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Factors contributing to the complete recovery of
severe acute malnutrition among under five years
children at Muhima District Hospital, Rwanda

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Factors contributing to the complete recovery of
Severe Acute Malnutrition among under five
years children at Muhima District Hospital,
Rwanda

Directed by Professor Sun Ha Jee

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Submitted to the Department of Global Health Policy,
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Program
and the Graduate School Public Health of Yonsei University
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Public Health

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DEDICATION

Sincerely, the work is dedicated: To my lovely wife: DIANE ISHIMWE,

To my lovely son: IAN TEIVA DUHIRWE

To my parents and my brother, sisters, May God bless you all!

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May God bless them always

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ABSTRACT

Background: Globally, the various reports have shown that number of children affected with Severe Acute Malnutrition (SAM) is very high. As per WHO reports, SAM is the third most common contributing factor to the deaths of under-5 children, almost 1 million annually, but this ratio is high in developing countries, including Rwanda. More specifically, Rwanda demographic health statistics (RDHS) of 2014-2015 reported that 36.7% of under five years of children were stunted, while 14% had severe malnutrition. Moreover, some studies reported socio-demographic, economic, and health-related factors associated with SAM but still a limited data is available on this issue.

Aim of the study: The current study aimed to assess factors contributing to the complete recovery from SAM among under five-years children and to recommend alternatives for prevention and control.

Methods: A retrospective cohort study was conducted among 200 under-5 children with SAM. Logistic regression analysis was performed to determine the independent predictors of complete recovery among SAM children treated at Muhima District hospital from January 1st, 2017 to September 30th, 2021.

Result of the study: As per the results of this study, different factors like; age, maternal education, HIV/AIDS status, cough, and two-way distance from OTP were found to be significant independent predictors of complete recovery. The most prominent factor was the SAM children with Positive HIV status during follow-up because they were less likely to be recovered than those with negative status with (OR: 0.23_CI: 0.062-0.912 _ P-value of 0.036).

CONCLUSION: The complete recovery was in the acceptable range of national and international standards. Conversely to age, maternal education, two-way distance from OTP, and cough during follow-up, the HIV- positive status was proven to contribute to complete recovery.

CHAPTER 1: INTRODUCTION

1.1. Introduction

The introductory part of this study draws the background, problem statement, significance of the study, research objectives, and questions to guide the researcher to come up with relevant results. This chapter presents the absolute snapshot of how both clinical treatment factors and sociodemographic background factors may predict length of admission/ or prognosis for severe acute malnutrition.

1.2. Background to the study

Malnutrition is a state of nutrition deficiency or excess of energy, protein, and other nutrients and causes measurable adverse effects to all parts of the human body (Kebede et al., 2020). The term ‘severe acute malnutrition’ has replaced ‘protein-energy malnutrition, which was used to describe children with severe wasting and kwashiorkor (again recognized as nutritional edema). Though, the term ‘severe malnutrition’ refers to severe wasting and kwashiorkor and better reflect the longstanding nature of the combined infectious and environmental commodities that can occur in such cases (Bhutta et al., 2017).

The Global Burden of Disease study estimates the number of deaths and disabilities directly related to protein-energy malnutrition. The 2015 Global Burden of Disease Study reported a global decline in the prevalence of severe malnutrition from 25.4 million in 1990 to 22.4 million in 2015. Nevertheless, 1990 might have represented a peak compared with previous years, during which figures were uncertain, and HIV was less prevalent. This influence is enormously significant in Sub-Saharan Africa, where HIV and severe malnutrition are strongly linked (Bhutta et al., 2017).

Severe acute malnutrition (SAM) is defined by less than 70% weight for length per height (WFL/H), by visible severe wasting, by the presence of pitting edema, and by mid-upper arm circumference in children of 6 to 59 months in children 6 to 59 months (Tefera et al., 2020b).

Whereas sociodemographic conditions, insufficient dietary intake (quality or quantity) and/or having tuberculosis (TB), human immune deficiency virus/acquired immune deficiency syndrome (HIV/AIDS), and

Diarrhea, which lead to nutrient mal-absorption

can be the fundamental and underlying causes of SAM(Tesfay et al., 2020). The current classification of malnutrition which is only based on body size or oedemas oedema, cannot indicate the etiology or specific nutritional deficits in an individual. Although his classification can effectively screen and identify malnutrition, it does not address specific nutrient deficiency a child might have or the biological variability among children. But still, those differences do not affect current empirical management strategies that aim to address the predominant macronutrient and micronutrient deficiencies and treat possible infections(Bhutta et al., 2017).

Though SAM is becoming a worldwide problem as it affects all segments of the population and is one of the top deadly diseases for children less than five years of age which is normally the time for fast growth and brain development(Tesfay et al., 2020).

Nevertheless, it is coming common that SAM may also affect infant less than six months of age with many indigent populations if they start feeding hard food to children before six months of their existence(Williams and Berkley, 2016).

The World Health Organization (WHO) and United Nations Children's Emergency Fund (UNICEF) defined severe acute malnutrition (SAM) as lightweight for height (WFH) less than (-) 3 standard deviations below the median reference population or WFH ratio of below 70%, visible severe wasting or presence of nutritional edema (pitting edema) or a mid-upper arm circumference (MUAC) less than 11 cm (Myatt, Khara and Collins, 2006).

Globally, SAM stays the top cause of death for children under five years of age, where more than ten million children die due to SAM before attending their fifth birthday every year, and this makes nine times more mortality rate when compared to a well-nourished

child(Myatt, Khara and Collins, 2006). In developing countries, 20–30% and 50–60% case fatality rates of SAM are accounted to marasmus and kwashiorkor, respectively(Myatt, Khara and Collins, 2006). Poverty is an established cause of malnutrition; the studies have reported that under nutrition is highly prevalent in places where 64% of people from low- and middle-income countries are struggling with severe poverty (Thompson et al., 2017). Poverty is 24.03%, ignorance 11.7%, disordered feeding 13.4%, nutritional status; repeated pregnancies 29.8%, parent's separation 9.7% and mother's health is 11,37% are established risk factors for severe acute malnutrition(Ijarotimi, 2013).

Environmental and hygienic conditions and consumption of contaminated food and water are also significant risk factors of late complete recovery of severe acute malnutrition (Tariq et al., 2018).

Even though a great number of severely malnourished children die at their home without any hospital care, there is also a high death rate for those who received hospital care(Tesfay et al., 2020). Despite such worldwide significance, illustrates how child recovery programs have not given the required attention for facility-based management of SAM(Tesfay et al., 2020).

In the developing world, where SAM is the most common reason for pediatric hospitalization, it is associated with a higher risk of morbidity and mortality, underlying for more than 50 percent of the ten to eleven million children under five years old who die every year from avoidable causes(Tesfay et al., 2020). According to studies from Kenya and Niger, recovery rate and LOS are strongly associated with co-morbidities like pneumonia, malaria, altered consciousness, weak pulse, inability to drink, temperature gradient, chest in-drawing, diarrhea & severe pallor(Tesfay et al., 2020).

Despite such worldwide significance, child recovery programs have not given the required attention for facility-based management of SAM (Trehan and Manary, 2015). According to the sphere standards, the recovery time of children treated in stabilization centers should

not exceed four weeks , and it calls attention if it takes longer than 6 weeks(Tefera et al., 2020b).

Completely Recovered children were those with no more medical complications and edema and who achieved and maintained a sufficient MUAC (≥ 12.5 cm) and WFH ($\geq 85\%$). These children were described as cured or recovered on their medical charts, and incompletely recovered children were children whose deaths were recorded, whose cases involved actions taken against medical advice, or who were lost during treatment with unknown status(Adimasu et al., 2020). A comorbidity was defined as any medical problem present besides SAM before or after admission. lastly, baseline anthropometric measurements (e.g., MUAC, weight, and height values) were recorded measurement at the time of admission and should also be used to assess whether a child has reached nutritional recovery(Adimasu et al., 2020).

1.3. Problem Statement

Globally children malnourished remain a common issue of public health, and it was most dominant in developing countries(Endris, Asefa and Dube, 2017).

Globally, malnutrition among under-five children remains a common issue of public health concern (UNICEF&WHO, 2018). This health issue was found to be most dominant in developing countries, including Rwanda (CFSVA, 2016). The World Health Organization counted 52 billion of under-five children wasted, 17 million of them severely wasted, 155 million stunted (UNICEF&WHO, 2018). In addition to this, undernutrition, especially severe acute malnutrition (SAM) among under five years children, it is identified as the major common cause of increased infection risks, morbidity , and mortality , as well as decreased mental and cognitive development(Endris, Asefa and Dube, 2017). Stunting, severe wasting, and intrauterine growth restriction together are responsible for 2.2 million deaths per year and 21% of disability-adjusted life-years for children younger than 5 years(Saaka et al., 2015). Children with severe acute malnutrition must be treated

proactively with intensive treatment care of short duration, aiming to take only a few weeks to be rehabilitated(Saaka et al., 2015).

UNICEF estimated 45% of all deaths among children aged between 0–59 months due to severe acute malnutrition and stated that ending acute malnutrition is a complex social and political challenge Prevention and long-term solutions involve *dismantling unequal power structures, *improving equitable access to health services and nutritious foods, *promoting breastfeeding and optimal infant and young child feeding practices, *improving water and sanitation, and *planning for cyclic food shortages and emergencies. Nevertheless, in the short term, children with severe acute malnutrition need urgent lifesaving treatment to survive(Bait et al., 2019).

Tackling malnutrition is a major global health priority that calls the attention to the United Nations’ Sustainable Development Goals (SDGs) and is highlighted directly in Goal 2 (‘Zero hunger’), which aims to “end hunger, achieve food security and improved nutrition and promote sustainable agriculture(Bhutta et al., 2017).

UNICEF and Action Against Hunger, unpublished data of September 2016, state that the lack of community awareness on acute malnutrition and community-based services for the management of acute malnutrition as the key contributing factor to the low monthly attendance rate for severe acute malnutrition screening at a community health post and poor engagement in the community-based programs (Mwangome et al., 2020).

A study done in Asian and African countries reported that recovery rates from SAM range from 25% to 95% at inpatient management and 50% to 93% at outpatient management program(Desyibelew et al., 2020).

In Sub-Saharan African countries where Rwanda is located, malnutrition continues to be a significant public health issue. Severe Acute Malnutrition itself was found to be associated with poverty, poor diet, and inadequate access to health care and with 50 % of childhood deaths due to underlying complications Severe Acute Malnutrition is among the causes of

reduced human immunity and induced children mental retardation, reduced economic growth, at family, community, and national level (Juma et al., 2016).

In Rwanda, the prevalence of stunting with Severe Acute Malnutrition included has decreased from 44.3 %. In 2010 to 38% in 2015, the RDHS (2014-2015 report). However, despite the improvement made to decrease malnutrition among under-five children, malnutrition is still high in Rwanda (Gaga Rukorera, 2019).

There is limited data on the factors contributing to the complete recovery from Severe Acute Malnutrition and recognizing precisely the proportion, the prevalence of Severe Acute Malnutrition among its type.

The reason why during this study, factors contributing to the complete recovery of Severe Acute Malnutrition among under five years children will be put into consideration in order to recommend alternative options for prevention.

1.4 Aim of the Study

The purpose of this study is to assess Factors contributing to the complete recovery of Severe Acute Malnutrition among under five years children treated at Muhima District Hospital, Kigali- Rwanda from January 1st, 2017 till September 30th, 2021.

1.5 Research Objectives

- (1) To describe the incidence and recovery status (including the proportion of complete or incomplete recovery and recovery time) of severe acute malnutrition among under five years children admitted/visited? in Muhima District Hospital during from January 1st 2017 till September 2021
- (2) To assess socio-economic and health-related factors associated with the complete recovery of severe acute malnutrition among under five years children at Muhima District Hospital from January 1st 2017, till September 2021
- (3) To identify predictors of complete recovery from SAM among children under five years of age at Muhima district Hospital from January 1st 2017, till September 2021

1.6 Research Questions

(1) What are incidence and recovery characteristics of severe acute malnutrition among under five years children admitted/visited? in Muhima District Hospital from January 1st 2017, till September 2021

(2) What are Health and Socio-economic related risk factors contributing to the complete recovery of Severe Acute Malnutrition cases among under five years at Muhima District Hospital from January 1st 2017, till September 2021

(3) what are predictors of complete recovery from severe acute malnutrition among under five years children at Muhima District Hospital from January 1st 2017,

till September 2021

1.7 Significance of the Study

The study findings will provide information on the prevalence of Severe Acute Malnutrition, health, and Socio-economic contributing factors to Severe Acute Malnutrition, and predictors determining its treatment time in under five years of children.

Firstly, the data from this study will be useful to health planners and policymakers such as those at the Ministry of Health and non-governmental organizations (NGOs) working together to set up adequate and suitable strategic malnutrition prevention measures. Secondly, the study findings will help the Muhima Hospital's managers for a better plan, monitoring, and evaluation of all treatment services, and looking for possible solutions to highlighted gaps according to research findings, all to reduce malnutrition cases in Nyarugenge District.

Finally, the findings from this study will be used as important literature for future researchers who want to conduct their researches in the same field.

1.8 Definitions of Key terms

a) Length of stay (LOS) is the time till recovery (LOS); it refers to the number of days/weeks it takes from hospitalization till when a child recovered from SAM of any kind. Children are recovered when they got relieved from medical complications and have gained and maintained WFL/WFH of 85%, and these children were described as cured or recovered on their medical charts(Tesfay et al., 2020).

b) The starting point is the time of the first visit

c) Symptom onset is the time when symptoms start

d) Admission time is the time when the “Order to Admit” is placed by the emergency department provider or the time when the inpatient bed request is placed, whichever is earlier.

e) Diagnosis is the identification of the nature of an illness or other problem by examination of the symptoms

f) The precise point is the time it takes for a complete recovery

g) The operational definition in previous studies is the statement of procedures used by researchers to measure specific variables

h) Endpoint is the Outcome Measure or event used to objectively measure the effect of a drug or other intervention being studied. For treatment of SAM endpoints can be complete recovery, partial recovery and no recovery.

i) Any clinical indicator or symptom indicator for complete recovery;

Criteria for discharging children from treatment

Children with severe acute malnutrition are considered to be discharged from treatment only when their WHZ is ≥ -2 or MUAC is ≥ 125 mm, and they have had no nutritional

edema for at least two weeks as recommended by the World Health Organization since 2013(Guesdon et al., 2021).

The anthropometric indicator used to confirm severe acute malnutrition should also be used to assess whether a child has reached nutritional recovery. For instance, if mid-upper arm circumference is used to identify that a child has severe acute malnutrition, then mid-upper arm circumference should assess and confirm nutritional recovery. Similarly, if weight-for-height is used to identify a child with severe acute malnutrition, then weight-for-height should be used to assess and confirm nutritional recovery(Guesdon et al., 2021).

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This section presents the result and the idea taken from different studies reviewed from different literature, including journals, articles, and other literature related to this topic that deals with factors contributing to the recovery rate of severe acute malnutrition.

The complete recovery of severe acute malnutrition is highly associated with socio-economic factors such as poverty, low family income and the nutritional status of under-five children is a sensitive sign of a country's health status and economic condition (Bain et al., 2013). Researchers found a high significance in the association between household wealth status and chronic childhood under malnutrition. The study findings showed how children of the poorest households had the highest risk at a rate of 62% of being chronically nourished than children of wealthiest households (Bain et al., 2013).

A study in Ethiopia illustrates a significant high recovery rate of severe acute malnutrition in Health Centers and Health Posts compared to Hospitals Commonly, since uncomplicated SAM children are treated as an outpatient program at health centers and health posts. On the contrary, the contrary, SAM children with different infections or co-morbidities are managed at Hospitals, and this calls attention to the reduced recovery rate (Desyibelew et al., 2020).

The recovery rate was within the acceptable ranges of International Sphere Standards. Experiencing a lower rate of weight gain and a higher average length of stay among enrolled SAM patients were identified as major problems for the program's effectiveness. Diarrhea, cough, and others were the most common medical complications affecting

children with SAM. Admission weight, edematous type of SAM, being dewormed, weight gain more than 8 g/kg/day, and consumption of Plumpy Nut were found to be significantly associated with time to recovery from SAM (Atnafe, Roba and Dingeta, 2019b). It was reported that severely malnourished younger children are more vulnerable to infections because of decreased immunity leading to mal-absorption of nutrients and insufficient feeding practices, and that Children with cough and fever during follow up were less likely to achieve fast recovery from SAM (Atnafe, Roba and Dingeta, 2019b). According to studies from Kenya and Niger, recovery rate and LOS are affected by comorbidities like pneumonia, malaria, altered consciousness, weak pulse, inability to drink, temperature gradient, chest in-drawing, diarrhea & severe pallor (Tesfay et al., 2020). A study done in Dire Dawa, Eastern Ethiopia showed that children who had cough and fever on admission day and during follow-up were less likely to achieve fast recovery (Atnafe, Roba and Dingeta, 2019b). A study in Debre Markos and Finote Selam hospital, Northwest Ethiopia stated that HIV-negative children had a 2.48 times higher probability of getting recovered from SAM prior to being HIV positive (Mekuria, Derese and Hailu, 2017). This is in the same line with the study findings of a study done in Woldiya general hospital that the effects of HIV/AIDS and malnutrition are interconnected and worsen one another in a vicious cycle (Chane et al., 2014). Further, a study on risk factors for mortality and management of children with complicated severe acute malnutrition at a tertiary referral hospital in Malawi reported that HIV infection holds an essential predictor of mortality in under five years children with severe acute malnutrition (Vonasek et al., 2020). There are also 3 studies from different parts of Ethiopia [(Tesfay et al., 2020), (Atnafe, Roba and Dingeta, 2019a), (Mena, Dedefo and Billoro, 2018)] which reported that children presented with retroviral infection at hospitalization were not as much to recover from SAM, as being reactive for HIV serostatus among the study participants had negatively affected the complete recovery from SAM. The same findings were found in the study of antibiotics as part of managing severe acute malnutrition in Malawi (Mena, Dedefo and Billoro, 2018).

A study in Uganda on the treatment outcome among under five years children hospitalized with SAM in Saint Mary's hospital, North Uganda, demonstrated how children who were HIV infected were significantly more likely to die during treatment compared to their HIV negative counterparts who were more likely to have a successful outcome. HIV infection as a risk factor for unsatisfactory results among severely malnourished children toward the present study complies with previously reported findings by other authors (Mena, Dedefo and Billoro, 2018). Another study in Ethiopia indicates a lower chance of recovering from SAM for children that showed up with diarrhea, palmar pallor, retroviral infection, other co-morbidities, and those who did not receive plumpy nut (Tesfay et al., 2020). A study in Ethiopia reported that maternal literacy is likely associated with better child feeding and caring practice and then the time it takes for complete recovery (Tefera et al., 2020b). Several studies reported that not only educated mothers used health care facilities but also followed the instructions given by health providers concerning feeding and caring practices, and this is certain to decrease the risk to SAM, which is compatible with the present study's findings (Bain et al., 2013). A study was done by Seid reported a positive correlation between parents' education and child health. The children with illiterate parents were about 12.3% likely to suffer from severe acute malnutrition by the lack of knowledge and skills for child nutrition. Even so, the income was likely to be low in the non-educated parents (Seid, Seyoum and Mesfin, 2017).

A study conducted in Dire Dawa, Eastern Ethiopia, on time of recovery and associated factors of children with severe acute malnutrition found that children with an admission weight greater than 7 kg, those who were dewormed, and those with weight gain of greater than 8 g per day. In addition, children coming from less than one-hour two-way distance to the OTP had a higher probability of recovering faster (Atnafe, Roba and Dingeta, 2019b). Another study in East Amhara Hospitals, Northeast Ethiopia, showed a significantly lower time-to-recovery rate among caregivers of children who travel more than one hour to receive nutrition services (Tefera et al., 2020b). Thus, caregivers who have limited access to OTP sites may only decide to bring their child to treatment when the malnutrition gets

severe, and this may compromise the treatment success rate. However, the above findings may also indicate that making the OTP service even more accessible to the community level may lead to improve treatment outcome(Tefera et al., 2020a). A study in Indonesia also identified the distance to health facilities among the main barriers to access to treatment for severe acute malnutrition(Bait et al., 2019). Evidence shows that reducing the distance barrier during the treatment of SAM totally at the household through community health workers positively affects beneficiary acceptance of and compliance with services, with implications for early presentation and effective recovery of cases of SAM(Puett and Guerrero, 2015).

Even so, marasmic children stayed longer in treatment , and a low Plumpy Nut consumption rate was associated with a longer stay on treatment. Though a higher weight at admission, deworming, and steady steady weight gain was positively associated with a fast recovery time. Besides that, an appropriate diet and care of SAM complying with the national protocol will be helpful to overcome lower weight gain and higher length of stay on treatment(Atnafe, Roba and Dingeta, 2019a).

A study conducted in a public hospital in Aksum, Ethiopia, illustrates how the median LOS till recovery from SAM was estimated to be 15 days (95% CI: 14.1, 15.9), which is in the acceptable range of international standards set by the SPHERE project and similar with the findings from institution-based researches in Bahirdar that reported 16 days of recovery time(Tesfay et al., 2020). Nevertheless, this finding is far less than the report from the Sidama zone Shebedino district of southern Ethiopia [29] , which found a median LOS of 36 days(Tesfay et al., 2020). It is also higher than fundings of a study conducted at East Amhara Hospitals, Northeast Ethiopia , with 11 days as the median of nutritional recovery time , and this was similar to findings in different studies conducted in Debremarkos and Finoteselam, South Wollo, Gondar, Tigray region, and Northern Ethiopia(Tefera et al., 2020a).

These dissimilarities call attention to differences in treatment and caring practices, health care settings, as well as health and socioeconomic factors among the study areas.

A study conducted in Ethiopia by Telahun Kasa Tefera 1, Solomon Mekonnen Abebe 2, Melkamu Tamir Hunegnaw 2, Freezer Girma Mekasha, states that Generally, the recovery rate and the nutritional recovery time of children with SAM were within the recommended national standards, Though, it was identified that being unable to enter phase 2 on day 10, using an NG tube for therapeutic feeding, and being admitted to referral hospitals were associated with more extended periods of recovery time(Tefera et al., 2020b).

Another study in Ethiopia showed how children with Anemia at admission time and those not provided plumpy nut had a lower chance of recovering early as they failed to enter phase 2 on day 10 and failed to gain more than 8 g/kg/day. Therefore, efforts should be strengthened to facilitate the early recovery of children by considering the identified predictors of recovery time(Asres, Prasad and Ayele, 2018).

The recovery rate was relatively higher than the Sphere standard and the national SAM management protocol. Co-morbidities and the treatments given were the main determinants of the recovery of children. Therefore, co-morbidities must be managed as early as possible, and the treatments given during the SAM management process need to be given with precaution(Bitew et al., 2020).

Children with pneumonia and edematous form of malnutrition have a reduced recovery rate(Derseh et al., 2018). This has been confirmed with retrospective study in Northwest Ethiopia that the Prognosis of SAM largely depends on the presence of other comorbidities at admission. Therefore, available intervention modalities need to address coexisting morbidities to achieve better outcomes in SAM children(Wagnew et al., 2019).

2.2. Conceptual framework

2.2.1. Description of the conceptual framework

The used conceptual framework as adopted from the article, Prevalence of Malnutrition and associated factors among children in Rural Ethiopiaby Endris, Asefa, H. and Dube, L. (2017). Its variables were clustered in social-demographic, social-economic, and client health-related history data which may contribute to the occurrence of severe acute malnutrition among under five years children

Though this study will not be concerned more with the consequences and complications of severe acute malnutrition, these factors will be used to assess Factors contributing to the complete recovery of Severe Acute Malnutrition among under five-year-old children at Muhima District Hospital, Kigali- Rwanda. The socio-demographic, social-economic and client health-related past data about parents of under-five children can contribute to the complete, partial, or no recovery from severe acute malnutrition.

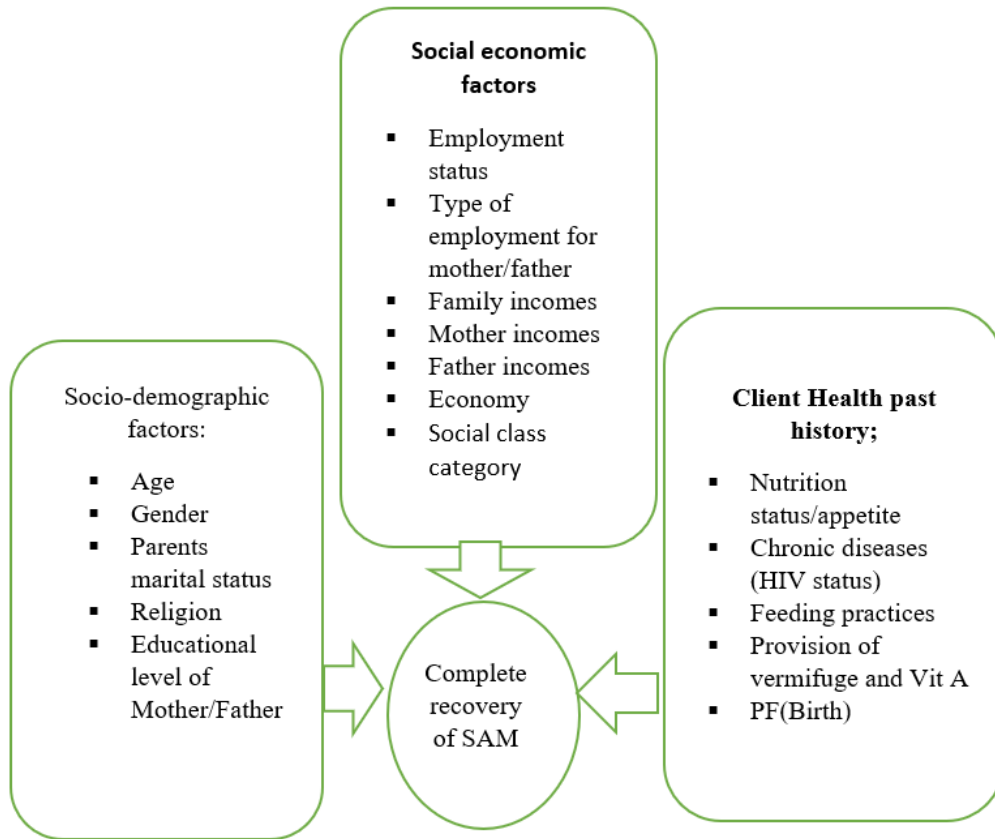


Figure 1: Conceptual Framework

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

This chapter defines and shows the research methods used by researcher to complete the study. It outlines overall research design, approach, setting, population, sampling methods, and inclusion and exclusion criteria, data collection procedures, instrument to use during data collection, data management, findings dissemination, ethical consideration and study limitation.

3.2. Research design

A retrospective cross-sectional study design and quantitative methods were used to assess Factors contributing to the complete recovery of Severe Acute Malnutrition among under five-year-old children at Muhima District Hospital by using data from 324 patient cards, between January 1, 2017, September 31, 2021.

3.3. Research setting

The study was conducted in Muhima District (Nyarugenge) Hospital. Nyarugenge District is one of three Districts in the City of Kigali.

Muhima is Nyarugenge District's Hospital and has Ten Health centers allocated in ten administrative Sectors, and all of them have nutrition services. Those health centers are; Muhima, Biryogo, Rwampala, Cor unum, Kabusunzu, Mwendo, Nyarurenzi, Butamwa, Rugarama , and Kanyinya.

3.4. Population

The study was conducted through a record review of eligible patient cards of under five-year-old children with Severe Acute malnutrition treated at Muhima District Hospital.

3.5. Inclusion criteria

All under five years of children treated at Muhima Hospital from January 1st 2017, till September 2021 were included in this study.

3.6. Exclusion criteria

All under five years children with less than 7 days of follow-up at the time of the study were excluded from the study.

All children less than 6 Months of birth were excluded from the study

All children above five years were excluded from the study

3.7. Sample size

A sample of 200 cards for under five years of children, was taken among 384 total number of patients under five years of age treated at Muhima District Hospital from January 1st 2017, till September 30th 2021

Sampling strategy

A simple random sampling strategy was used to select the patient cards by which the research assistant extracted information with a structured questionnaire.

3.8. Data Collection instruments

The questionnaire was used to extract information on patient cards.

3.9. Validity and reliability of research instruments.

After adopting a questionnaire used by other research, I passed a validity test.

3.10. Data collection procedure;

After obtaining ethical permission to collect data from Yonsei university and one of Muhima District Hospital; Three research assistants were recruited and trained via zoom meeting about my research objectives, questionnaire, and how to fill it before starting data collection. Moreover, the data collection tool was pretested before the actual data collection to maintain data quality.

Three research assistants collected data by using a structured questionnaire to extract information from the patient cards. The collected information includes the sociodemographic characteristics of each child, including age, sex, OTP site; patient

baseline information including date of admission, type of admission, admission anthropometry, and routine admission medication; follow up information on weight, MUAC, edema, Plumpy-nut provided per week, appetite test, treatment outcome, follow up date, and date outcome ascertained.

Data collection took place from September to October 2021.

3.11. Data analysis

Data has been checked for completeness before entering, cleaning, and analyzing using the statistical package for SAS and SPSS version 25 software.

Descriptive statistics (percentage, measurement of central tendency, frequency, mean, and dispersion standards deviations) were used to describe and present the data.

The chi-square and bivariate regression were used to know the relationship between health and socio-economic related factors contributing to the complete recovery of severe acute malnutrition.

3.12. Data quality control

To ensure the quality control in this study, data was collected using valid tools, and 3 bachelor's degree Health and Sanitation Officers research assistants were trained for 2 days on objectives and data collection technics of the study and data collection process so that they can extract the required information from the patient card.

During the data collection, precautions were made to prevent repetition interviews from the same participants, and responses were checked on a daily basis for the completeness and consistency of the tool to ensure the quality of data.

Furthermore, during data collection, the questionnaire was checked through pre-test for participants for non-participating health facilities to ensure its reliability. Data was continuously entered and counter-checked by the principal researcher thoroughly before starting data analysis.

3.13. Data management

All data pertaining to the current study are kept in both hard and soft copies, sources of information are kept by the researcher and university library, and the main research findings will be shared with the academic staff, administration of Muhima District Hospital. The research-related documents are kept confidential under Yonsei University 's research policies.

3.14. Ethical considerations

Ethical approval for the proposal was provided by Yonsei University and the permission of Muhima District Hospital for ethical clearance.

Through the research process, ethical principles such as individual right to respect, beneficence, confidentiality, and privacy were endorsed.

All information was confidential, and participants were anonymous when recording their data, and no incentives were provided to participants.

3.15. Data Dissemination

The findings will be presented to the public defense of Yonsei university and finally be submitted to the school. The findings (Hard or soft copies) will also be communicated to the District Health administrative bureau of Muhima District, Kigali- Rwanda, and finally, the findings will be prepared for national or international journals for publications. The findings will also be presented at scientific conferences and national programs.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.1. Introduction

This chapter presents the study findings by use of tables with a short summary of the contents. The results are presented according to research objectives, and the main objective of the study was to assess the factors contributing to the complete recovery of severe acute malnutrition among under five years children at Muhima District Hospital, Kigali-Rwanda, by using data from 200 patient cards, between January 1st 2017, and September 31, 2021

Table 1: Socio-demographic and economic characteristics of the study participants

Items		No Recovery	Recovery	P-value
Gender	Male	14 (13.2)	92 (86.8)	0.7316
	Female	14 (14.9)	80 (85.1)	
Age of children (Months)	6-11	2 (6.7)	28 (93.3)	0.4979
	12-23	9 (14.1)	56 (86.2)	
	24-35	9 (14)	55 (86.0)	
	36-47	7 (22.6)	24 (77.4)	
	48-59	1 (10.0)	9 (90.0)	
Maternal education	No formal education	7 (6.5)	100 (93.5)	0.0043
	Primary school	16 (21.6)	58 (78.4)	
	Secondary school	5 (26.3)	14 (73.7)	
Paternal education	No formal education	8 (8.2)	89 (91.2)	0.0714
	Primary school	16 (20)	64 (80.0)	
	Secondary school	4 (17.3)	19 (82.7)	
Mother's Occupation	housewife	14 (10.7)	117 (89.3)	0.0628
	others	14 (20.2)	55 (79.8)	
	Secure	0 (0.00)	2 (100.0)	

Household food security status	Mild	4 (33.3)	8 (66.7)	
	Moderate	23 (12.8)	157 (87.2)	
	Severe	1 (16.7)	5 (83.3)	
Two-way walking distance to the OTP	Less than an hour	4 (8.0)	46 (92)	0.1580
	More than an hour	24 (16)	126 (84)	
Visited at home by CHWs during the treatment	Yes	0 (0.0)	4 (100.0)	0.4150
	No	28 (14.2)	168 (85.8)	
Receiving nutrition education during treatment	Yes	1 (20.0)	4 (80.0)	0.6954
	No	27 (13.9)	168 (86.1)	
Nutritional diagnosis at admission	Marasmus	18 (15.3)	99 (84.6)	0.7983
	Kwashiorkor	9 (12.0)	66 (88.0)	
	Marasmus-kwashiorkor	1 (12.5)	7 (87.5)	
Ailment in the past 2 weeks	Diarrhea	3 (5.4)	52 (94.6)	0.0811
	Cough	2 (25)	6 (75)	
	Fever	23 (16.8)	114 (83.2)	
Breastfeeding status at admission	Still breastfeeding	15 (14.6)	88 (85.4)	0.8130
	Stopped breastfeeding	13 (13.4)	84 (86.6)	
Dietary diversity score at admission	Suboptimal	27 (13.6)	172 (86.4)	0.0130
	Optimal	1 (100.0)	0 (0.0)	

RUTF sharing at first follow up	Yes	1 (33.3)	2 (66.7)	0.3309
	No	27 (13.8)	170 (86.2)	
RUTF selling during the first week	Yes	0 (0.0)	3 (100.0)	0.901
	No	28 (14.2)	169 (85.7)	
Caregivers' perception on RTUF	Food and medicine	25 (12.9)	170 (87.1)	0.0001
	Food for SAM	3 (100.0)	0 (0.0)	
	Medicine for SAM child	0 (0.0)	2 (100.0)	

OTP: Out Patient

RUTF: Ready-to-use therapeutic Food

SAM: Severe Acute Malnutrition

In the presented study (Table 1) results of 200 participants where 106 were boys and 94 girls, 86.8% (n=92) boys were recovered from SAM, 13.2% were not, and 85.1% (n=80) girls were also recovered while 14.9% (n=14) girls were not recovered from SAM. Age was also one of the study variables, and the majority of 56 (86.2%) recovered children were in the range of twelve to twenty-three months of age. The majority of 100 (93.5%) recovered children had mothers with no formal education, and 89 (91.2%) were recovered children whose fathers have no formal education. Regarding employment, housewife mothers had the majority of recovered children, 117 (89.3%). Concerning household food security status, 87.2% (n=157) of children were recovered from SAM. Regarding two-way walking distance to the OTP, 92% (n=46) recovered children were from less than one hour to the OTP, while 84% (n=126) were from more than one hour to the OTP. 85.8% (n=168) recovered community health workers at home did not visit children during the treatment. As regard nutritional diagnosis at admission,

marasmus cases were 117 and 84.6% (n=99) were recovered, Kwashiorkor cases were 75 and 88% (n=66) were recovered, and Marasmus-kwashiorkor cases were 8 where 87.5% (n=7) were recovered. With regards to ailment in the past 2 weeks, 55 participants had diarrhea, and 52(94.6%) of them were recovered, 8 participants were coughing, and 6(75%) of them were recovered, and among 137 participants who had a fever 114(n=83.2) were recovered. According to the breastfeeding status at admission, a great number of recovered children, 88(85.4%), were still breastfeeding. Concerning dietary diversity score at admission, 199 participants had suboptimal levels, and 86.6% (n=172) were recovered. Regarding caregivers' perception of RTUF, a majority of 170(87.1%) of recovered children were from caregivers who took RUTUF as food and medicine.

Table 2: Identification of predictors to complete recovery of SAM children under five years of age

Items	No recovery	Recovery	P-value	
Age group of children	Younger than 24 months	10 (10.3)	87 (89.7)	0.1444
	Older than 24 Months	18	85	
Sex of child	Male	14 (13.2)	92 (86.8)	0.3196
	Female	14 (14.9)	80 (85.1)	
Maternal education	No formal education	7 (6.60)	100 (93.4)	0.0192
	Primary school	16 (21.7)	58 (78.3)	
	Secondary school	5 (26.3)	14 (73.7)	
Paternal education	No education	8 (8.2)	89 (91.8)	0.1474
	Primary school	16 (20)	64 (80)	
	Secondary school	4 (17.3)	19 (82.7)	
Household food security status	Secure	0 (0)	2 (100)	0.9251
	Mild	4 (33.3)	8 (66.7)	

	Moderate	23 (12.8)	157 (87.2)	
	Richest	0 (0)	1 (100)	
Household wealth index	Middle	4 (10.6)	34 (89.4)	0.3845
	Poorer	24 (16.1)	125 (83.9)	
	Poorest	0 (0)	12 (100)	
Two-way distance from OTP	More than one hour	4 (8)	46 (92)	0.0365
	Less than one hour	24 (16)	126 (84)	
Dietary diversity score	Sub optimal	27 (13.6)	172 (86.4)	0.6859
	Optimal	1 (100)	0 (0)	
Breast feeding	Yes	15 (14.6)	88 (85.4)	0.9545
	No	13 (13.4)	84 (86.6)	
Nutritional diagnosis at admission	Marasmus	18 (15.3)	99 (85.7)	0.7816
	Kwashiorkor	9 (12)	66 (88)	
	Marasmus-kwashiorkor	1 (12.5)	7 (87.5)	
Diarrhea during admission or follow up	Yes	21 (14.9)	120 (85.1)	0.5734
	No	7 (11.9)	52 (88.1)	
Cough during admission or follow up	Yes	27 (16.7)	135 (83.3)	0.0248
	No	1 (2.7)	37 (97.3)	
Fever during admission	Yes	7 (16.2)	36 (83.8)	0.6269
	No	21 (13.3)	136 (86.7)	
Oedema	Yes	28 (17.2)	134 (82.8)	0.0057
	No	0 (0)	38 (100)	
Pneumonia	Present	28 (14.07)	171 (85.93)	0.6859
	Absent	0 (0)	1 (100)	
Anemia	Anaemic	0 (0)	2 (100)	0.5663
	Not anaemic	28 (14.1)	170 (85.9)	
Tuberculosis	Yes	27 (13.8)	170 (86.2)	0.3309
	No	1 (33.3)	2 (66.7)	
HIV status	Negative	22 (12)	162 (88)	0.0047
	Positive	6 (37.5)	10 (62.5)	
Vitamin A	Given	25 (14.3)	149 (85.7)	0.6982
	Not given	3 (11.6)	23 (88.4)	
	Yes	27 (13.9)	168 (86.1)	0.6954

RUTF practice	sharing	No	1 (20)	4 (80)	
RUTF practice	selling	Yes	27 (14.06)	165 (85.94)	0.9007
		No	1 (12.5)	7 (87.5)	
Maternal perceived on the severity of SAM		Not aware of any consequences	0 (0)	2 (100)	0.7173
		Death and disability	0 (0)	2 (100)	
		Disability	28 (14.2)	168 (85.8)	
		Death	28 (14)	172 (86)	

The study (Table 2) reported that 107 participants were from mothers with no formal education and that 100(93.4%) were recovered with a p-value of 0.0192; the majority 125(83.9%) of recovered participants had a poorer household wealth index with a p-value of 0.3845. A large proportion of 84%(n=126) of recovered children had less than an hour two-way distance from OTP with a p-value of 0.0365. About nutritional diagnosis at admission or follow up; among 162 of children with cough, 83.3%(n=135) were recovered with a p-value of 0.0248, among 162 children with oedema, 82.8%(n=134) were recovered with a p-value of 0.0057, among 199 children with pneumonia, 85.93(n=171) were recovered with 0.6859 as p-value, among 197 children with tuberculosis, 86.2%(n=170) were recovered with a p-value of 0.3309, 88%(n=162) recovered children with a p-value of 0.0047 were from 184 children group with negative HIV status.

Table 3: Anthropometric indicators that were used to confirm SAM

Items	No recovered	Recovered	P-value
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Oedema	Yes	0 (0.0)	38(100.0)	0.0057
	No	28 (17.0)	134 (83.0)	
MUAC is less than 110mm(11.0cm)	Yes	28 (14.0)	170 (86.0)	0.5663
	No	0 (0.00)	2 (100.0)	
Weight for height/length was less than minus 3SD Z-score below the median	Yes	27 (14.0)	168 (86.0)	0.6954
	No	1 (20.0)	4 (80.0)	

The analysis results (Table 3) showed the anthropometric indicators used to confirm severe acute malnutrition: oedema, Mid upper arm circumference (MUAC), and weight for height or length. The study reported that 100% (n=38) of children with oedema were completely recovered and among 162 children without oedema, 134(83%) were recovered while 28(17%) were not recovered, and the p-value was 0.0057. Among 198 Children with MUAC less than 110mm(11.0cm), 86% (n=170) were recovered with a p-value of 0.5663. With regards to the majority, 168(86%) of children with less than -3SDz-score of weight for height or length were recovered with a p-value of 0.6954.

Table 4: Clinical indicator or symptom indicator for complete recovery

Items		No recovered	Recovered	P-value
No oedema for at least 2 weeks	Yes	0 (0.0)	79 (100)	-0.0001
	No	28 (23.0)	93 (77.0)	
weight-for-height/length is \geq-2 Z-scores	Yes	27 (14.0)	168 (86.0)	0.6954
	No	1 (20.0)	4 (80.0)	

mid-upper-arm circumference is ≥ 125 mm	Yes	27 (14.0)	167 (86.0)	0.8484
	No	1 (16.7)	5 (83.3)	
The precise point (the time it takes for a complete recovery)	0-15 days	3 (23.0)	10 (27.0)	0.0145
	16-30 days	25 (18.0)	114 (82.0)	
	31-45 days	0 (0.0)	34 (100.0)	
	45 days-	0 (0.0)	14 (100.0)	
	More			

The results (Table 4) showed that 100% (n=79) of confirmed recovered children were not having Oedema for at least two weeks, and with the p-value of -0.0001, weight-for-height/length for 86% (n=168) of confirmed recovered children was superior to -2 Z-scores, and the mid-upper-arm circumference for 86% (n=167) was superior to 125mm(12.5cm). According to the precise point of time, it took for a complete recovery since treatment, 114(82%) of recovered children were in the group 16-30 days.

Table 5: Binary logistic regression for completely recovered participants

Items		Child completely recovered		
		OR	95% CI	P-value
Age of children (Months)	6-11	1.00		
	12-23	0.78	0.143 – 4.251	0.774
	24-35	1.03	0.179 – 5.974	0.970
	36-47	0.75	0.122 – 4.690	0.763
	48-59	0.39	0.027 – 5.749	0.498
Gender	Male	1.00		
	Female	1.19	0.499 – 2.865	0.688
Maternal education	No formal education	1.0		
	Primary school	2.34	0.488–11.233	0.2875

	Secondary school	0.66	0.161 – 2.774	0.579
Two-way distance from	Less than one hour	1.00		
	More than one hour	0.35	0.041 – 3.085	0.349
OTP				
Cough	Yes	1.00		
	No	3.75	0.450–31.327	0.221
HIV	Negative	1.00		
	Positive	0.23	0.062 – 0.912	0.036

The study Results (Table 5) show that participants in the age group of twenty-four to thirty-five months were more likely to recover ultimately faster than children of six to eleven months with (OR: 1.03_CI: 0.179-5.974_p-value of 0.970).

Female participants were more likely to be completely recovered than the male with (Or:1.19_CI: 0.499-2.865_P-value 0.688).

Children whose mothers have primary education were more likely to get recovered entirely than those whose mothers have no formal education with (OR:2.23_CI: 0.488-11.233_P-value of 0.287). Participants who made more than the one-hour two-way distance from OTP were less likely to be completely recovered than participants who used less than the one-hour two-way distance from the OTP with (OR:0.35_CI: 0.041-3.085_P-value of 0.349). children who did not experience cough during follow-up were more likely to be wholly recovered than those who had cough with (OR:3.757_CI: 0.450-31.327_P-value of 0.221). Children with Positive HIV status during follow up were less likely to be completely recovered than those with negative status with (OR: 0.23_CI: 0.062-0.912 _ P-value of 0.036).

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter comes up with detailed information and explanations of the generated findings. Illustrate isolated proportion of factors contributing to the complete recovery from severe acute malnutrition in under five years young children nearly socio-demographic, socioeconomic and health-related characteristics.

They are explained by supporting previous studies. Finally, these findings will help to build a conclusion and provide recommendations to different levels.

This study assessed the contributing factors to the complete recovery of under-five children with severe acute malnutrition managed on an outpatient basis from January 1st 2017, till September 30th, 2021. The complete recovery was negatively affected by many factors, including maternal illiteracy, Two-way distance from OTP, Cough while follow-up, and HIV status of the children. In addition, confounding factors like age of the child and gender can contribute to the time of complete recovery; the study revealed that the more extraordinary age group of the children, the greater chance for a quick, complete recovery as participants in the age group of twenty-four to thirty-five months were more likely to recover completely faster than children of six to eleven months with (OR: 1.03_CI: 0.179-5.974_p-value of 0.970. This is in line with a reported study in Ethiopia that younger children with SAM were more vulnerable to infections due to mal-absorption of nutrients caused by decreased immunity and insufficient feeding practices (Atnafe, Roba and Dingeta, 2019b). Different results were found in Debre Markos and Finote Selam hospitals, Northwest Ethiopia, where a retrospective cohort study on treatment outcome and associated factors of SAM. It showed that being in the younger age group was positively associated with recovery time from SAM with 34% lower probability of recovery from

SAM for children aged from 24 to 35 months compared to 6–11 months old children(Mekuria, Derese and Hailu, 2017).

In the present study, maternal literacy is identified as having no influence or difference of Complete recovery of children from SAM. The present study reported that there is no difference in recovery between Children whose mothers have primary education and those whose mothers have no formal education with a non-significant P-value of 0.287. Different findings were found by a study in Ethiopia that maternal literacy is likely to be associated with better child feeding and caring practice(Tefera et al., 2020b). Several studies reported that not only educated mothers used health care facilities but also followed the instructions given by health providers concerning feeding and caring practices , and this is certain to decrease the risk to SAM, which is compatible with the present study’s findings (Bain et al., 2013). This was also supported by the findings of the study done by Seid , who reported the positive correlation between parents’ education and child health. The children with illiterate parents were about 12. 3% likely to suffer from severe acute malnutrition following the lack of knowledge and skills for child nutrition. Even so, the income was likely to be low in the non-educated parents (Seid, Seyoum and Mesfin, 2017). However, same findings were found in the study of Recovery rate and determinants in treating children with severe acute malnutrition using outpatient therapeutic feeding program in Kamba District, South West Ethiopia. It revealed no relationship between maternal education and time for complete recovery from SAM as socio-demographic information was not registered in the standard OTP cards(Shanka, Lemma and Abyu, 2015). Nevertheless, the finding is credible and anticipatable as maternal literacy is certain to be aligned with better child feeding and caring practice, adoption of nutritional advice, and superior household economic status(Teshome, Boshia and Gebremedhin, 2019).

Children who used more than the one-hour two-way distance from OTP were less likely to complete recovery than those with less than the one-hour two-way distance from the OTP.

Findings were similar to the following research results; participants coming from more than an hour fall away to OTP were near to defaulting and missed visits, which extended the period in treatment for complete recovery(Bailey et al., 2020). A study conducted in Dire Dawa, Eastern Ethiopia, reported that Another reason for the poor recovery rate and delayed recovery time from the interviewed data had

additional co-morbidities, availability of Plumpy Nuts, distance from their home to the health center(Atnafe, Roba and Dingeta, 2019b). Another study in East Amhara Hospitals, Northeast Ethiopia, showed a significantly lower time-to-recovery rate among caregivers of children who travel more than one hour to receive nutrition services(Tefera et al., 2020b). Thus, caregivers who have limited access to OTP sites may only decide to bring their child to treatment when the malnutrition gets severe, and this may compromise the treatment success rate. However, the above findings may also indicate that making the OTP service even more accessible to the community level may lead to improve treatment outcome(Tefera et al., 2020a). A study in Indonesia also identified the distance to health facilities among the main barriers to access to treatment for severe acute malnutrition(Bait et al., 2019). Evidence shows that reducing the distance barrier, during the treatment of SAM totally at the household through community health workers positively affects beneficiary acceptance of and compliance with services, with implications for early presentation and effective recovery of cases of SAM(Puett and Guerrero, 2015).

The present study revealed that coughing during admission or follow-up could be a barrier to a quick, complete recovery, and results showed that children who did not

experience cough during follow-up were more likely to get recovered completely than those who had cough with (OR:3.757_CI: 0.450-31.327_P-value of 0.221. This is supported by a study done in Dire Dawa, Eastern Ethiopia, whose findings showed that children who had a cough (CHR = 0.81, 95% CI: (0.68–0.97)) (P < 0.05) and fever on admission day and during follow up were less likely to achieve fast recovery from SAM (CHR = 0.72, 95% CI: (0.55–0.96))(Atnafe, Roba and Dingeta, 2019b).

According to the bivariate regression analysis, there was a significant difference in the time it takes for complete recovery between children with HIV positive and negative status. The study showed how HIV infection among children was negatively associated with the complete recovery from SAM. Children with Positive HIV status during follow-up were less likely to be completely recovered than those with negative status with (OR: 0.23_CI: 0.062-0.912 _ P-value of 0.036. Results are supported with a study in Debre Markos and Finote Selam hospital, Northwest Ethiopia, which stated that HIV negative children had a 2.48 times higher probability of getting recovered from SAM prior to HIV positive children(AHR=2.48, 95% CI: 1.23-5.01)(Mekuria, Derese and Hailu, 2017). This is in the same line with the study findings of a study done in Woldiya general hospital that the effects of HIV/AIDS and malnutrition are interconnected and worsen one another in a vicious cycle(Chane et al., 2014). Further, a study on risk factors for mortality and management of children with complicated severe acute malnutrition at a tertiary referral hospital in Malawi reported that HIV infection holds an essential predictor of mortality in under five years children with severe acute malnutrition(Vonasek et al., 2020). In line with these research findings, 3 studies from different parts of Ethiopia [(Tsfay et al., 2020), (Atnafe, Roba and Dingeta, 2019a), (Mena, Dedefo and Billoro, 2018)] reported that children presented with retroviral infection at hospitalization were not as much to recover from SAM, as being reactive for HIV serostatus among the study participants had negatively affected the complete recovery from SAM. The same results were found in the study of antibiotics as part of the management of severe acute malnutrition conducted in Malawi(Mena, Dedefo and Billoro, 2018).

A study in Uganda on the treatment outcome among under five-year-old children hospitalized with SAM in Saint Mary's hospital Iacor, North Uganda, found supporting results. It demonstrated how children who were HIV infected were significantly more likely to die during treatment compared to their HIV-negative counterparts, who were more likely to have a successful outcome. Thus, HIV infection as a risk factor for unsatisfactory results among severely malnourished children toward the present study comply with previously

reported findings by other authors(Mena, Dedefo and Billoro, 2018).however another Ugandan study found no adequate association between HIV positive status and complete recovery or no recovery. attributed to the effect of HIV being overshadowed by the prominent effect of fluid overload, which means that appropriate management of severe malnutrition may unveil the effect of HIV on no recovery or mortality. (Bachou et al., 2006).

5.2 Limitations of the study

Even though the strength of this paper comes from its study design (cohort), it was based on patients' secondary data, in which incompleteness was observed to some extent; it was also impossible to analyze the socio-economic characteristics of parents/guardians and factors related to patient treatment (medical/pharmaceutical supplies and healthcare provider expertise) that could have influenced the outcome variable in a desirable or undesirable way.

5.3 Conclusion

This research figured out that the complete recovery from severe acute malnutrition is in the acceptable range of the national and international standards set to manage SAM in children under five years of age. It also revealed non-significant differences in complete recovery among different predictor variables. However, the study indicates that the complete recovery was negatively affected by many factors, including maternal illiteracy, Two-way distance from OTP, Cough during follow-up, and HIV status of the children.

There was no influence of Covid-19 during data collection because same interventions were applied during treatment of SAM children before corona (2017-2019) and after corona (2020-2021). In addition to that research assistants selected the sampled patients' cards at the hospital's malnutrition treatment center.

5.4 Recommendations

The Community management of severe acute malnutrition in the district or in other similar settings can enhance treatment outcomes by improving access to OTP sites, limiting a long, two-way distance from OTP, discouraging RUTF selling and sharing behavior, giving close follow-up to children of younger age with HIV, cough, tuberculosis, diarrhea and other health-related co-morbidity due to their weak immune system.

Ministry Of Health and partners should work jointly with district hospitals to enhance HIV prevention programs, especially services provided to HIV-positive mothers to produce children safe from the virus.

You cannot tackle malnutrition without taking into account the household wealth index, at the base of women empowerment by education. Though stakeholders', national and international, should be involved in order to enhance household food security status.

Nyarugenge District social public officials should take close monitoring and evaluation to ensure that the under five years children's health is improving along with the implementation of available health promotion related policies.

Finally, we suggest a prospective cohort study on problems related to complete and non-complete recovery from severe acute malnutrition for further investigation

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APPENDICES

Appendix 1: Timeline

TIME	ACTIVITY
May 2021- July 2021	Writing thesis proposal
2021-September 2021	First thesis proposal defense
September-October 2021	Collecting data
November 2021	Second Dissertation Defense
December 2021	Submission of the final thesis

Appendix 2: English questionnaire

Factors contributing to the complete recovery of Severe Acute Malnutrition among under five years children at Muhima District Hospital, Rwanda from January 1st 2017 till September 2021

1.Socio-demographic and economic characteristics of the study participants

Sex of the child

Gender

Male

Female

Age of children (months)

6–11

12–23

24–35

36–47

48–59

Maternal education

No formal education

Primary school

Paternal education No formal education Primary school**Mother's occupation** Housewife Others**Agro-ecological zone** Highland Midland**Household food security status** Secure Mild Moderate Severe**Two-way walking distance to the OTP** Less than an hour More than an hour**Visited at home by CHWs during the treatment** Yes No

Receiving nutrition education during the treatment Yes No**Nutritional diagnosis at admission** Marasmus Kwashiorkor Marasmus-Kwashiorkor**Ailment in the past 2 weeks** Diarrhoea Cough Fever**Breastfeeding status at admission** Still breastfeeding Stopped breastfeeding**Dietary diversity score at admission** Suboptimal Optimal**RUTF sharing at first follow-up** Yes No**RUTF selling during the first week**

Yes

No

Caregivers' perception on RUTF

Food and medicine

Food for SAM child

Medicine for SAM child

2. What should be the predictors of complete recovery of SAM in the following?

Age group of children

Younger than 24 months

Older than 24 months

Sex of child

Male

Female

Maternal education

Primary school

No education

Paternal education

Primary school

No education

Ecological zone

Midland

Highland 0.62

Household food security status

Mild insecurity

Moderate insecurity

Severe insecurity

Household wealth index

Richest

Richer

Middle

Poorer

Poorest

Two-way distance from health post

More than an hour

Less than an hour

Dietary diversity score

Optimal

Suboptimal

Breast feeding

Yes

No

Nutritional diagnosis at admission

Marasmus

Kwashiorkor

Marasmus-Kwashiorkor

Diarrhea during admission or follow-up

Yes

No

Cough during admission or follow-up

Yes

No

Fever during admission or follow-up

Yes

No

Oedema

Yes

No

Pneumonia

Present

Absent

Anaemia

Anaemic

Not anaemic

Tuberculosis

Yes

No

HIV status

Positive

Negative

Vitamin A

Given

Not given

RUTF sharing practice

Yes

No

RUTF selling practice

Yes

No

Maternal perceived on the severity of SAM

Not aware of any consequences

Death and disability

Disability

Death

3. Incidence and recovery status (including proportion of complete or incomplete recovery and recovery time) of severe acute malnutrition among under five years children admitted/visited in Muhima District Hospital during from January 1st 2017 till September 2021

What is the admission/date of malnutrition diagnosis?

...../...../.....(Date/Month/Year)

At the diagnosis day or admission day,

Oedema?

Yes

No

MUAC is less than 110mm(11.0cm)?

Yes

No

Weight-for height/length was less than Minus 3SD Z-score below the median?

Yes

No

What is the date of discharge?

...../...../.....? (Date/Month/Year)

At the discharge day (or at the questionnaire response day?)

No oedema for at least 2 weeks?

Yes

No

weight-for-height/length is ≥ -2 Z-scores?

Yes

No

mid-upper-arm circumference is ≥ 125 mm?

Yes

No

The precise point (the time it takes for a complete recovery)

0-15 days

16-30 Days

31-45 days

45days-More

At the discharge day,

The child was completely recovered?

Yes

No

The child was partially recovered?

Yes

No


The child was not recovered?

Yes

No

Appendix 3: Request for permission on data record

DUHIRWE Chaste
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Republic of Korea
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Tel: +821021921579

Form Reception
Hôpital Muhima Seoul, 08/11/2021
Date: 08/11/2021
Signature: 

The Director General, Muhima District Hospital, Kigali, Rwanda

Through The Corporate Division Manager/ Nyarugenge District

Re: Request for permission on data Usage

Dear Director,

I am an employee of Nyarugenge District and work as Sector Health and Sanitation Officer in Nyarugenge Sector. I have been awarded a scholarship to pursue a full time Master Degree program in Health Policy and Financing Capacity Building at Yonsei University in Republic of South Korea.


In fact, I would like to collect secondary data through record review of eligible patient cards of under five years children with severe acute malnutrition treated at Muhima District Hospital from January 1st 2017 till September 30th 2021. A structured checklist will be used as a method of data collection. The data will be used to develop a master's thesis with the title "Factors contributing to the complete recovery of severe acute malnutrition among under five years children at Muhima District Hospital, Rwanda.

In this regard, I am requesting a permission to allow me the usage of data with a purpose of producing useful recommendations to health planners and policy makers such as those at Ministry of Health and non-governmental organization (NGOs) working together to set up adequate and suitable strategic malnutrition prevention and control measures, the study findings will also help the Muhima Hospital's managers for a better plan, monitoring and evaluation of all treatment services and also look for possible solutions to highlighted gaps according to research findings, all in order to reduce malnutrition cases in Nyarugenge District. In addition, the findings from this study will be used as important literature for future researchers who want to conduct their researches in the same field.

Attached herewith the data usage request letter from the chair of department of Global health security, Graduate school of public health at Yonsei University, republic of Korea.

Please accept the assurances of my highest consideration.

Sincerely,

 DUHIRWE Chaste

C.C
- The Mayor of City of Kigali

