Predictors of Recovery from Complicated Severe Acute Malnutrition among Children 6-59 Months Admitted at Mbale Hospital, Uganda

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KEYWORDS: Severe acute malnutrition, wasting, deworming, health outcomes, treatment outcome, Uganda, incidence, quantitative methods

ABSTRACT

Introduction: In Uganda, 300,000 children under 5 years are acutely malnourished with 1.3% suffering from Severe Acute Malnutrition (SAM). Mbale Regional Referral hospital (MRRH) nutrition unit admits SAM children with comorbidities into inpatient care striving to ensure recovery, reduce morbidity and mortality. We assessed the incidence and predictors of time to recovery among SAM children admitted as inpatients in MRRH nutrition unit. **Methods:** We reviewed records of children 6-59 months old managed at the inpatient unit for SAM at MRRH from 2013 to 2016. Data on patient demographics, comorbidities, medications administered, and treatment outcomes were collected from the integrated nutrition register and patient charts. Recovery incidence was determined using Kaplan Meier survival analysis. Cox proportional hazards regression competing risks model with death, default and transfer as competing risks was fit to identify predictors of time to recovery. **Results:** Overall, 322 patient records were reviewed of which 183 (56.8%) were males with median age of 19 months (IQR; 14-26 months). Of these, 246 (76.4%) recovered with recovery incidence of 31.3 per 1000 person days and a median recovery time of 27 days (IQR; 16-38 days). Children with SAM who were dewormed during treatment were 33% more likely to recover faster compared to their counterparts who were not dewormed (AHR= 1.33; C.I = 1.01-1.74). **Conclusion:** Recovery was in acceptable range of Sphere standards and deworming was a predictor of time to recovery. The Uganda Ministry of health should ensure nutritional rehabilitation units follow the stipulated guidelines for management of SAM. Findings were limited by missing data.

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RECEIVED
25/05/2020

ACCEPTED
31/03/2021

PUBLISHED
31/03/2021

LINK

https://www.afenet-journal.net//content/article/4/5/full/

CITATION
Magdalene Odikro et al. Predictors of Recovery from Complicated Severe Acute Malnutrition among Children 6-59 Months Admitted at Mbale Hospital, Uganda. J Interval Epidemiol Public Health. 2021 March; 4(1): 5
DOI: https://doi.org/10.37432/jieph.2021.4.1.34

Introduction

The World Health Organization (WHO) defines severe acute malnutrition (SAM) amongst children from 6 months to 59 months as a very low weight for height (below -3z scores of the median WHO growth standards), mid upper arm circumference 11.5 or the presence of bilateral pitting edema [1]. Globally, 17 million children under five years were affected with 16 million (94%) coming from low and-middle income countries [2]. Africa alone accounts for about 4.3million of children with SAM with one million preventable deaths recorded annually [2,3]. About 4.0% of Ugandan children below five years are wasted, 1% are severely wasted and under five mortality rate is at 64 deaths per 1000 live births of which 50% are directly or indirectly malnutrition related [4].

In the Uganda health system, children suspected to be malnourished are nutritionally screened and categorized following the Integrated Management of Acute Malnutrition (IMAM) guidelines [5]. Children diagnosed with SAM without any co-morbidities and are able to pass the appetite test are treated in the outpatient unit [5]. About 85% of children with SAM need outpatient care [6]. The remaining 15% of children with complicated SAM (i.e., SAM with no appetite, edema or co-morbidities including high fever, severe hydration, severe anemia and convulsions) are managed in inpatient therapeutic centers (ITC) [7]. Management of complicated SAM follows IMAM guidelines with a goal of ensuring that affected children recover from the condition [7]. Children recover when they become free of complications, lost edema and gain and maintain normal weight of > -2 standard deviation or MUAC >12.5 for at least two consecutive weeks [7,8]. Additionally, all inpatient units should strive to achieve the minimum acceptable levels of recovery that is set at 75% according to Sphere standards [9].

The Mbale regional referral hospital nutrition unit (MRRNU) has been known to have high caseloads with reports of the unit being overwhelmed [10,11]. Prevalence of SAM is estimated at 2.7% in the Bugisu region which is largely served by MRRH against 1.3% at national level [4]. Optimizing the management of SAM remains critical as children with SAM need care in order to recover from the condition and it is unlikely that SAM will be eliminated in the foreseeable future [12,13]. The MRRHNU operates both inpatient and outpatient units. The children with complicated SAM admitted to the inpatient unit are managed using WHO´s 10 steps for management. After complications are resolved, the children are discharged from the ITC to the OTC and managed at the OTC until attainment of the recovery criteria and discharge from the program.

Studies conducted in Ethiopia found recovery incidence of between 36.1 per 1000 person days and 149.0 per 1000 person days [18,19]. Identified predictors of time to recovery have included sociodemographic factors; age and sex, admission characteristics; type of SAM and weight gain, comorbidities; HIV and TB and medications administered during rehabilitation; Vitamin A and folic acid [19-24]. There is paucity of studies assessing the incidence and predictors of time to recovery among SAM children in Uganda. This study assessed the incidence and predictors of time to recovery among children with SAM admitted as inpatients at the Mbale regional referral hospital nutrition unit.

Methods

Study site and setting

The study was conducted in Mbale regional referral hospital (MRRH), Eastern Uganda, with a bed capacity of 355-beds. MRRH has a catchment area that spans over 11 districts and an annual inpatient admission of 47,354. The study site was the Nutrition Unit at Mbale regional referral hospital. The nutrition unit is under the pediatric department and has been operating since 1953. The inpatient therapeutic center is a 19-bed capacity unit that admits children with complicated severe acute malnutrition from the over 11 districts that make up the catchment area of the hospital. The unit admits an average of 40 children per month and is overseen by five full time staff including a senior nutritionist, a medical officer nursing assistant. Screening of children is mainly done at the outpatient department (OPD) of the children´s ward where the MUAC, weight, length/height are taken. Assessment for medical complications and the appetite test are also performed accordingly. Children who are diagnosed with SAM but do not have complications are treated at the units OTC while those with complications or unable to pass the appetite test are admitted in the

ITC. In the ITC, commercial feeding formulas-F75, F100 and Ready to Use Therapeutic Foods (RUTF) sourced from UNICEF are used for the management of SAM children. Because the unit is operating both the outpatient and inpatient units, children admitted in the ITC are managed for complications and discharged to the OTC for management until they fully recover. The OTC of the unit recruits on a daily basis with follow up´s once every week on Wednesdays. The records for the children remain the same and they are discharged from the program when they meet the criteria for recovery.

Study design and period

We conducted a cross sectional study using quantitative review of records of children with SAM managed as the inpatient therapeutic unit of MRRH from January 2013 to December 2016.

Study population and selection

The study population comprised of all records of SAM children 6-59 months managed at the inpatient unit of MRRH nutrition unit from January 2013 to December 2016. All the records available were first reviewed to ensure eligibility. Of the 600 children´s records reviewed, 120 of the children managed exclusively as outpatients were excluded together with 57 records of children below 6 months and above 5 years. An additional 101 records that were destroyed by rain were excluded due to ineligibility of the information in the folders and 322 complete records were included in the study (**Figure 1**).

Data sources

The data sources for the study were the nutrition unit register (HMIS 077) where patient demographics, admission date, type of SAM, HIV and ART status at admission, discharge date and treatment outcome were extracted. Data on medications administered to the patients, supportive treatments, immunization status of patients and anthropometric records over the stay period were extracted from patient charts. The patient charts were also used to triangulate information from the register.

Data collection

Data were captured from patient registers and charts using a pre-designed structured excel form. Registers were first reviewed for eligibility and unique identifier numbers from registers were used to retrieve patient charts from the MRRH nutrition unit file storage unit.

Study variables

The dependent variable of this study was time to recovery from SAM. This was defined as the time from admission to recovery: attainment of weight of >-2SD or MUAC 12.5cm or discharge from the program as recovered. For this study all children discharged as recovered from their records were considered as recovered. SAM patients who died, were transferred, and defaulted were considered as competing risks during the analysis. The independent variables extracted included socio-demographics including age and sex, baseline characteristics including mid upper arm circumference (MUAC), weight, height, nutritional status (edematous, wasting or both wasting and edema, presence and grade of edema), comorbidities present (i.e., HIV, TB, malaria), rehabilitation characteristic including medications administered, IV fluids, blood transfusion.

Data analysis

The dataset was exported to Stata version 13 for analysis. The proportion of children who recovered was computed using the formula designated in the IMAM guidelines [7].

$$\text{Recovery Rate} = \frac{\text{Number of clients successfully discharged as recovered}}{\text{Total number of admissions}} * 100$$

Average length of stay and average weight gain were also calculated using the formulae;

$$\text{Average length of stay} = \frac{\text{Sum of length of stays (}\textit{From admission to discharge}\text{)}}{\text{Total number of admissions}}$$

$$\text{Average weight gain} = \frac{\text{Weight (kg) at admission} - \text{minimum weight (kg)}}{\text{Minimum weight (kg)} * \text{length of stay (days)}} \times 1000$$

Due to unavailability of anthropometric measurements for all the children, average weight gain was calculated among a random sample of 40 wasted and edematous children respectively. This number is enough to provide a good estimate of the average weight gain [25].

The determined proportions were compared with set international SPHERE standards. The data was then set as survival data using the "stset" command. The "stset" command sets the data to calculate the exact time contributed by each individual. Time to recovery for each child who recovered from SAM and for censored observations (i.e., children who died, defaulted or were transferred out), their exact time contributed until censoring was used in the analysis. Kaplan Meier survival analysis with was performed to determine the incidence of recovery.

To determine predictors of recovery, cox proportional hazards regression was used. At bivariate level, associations between each independent variables and time to recovery were assessed using p-values. The $p<0.05$ was considered statistically significant. In building the multivariate model, variables with 0.02 significance at bivariate level and those shown to be important confounders from literature were included. Using stepwise elimination method, a multivariate cox proportional hazard regression model of the predictors of recovery with default as competing risk was fit. Default was set as the competing risk because it had the highest proportion compared to proportion of death and transfer. A competing risk analysis is considered when another event of a competing risk hinders the observation of the event of interest (recovery) or modifies the chance that this event occurs [26] Associations with $p<0.05$ between independent and our outcome of interest (time to recovery) were considered significant. Since the medications and co-morbidities were considered as independent during analysis, we applied several interaction terms in the final model to assess for possible interaction between the variables. We chose the best model after comparing the fitness of the final models (global test under chi squared distribution). A Cox-Snell residual plot was also fit to ensure the final model did not violate the proportional hazards assumption. Unadjusted and adjusted hazard ratios (HR) and their corresponding 95% confidence intervals (CI) were used to measure the strengths (and direction) and statistical significance of associations.

Ethical approval

The study was approved by Makerere University School of Public Health Higher Degrees, Research and Ethics Committee. Administrative clearance was received from the Mbale Regional Hospital Institutional Review Committee (MRHIRC). This study did not involve direct contact with patients and anonymity was maintained by using identifier numbers instead of patient names.

Results

Socio-demographic and admission characteristics

Records of 322 children were reviewed. Out of these, 183 (56.8%) of the children were males and the median age was 19 months (IQR; 14-26). The age group of 12 to 23 months made up the highest percentage of the children 157 (48.8%). Majority of the children managed in the nutrition unit were from Mbale district 124 (38.5%) followed by those from Budaka district 34(10.6%). Predominantly, 237 (73.4%) of the children were edematous. Out of these, a total of 214 (66.5%) had edema only and 23 (7.1%) were both wasted and edematous with about 126 (39.1%) of them having grade three edema (Table 1).

Medical comorbidities, routine medications and supportive treatments

The most common medical comorbidities among admitted children included fever 267 (83.2%), respiratory tract infections (RTI´s) 198 (61.5%) and dehydration 172 (53.4%) (Figure 2). For routine medication, 263 (81.7%) of the children were given amoxicillin, 190 (59.0%) received albendazole and 70 (21.7%) were administered folic acid. Also, 12 (3.7%) of the children received blood transfusion (Table 2).

Comparison of treatment outcomes and Sphere standard rates

Of the 322 children, 69 (21.4%) defaulted treatment, 4 (1.2%) died, 3 (0.9%) were transferred to other facilities and 246 (77.1%) recovered. Recovery and death rates were in line with Sphere standards but default was above recommended Sphere standard rate (Table 3). Average length of stay in the hospital was at 24 days. Children with edematous malnutrition had an average weight gain rate of 4 g/kg/day and non-edematous children had an

average rate of weight gain of 7.76g/kg/day (Table 3).

Time to recovery among children with complicated SAM managed at MRRH nutrition unit.

The total time at risk for the entire cohort was 7858 days and cumulative incidence of recovery was as 0.0313 (31.3 per 1000 person days). Children stayed in the program for a minimum of one day to a maximum of 97 days with median survival time of 27 days (IQR=16-38). Recovery happened across the 97 days until the last days but majority of the children recovered in the earlier 40 days after admission (Figure 2).

Predictors of time to recovery from complicated SAM among children managed at MRRH nutrition unit.

Bivariate analysis indicated that everyday children who were dewormed at some point during treatment were 48% more likely to recover on that day compared to their counterparts who were not dewormed (CHR =1.49 95%: 1.15-1.92).

Females were 7% less likely to recover faster compared to males (CHR= 0.93 95% C.I: 0.74-1.22). Children who were HIV positive were 42% less likely to recover faster compared to children who were HIV negative (CHR = 0.93 95% C.I: 0.73-1.20, CHR= 0.42 95% C.I: 0.15-1.13). Also, edematous children were 24% less likely to recover faster compared to those with wasted children whereas those were both edematous and wasted were 9% less likely to recover faster compared the children with marasmus (CHR= 0.76 95% C.I 0.56-1.02, CHR= 0.91, 95% C.I: 0.52- 1.62). However, only deworming was significantly associated with time to recovery at bivariate level.

After controlling for confounders through backward cox regression method with competing risk, deworming remained a significant predictor of time to recovery. Children who were dewormed were 33% more likely to recover faster compared to their counterparts who were not dewormed (AHR=1.34; 95% C.I: 1.02-1.75) (Table 4). Interaction terms were applied for various variables however, since none was significant, the final model reported does not have any interaction terms.

Discussion

This study assessed the incidence and predictors of recovery from SAM amongst children admitted to the inpatient unit of MRRH nutrition unit. We found that overall, 76.4% of admitted children recovered, 1% died, 24% defaulted treatment and 0.9% were transferred. The median recovery time was at 27 days with a rate of weight gain of 4g/kg/day and 8g/kg/day for edematous and wasted children respectively. The identified predictor of time to recovery was deworming.

Recovery was in line with the recommended threshold of >75% by Sphere standards [9]. Similar studies including a clinical audit conducted in Malawi among children below five years and a retrospective cohort study conducted in Northwest Ethiopia among children 6-59 months old also found recovery rates of 78% [21,24]. These recovery rates were higher than the rate found in this study but also in line with Sphere thresholds. However other studies found low recovery rates below the Sphere standards. Recovery rate was at 3% in a study assessing clinical outcomes among children 6-59 months old in Kenya, 58% in a study conducted among children below five years in Bahir Dar Felege Hiwot referral hospital in Northwest Ethiopia and 67% in another study among children 6-59 months in Northern Uganda [22,27,28]

The incidence of recovery in this study was at 31.3 per 1000 person days. This incidence was lower than the incidence of 149 and 36 per 1000 person days that were found in two separate studies conducted in Dire Dawa and Haramaya in Ethiopia respectively [18,20]. The difference in the recorded incidences may be due to the differences in study designs employed, the study populations and the study settings. The study population in Dire Dawa included children from the age range of 0 to 60 months while this study only included children from 6 to 59 months. Additionally, the differences in the study designs could be a contributing to the differences in recorded incidences.

Over the three-year period, mortality rate was at 1%. This mortality rate is very low when compared to existing findings in Africa and Uganda that have reported mortality from 9.8% to 46% [29-32]. The mortality rate reported in our study does not

represent the reality of mortality from complicated SAM from MRRH due to the set-up of the operation of the unit. Severely malnourished Children who come in at critical stages are attended to at the critical care unit and are only transferred to the ITC when their condition stabilizes. Similarly, when the condition of the children already on admission worsens, they are moved to the critical care unit until their condition stabilizes. Most of the deaths therefore happen at the acute care unit and because the data is not kept electronically, this information is rarely updated in the records of the nutrition unit.

In this study, 24.3% of the cohort defaulted treatment which is above the recommended Sphere threshold of 15% [29-32]. This represents default at any point during treatment (ie. During admission in ITC or after discharge to OTC) before achieving recommended recovery criteria. This high default rate is an indicator of ineffective service provision as any defaulter represents a potential death [5]. The high default rate in this study is likely due to the fact that the study was set in the ITC of a regional referral hospital which required care takers to move from their communities to the nutrition unit during the period of hospitalization and also to move from their communities to attend the OTC days. Over 60% of the admitted children were not from Mbale township. This movement presents with loss of time to cater for livelihood and economic activities at home together with challenges of finding care takers for any remaining siblings at home thereby leading care takers to default treatment. In Malawi, a qualitative study focused on exploring the perspective of care givers on quality of care in Nutritional rehabilitation units found that one of the major themes from care givers was "My children back home" - an indication of the care takers multiple responsibilities and challenges [17]. Similarly, a comparative qualitative study conducted in Ethiopia and Pakistan found that barriers to accessing SAM treatment services were related to high opportunity costs [33].

Children who were dewormed were more likely to recover faster compared to their counterparts. Among children with SAM, worms further exacerbate their situation by competing for nutrients in the bowel, sustaining chronic inflammation, causing mal-absorption and contributing to chronic anemia [34]. Deworming children with SAM will therefore increase their appetite, repair damaged gut and ability to absorb nutrients thereby quickening their recovery from SAM. A similar study conducted among children with complicated SAM and treated in ITC in Ethiopia also found an association between deworming and recovery [35]. The IMAM guidelines also stipulate routine administration of deworming medications (Albendazole/Mebendazole). This should be given either in the second phase of ITC treatment or before transfer to OTC [7]. In our study, demographics including age and sex and comorbidities such as HIV and TB did not affect length of stay. This contradicts findings from previous studies where demographics and comorbidities were strongly associated with length of stay amongst children managed in the ITC [21,22,36].

This study was not without limitations. This study relied on secondary data therefore findings were majorly limited by missing data and therefore findings should be interpreted cautiously. Excluding the records that were incomplete presents with bias to the finding. The children with incomplete records could have been the ones who passed away or could have had characteristic that could potentially change the findings presented in this manuscript. For albendazole administration (deworming), it was not clear at which stage it was administered to the children based on the quality of the records. It is possible that deworming was at the later stages of treatment, then those who died, defaulted or transferred would not have been dewormed thereby giving a false association. To counter this limitation, we used a competing risk analysis model with defaulting as a competing risk. Nevertheless, study findings should be interpreted cautiously with consideration of these limitations.

Conclusion

Recovery was in acceptable range of Sphere standards. Deworming was a positive predictor of time to recovery from SAM. We recommend that the Ministry of health Uganda puts in place measures to ensure that all nutrition rehabilitation units follow the guidelines for management of SAM.

Areas for further Research

We recommend that a prospective study to determine specific predictors of recovery and other treatment outcomes be carried out among SAM children treated in ITC with focus on collection of larger scope of covariates.

What is known about this topic

It is already known that in Africa alone, SAM accounts for about one million preventable deaths recorded annually. It has been documented that about 4.0% of Ugandan children below five years are wasted, 1% are severely wasted and under five mortality rate is at 64 deaths per 1000 live births of which 50% are directly or indirectly malnutrition related.

What this study adds

This study assessed the incidence and predictors of recovery among children with SAM managed at Mbale regional referral hospital nutrition unit to add to the available literature on recovery from SAM amongst children admitted at Inpatient Therapeutic Units.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MAO: Conceived, and led in the design and implementation of the study, supervised data collection, analyzed the data and wrote the first version of the manuscript and revised the paper for substantial intellectual content. She was responsible for submission of the paper. HW and ME: made substantial contributions to the conception and design of the study, revised the paper for important intellectual content, and gave the final approval for submission of the manuscript. ANK, FM and GK: made substantial contributions in revising the paper for important intellectual content, and gave the final approval for submission of the manuscript.

Acknowledgments

We thank the staff of MRRH nutrition unit for their support in acquiring background information especially Mr. Kijogo Siraje – Senior Nutritionist at the nutrition unit and the Mbale District Health Officials who generously gave their support for this research. The study was supported by Makerere University School of Public Health through Cooperative Agreement Number: 5U2GGH000817-03 ("Provision of Comprehensive HIV/AIDS services and developing national capacity to manage HIV/AIDS Programs in Uganda&auot;) from the US-Centers for Disease Control and Prevention. The data collection for this study was funded by the Regional Universities Forum for Capacity Building (RUFORUM). In addition, African Field Epidemiology Network (AFENET) funded the writing workshop that led to the production of a complete draft of this manuscript. The contents of this article are however solely the responsibility of the authors and do not necessarily represent the views of RUFORUM, US-Centers for Disease Control and Prevention, and Makerere University School of Public Health and AFENET.

Tables and figures

Table 1: Socio-demographic and admission characteristics of children 6- 59 months managed for SAM in MRRH, Uganda, 2013-2016

Table 2: Major comorbidities, routine medications and supportive treatments administered to SAM children managed at MRRH nutrition unit, 2013 to 2016.

Table 3: Comparison of Study results with International Sphere Standards.

Table 4: Bivariate and multivariate cox proportional hazard regression model for predictors of time to recovery among children 6-59 months managed for SAM at MRRRH nutrition unit from January 2013 to December 2016.

Figure 1: Flow chart showing sampling procedures for predictors of time to recovery from SAM among Children 6- 59 months managed for SAM in MRRH, Uganda from January 2013 to December 2016.

Figure 2: Overall Kaplan Meier recovery estimate depicting time to recovery from SAM among Children managed in ITC of Mbale Regional Referral Hospital, January 2013 to December 2016.

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Table 1: Socio-demographic and admission characteristics of children 6- 59 months managed for SAM in MRRH, Uganda, 2013-2016		
Characteristic	**Frequency**	**Percent (%)**
Socio-demographic characteristics		
Sex		
Male	183	56.8
Female	139	43.2
Age		
6-11	38	11.8
12-23	157	48.8
24-35	75	23.3
36-47	34	10.6
48-59	18	5.6
District		
Mbale	124	38.5
Budaka	34	10.6
Sironko	29	9.0
Manafwa	25	7.8
Other	110	34.2
Admission characteristics		
Type of SAM		
Only edema	214	66.5
Wasting	85	26.4
Both edema and wasting	23	7.1
Admission type		
New admission	294	91.3
Re –admission	28	8.7
Weight For Height (WFH) at admission?		
<70%	306	95.0
70-79.9%	1	0.3
>80%	15	4.7
Edema status at admission		
Not present	86	26.7
Grade one	34	10.6
Grade two	76	23.6
Grade three	126	39.1

Table 2: Major comorbidities, routine medications and supportive treatments administered to SAM children managed at MRRH nutrition unit, 2013 to 2016		
Characteristic	**Frequency**	**Percent (%)**
Major Comorbidities		
Fever	268	83.2
Respiratory Tract Infections	198	61.5
Dehydration	172	53.4
Diarrhoea	161	50.0
Vomiting	135	41.9
Malaria	126	39.1
Tuberculosis	10	3.1
HIV Positive	7	2.2
HIV exposed	13	4.0
Routine Medications Administered		
IV antibiotics	303	94.1
Amoxicillin	263	81.7
Albendazole (Deworming)	190	59.0
Paracetamol	171	53.1
Vitamin A	120	37.3
Folic acid	70	21.7
Supportive Treatments Given		
Blood transfusion	12	3.7
Oxygen therapy	6	1.9

Table 3: Comparison of Study results with International Sphere Standards			
Indicators	**Results (%)**	**The SPHERE Standards Reference Values**	
		ITC MINIMUM VALUE	**CRITICAL VALUE**
Recovery rate	76.4	>75%	<50%
Death rate	1.2	<10%	>15%
Default rate	21.4	<15%	>25%
Average length of stay	26.4	<28 days	>42 days
Average Rate of weight gain	· 4g/kg/day (edematous) · 7.76g/kg/day (non- edematous)	8g/kg/day	

Table 4: Bivariate and multivariate cox proportional hazard regression model for predictors of time to recovery among children 6-59 months managed for SAM at MRRRH nutrition unit from January 2013 to December 2016

Variables	Status		CHR (95% C.I)	AHR (95% C.I)	P value
	Recovered Freq. (%)	Censored Freq. (%)			
Sex					
Male	139 (75.96)	44 (24.04)	1.0	1.0	
Female	107 (76.98)	32 (23.02)	0.93 (0.73-1.20)	0.94 (0.72-1.21)	0.632
Age					
<12months	44 (67.69)	21 (27.63)	1.0	1.0	
≥ 12months	202 (78.60)	55 (21.40)	1.13 (0.81-1.57)	1.36 (0.94-1.99)	0.105
Type of SAM					
Wasting	58 (68.24)	27 (31.76)	1.0	1.0	
edematous	173 (80.84)	41 (19.16)	0.76 (0.56-1.02)	1.06 (0.73-1.53)	0.764
Both Wasting and Edematous	15 (65.22)	8 (34.78)	0.91 (0.52-1.62)	0.88 (0.46-1.69)	0.708
TB status					
Negative	184 (73.31)	67 26.69)	1.0		
Positive	6 (60.00)	4 (40.00)	1.05 (0.46-2.36)		
Unknown	56 91.80)	5 (8.20)	1.33 (0.98-1.79)		
HIV status					
Negative	177 (75.00)	59 (25.00)	1.0	1.0	
Positive	4 (57.14)	3 (42.86)	0.42 (0.15-1.13)	0.49 (0.20-1.17)	0.107
Exposed	9 (69.23)	4 (30.77)	1.65 (0.84-3.24)	1.08 (0.52-2.26)	0.835
Unknown	56 (84.85)	10 (15.15)	1.02 (0.76-1.39)	1.22 (0.89-1.64)	0.208
Measles					
Absent	97 (75.2)	32 (24.8)	1.0	1.0	
Present	66 (76.7)	20 (23.3)	1.03 (0.75-1.41)	0.99 (0.72-1.36)	0.941
Unknown	83 (77.6)	24 (22.4)	1.21 (0.89- 1.62)	1.21 (0.89-1.64)	0.413
Dehydration					
Absent	121 (80.67)	29 (19.33)	1.0		
Present	125 (73.10)	46 (26.90)	1.02 (0.79- 1.32)		
Anemia					
Absent	212 (75.71)	68 (24.29)	1.0		
Present	34 (80.95)	8 (19.05)	1.14 (0.79-1.65)		
Deworming					
Not Dewormed	143 (75.26)	47 (24.74)	1.0	1.0	
Dewormed	103 (78.03)	29 (21.97)	1.49 (1.15-1.92)	1.34 (1.02-1.75)	0.035
Vitamin A					
Not given	155 (76.73)	47 (23.27)	1.0		
Given	91 (75.83)	29 (24.17)	1.02 (0.79-1.32)		
Folic acid					
Not given	191 (75.79)	61 (24.21)	1.0	1.0	
Given	55 (78.57)	15 (21.43)	1.11 (0.82-1.50)	1.12 (0.81-1.56)	0.478
Paracetamol					
Not given	122 (80.79)	29 19.21)	1.0		
Given	124 72.51)	47 27.49)	1.01 (0.78-1.29)		
IV fluids					
Not given	13 (68.42)	6 (31.58)	1.0	1.0	
Given	233 (76.90)	70 (23.10)	0.94(0.54-1.68)	1.02 (0.54-1.89)	0.949

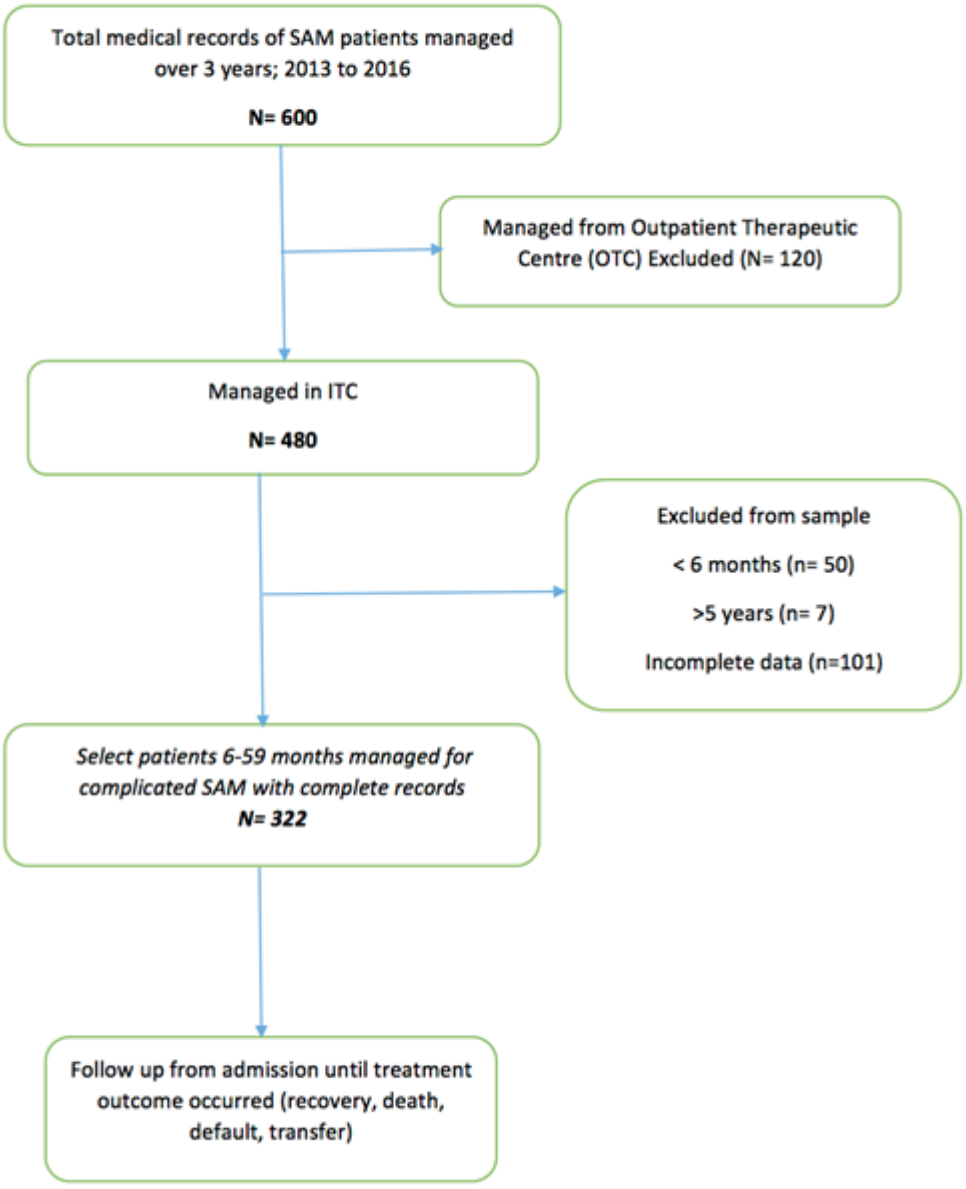

Figure 1: Flow chart showing sampling procedures for predictors of time to recovery from SAM among Children 6- 59 months managed for SAM in MRRH, Uganda from January 2013 to December 2016

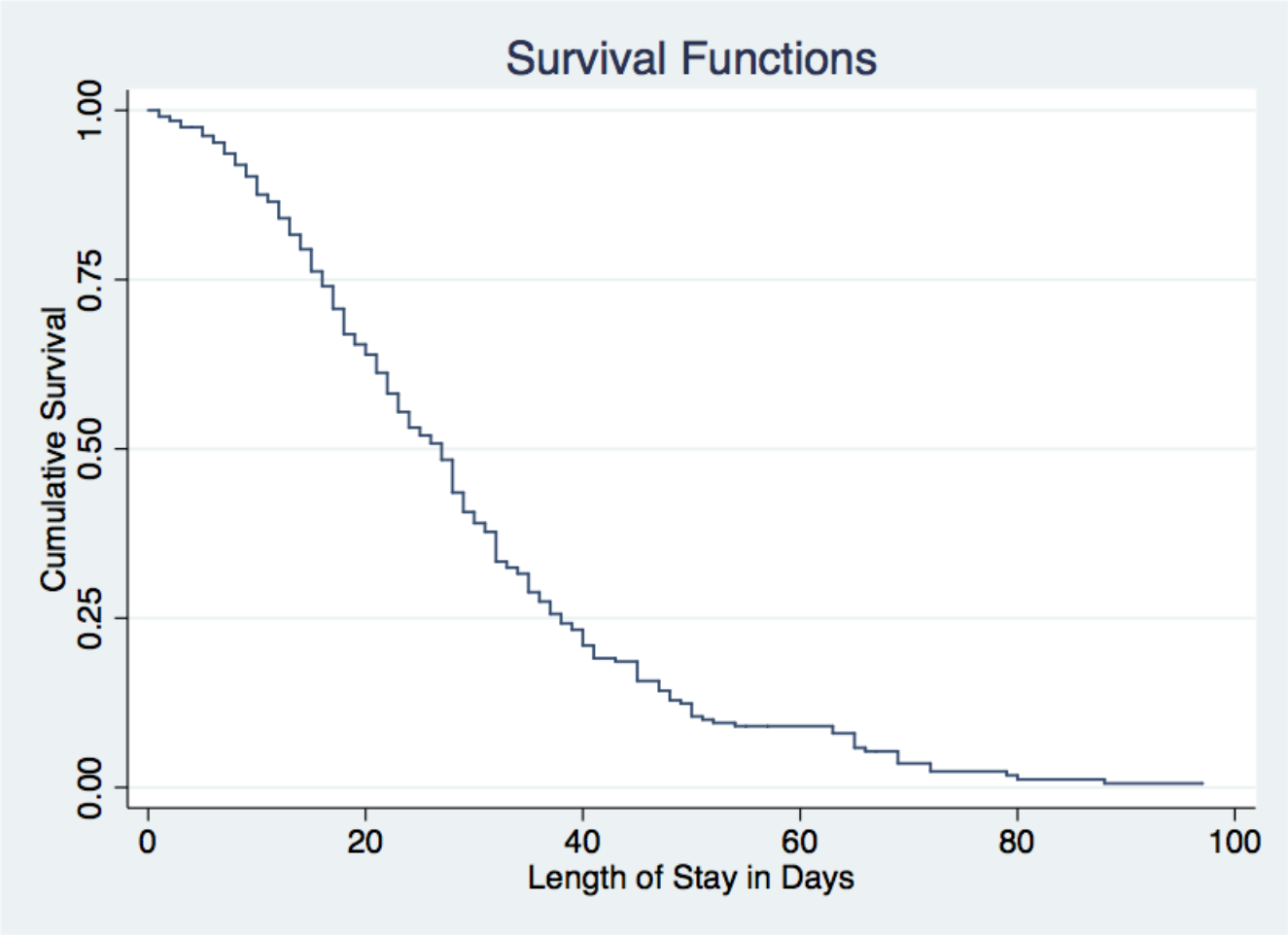

Figure 2: Overall Kaplan Meier recovery estimate depicting time to recovery from SAM among Children managed in ITC of Mbale Regional Referral Hospital, January 2013 to December 2016