers were farmers. Children from Ubudehe category 1 households were more likely to relapse into acute malnutrition than their counterparts from households in other Ubudehe categories. For instance, relapse of acute malnutrition occurred on 32.1% of children from Ubudehe category 1 households, comparatively to 18.1% and 20.5% of children from Ubudehe category 2 and 3 respectively.

Table 4. 9. Food, Water and Sanitation Services status at the household as socioeconomic factors of relapse of acute malnutrition

This table presents socio-economic factors in terms of access to food, water and sanitation services and their linkage to relapse of acute malnutrition among children aged under five years who were had been discharged from malnutrition treatment programmes. Those are source of drinking water and time to the source, handwashing, training on preparation of balanced diet,

eating porridge in six months prior to data collection, number of meals per day and provision of specific meal to the child.

Table 4.9. Food, Water and Sanitation Service of the Household

n=125

	Relapse Malnutrition			
	Yes	**No**	**Total**	**P-value**
	n (%)	**n (%)**	**n (%)**	
Time to the source of drinking water				
Less than 14 min	5(19.2)	19(19.1)	24(19.2)	
15-30 min	8(30.7)	36(36.3)	44(35.2)	0.79
Above 31 min	13(50.0)	44(44.4)	57(45.6)	0.84
Source of drinking water				
Tap	1(50.0)	1(50.0)	82(65.6)	
Spring	16(19.5)	66(80.4)	2(1.6)	0.03
Boiled water	0(0	3(100)	3(2.4)	-
Lake or swamp	9(23.68)	29(76.3)	38(30.4)	0.60
Mother trained on food preparation				
Yes	21(80.7)	71(71.7)	92(73.6)	0.45
No	5(19.2)	28(28.2)	33(26.4)	
Child eats porridge				
Yes	18(20.9)	68(79.0)	86(68.8)	
No	8(20.5)	31(79.4)	39(31.2)	
Number of handwashing events				
Less than 2 times	21(84)	4(16)	25(20)	0.001
More than 3 times	5(5)	95(95)	100(80)	
Number of HH meal per day				
Once	11(20.3)	43(79.6)	54(43.2)	
Twice	15(22.3)	52(77.6)	67(53.6)	0.81
Thrice	0(0)	4(100)	4(4.3)	
Child given specific meal				
Yes	10(30.3)	23(69.7)	33(26.4)	0.12

No	16(17.3)	76(82.6)	92(73.6)

Source: computed from SPSS, version 22

From the table 4.9, households which self-reported to take one meal per day were 1.15 more likely to have a child with relapse of acute malnutrition than households which have two meals per day (AOR=1.15,95% CI=0.4-1.9). Strong association for number handwashing events and relapse of acute malnutrition has been found. The greater number of handwashing events the less the chance of having a case of relapse of acute malnutrition. Households whose members are taken above 31 minutes to the source of drinking water have been found to be at 1.12 times risk to have a child with relapse of malnutrition than those using less than 30 minutes to the source of drinking water.

HHs whose source of drinking water is spring had 4 times more chances to have relapse of malnutrition than families those which get water from taps (AOR=4.1, 95% CI=0.2-6.9) and 1.2. times more chance compared to HHs whose drinking water source is lake or swamp (AOR=1.2, 95% CI=0.5-3.2). Children who were given specific meals were 2 times less likely to develop relapse of acute malnutrition than those who were not given specific meals.

Table 4. 10. Multivariate analysis parent's demographics and Relapse cases

(n=125)

Variable name	Odds ratio (OR)	95% CI	P-value
Father's occupation			
No occupation	1.33	0.3-4.9	0.66
Agriculture (base)			
Full time job	0.74	0.1-2.4	0.58
Part time job	1.0	0.3-3.1	0.94
Mother's occupation			
No occupation (base)			
Agriculture	0.83	0.2-2.6	0.76
Part time job	0.33	0.7-1.4	0.14
Ubudehe Category			
Category 1	1.8	0.5-5	0.30
Category 2	0.8	0.2-2.5	0.77
Category 3(base)			
Religion			

Islam (base)			
None	0.4	0.04-4.0	0.4
Catholic	0.9	0.3-2.8	0.9
Protestant	0.8	0.2-3.1	0.8
Under five years children			
One (base)			
Two	0.8	0.3-2.2	0.7
Three	1.2	0.3-4.6	0.7
Four	0		
Mother's age at delivery			
<20 (base)			
21-25	2.5	0.4-15	0.3
26-30	0.9	0.1-5.7	0.9
>31	1.2	0.2-6.5	0.7

Source: computed from SPSS, version 22

As shown in this table 4.10, children whose fathers were jobless were 1.3 times more likely to have a relapse of acute malnutrition than those whose fathers were farmers (AOR=1.3, 95% CI=0.3-4.9). Children whose fathers had a full-time job were 1.3 times less likely to have a relapse of acute malnutrition than those whose fathers were farmers. Children whose mothers were engaged in agriculture were 1.2 times less likely to relapse to acute malnutrition than those whose mothers had no occupation. Households in Ubudehe Category 1 are 1.8 times more likely to have a relapse of acute malnutrition than those in Ubudehe Category 3 (AOR=1.8, 95% CI=0.5-5). Children in families where there were three children aged under five years were 1.2 times more likely to have a relapse of acute malnutrition than children in families where there was one child aged under five (AOR=1.2, 95% CI=0.3-4.6).

5. Summary, conclusions and recommendations

The study aimed at determining factors associated with relapse of acute malnutrition among children under five years old who had had acute malnutrition and had been discharged from malnutrition treatment programmes in two years prior to data collection in Bugesera district. It looked at the prevalence of relapse of acute malnutrition among children aged under five, sought to determine maternal and child factors associated with relapse of acute malnutrition and socio-economic factors associated with the condition.

5.1.1. Prevalence of relapse of acute malnutrition

Prevalence of relapse of acute malnutrition among children aged under five was found to be at 21% in Bugesera District as 26 of the 125 caretakers of children reported that their children had more than one episode of acute malnutrition.

5.2.2. Maternal and child related factors associated with relapse of acute malnutrition among under five years old children of Bugesera District

Handwashing habit of the mother was found as a maternal factor associated with relapse of acute malnutrition since it is statistically significant (p=0.001). Children whose mothers washed hands more frequently than others, less likely had a relapse of acute malnutrition. This finding is in line with findings from another study conducted in Ethiopia(Abitew et al., 2020). Admission to malnutrition treatment programs at a MUAC measure ranging from 11.5 to 12.4 centimetres is a child related factor associated with relapse of acute malnutrition (p=0.00). Basing on coloring of the MUAC, this MUAC measure range is the yellow MUAC. According to the protocol of treating acutely malnourished children, children admitted having a MUAC measure ranging between 11.5 and 12.4 cm are not treated using Ready-To-Use Therapeutic Foods. The foods are used for children having a MUAC measure of 11.4 centimeters and less(Health, 2018). This implies difficulty for those children in achieving stable MUAC after discharge.

5.2.3. Socio-economic factors associated with relapse of acute malnutrition among under five years old children of Bugesera District

The socio-economic factors found to be associated with relapse of acute malnutrition are drinking water from springs (p=0.03), being from a family categorized in Ubudehe category one (indexed as the poorest according to Ubudehe structure in Rwanda) (AOR=1.3, 95% CI), having a father without an occupation (AOR=1.8, 95% CI), being from a family which has three children aged under five years (AOR=1.2, 95% CI), and having one meal per day was found to be another factor of relapse of acute malnutrition as households which self-reported to take one meal per day had their children relapsed (AOR=1.15,95% CI=0.4-1.9).

5.2. Conclusions

The prevalence of relapse of acute malnutrition among under five years old children in Bugesera District is 21%. Maternal and child factors of relapse of acute malnutrition are poor handwashing habit of the mother or caretaker, admitting malnourished children to treatment programs at a 11.5 to 12.4 centimetres Mid Upper Arm Circumference. Socio-economic factors of relapse of acute

malnutrition are using spring water for drinking, joblessness of fathers, belonging to households in Ubudehe category One, being from a family where there are at least three children aged under five and taking only one meal per day. Limitations were that some parents did not remember all the events of acute malnutrition their children had. This was overcome by using a data collection tool made of close-ended questions with pre-established options of responses. Another limitation is that the study being conducted in only one District among the thirty that compose the country, findings cannot be generalized for the whole country.

5.3. Recommendations

Bugesera District authorities are recommended to strengthen mobilization on hand hygiene among caregivers of children aged under five years, on the use of safe water for drinking, and on child spacing through the use of family planning services. Job creation should also be strengthened to help family members get occupations and economically empower poor families, hence help them graduate from Ubudehe category one and empower them to afford more than one meal per day. The Ministry of health is recommended to include the use of Ready-To-Use Therapeutic Foods among methods of treatment of moderate acute malnutrition to help children moderate acute malnutrition achieve and maintain a stable MUAC upon treatment.

REFERENCES

Abitew, D. B. (2020). Predictors of relapse of acute malnutrition following exit from community-based management program in Amhara region, Northwest Ethiopia: An unmatched case-control study. PLoS ONE, 15(4), 1–17. https://doi.org/10.1371/journal.pone.0231524 last accessed 14/02/2021.

Adair, L. S. (2013). Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies. DOI:https://doi.org/10.1016/S0140-6736(13)60103-8.

Akparibo, R. (2017). Recovery, relapse and episodes of default in the management of acute malnutrition in children in humanitarian emergencies: A systematic review. Humanitarian Evidence Programme. https://fic.tufts.edu/assets/Acute-Malnutrition-Systematic-Review.pdf LAST accessed on 15/02/2021.

Asres, G. (2011). Nutritional assessment of Ethiopian Beta-Israel children: a cross-sectional survey. Breastfeed Med. 2011 Aug;6(4):171-6. doi: 10.1089/bfm.2011.0016.

Banerjee, C. (2016). Follow-up status of children with SAM treated with RUTF in peri-urban and rural Northern Bangladesh. https://www.ennonline.net/fex/50/samfollowupbangladesh last accessed on 15/02/2021.

Bhadoria, A. S. (2017). Prevalence of severe acute malnutrition and associated sociodemographic factors among children aged 6 months–5 years in rural population of Northern India: A population-based survey. DOI: 10.4103/jfmpc.jfmpc_421_16 last accessed 15/2/2021.

Bhandari, N. (2016). Efficacy of three feeding regimens for home-based management of children with uncomplicated severe acute malnutrition: a randomised trial in India. http://dx.doi.org/10.1136/bmjgh-2016-000144.

Binagwaho, A. (2011). Underdiagnosis of malnutrition in infants and young children in Rwanda: Implications for attainment of the Millennium Development Goal to end poverty and hunger. International Journal for Equity in Health DOI: 10.1186/1475-9276-10-61 ·.

Black, R. E. (2013). the Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low-income and middle-income countries. doi:10.1016/S0140-6736(13)60937-X.

Bloss, E. (2004). Prevalence and Predictors of Underweight, Stunting, and Wasting among Children Aged 5 and Under in Western Kenya. DOI: 10.1093/tropej/50.5.260.

BugeseraDistrict. (2019). Bugesera District Bi-Annual Nutrition Bulletin. http://www.bugesera.gov.rw/fileadmin/_migrated/content_uploads/Bulletin_corrected_NEW1.pdf last accessed 14/2/2021.

Burza, S. (2016). Seasonal effect and long-term nutritional status following exit from a Community-Based Management of Severe Acute Malnutrition program in Bihar, India. https://doi.org/10.1038/ejcn.2015.140.

Buzigi, E. (2018). Trends of Child Wasting and Stunting in Uganda from 1995 to 2016, and Progress Towards 65TH World Health AssemblyGlobal Nutrition Targets. DOI: 10.11648/j.jfns.20180604.11.

Chang, C. Y. (2013). Children Successfully Treated for Moderate Acute Malnutrition Remain at Risk for Malnutrition and Death in the Subsequent Year after Recovery . https://doi.org/10.3945/jn.112.168047.

Dandona, L. (2019). The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. Gurugram 122002, National Capital Region, India: Lancet Child Adolesc Health https://doi.org/10.1016/.

Demissie, S. (2013). Magnitude and Factors Associated with Malnutrition in Children 6-59 Months of Age in Pastoral Community of Dollo Ado District, Somali Region, Ethiopia. DOI: 10.11648/j.sjph.20130104.12.

Desalegne Amare, A. N. (2016). Prevalence of Undernutrition and Its Associated Factors among Children below Five Years of Age in Bure Town, West Gojjam Zone, Amhara National Regional State, Northwest Ethiopia. Hindawi Publishing Corporation http://dx.doi.org/10.1155/2016/7145708.

Dipasquale, V. (2020). Acute Malnutrition in Children: Pathophysiology, Clinical Effects and Treatment. doi: 10.3390/nu12082413 last accessed 15/2/2021.

Dodos, J. (2018). Individual and household risk factors of severe acute malnutrition among under-five children in Mao, Chad: a matched case-control study. https://archpublichealth.biomedcentral.com/articles/10.1186/s13690-018-0281-5 last accessed on 15/2/2021.

Dop, M. C. (2016). Malnutrition, definition, causes, indicators for assessment from a « Public Nutrition » perspective. Montpellier, France: available at http://www.masterhdfs.org/masterHDFS/wp-content/uploads/2014/05/malnutriton-dop-part-I.pdf last accesssed on 10 April 2020.

Ellen, S. (2020). Slovin's Formula Sampling Techniques. available at https://sciencing.com/slovins-formula-sampling-techniques-5475547.html last accessed on 1/07/2021.

Fink, G. (2011). The effect of water and sanitation on child health: evidence from the demographic and health surveys 1986–2007. Int J Epidemiol.40:1196–204. doi:10.1093/ije/dyr102.

Frozanfar, M. K. (2015). Acute malnutrition among under-five children in Faryab, Afghanistan: prevalence and causes. https://pubmed.ncbi.nlm.nih.gov/27019527/ last accessed 15/02/2021.

Gachau, S. (2018). Prevalence, outcome and quality of care among children hospitalized with severe acute malnutrition in Kenyan hospitals: A multi-site observational studyPLoS ONE 13(5): e0197607. https://doi.org/10.1371/journal.pone.0197607 last accessed 15/2/2021.

Gebre, A. (2019). Prevalence of Malnutrition and Associated Factors among Under-Five Children in Pastoral Communities of Afar Regional State, Northeast Ethiopia: A Community-Based Cross-Sectional Study. Journal of Nutrition and Metabolism https://doi.org/10.1155/2019/9187609.

Gebre, A. (2019). Prevalence of Malnutrition and Associated Factors among Under-Five Children in Pastoral Communities of Afar Regional State, Northeast Ethiopia: A

Community-Based Cross-Sectional Study. Journal of Nutrition and Metabolism https://doi.org/10.1155/2019/9187609.

Grellety, E. (2017). Effects of unconditional cash transfers on the outcome of treatment for severe acute malnutrition (SAM): a cluster-randomised trial in the Democratic Republic of the Congo. https://doi.org/10.1186/s12916-017-0848-y accessed 15/2/2021.

Hoddinott, J. (2013). The economic rationale for investing in stunting reduction. https://doi.org/10.1111/mcn.12080.

Indi, T. (2015). Extending Supplementary Feeding for Children Younger Than 5 Years With Moderate Acute Malnutrition Leads to Lower Relapse Rates. doi: 10.1097/MPG.0000000000000639.

Kebede Mengistu, K. A. (2013). Prevalence of Malnutrition and Associated Factors Among Children Aged 6-59 Months at Hidabu Abote District, North Shewa, Oromia Regional State. Journal of Nutritional Disorders & Therapy DOI: 10.4172/2161-0509.1000T1-001.

Koletzko, B. (2017). Pediatric nutrition in practice: 2nd revised edition. doi: 10.4103/0971-5916.211683 last accessed 15/2/2021.

Kramer, M. S. (2012). Optimal duration of exclusive breastfeeding. Cochrane Database Syst Rev. 2012 Aug 15;(8):CD003517. doi: 10.1002/14651858.CD003517.

Krebs, N. F. (2011). Complementary Feeding Study Group. Meat consumption is associated with less stunting among toddlers in four diverse low-income settings. Food Nutr Bull. 2011;32:185–91.

Kumi-Kyereme, A. (2016). Household wealth, residential status and the incidence of diarrhoea among children under-five years in Ghana. https://doi.org/10.1016/j.jegh.2015.05.001 last accessed 15/02/2021.

Legason, I. D. (2018). Prevalence of acute malnutrition among children ages 6-59 months: Results from a baseline nutrition survey in North-Western Uganda. DOI: 10.35841/nutrition-human-health.2.1.7-12 last accessed on 15/02/2015.

Maninder, S. S. (2016). Methodology Series Module 3: Cross-sectional Studies. doi: 10.4103/0019-5154.182410 last accessed on 14/07/2021.

Maust, A. (2015). Severe and Moderate Acute Malnutrition Can Be Successfully Managed with an Integrated Protocol in Sierra Leone. https://doi.org/10.3945/jn.115.214957 last accessed 15/2/2015.

Mehta, N. (2013). Defining pediatric malnutrition: a paradigm shift toward etiology-related definitions. https://connects.catalyst.harvard.edu/Profiles/display/25905296 last accessed 15/2/2021.

Mengistu. (2013). Prevalence of Malnutrition and Associated Factors Among Children Aged 6-59 Months at Hidabu Abote District, North Shewa, Oromia Regional State. Journal of Nutritional Disorders & Therapy DOI: 10.4172/2161-0509.1000T1-001.

Mengistu. (2013). Prevalence of Malnutrition and Associated Factors Among Children Aged 6-59 Months at Hidabu Abote District, North Shewa, Oromia Regional State. J Nutr Disorders Ther T1: 001. doi:10.4172/2161-0509.T1-001.

Mohammadinia, S. P. (2012). The Prevalence of Malnutrition among Children under 5 Years old Referred to Health Centers in Iranshahr during 2010-2011. Iranshahr, Iran.: Zahedan University of Medical Sciences.

National Institute of Statistics of Rwanda, N. (2016). Rwanda Demographic and Health Survey 2014-15. Rockville, Maryland, USA: NISR, MOH, and ICF International. available at https://dhsprogram.com/pubs/pdf/FR316/FR316.pdf accessed on 23/4/2020.

Nkurunziza, S. (2017). Determinants of stunting and severe stunting among Burundian children aged 6-23 months: evidence from a national cross-sectional household survey, 2014. doi: 10.1186/s12887-017-0929-2.

Ojofeitimi, E. O. (2003). A Study on Under Five Nutritional Status and its Determinants in a Semi-Rural Community of Ile-Ife, Osun State, Nigeria. Doi: 10.1177/026010600301700103.

Onyango, A. W. (2013). Complementary feeding and attained linear growth among 6–23-month-old children. Public Health Nutr.;19:1–9. doi:10.1017/S1368980013002401.

Özaltin, E. (2010). Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. JAMA doi: 10.1001/jama.2010.450.

RDHS. (2016). Rwanda Demographic and Health Survey. Available from. https://dhsprogram.com/pubs/pdf/FR316/FR316.pdf Accessed on 12th February 2021.

RDHS. (2016). Rwanda Demographic and Health Survey. Available from. https://dhsprogram.com/pubs/pdf/FR316/FR316.pdf Accessed on 14th February 2021.

RDHS. (2016). Rwanda Demographic and Health Survey. Available from. https://dhsprogram.com/pubs/pdf/FR316/FR316.pdf Accessed on 18th February 2020.

Saha, K. K. (2008). Appropriate infant feeding practices result in better growth of infants and young children in rural Bangladesh. The American journal of clinical nutrition.

Siddiqi, N. (2011). Malnutrition of Under-Five Children: Evidence from Bangladesh. Asian Journal of Medical Sciences 2: 113-118. 5 https://doi.org/10.3126/ajms.v2i2.3662.

Somassè, Y. E. (2015). Relapses from acute malnutrition and related factors in a community-based management programme in Burkina Faso. DOI: 10.1111/mcn.12197 last accessed 14/02/2021.

SphereAssociation. (2018). The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response, fourth edition, Geneva, Switzerland,. https://spherestandards.org/wp-content/uploads/Sphere-Handbook-2018-EN.pdf last accessed 14/02/2021.

Stephenson, K. B. (2019). Development of Acute Malnutrition Despite Nutritional Supplementation in Malawi. 68(5), 734–737. https://doi.org/10.1097/MPG.0000000000002241 last accessed 14/2/2021.

Stobaugh. (2018). Household-level factors associated with relapse following discharge from treatment for moderate acute malnutrition. 1039–1046. https://doi.org/10.1017/S0007114518000363 last accessed 14/2/2021.

Stobaugh. (2018). Relapse after severe acute malnutrition: A systematic literature review and secondary data analysis. DOI: 10.1111/mcn.12702 last accessed on 15/02/2021.

Sunguya, B. F. (2019). Trends in prevalence and determinants of stunting in Tanzania: an analysis of Tanzania demographic health surveys (1991–2016). Nutritional Journal https://nutritionj.biomedcentral.com/articles/10.1186/s12937-019-0505-8 last accessed on 19/4/2020.

Tadesse, E. (2018). An integrated community-based outpatient therapeutic feeding programme for severe acute malnutrition in rural Southern Ethiopia: Recovery, fatality, and nutritional status after discharge. DOI: 10.1111/mcn.12519 last accessed on 15/2/2021.

Tadesse, E. (2018). An integrated community-based outpatient therapeutic feeding programme for severe acute malnutrition in rural Southern Ethiopia: Recovery, fatality, and nutritional status after discharge." Maternal & child nutrition 14(2): e12519. doi: 10.1111/mcn.12519. Epub 2017 Oct 10. LAST accessed 14/2/2021.

Victora, C. G. (2010). Worldwide timing of growth faltering: revisiting implications for interventions. Pediatrics. 2010 Mar;125(3):e473-80. doi: 10.1542/peds.2009-1519.

WFP. (2018). World Food Program/ Rwanda country strategic plan (2019–2023). https://docs.wfp.org/api/documents/53e2deb348c64401aeebda0cd5525df4/download/ last accessed 14/2/2021.

WHO. (2007). A Joint Statement by the World Health Organization, the World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children's Fund. https://www.who.int/maternal_child_adolescent/documents/a91065/en/ LAST ACCESSED ON 14/02/2021.

WHO. (2013). Nutrition: Guideline: updates on the management of severe acute malnutrition in infants and children, World Health Organization; 2013. Available from:. http://apps.who.int/iris/bitstream/10665/95584/1/9789241506328_eng.pdf?ua=1. Last accessed 15/2/2021.

WHO. (2018). 2018 Global Nutrition Report. https://www.who.int/nutrition/globalnutritionreport/en/#:~:text=The%202018%20Global%20Nutrition%20Report,unprecedented%20opportunity%20to%20do%20so. Last accessed 14/02/2021.

Wolde, T. (2016). Prevalence of Acute Malnutrition (Wasting) and Associated Factors Among Preschool Children Aged 36-60 Months at Hawassa zuria, South Ethiopia: a community based cross sectional study. http://dx.doi.org/10.4172/2155-9600.1000466.

World Health Organization, W. (2014). Global nutrition targets 2025: stunting policy brief (WHO/NMH/NHD/14.3). Geneva: World Health Organization: Available at https://www.who.int/nutrition/publications/globaltargets2025_policybrief_stunting/en/ accessed on 8/5/2020.