AUDIT OF CARE FOR CHILDREN AGED 6 TO 59 MONTHS ADMITTED WITH SEVERE MALNUTRITION AT KENYATTA NATIONAL HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN PAEDIATRICS AND CHILD HEALTH, UNIVERSITY OF NAIROBI

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DECLARATION

I declare that this dissertation in part fulfilment of the requirements for M.Med, Paediatrics and Child Health is my original work and has not been presented at any University or forum.

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DEDICATION

I dedicate this work to my lovely wife Lois and our three lovely children Mbindyo, Muuo and Mukii.

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ABBREVIATIONS

ANOVA	Analysis of Variance
ETAT	Emergency triage assessment and treatment
ELISA	Enzyme Linked Immunosorbent Assay
HIV	Human Immunodeficiency Virus
HSD	Half Strength Darrow's
IV	Intravenous
IVF	Intravenous fluids
KDHS	Kenya Demographic and Health Survey
KNH	Kenyatta National Hospital
RTUF	Ready to use Formula
NCHS	National Centre for Health Statistics
NGT	Nasogastric Tube
ORS	Oral Rehydration Solution
PCR	Polymerase Chain Reaction
PFC	Paediatric Filter Clinic
PI	Principal Investigator
PO	Per Oral
RBS	Random Blood Sugar
ReSoMal	Rehydration Solution for Malnutrition
UNICEF	United Nations Children Fund
UoN	University of Nairobi
WHO	World Health Organization

ABSTRACT

Background: World Health Organization treatment guidelines for severe malnutrition aim to improve the quality of inpatient care and reduce mortality. This study audited quality of care for severely malnourished children admitted at Kenyatta National Hospital, a large tertiary level health facility.

Patients and methods: This was a prospective study of 101 children, aged 6 to 59 months with severe malnutrition admitted between 1st February and 28th April 2008. A data pro-forma sheet was prepared according to steps in the WHO guidelines and applied to each patient thus assessing care provided during hospitalization. The care of the children was provided by clinicians, nurses and nutritionists.

Results: Overall, 58.5% of children had marasmus and 47.5% of children were younger than one year old. Common co-morbidities at admission were diarrhoea (70.3%) and pneumonia (51.4%). Of the eight steps of care evaluated, five steps were followed correctly in less than 55% of cases. The proportion of children appropriately managed was 7.9 % (95% CI 2.6-13.2) in step 1, 46.5% (95% CI 36.8-56.2) in step 2, 54.9 %(95% CI 43.3-66.5) in step 3, 55.4% (95% CI 45.7-65.1) in steps 4 and 6. 90% (95% CI 85.1-96.9) in step 5, 16.8% (95% CI 9.5-24.1) in step 7 and 23.8% (95% CI 13.6-34.0) in step 8.

Conclusion: Quality of care for children admitted with severe malnutrition at KNH is inadequate and often does not follow the evidence based WHO guidelines.

1.0 INTRODUCTION AND LITERATURE REVIEW

Severe malnutrition is a common cause of preventable morbidity and mortality among children aged below 5 years in developing countries [1]. Globally levels of malnutrition have not declined since 1980 and sub Saharan Africa shoulders the highest burden of childhood malnutrition [2, 3]. In the year 2004, prevalence of malnutrition in children aged below 5 years worldwide was estimated at 29%, with levels in the African continent estimated at 33.8% [2]. According to the Kenya Demographic and Health Survey (KDHS) of the year 2003, the prevalence of stunting, underweight and wasting among children aged below 5 years were 31%, 20% and 6%, respectively [4]. The trends in nutritional indicators as measured in the 1993, 1998, 2003 KDHSs, document no significant change in prevalence of malnutrition in Kenya over the last 10 years [4, 5].

Malnutrition forms an important risk factor for illness and death among young children and is an underlying cause of 60% of the 12 million deaths from preventable causes among children aged below five years [6-8]. World Heath Organizations estimates that worldwide, 9 % of children below five years suffer from wasting and are at increased risk of death or severe impairment of growth and psychological and cognitive development. Severe malnutrition is estimated to be a direct cause of 300,000 deaths annually mainly in sub-Saharan Africa [6].

The World Health Organization (WHO) defines severe malnutrition requiring hospital admission as weight for height measurement of less than 70% of the median or three standard deviations or more below the mean NCHS/WHO reference values (severe wasting), the presence of symmetrical bipedal pitting edema of nutritional origin (edematous malnutrition) or visible signs of severe malnutrition in children aged less than five years [1].Severe malnutrition is a common problem in hospitals in economically poor countries and is associated with poor outcome [9, 10]. Over the last five decades, hospital mortality rates of severe malnutrition have remained high with an average case fatality rate of 20% to 30% and rates of up to 50% being found in many hospitals in developing countries, particularly in Africa [7, 11-13]. Therefore improving clinical management and appropriate care of severe malnutrition forms an important part of

fulfilling the fourth United Nations Millennium Development Goal that aims at reducing by two thirds the mortality rate among children aged below five years by the year 2015 from the baseline of year 1990 [14]. The high inpatient death of severe malnutrition in the developing world has been attributed to an outdated and inappropriate clinical care and that mortality is preventable with correct management [1, 7, 15-17].

In severe malnutrition physiological adaptations to low food intake results in reductive adaptation of all body systems and this limits the ability of the body to respond to infections and other stressors. Marasmus results from loss of subcutaneous fat and muscles because of endogenous mobilization of all available energy and nutrients. Kwashiorkor manifests with edema, changes to hair and skin color, anaemia, hepatomegally, lethargy and severe immunodeficiency. One essential effect of severe malnutrition is the fatty degeneration of the heart which causes subclinical or overt cardiac insufficiency and increases the risk of cardiac failure with iatrogenic fluid or sodium load. Loss of subcutaneous fat markedly reduces the body's capacity for temperature regulation and water storage.

As a consequence malnourished children become dehydrated, hypothermic and hypoglycemic more quickly and severely than normal children. Associated atrophy of the mucosa of the small bowel leads to loss of absorptive as well as loss of digestive capacity. Severe malnutrition is associated with chronic hypovolemia leading to secondary hyperaldosteronism. This causes sodium retention and loss of potassium through urine excretion hence severely malnourished have low total body potassium. Severely malnourished children have immunodeficiency in the humoral and cellular subsystem from protein deficiency and also lack immune mediators like tumor necrosis factor. Most children with severe malnutrition have asymptomatic infections because their immune system fails to respond with chemotaxis, opsonization, and phagocytosis of bacteria, fungi or viruses. Hence severely malnourished children are at risk of several life threatening problems mainly hypoglycemia, hypothermia, serious infection, and severe electrolyte disturbances mainly low body potassium levels.

The management of children with severe malnutrition emphasizes systematic approach to care mainly careful assessment, special treatment and management with regular feeding of small quantities of appropriate feeds, slow rehydration using low sodium fluids and monitoring due to the increased vulnerability. In an effort to improve the quality of hospital care for severely malnourished children and reduce case fatality rates, the World Health Organization developed evidence based clinical guidelines on the treatment and management of severe malnutrition in developing countries that emphasizes adequate and prompt triage, assessment and treatment [1, 18- 21]. The WHO protocol gives 10 steps that need to be followed in the hospital care of severe malnutrition divided into stabilization and rehabilitation phases. For successful treatment of severe malnutrition, the guidelines emphasizes effective and prompt handling of complications and co-morbidities, mainly treatment and prevention of hypoglycemia, hypothermia, dehydration, electrolyte imbalance, infection, micronutrient deficiencies, use of appropriate starter and rehabilitation feeds, sensory and emotional support and preparation for future follow up. The guidelines have since then been adopted by the Ministry of Health, Kenya and incorporated into the Basic Pediatric Protocol [22]. Sufficient evidence exists to show that use of appropriate oral rehydration solution, antibiotics, and micro nutritional and electrolyte supplements, mainly zinc, vitamin A, potassium, feeding regimens results in reduction of child mortality from severe malnutrition [23, 24]. In addition to nutritional and medical treatment, love and care, a stimulating environment, structured play therapy, and mothers involvement in the care of the child are important components of successful therapy of the severely malnourished child [25].

Studies have provided evidence that use of the standardized WHO protocol results in improvement of care and subsequently a decline in case fatality associated with severe malnutrition. In a review of 140 studies on management of severe malnutrition in developing countries, Bhan et al, found evidence that careful assessment and appropriate treatment using WHO standardized protocol reduces morbidity and mortality [16]. Though case fatality rate of severe malnutrition remained high in many hospitals in developing countries averaging 40% to 50%, hospitals that had adopted the standardized

treatment protocol reduced case fatality to as low as 6% . It was observed that severely malnourished children managed using standardized treatment protocol had less risk of hypoglycemia, were more successfully rehydrated orally, had less risk for severe complications, had uneventful discharge and had a greater weight gain than those managed on non protocol treatment [24].

In a pre and post intervention study, Ashworth et al, observed that case fatality rates from severe malnutrition markedly fell in two hospitals in South Africa after implementation of WHO treatment protocol despite inadequate resources and incomplete implementation of guidelines [17]. Case fatality rates fell from 46% to 21% and 25% to 18% respectively at both Mary Theresa and Sipetu hospitals. Practices those were associated with a decline in case fatality in the post intervention period included 3 hourly feeds day and night, keeping children warm, giving oral instead of intravenous fluids except in shock, routine administration of antibiotics and micronutrients and elimination of diuretics for kwashiorkor. However mortality rates remained higher than the target rate of 5% in the WHO protocol. It was observed that most deaths that occurred were preventable and case fatality rates of 5% were possible in both hospitals if all avoidable causes of death could be eliminated. Poor case management resulting from errors by doctors and nurses was the main determinant of death. Deaths were attributed to inadequate feeding, poor management of dehydration and infection, inadequate resources, weak health systems and inadequate knowledge and skills of hospital staff. Implementation of the WHO protocol was shown to be feasible and that generally it resulted in improvement of quality of care.

Similarly in Malawi where full compliance with protocol was not achieved, Morris et al. observed that mortality rates fell from 55% to 15.7% before and after implementation of WHO standardized protocol [26]. However faulty management of dehydration, hypoglycemia and hypothermia continued to impact negatively on outcome and only 39% of children attained target of 100% weight for height.

Other studies done in Brazil, Colombia and South Africa have provided strong evidence that use of WHO standardized treatment protocol improves outcome and reduces case

fatality of severe malnutrition [27-29]. Benefits were observed despite inadequate implementation of protocol. Fifty per cent of deaths in children with severe malnutrition managed with non-protocol treatment occurred in the first 48 hours .Severe dehydration at admission, inadequate management and treatment of sepsis, hypoglycemia, hypothermia, and poor feeding and rehydration practices were the main risk factors for death. Gerardo et al observed that the quality of care was generally poor where WHO standardized protocols was not used and this lead to unnecessary deaths and morbidity [30].

2.0 JUSTIFICATION AND UTILITY OF STUDY

Severe malnutrition is an important cause of childhood morbidity and mortality at Kenyatta National Hospital, contributing about 5% of all admissions and 10% of all paediatric deaths [31]. Hospital statistics for the period 1999 to 2005 reveals that 21.7 to 28.8% of children admitted with severe malnutrition died. Comparison with Previous studies done at KNH among children admitted with severe malnutrition show no decline in case fatality rates over the last 30 years [32, 33]. Adoption and use of standardized WHO treatment protocol in hospitals worldwide has been shown to result in a decline in hospital case fatality rate for severe malnutrition.

At Kenyatta National Hospital there is no official hospital protocol for the management of severe malnutrition but components of the WHO guidelines have been incorporated in the Hospital Standard Operating Procedures (SOPs) of the year 2006. Although the WHO guideline on management of severe malnutrition has not been formally introduced at KNH, some members of staff have undergone training on Emergency Triage Assessment and treatment plus admission (ETAT+) in which care for children with severe malnutrition forms a critical component of the training. Moreover, it is reasonable to expect clinicians at KNH to follow WHO evidence based treatment protocol since KNH is a teaching hospital. The extent to which care based on WHO guidelines was practiced in this hospital was unknown.

No study had been carried out to assess the care given to children with severe malnutrition at Kenyatta National Hospital and how it compares to WHO guidelines. Hence, it was important to systematically evaluate the care given to severely malnourished children and determine areas, which require improvement.

This study documented the care for severe malnutrition at Kenyatta National Hospital and how the current practices compared to World Health Organization guidelines. The study focused on the first 8 steps of care due to their impact on mortality.

The results obtained would be expected to provide a basis on how to improve care, and guide future policy formulation with regards to management of severe malnutrition at KNH.

3.0 STUDY QUESTION

To what extent does inpatient care for children with severe malnutrition at Kenyatta National Hospital follow World Health Organization guidelines?

4.0 OBJECTIVES OF THE STUDY

4.1 Broad objective

To audit care of severely malnourished children aged between 6 and 59 months at Kenyatta National Hospital

4.1.1 Specific objectives

1. To describe the current practices in inpatient care of severely malnourished children at KNH
2. To determine the proportion of children appropriately managed according to the first eight steps of care

5.0 METHODS

5.1 Study design

Prospective audit of care for patients admitted with severe malnutrition at KNH.

5.1.1 Study area

This study was carried out in the general paediatric wards of Kenyatta National Hospital. Kenyatta National Hospital is a 2000 bed hospital that serves both as a teaching hospital and a national tertiary referral health facility. It is also the primary referral facility for Nairobi Province and surrounding districts. The hospital has four general paediatric wards each with a section reserved for the admission of severe malnutrition. Patients are admitted to the wards from the Paediatric Filter Clinic (PFC). Clinical care in PFC is given by a Consultant Paediatrician, Resident-Paediatrician, Paediatric Clinical Officers and Nurses. Consultant Paediatricians, Resident Paediatricians, Medical Officer Interns, nurses, nutritionists and other essential paramedics cover the wards. The resident Paediatricians together with the Medical Officer Interns are responsible for the initial evaluation and management of patients admitted to the wards with the ward consultants doing further re-evaluation and management of patients during routine ward rounds. Administration of drugs, fluids, feeds and monitoring of patients is done by the nurses. The nutritionists are responsible for the preparation and provision of appropriate feed, weight monitoring, nutritional counselling and nutritional follow up once patients are discharged.

5.1.2 Study population

Children aged 6 to 59 months admitted with a diagnosis of severe malnutrition.

5.1.3 Sample size calculation

The sample size was calculated according to WHO formula for calculating one sample size using precision around a proportion [34].

The following formula was used:

$$N = \frac{z^2 p (1-p)}{d^2}$$

N = minimum sample size required for the study

z = 1.96 (normal deviate corresponding to 95 % confidence interval)

d = 0.1 (Accepted degree of precision around mean. This precision would give a small sample size and results obtained would have a confidence interval of ±10% around estimates of the proportion of children receiving appropriate care)

p = 50 %(the proportion of children with severe malnutrition receiving appropriate care. This value is unknown but is assumed to be 50%)

Thus

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.1^2}$$

$$= 96$$

The minimum number of subjects was 96.

5.2 Inclusion criteria

- Children aged 6 to 59 months with severe malnutrition (defined as WHZ< -3SD or edema of both feet)
- Informed consent obtained from parent / guardian.

5.2.1 Exclusion criteria

- Children with severe malnutrition secondary to known chronic illnesses – cancer, cardiac disease, renal disease.

5.2.2 Sampling criteria

Consecutive enrolment of patients who satisfied the study criteria and for whom consent was given was done until the desired sample size was achieved.

5.3 Study procedures

The Principal Investigator (PI) visited the general paediatric wards daily between 8 am and 9 pm and recruited eligible patients. Informed consent was obtained from the parent / guardian before a patient was recruited into the study (Appendix 1). All patients enrolled in the study had weight and length/height measured and Z scores calculated as per NCHS/WHO reference values and documented. Weight was measured to the nearest 100 gm using Soehnle electronic scale and height/length to the nearest centimeter using a modified stadiometer obtained from United Nations Children's Fund (UNICEF) .To ensure uniformity in measurement and reduce the margin of error; all measurements were done by the principal investigator. The PI reassessed the nutritional status of patients admitted to the ward with a diagnosis of severe malnutrition on day 1 of admission and relevant clinical findings were documented in a pro-forma sheet (appendix 2). Children who did not satisfy the eligibility criteria were not enrolled in the study. Review of case records was done on day 7 and on death or discharge. Relevant information was abstracted and entered in a pro- forma sheet. Information collected was supplemented with information obtained through a structured interview with care givers and also direct observations done in the ward during recruitment and daily visits (Appendix 5). .

Care givers were interviewed at the end of first week using an open ended questionnaire on the care given to the child in the initial phase of treatment for those children who were alive by end of the first week

An inventory of commodities necessary in the management of severe malnutrition, availability and reliability of supplies was done using a self administered questionnaire with nurses and nutritionists (appendixes 3 and 4).

6.0 DATA MANAGEMENT

The principal investigator was responsible for collection, computer entry, and safety of data. All data were handled in strict confidence. Data were checked for completeness, accuracy, and consistency and entered into computer. Data were analyzed using SPPS version 14 software. Weight for height Z scores were calculated using EPINUT. Descriptive data are presented as frequency tables, bar graphs, pie charts and cross tabulation. Categorical data were compared using chi square, while student's t test and analysis of variance (ANOVA) were used for comparison of continuous data. An outcome was considered significant if p value was equal or less than 0.05. Summary of inventories, regularity of supplies, staff and care giver perceptions were made.

7.0 ETHICAL CONSIDERATIONS

Approval to carry out the study was given by KNH Ethics Review and Research committee. Data were secured to ensure confidentiality. A written consent was obtained from parent/ guardian for any child to be enrolled into the study. Any life threatening condition identified was communicated to the ward clinician and resuscitation and emergency care was done if indicated. For the health workers, informed consent was obtained before participation in the study.

8.0 RESULTS

This study was conducted in the general paediatric wards of KNH from 1st February to 28th April 2008. A total of 101 children admitted with severe malnutrition were recruited in the study. Out of these, 58 (57%) were boys and 43 (43 %) were girls giving a male: female ratio 1.4:1.

The most frequent type of severe malnutrition was marasmus (58%), followed by marasmic–kwashiorkor (27%) and kwashiorkor (15%) as shown in table 1 below.

TABLE 1: Sex distribution according to type of malnutrition N=101

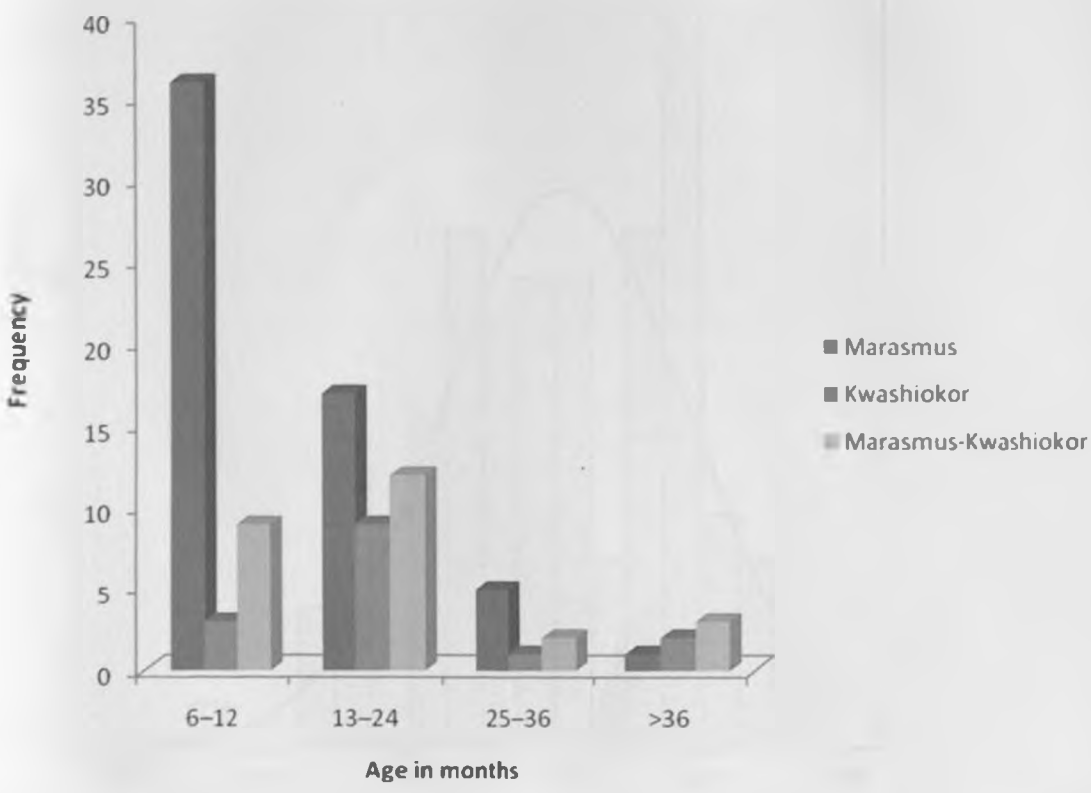
	Marasmus	Kwashiorkor	Marasmic-Kwashiorkor	**Total**
Male (%)	36(62.1%)	11(19%)	11(19%)	**58(57%)**
Female (%)	23(53.5%)	4(9.3%)	17(37.2%)	**43(43%)**
Total (%)	**59(58.4%)**	**15(14.9%)**	**27(26.7%)**	**101(100%)**

On further analysis, there was no sex based differences in frequency between kwashiorkor and marasmus (OR 1.76, 95% CI 0.44-7.51, p value=0.38) and between marasmic-kwashiorkor and marasmus (OR 0.41, 95% CI 0.15-1.14, p value=0.058).

The median age was 13.0 months with a range of 6 to 59 months. Overall 85.1% of the children were aged below 24 months.

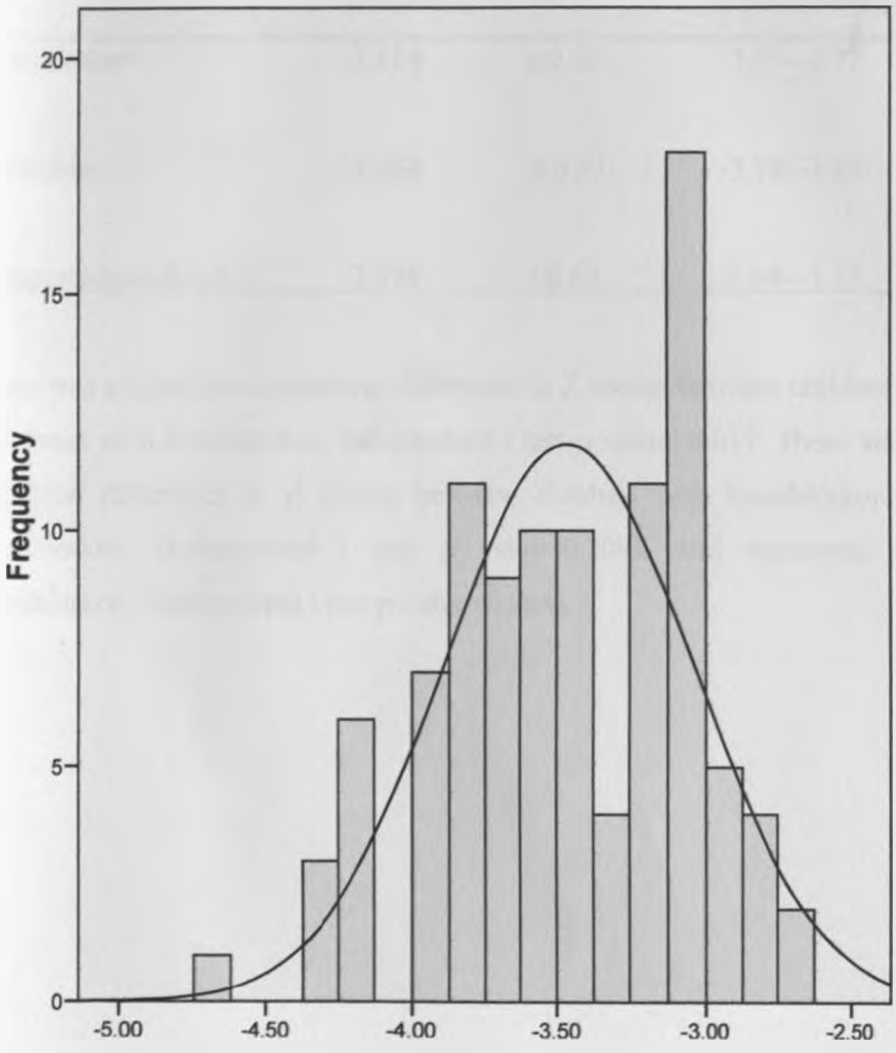
As illustrated in figure 1 below children with marasmus were significantly younger than those with kwashiorkor and marasmic- kwashiorkor. The mean age for children with marasmus was 14.4 months (SD±8.5), kwashiorkor 21.9 months (SD±13.8) and marasmic- kwashiorkor18.7 months (SD±10.6) and this was statistically significant ANOVA p value=0.019.

Fig 1: Age distribution by type of malnutrition N=101



Weight for height Z scores were approximately normally distributed with a mean of -3.5 (SD±0.6) and a median of - 3.5 Z scores as shown in Fig.2 below.

FIGURE 2: Distribution of WHZ



The mean Z score for kwashiorkor was -3.15, marasmus -3.56 and marasmic-kwashiorkor -3.39 as illustrated in table 2 below.

TABLE 2: Z scores weight/ height according to type of malnutrition

	MeanWHZ	SD	95% confidence interval
Kwashiorkor	-3.154	±0.69	-3.54—2.77
Marasmus	-3.563	± 0.53	-3.70—3.43
Marasmic-kwashiorkor	-3.391	±0.62	-3.64—3.15

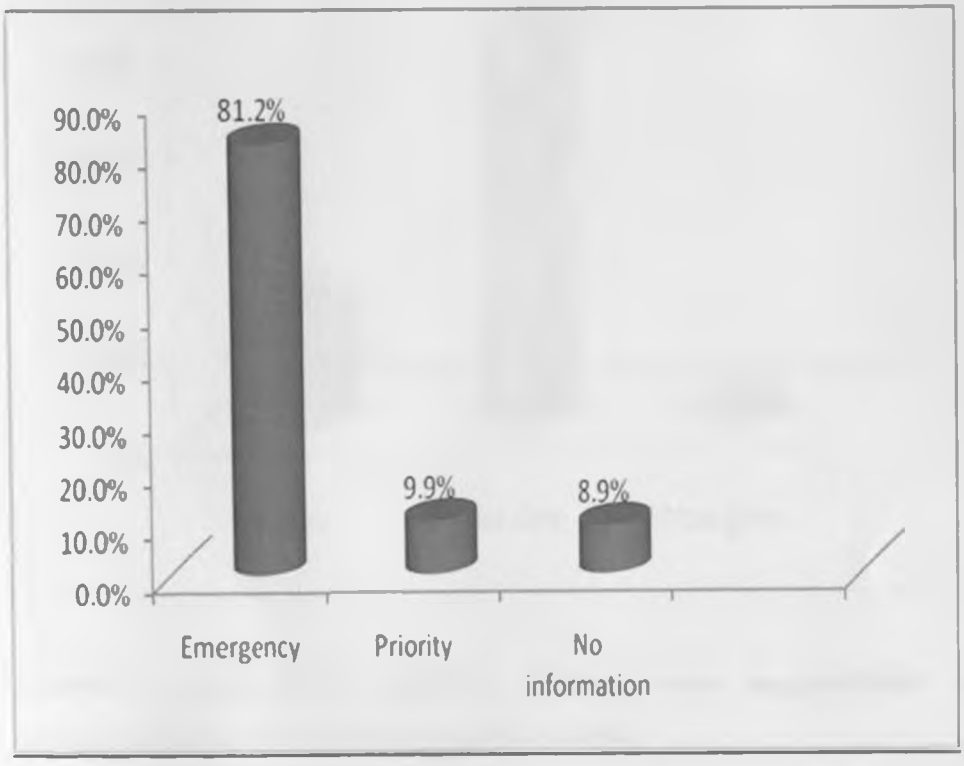
There was a significant statistical difference in Z scores between children with marasmus and those with kwashiorkor, independent t test p value=0.017. There was no significant statistical difference in Z scores between children with kwashiorkor and marasmic-kwashiorkor, (independent t test p value=0.209), and marasmus and marasmic-kwashiorkor, (independent t test p value=0.204).

8.1 Emergency management at Paediatric Filter Clinic

8.1.1 TRIAGE

Appropriate triage is crucial in reducing time spent at the outpatient department before accessing care for the severely ill child. At PFC 81.2% of children were triaged as emergency cases and 9.9% as priority cases as shown in fig.3 below.

Figure 3: Triage at PFC

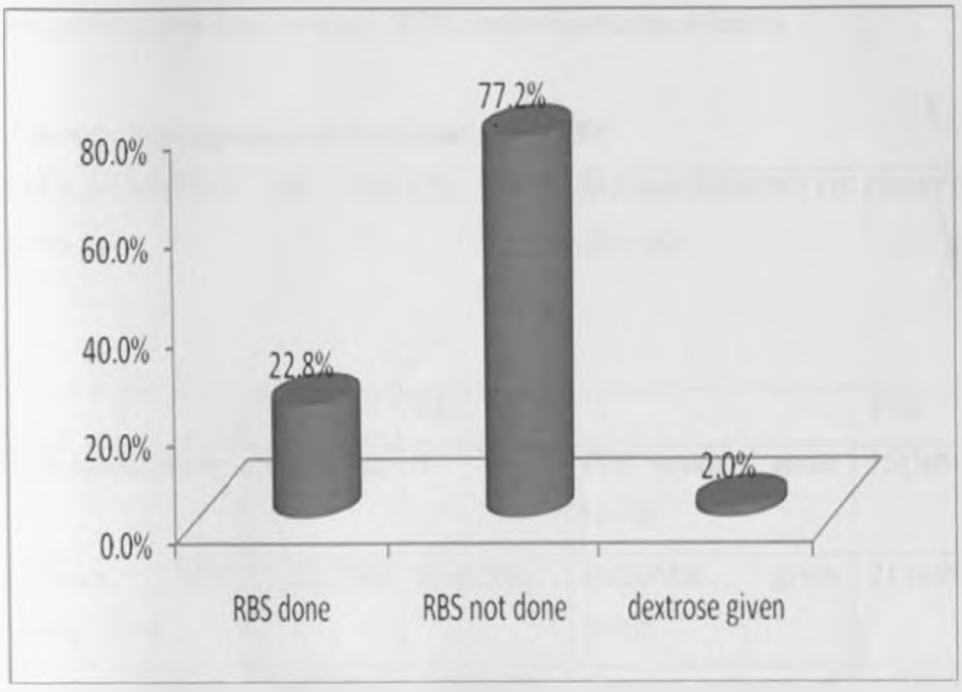


Overall 91.1% (95% CI 85.6% -96.6%) of children were appropriately triaged.

8.1.2 STEP 1: TREAT / PREVENT HYPOGLYCEMIA AT PFC N=101

As illustrated in figure 4 below, out of the 101 children, 23 (22.8 %) had a random blood sugar done at pediatric emergency clinic. Two children had a random blood sugar (RBS) less than 3 mmol/l and this was corrected with right volume of 10% dextrose bolus. No feeding or presumptive treatment for hypoglycemia was documented at PFC.

Figure 4: Diagnosis and Treatment of hypoglycemia at PFC



Overall a total of 23 (22.8%) children were appropriately managed for hypoglycemia at PFC (95% CI 14.6%–31.0%).

8.1.3 STEP 3: TREAT / PREVENT DEHYDRATION AT PFC N=101 (Table 3 below)

A total of 64 (63.4%) children were documented to have diarrhoea at PFC. 14 (21.9%) were in hypovolemic shock and 50(78.1%) were documented as having dehydration. Out of the 14 children in hypovolemic shock, nine children were inappropriately treated with normal saline and 15 children not in shock were wrongly put on IV fluids. A total of 21 children not in shock were appropriately rehydrated with ReSoMal. The rest were rehydrated with conventional WHO oral rehydration solution.

Table 3: Management of dehydration at PFC

MANAGEMENT OF SHOCK PFC (N=14)			MANAGEMENT OF DEHYDRATION N = 50		
	YES	NO		YES	NO
IVF given N=14	14(100%)	0	IVF wrongly given N=50	15(30%)	35(70%)
Correct IVF given N=14	5 (35.7%)	9(64.3%)	ReSoMal given N=35	21 (60%)	14(40%)
Correct volume of fluid given 1ST hour N=5	2 (40.0%)	3 (60.0%)	Correct volume of ReSoMal given N=21	13(61.9%)	8(38.1%)
Number correctly managed for shock	**2(14.3%)**	**12(85.7%)**	**Number correctly managed for dehydration**	**13 (26%)**	**37(74%)**

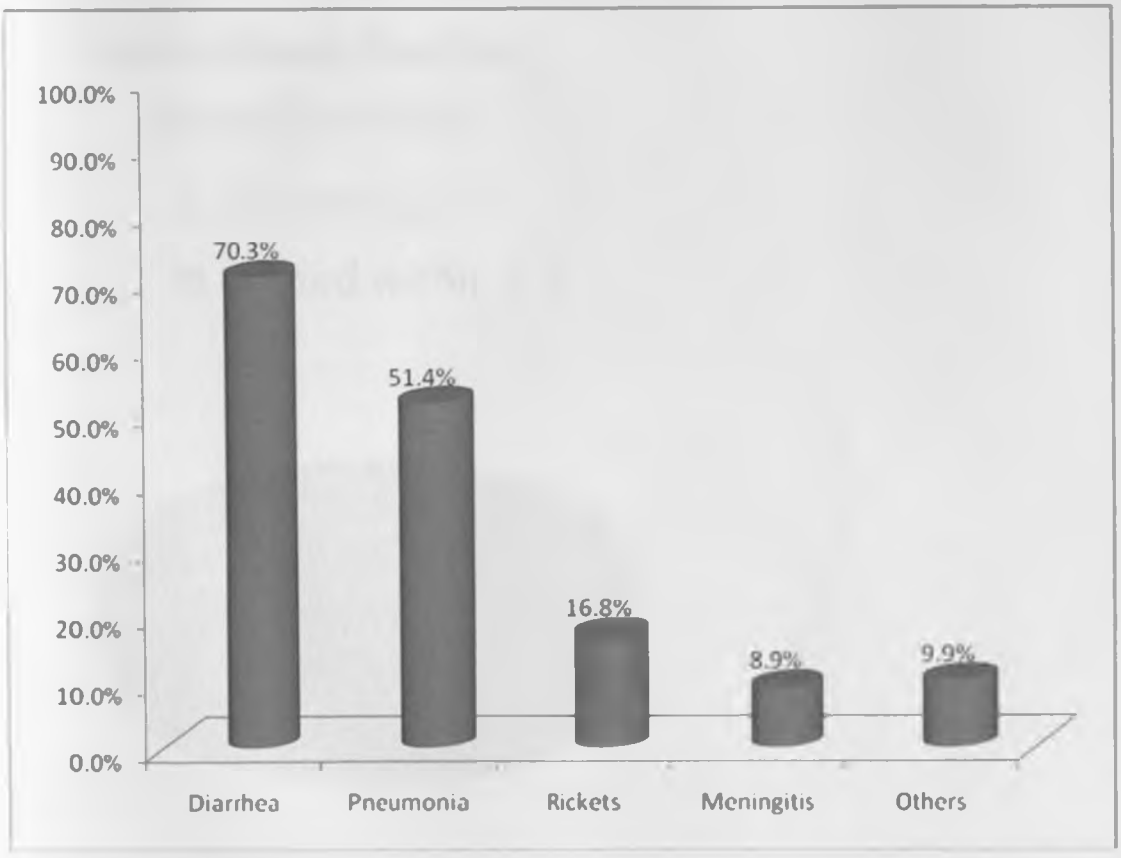
Overall 24.6% of children with diarrhea were appropriately managed as per WHO guidelines step 3 at PFC (95% CI 14.8% – 35.5%).

8.2 WARD MANAGEMENT

8.2.1 CO-MORBID CONDITIONS N=101

The most common co-morbid clinical conditions documented at admission were diarrhoea and pneumonia (Fig.5). Many children had more than one co-morbid condition at presentation.

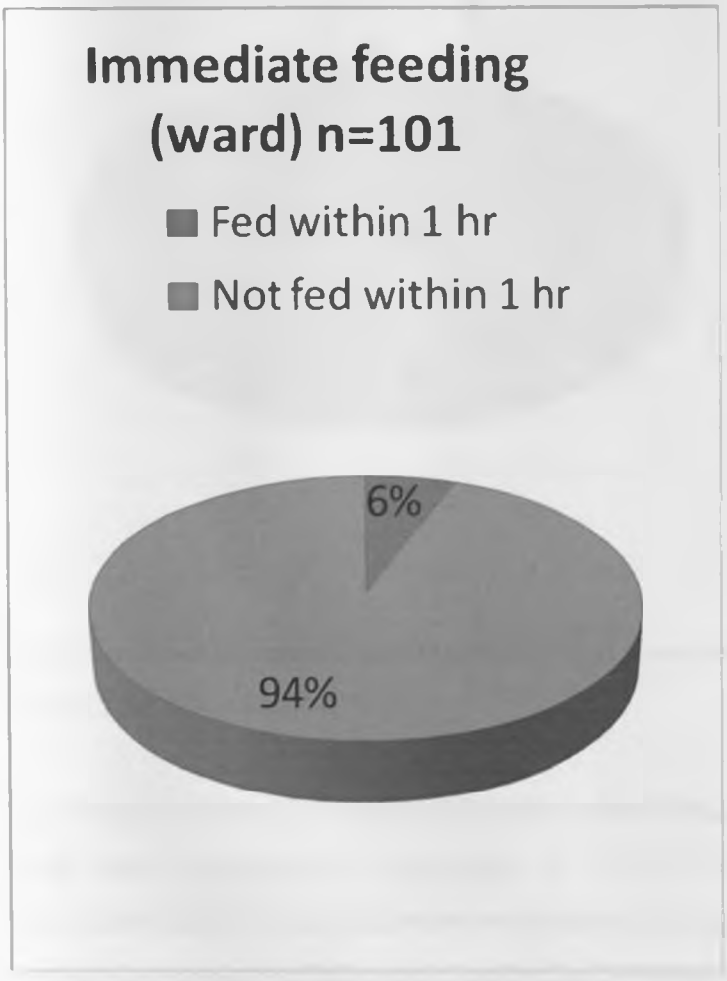
Figure 5: Co-morbid conditions at admission



8.2.2 STEP 1: TREAT AND PREVENT HYPOGLYCEMIA

In the wards, seven children of the 78 whom random blood sugar was not done at PFC had a random blood sugar test done. None of the seven children had a random blood sugar less than 3 mmol/l and none had intravenous or oral dextrose given. Presumptive treatment of hypoglycemia with oral 10% dextrose or sugar water for children who did not have RBS done was not documented. Immediate feeding was not routinely done with 6 children fed within the first hour of arrival in ward (Fig.**6**).

Figure 6: Immediate feeding in ward

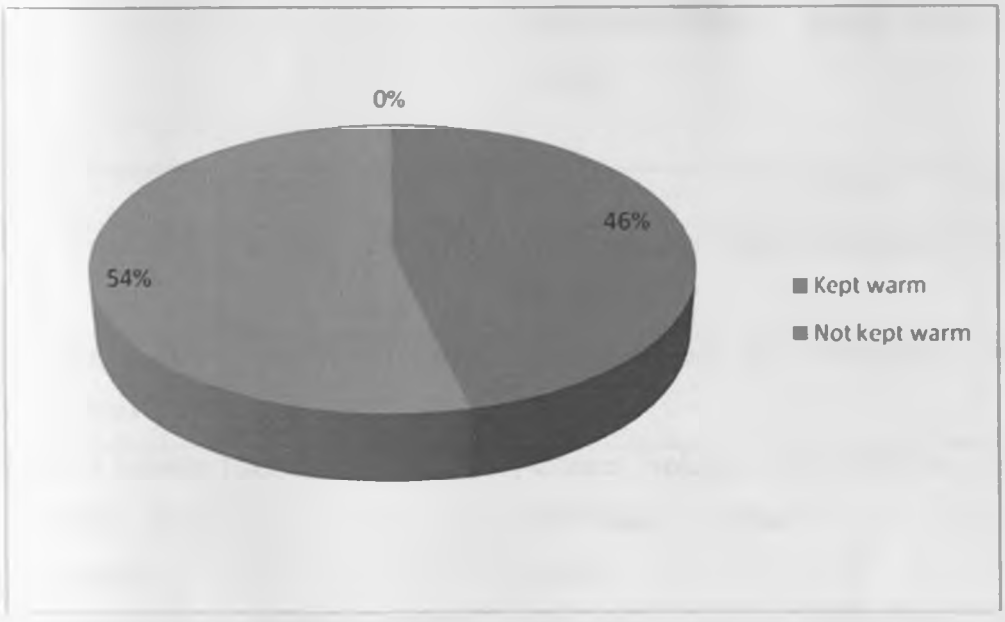


In the ward, 7.9%(95% CI 2.6 -13.2) of children were appropriately managed for step 1 according to WHO guidelines

8.2.3 STEP 2: TREAT /PREVENT HYPOTHERMIA

A total of 54 (53.5%) children were not kept in warm. Out of 92 mothers with children alive on day two of admission, 14 (13.9%) of mothers had been given instructions on how to keep their children warm through proper clothing and minimal washing and exposure of children. All of the mothers instructed on how to keep a child warm were in the malnutrition rooms that also had a functional heater (Fig.7).

Figure 7: Prevent / treat hypothermia N= 101



The proportion of patients appropriately kept warm were 47 (46.5%) (95% CI 36.8% – 56.2%)

8.2.4 STEP 3: TREAT / PREVENT DEHYDRATION.

In the wards, diarrhoea was documented in 71(70.3 %) children, seven more than was documented in PFC. Four children were admitted in shock, 21 children were classified as severely dehydrated with the rest classified as having dehydration (Figure 7). Out of the four children documented to have shock, three had been diagnosed with shock at PFC. Overall two children with hypovolemic shock were appropriately managed as per WHO guidelines. Inappropriate use of intravenous fluids for children not in hypovolemic shock was documented, with 19 children being put on IV fluids. A total of 40 children were

rehydrated with ReSoMal, out of whom 37(92.5%) of them got the correct volume of oral fluid (Table 4). Concurrent administration of F75 in children rehydrated with ReSoMal was done in only twelve children. Monitoring of changes in pulse and respiratory rate as signs of over hydration was not adequately done with documentation done for only four children.

Table 4: Management of dehydration in ward

MANAGEMENT OF SHOCK N=4			MANAGEMENT OF SEVERE DEHYDRATION/ SOME DEHYDRATION N = 67		
	YES	NO		YES	NO
IVF given N=4	3(75%)	1(25%)	IVF wrongly given N=67	19(28.4%)	48(71.6%)
Correct IVF given N=3	2(66.7%)	1(33.3%)	ReSoMal given =48	40(83.3%)	8(16.7%)
Correct volume of fluid given 1ST hour N=2	2(100%)	0	Correct volume of ReSoMal given N=40	37(92.5%)	3(7.5 %)
Number correctly managed for shock	**2(50%)**	**2(50%)**	**Number correctly managed for dehydration**	**37(55.2%)**	**30(44.8%)**

Overall 54.9% of children with diarrhoea were appropriately managed in step 3 (95% CI 43.3% – 66.6%).

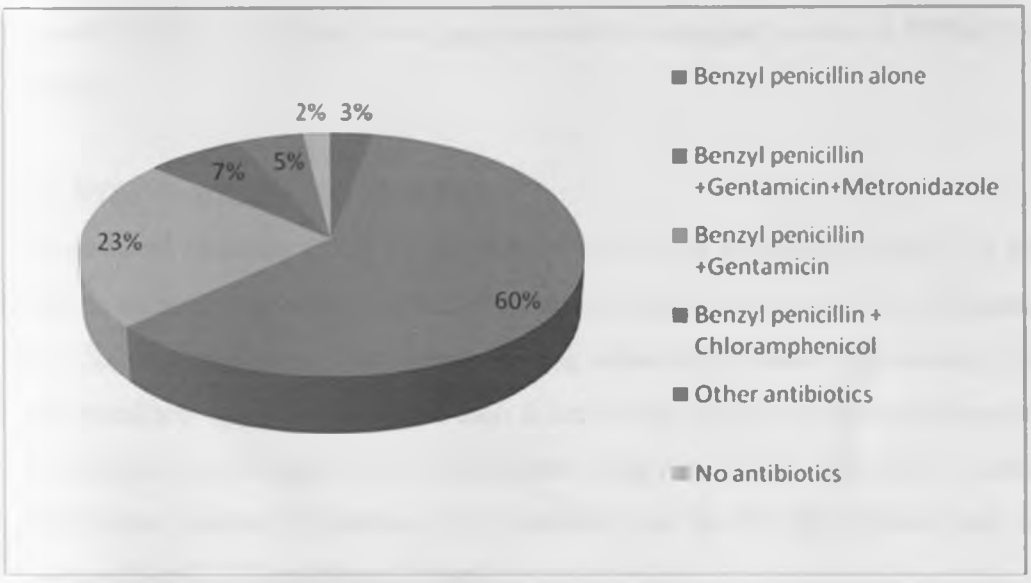
8.2.5 STEP 4: CORRECT ELECTROLYTE IMBALANCE

A total of 56(55.4%) children were fed on ready to use formula F75 that contains extra potassium and magnesium. Four children with edematous malnutrition were wrongly given furosemide for their edema. **Thus in step 4, percentage of children appropriately managed was 55.4% (95% CI 45.7% – 65.1%).**

8.2.6 STEP 5: TREAT INFECTIONS ROUTINELY

Ninety one children were appropriately managed with broad spectrum antibiotics and correct dosages as per WHO guidelines (Fig 8).

Figure 8: Antibiotics given



In step 5, 90% of children were appropriately managed (95% CI 85.1% – 96.9%).

8.2.7 STEP 6: CORRECT MICRONUTRIENT DEFFICIENCES

Out of the 101 children 62 (61.4 %) received high dose vitamin A on day one in ward. 55.4% of children received F75 that contains adequate zinc and other essential micronutrients. Overall 56(55.4%) children received 4 micronutrients, 29(28.7%) received 3 micronutrients, 12 (11.9%) received one micronutrient and 4 ((4%) received

none (Table 5). Iron was appropriately not prescribed in the acute phase except for 3 children. However it was also not prescribed in the rehabilitation phase.

Table 5: Administration of micronutrients

Micronutrient	Yes %	No %
Vitamin A given(N=101)	62 (61.4%)	39 (38.6%)
Correct dose of Vitamin A (N= 62)	49 (79.0%)	13 (21%)
Multivitamins given (N= 101)	90 (89.1%)	11 (10.9%)
Folic acid given(N=101)	72 (71.3%)	29 (28.7%)
Zinc given (N=101)	56(55.4%)	45 (44.6%)

Overall 55.4% of children were appropriately managed in step 6 (95% CI 45.7%–65.1%).

8.2.8 STEP 7: FEED CAUTIOUSLY

A total of 56 children (55.4 %) were fed with F75 in the initial phase. The rest of 45 children were fed on ward special milk, normal cow's milk and a few on routine ward diet. Children continued with breast feeding where applicable. The average volume of F75 prescribed was 125 ml/ kg per day. A total of 46(82.1%) children of those started on F75 received more than 80% of calculated amounts as per caretakers' interview and observations. Route of feeding was specified for 66.1% of children and feed was monitored for 32.1% children (Table 6).

Table 6: Starter formula F75 given N= 101

	YES	NO
	Number %	Number %
Fed with F75 (N= 101)	56 (55.4%)	45 (44.6%)
Correct feed volume in the initial phase (N = 56)	46 (82.1%)	10 (17.9%)
Fed in the first hour of arrival in ward (N=56)	6 (10.7%)	48 (89.3%)
Route of feeding specified (N= 56)	37 (66.1%)	19 (33.9%)
Feed intake monitored (N=56)	18 (32.1%)	38 (67.9%)

The median time from admission to first feed was 14 hours with only six children being fed within one hour. Majority of children (58.5%) had documented feed after 12 hours in the ward with 33.7% of children being fed after 19 hours of arrival in ward (Table 7).

Table 7: Time duration from arrival in ward to first feed.

Time to first feed(hours)	Frequency	Percent	Cumulative percent
1 – 6	26	25.7	25.7
7 – 12	12	11.9	37.6
13 – 18	25	24.8	62.4
> 19	34	33.7	96.1
No information	4	4	100
Total	101	100	100

Four children were in hypovolemic shock and not eligible for immediate feeding while seven children on ReSoMal were concurrently put on F75 by the fourth hour as per the WHO guidelines.

Overall in step 7, 16.8% of children were appropriately managed according to WHO protocol (95% CI 9.5% - 24.1%).

8.2.9 STEP 8: CATCH UP FEED N=56

The initial phase had a median duration of 6 days (range 2-12 days). A total of 67(63.3%) children were alive by day six and eligible for F100 of whom 64.2% were started on F100 (Table 8).

Table 8: Catch up feed given

	Number	%
Transition to F100 prescribed N=67	43	64.2
Correct feed volume during transition N= 43	27	62.7
Feed volume increased after transition N=43	16	37.2

In step 8, 23.8% of children were appropriately managed (95% CI 13.6% – 34.0%).

8.3 BLOOD TRANSFUSION PRACTICES

A total of 12 (11.9%) children were transfused blood but only one had correct volume of 10ml/kg prescribed. Four children had a hemoglobin level of less than 5gm/dl. Four children had no documented hemoglobin level and were transfused based on physicians' clinical judgment.

8.4 HIV STATUS

Out of the 92 children alive after 24 hours, 56 (60.9%) were tested for HIV using rapid ELISA test, out of whom 49(87.5%) children tested negative for HIV antibodies (Table **9** below). Out of the eight children with positive HIV antibodies, seven were below 18 months of age of whom one had confirmed HIV infection with PCR while infection was not confirmed in the other six.

Table 9: HIV test

HIV TEST N=92	Yes	
	Number	%
Number tested	56	60.9
HIV antibodies negative	49	87.5
HIV antibodies positive but infection not confirmed	6	10.7
Confirmed HIV infection by PCR / ELISA	2	2.2%

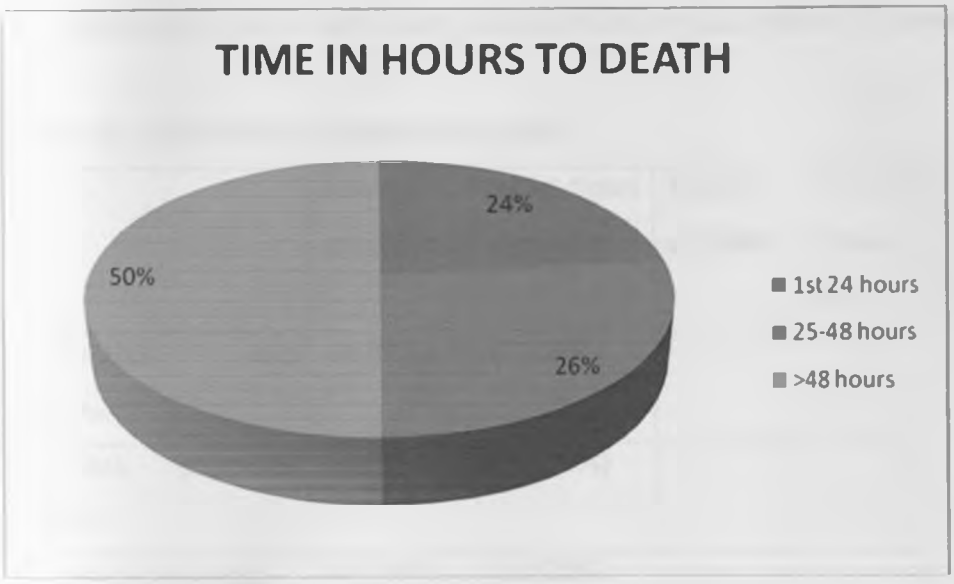
8.5 NURSING PROCEDURES N=101

Nursing care is central in the proper care of children with severe malnutrition since such children tend to deteriorate easily without warning. In this study 6.9% of children had six hourly pulse rate, temperature and respiratory rate monitored in the 1st two days. The rest were not monitored at all or erratic inadequate monitoring.

8.6 OUTCOME

From the study population of 101 patients, 38 patients died translating into case fatality rate of 38% **(95% CI 28.5%-47.5%).** Half of the deaths 19 (50%) occurred before 48 hours as shown in fig: 9 below.

Figure: 9: Duration in hours from admission to death N= 38.



Overall 46.7 % of children with kwashiorkor, 44.4 % of children with marasmic-kwashiorkor and 32.8% of children with marasmus died, χ^2 p value=0.443 (Table **10** below).

Table 10: Outcome according to type of malnutrition n =101

OUTCOME	Marasmus	Kwashiorkor	Marasmus-Kwashiokor
Alive	40(67.7%)	8(53.3%)	15(55.6%)
Dead	19(32.3%)	7(46.7%)	12(44.4%)
Total	59(100%)	15(100%)	27(100%)

χ^2 p value=0.443

8.7 INVENTORY OF ESSENTIAL SUPPLIES

An inventory of essential supplies was done through observations in the ward and structured interviews with nurses and nutritionists. A total of 50 health workers were interviewed.

Throughout the entire duration of the study, essential supplies were largely available as shown in table **11** below. Potassium chloride was available in intravenous preparation only. However no ward had written guidelines on the management of severe malnutrition.

Table 11: Availability of essential supplies

	Always available	Most times available	Rarely available	Never available
Glucometer and glucostix	44(88%)	6 (12%)		
ReSoMal(premixed sachets)	36(72%)	14 (28%)		
F75(pre-mixed bags)	40 (80%)	10 (20%)		
F100(pre-mixed bags)	40 (80%)	10 (20%)		
Potassium chloride	28 (56%)	20 (40%)	2(4%)	

8.8 CARE GIVER'S KNOWLEDGE AND PRACTICES N=61

A total of 61 caregivers were interviewed at the end of day 7 to assess knowledge and actual practices in care. Of the 61 care givers, 39 (63.9%) lacked knowledge that their children had severe malnutrition apart from the other co-morbid conditions.

Overall 31.1% of caregivers knew that starter milk F75 was a major component of the treatment regime their children were receiving. The majority of the mothers 41 (67.2%) gave three hourly feeds and 42 (68.9%) gave the correct volumes of milk per feed. Only 11(18%) of mothers provided psychological stimulation to children through play and personal interaction with child (Table **12**).

Table 12: Care giver's knowledge and practices n=61

		Yes		No	
	Care giver's knowledge and practice	Number	%	Number	%
1.	Knew child has severe malnutrition	22	36.1	39	63.9
2.	Knew F75 milk is a treatment	19	31.1	42	68.9
3.	Gave3 hourly feeds	41	67.2	20	32.8
4.	Gave correct amount of feed	42	68.9	19	31.1
5.	Provided stimulation and play	11	18.0	50	82.0

9.0 DISCUSSION

This study evaluated current practices of care of children with severe malnutrition at Kenyatta National Hospital, a large tertiary teaching hospital and how it compares with the WHO guidelines.

The majority of the children were younger than 2 years old, and 47.5% were younger than 12 months. This age distribution among severely malnourished is similar to what other studies found in Colombia, Uganda, and South Africa ([17, 29, 35]. Marasmus was the commonest presentation and the burden was highest among those aged 6-12 months. This contrasts with what Bernal et al, Colombia and Bachou et al, Uganda found in that kwashiorkor was the commonest presentation in the two studies [29, 35]. In Colombia kwashiorkor presented in a much younger age group than marasmus. Although this study did not address feeding practices, the 2003 KDHS, found early weaning from breast-feeding, early and inappropriate introduction of complementary nutrition and inappropriate choice of weaning foods a problem in infant feeding in Kenya (4). The peculiar weaning practices noted in the 2003 KDHS could be associated with the presentation seen in this study population.

The most common clinical presentation in this study population was diarrhoea with over 70% of the children suffering from diarrhoea at admission. This is similar to observations made by Khanum [36] and Bernal [29] where they found 60% and 50% respectively of children with severe malnutrition had diarrhea. Pneumonia was also a common complication found in this study.

There was good triaging of patients at PFC with more than 90% of children appropriately triaged. Similar studies in South Africa and Colombia found that emergency triaging at the emergency departments was poorly practiced resulting in long waiting times of up to 8 hours before accessing care [37]. The good triaging practices at KNH could be attributed to appropriate training in ETAT at KNH unlike in South Africa where nurses in the outpatient department had not received appropriate training.

Prompt diagnosis, treatment and prevention of hypoglycemia was inadequately done at both PFC and ward despite availability of dextrostix / glucometer and F 75. There was a long delay in initiating feeding with a median waiting time of 14 hours. Ashworth in South Africa found a similar delay in giving first feed with children waiting for up to 11 hours before feeding. No night feeds were given in most wards and children admitted late in the evening had to wait till the following day for breakfast normally served at 9.00 a.m. This may be attributed to ignorance of nursing staff on the risk of hypoglycemia in such children and unawareness on the WHO guidelines and also the perception that providing feeds to such children is the work of the nutritionist not the nurse. It is also probable that nurses did not treat feeds for malnourished children as "drug" but rather as routine feed. Poor staffing levels with few overburdened nurses in the various wards could also be a contributory factor. Absence of written guidelines on management of severe malnutrition and lack of training on management of severe malnutrition among nursing staff could also be contributory to findings in this study. NGT feeding was prescribed for 40% of children unlike South Africa where NGT feeding for critically ill children was uncommon.

Children with severe malnutrition are susceptible to hypothermia. Prompt diagnosis and treatment of hypothermia was poor in this study. As in the South African study temperatures were rarely checked on admission to ward and no routine measurements were carried out. From this study it was noted that critically ill children and those with diarrhea were unlikely to be kept in warm rooms since all acute rooms did not have a heater during the entire duration of the study. Children with diarrhea were not nursed in "malnutrition rooms" but in non -warmed diarrhea rooms together with other normal children with diarrhea. However unlike in South Africa electric heaters were largely available and mothers were admitted with their children though only 13.9% were trained on how to keep children warm.

Because of the difficulty in diagnosis of dehydration in severe malnutrition and estimation of its severity, rehydration fluid should only be given intravenously only if children are in shock. Severely malnourished children not in shock should be rehydrated

orally using ReSoMal which has low sodium and high potassium. These guidelines were not adequately followed and a large number of children not documented to be in shock were indiscriminately prescribed IV fluids both at PFC and in the wards. This could be due to lack of well trained motivated clinicians. Choice of appropriate IVF for shock was unsatisfactory in PFC compared to the wards with 64.3% of children being resuscitated with normal saline. This observation could be explained by differences in knowledge and skills of health workers with wards being managed by more skilled personnel. Oral rehydration was also poorly done in PFC compared to wards and there was high likelihood of standard ORS being used in PFC than in wards. Neither monitoring for signs of over hydration nor recording volumes of fluids given was properly done at both PFC and the wards. This could be due to lack of knowledge about dangers of over hydration and also the limited number of nursing staff. Similar practices were observed by Puone et al in South Africa, where they found indiscriminate use of intravenous fluids and lack of monitoring was due to lack of knowledge about dangers of intravenous therapy and over hydration in severe malnutrition[38].

Infections are very common in malnourished children but can be difficult to diagnose because common signs, such as fever, inflammation and crepitations are often missing [39]. Broad spectrum Antibiotics are routinely administered to severely malnourished children because these children may not present signs or symptoms of infection. In this study 91 % of children received appropriate broad spectrum antibiotics with both gram positive and negative cover unlike in South Africa where antibiotics were not routinely used. This could be due to the training of clinicians in emergency triage and treatment plus inpatient care at KNH

The increasing severity of the biochemical imbalance in malnourished children is enhanced by the deficit of vitamins and minerals mainly zinc folic acid, vitamin A and copper. Therefore, high dose vitamin A, folic acid, other vitamins, and mineral supplements, given at the start of therapy, are fundamental in improving outcome [40]. In this study only 39% of children received all micronutrients with correct dose of vitamin

A being given to less than 50% of children. A similar finding was documented in South Africa where most of the micronutrients were not routinely supplemented.

Children with severe malnutrition should be given small frequent feeds of a starter formula and continue breastfeeding where applicable. In this study 55.4% of children were fed with F75 with the rest being fed on porridge, normal milk and some on routine ward diet. Ashworth in South Africa found that children were being fed on full strength milk and adult meals. Ready to use starter formula F75 was always available in the ward unlike in South Africa. Monitoring and computing daily feeds was rarely done. Studies done in other places have shown that activities that require frequent physician and nursing staff bedside presence are often poorly done [41]. Severe shortage of nursing staff at KNH and possible lack of knowledge about the special needs of severely malnourished could explain above findings.

The initial phase had a median duration of 6 days. Bernal in Colombia found on average, appetite improved by the fifth day of hospitalization. At this time children attained the minimal necessary metabolic and physiological requirements and could transit to rehabilitation phase safely [29]. In our study, 64.2% of children alive at day six started the rehabilitation phase with 62.7% receiving the correct feed volume during the transition. However feed volume was increased after transition for 37.2%.of children only. In this study it was observed that failure to increase volume of feed was mainly due to failure by doctors to change prescription of feeds accordingly.

In our study most of the children were accompanied by care givers who were responsible for feeding and oral rehydration of the children. It was also observed that care givers were responsible for charting of feeds, although task was often poorly done and no proper supervision systems were in place. For the duration of the study, most of the caregivers developed the ability to feed their children competently. However, it was noted that a few were sharing their ward diet with the children. Hence from this study there is a great potential for care givers to contribute to care of children in view of the shortage of

nursing staff. However, close supervision and training would be required, a factor that was missing in all wards.

Severe malnutrition is often a common finding in HIV infected children. In this study, only 14% of children tested were confirmed either as infected or exposed to maternal HIV infection. Studies in the region have found the proportion of severely malnourished who are HIV 1 infected was 30% and above [35, 42, 43]. However apart from the Kampala study, other studies were carried out in the pre highly active antiretroviral therapy period. The low prevalence of HIV 1 infection in this study could to be due to successful implementation of prevention of mother to child program and scaling up of HIV treatment and care resulting in more healthier cohort and reduced tendency to wasting and hospitalization.

Case fatality rate was high in this study at 38%. Bernal in Turbo Colombia found a mortality rate of 5.7%. A study in Bangladesh reported a 17% mortality rate while in South Africa a rate of 6% was obtained with rigorous application of WHO protocol. Although it is difficult to compare case fatality across various studies due to population characteristic differences, studies have shown that implementation of WHO guidelines results in a decrease in hospital based case fatality rate [17, 29, 44]. The high case fatality rate in this study could be a factor of poor clinical care. Out of the 38 patients who died 35/38(92%) were inappropriately managed for hypoglycemia. Management of hypothermia, dehydration, electrolyte and micronutrient imbalance and feeding were also inadequate among those who died. However most of the children in this study did not receive appropriate care thus deaths cannot be attributed poor care only. Other factors that could be contributing to high mortality in this study may be the severity of illness probably due to delayed hospital presentation, with acute medical conditions mainly diarrhea and acute respiratory tract infections being the primary reason for hospital presentation, hence critically ill patients requiring intense medical and nursing care.

From this study, severe malnutrition remains poorly managed at KNH with critical deficiencies in care being observed in majority of steps. Major shortfalls in care found in

this study include delayed diagnosis and treatment of hypoglycemia and hypothermia, delay in prompt start of therapy especially initial feeding of children, inadequate and erratic basic nursing care like monitoring of feeds, fluid and vital signs. However supply of major commodities was good most of the times compared to what Chopra found in South Africa [17]

Finally clinical approach to improve quality of care at KNH should be to be accompanied by efforts to improve health system infrastructure and management. The rooms set aside for care of children with severe malnutrition are small and most times highly congested, with a single bed accommodating up to six children. This makes it difficult to maintain proper hygiene and cross infection is a major problem.

Shortage of nurses and nutritionists and low morale noted in this study compromised quality of care and this has been noted in other studies [45, 46]. Availability of adequate skilled, motivated, well trained staff is a vital determinant of successful implementation.

9.1 STUDY LIMITATIONS

- The study was not designed to assess staff's knowledge of the WHO guidelines.

9.2 CONCLUSION

- Quality of care for children admitted with severe malnutrition at KNH is inadequate and often does not follow the evidence based WHO protocol.

9.3 RECOMMENDATIONS

- There is need to assess knowledge of staff on the WHO protocol and carry out training according to gaps identified.
- There is a need to form a hospital nutrition team to address gaps in the implementation of the WHO protocol and carry out routine supervision and regular audits on the care of severe malnutrition.
- . KNH need to consider the establishment of a specialized malnutrition unit. This will make it possible to improve skills and care for severely malnourished children.

Appendix 1

Consent explanation form

IP/NO Study number Date

AUDIT OF CARE OF CHILDREN WITH SEVERE MALNUTRITION AT KENYATTA NATIONAL HOSPITAL.

Investigator: **Dr Charles M Nzioki**, Postgraduate student, Department of Paediatrics, University of Nairobi.

Supervisors: Dr. Irimu G, Prof. Musoke, Dr. English M. Lecturers', Department of paediatrics, University of Nairobi.

Investigators statement

We are conducting a study to evaluate the care provided to children admitted with severe malnutrition in this hospital. Your child has been identified as having severe malnutrition .I am requesting you to join this study. This form provides you with information to enable you to decide whether to allow your child to take part in the study or not. Your participation is wholly voluntary.

Purpose of study

Children with severe malnutrition are admitted to our wards daily. We wish to look at the care given to children like yours admitted into our general pediatric wards. Information obtained will enable us assess the care and where possible make improvements.

Procedures

As a part of this study we are interested in assessing the nutritional status of your child by taking his/her weight and height. We will look at the clinical records of your child and abstract data including care received clinical findings and results of laboratory investigations.

Risks

No direct risks to your child are foreseen as a result of taking part in this study .The information obtained in this study will be used for the purpose of improving care for children.

Benefits

This study may not benefit your child immediately.

The information obtained in this study will enable the hospital identify any weaknesses in the treatment of severe malnutrition. This will aid in improving the care given to children with this illness.

Confidentiality

Information obtained will be held in strict confidence .We will not publish or discuss any information obtained in any way that could be linked to your child.

Rights

Participation in the study is entirely voluntary and you may refuse or withdraw your consent at any stage without influencing the care your child is receiving in any way. You have a right to ask any question and clarifications.

Parents / Guardians consent form

The study above has been explained to me. I have understood its purpose and my rights as a subject in the study. I have had a chance to ask questions and have been assured that if in future I have any questions about the study or my rights as a subject, I can ask the investigator. I understand that I can withdraw from the study at any time. I voluntarily agree to participate in the study.

Signed (parent/guardian) ---------- Date

Sign (Investigator) ---------- Date

Appendix 2

HEALTH WORKERS CONSENT FORM

I am Dr. Charles Nzioki, from the department of pediatrics and child health of the University of Nairobi. I am carrying out a study on the management of children with severe malnutrition at KNH as part of my post graduate training in the same department. The aim of the study is to audit care of children with severe malnutrition admitted at Kenyatta National Hospital in order to determine areas of care that need improvement and thus better outcome for such children.

The information collected will be anonymous. No record of name, qualification or area of work will be indicated.

I request you to take part in the study and give consent for participation in the same.

Consent given Yes ☐ No ☐

Signature _____

Date _____ /_____ /_____

Appendix 3

SEVERE MALNUTRITION CARE STUDY

Study Number Ward-------- Date----/---/2007 IP/No----------

Fill in the appropriate response in the spaces provided.

A) Demographic characteristics of the patient

1. Date of birth----------

2. Age in months ------- months

3. Sex Male ☐ Female ☐

B) **Anthropometric measurements by PI**

4. Body weight ----------kg--------gm

5. Height / length ----------cm

6. Bilateral pedal edema present? Yes ☐ No ☐

7. Severe visible wasting seen? Yes ☐ No ☐

8. Weight/ length Z scores - 2SD ☐ - 2 SD-3SD ☐ -3SD -4SD ☐ <-4SD ☐

9. Classification of severe malnutrition by PIKwashiorkor ☐ Marasmus ☐

Marasmic -Kwashiorkor ☐ Non severe malnutrition ☐

C) Emergency management at Pediatric Filter Clinic

10. How was the Patient triaged at PFC?

Emergency ☐ Priority ☐ Non urgent ☐ No information ☐

11. **Step 1.**Treat/prevent hypoglycemia

(i) Was random blood sugar done at PFC? Yes ☐ No ☐

If yes

(ii)Results of RBS ----------mmol/l

12. **Step 3.** Treat /prevent dehydration

(i) Was diarrhea present? Yes ☐ No ☐ No information ☐

If yes proceed to (ii), if no proceed to **D**

(ii) Was hypovolemic shock documented? Yes ☐ No ☐

If child in shock proceed, if no skip to (viii)

(iii) Did patient have IVF prescribed? Yes ☐ No ☐

(iv) Was choice of IVF correct? Yes ☐ No ☐

(v) Was amount of IVF given in first hour correct? Yes ☐ No ☐

(vi) Was fluid monitored and volumes recorded? Yes ☐ No ☐

(vii) Was there medical review after 1 hour of IVF? Yes ☐ No ☐

(viii) Did patient have ReSoMal prescribed? Yes ☐ No ☐

(ix) Was the correct volume of ReSoMal used? Yes ☐ No ☐

(x) Was the ReSoMal monitored? Yes ☐ No ☐

D) Assessment on admission to the ward

13. Temperature at admission---------^{0}C

14. Edema documented by ward clinician? Yes ☐ No ☐

15. Visible severe wasting documented by ward clinician? Yes ☐ No ☐

16. Admission diagnosis by admitting ward clinician

Marasmus ☐ Marasmic-Kwarshiokor ☐ Kwashiorkor ☐ Not classified ☐

17. Other co-morbid conditions specified by admitting clinician.

(i) ----------

(ii) ----------

(iii)----------

E) Ward management

18. **Step 1.**Treat/prevent hypoglycemia

(i) Was random blood sugar done? Yes ☐ No ☐

(ii) Results of RBS --------mmol/l

19. **Step 2.**Treat /prevent hypothermia

(i) Was child kept warm? Yes ☐ No ☐

If yes how?

(ii) Heater provided? Yes ☐ No ☐

(ii) Instructions given to mother to keep warm? Yes ☐ No ☐

20. **Step 3.** Treat /prevent dehydration

(i) Was diarrhea present? Yes ☐ No ☐ No information ☐

If yes proceed to (ii)

(ii) Was hypovoleamic documented? Yes ☐ No ☐

If child in shock proceed, if no skip to (viii)

(iii) Did patient have IVF prescribed? Yes ☐ No ☐

(iv)Was choice of IVF correct? Yes ☐ No ☐

(v)Was amount of IVF given in first hour correct? Yes ☐ No ☐

(vi) Was fluid monitored? Yes ☐ No ☐

(vii)Was there medical review after 1 hour of IVF? Yes ☐ No ☐

(viii)Did patient have ReSoMal prescribed? Yes ☐ No ☐

(ix)Was the correct volume of ReSoMal used? Yes ☐ No ☐

(x)Was F75 given concurrently with ReSoMal in the initial 10 hours? Yes ☐ No ☐

(xi) Was the ReSoMal intake monitored? Yes ☐ No ☐

21. **Step 4.** Correct electrolyte imbalance

(i) Was at least 4mmol/kg extra potassium prescribed/ supplemented? Yes ☐ No ☐

iii) Were diuretics wrongly given for edema? Yes ☐ No ☐

22. **Step 5**. Treat / prevent infection

(i) Were antibiotics prescribed? Yes ☐ No ☐

(ii) If yes, what antibiotics prescribed? Crystalline penicillin ☐ Gentamicin ☐

Metronidazole ☐ others (specify) ☐

23. **Step 6.** Correct micro -nutrient deficiencies

(i) Was vitamin A given? Yes ☐ No ☐

(ii) Was correct vitamin A dose given? Yes ☐ No ☐

(iii) Was Zinc given? Yes ☐ No ☐

(iv) Was Folic acid given? Yes ☐ No ☐

(v) Was multivitamin given? Yes ☐ No ☐

(vi) Was iron withheld in acute phase? Yes ☐ No ☐

(vii) Was iron given in catch up phase if indicated? Yes ☐ No ☐

24. **Step 7.** Initiate feeding / starter feeds

(i) Was starter formula F75 prescribed? Yes ☐ No ☐

(ii) Amount prescribed ----------mls/kg/day

(iii) Was child fed within 1 hour of admission? Yes ☐ No ☐

(iv) If no duration of ward stay before first feed given --------hours

(v) What was the frequency of feeds?2hrly ☐ 3hrly ☐ Not specified ☐

(vi) Route of feeding Oral ☐ NGT ☐ Not specified ☐

(vii) Mean days on starter formula----------

(viii) Was feed intake monitored daily? Yes ☐ No ☐

25. **Step 8.** Rehabilitation feeds **(if** alive by day 7**)**

(i) Was transition to F100 prescribed? Yes ☐ No ☐

(ii) Was correct feeding volume prescribed in transition period? Yes ☐ No ☐

(iii) Was volume of F100 increased after the transition period Yes ☐ No ☐

26. Was patient transfused blood? Yes ☐ No ☐

If yes proceed

(i) Was it indicated? Yes ☐ No ☐

Hemoglobin ---------gm/dl

(ii) Was correct volume given? Yes ☐ No ☐

(iii) Was patient given furosemide? Yes ☐ No ☐

27. Was pulse, respiratory rate, temperature monitored at least 6 hourly in the first two days? Yes ☐ No ☐

G) Laboratory results

28. HIV test done? Yes ☐ No ☐

(i) If yes what test? Rapid test ☐ ELISA ☐ PCR ☐

(ii) What is the test result? HIV infection confirmed ☐ HIV negative ☐ HIV exposed ☐

H) Outcome

29. Discharge Alive ☐ Dead ☐

30. Duration of hospital stay ----------day

Appendix 4

Care givers interview at end of first week

Fill in the caregivers' responses in the spaces provided. Let the caregiver explain then indicate the response as provided.

1. Have you been informed about the cause of your child's illness?

   If yes, explain----------

2. Do you know the treatment your child is receiving for this illness?

   If yes, explain-------

3. In the last one day, how many times did the child feed?

   i) During the day ----------

   ii) During the night ---------- -----

4. Who feeds the child?

   i) During the day---------

   ii) During the night----------

5. Have you been informed on the amount of milk the child is supposed to take at each feed? ----------

6. Are the feeds measured? ----------Explain

7. Have you been informed on how to keep your child warm?

   If yes, explain ----------

8. Do you always have a heater in the room?

9. Have you been informed on the importance of playing with the child?

If yes explain

Appendix 5

Health workers (nurses/ nutritionists) questionnaire – severe malnutrition care

Please answer the following questions in the spaces provided.

Date of interview----------

1. Indicate the availability of the following commodities

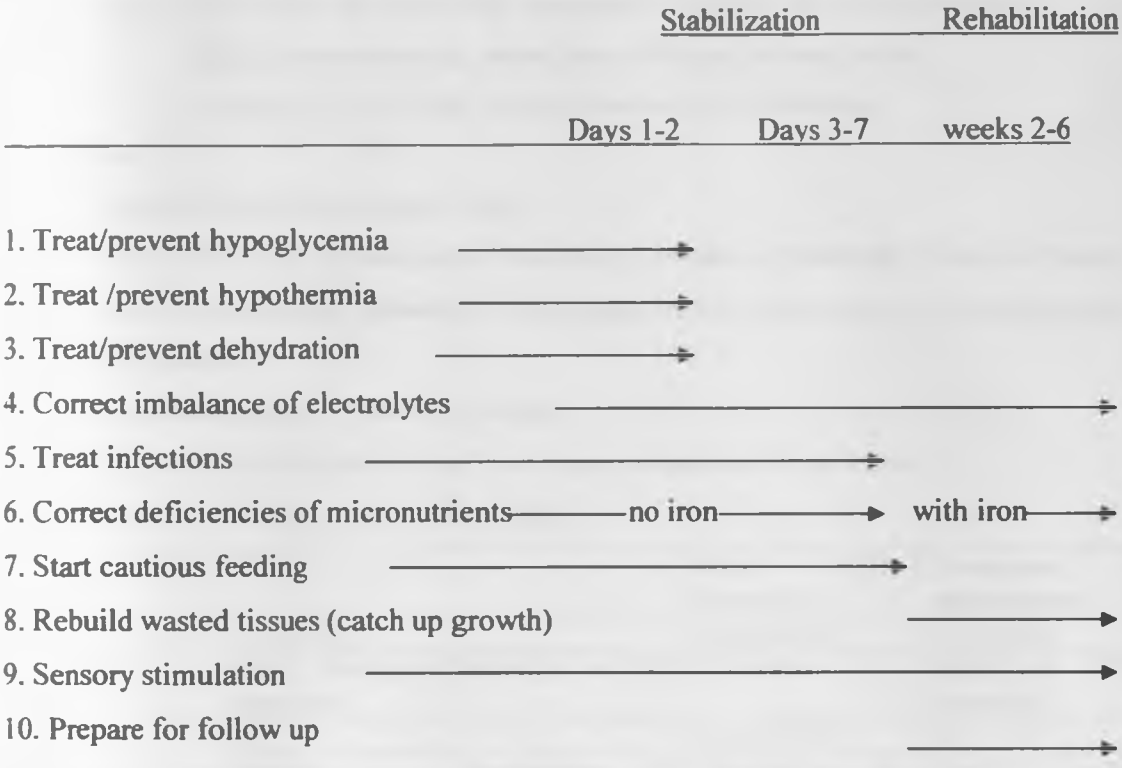
Drug	Always available	Available most of the times	Rarely available	Never available
Glucometer and glucostix				
ReSoMal				
F75				
F100				
Potassium supplement				

2. How many heaters in functional condition are available for use by malnourished children in your ward? ----------

Appendix 6

Ten steps in the care of severely malnourished children

Time frame for the management of the child with severe malnutrition



Source of chart: Pocket book of Hospital care for children; guidelines for the management of common illnesses with limited resources, *WHO*, 2006: page 176.

Appendix 7

Micronutrient replacement

Give daily for at least 2 weeks:

- A multivitamin supplement
- Folic acid (5mg on day1, then 1mg/day)
- Zinc(2mg/kg/day)
- Give vitamin A orally (aged<6months:50000 IU; aged 6-12months:100000 IU; older children: 200000 IU) on day 1.

Source of chart: Pocket book of Hospital care for children; guidelines for the management of common illnesses with limited resources, *WHO*, 2006: page 183.

Appendix 8

Fluid management in severe malnutrition

Do not use the IV route for rehydration except in shock. Give ReSoMal orally or by NGT. Give 5ml/kg every 30 minutes for the first 2 hours then give 5—10ml/kg for the next 10 hours.

Shock Reduced consciousness, absent, slow (<60bpm) or weak pulse.

15mls/kg in 1 hr of Half Strength Darrow's in 5% dextrose.

If improves

- Repeat this bolus over another 1 hour.
- Then switch to oral or nasogastric fluid using ReSoMal at 10 ml/kg/hr for up to 10 hours.
- As soon as conscious, introduce F75 and appropriately reduce amount of ReSoMal given.

If does not improve

- Give maintenance IV fluid at 4 ml/kg/hr.
- Transfuse 10 ml/kg whole blood over 3 hours as soon as it is available.
- Introduce F75 after transfusion complete.

	Shock		**Oral /NGT/ ReSoMal**	**Emergency maintenance**
	15 mls/kg		10mls/kg/hr	4mls/kg/hr
	Half Strength Darrow's in 5% Dextrose		ReSoMal	HSD in 5% Dextrose
	Iv		Oral /NGT/	iv
Weight kg	**Shock** = over 1 hour	**Drops/min if 20drops/ml giving set**	**10mls/lg/hr** for up to 10 hours	Hourly until transfusion
4.00	60	20	40	15
5.00	75	25	50	20
6.00	90	30	60	25
7.00	105	35	70	30
8.00	120	40	80	30
9.00	135	45	90	35
10.00	150	50	100	40
11.00	165	55	110	45
12.00	180	60	120	50
13.00	200	65	130	50
14.00	220	70	140	55
15.00	240	80	150	60

Source of chart:

- Pocket book of Hospital care for children; guidelines for the management of common illnesses with limited resources, *WHO*, 2006: page 179.
- Basic Pediatric Protocols. *Ministry of Health, Kenya*, 2004: page 23

Appendix 9

Feeding children with severe malnutrition

1) If respiratory distress or edema get worse or the jugular veins are engorged reduce feed volumes.
2) When appetite returns (and edema much improved) change from F75 to F100, for the first 2 days use same feed volume as for F75. Then increase to the minimum F100 volume and continue increasing feeds by 10 mls per feed stopping when the child is not finishing the feeds or if the maximum is reached.

Weight (kg)	F75 – acute feeding				F100 –catch up feeding		
	No or moderate edema		Severe edema even face			3 hourly feed volume	
	Total Feeds/ 24hrs	3 hourly feed volume	Total Feeds in 24 hrs	3 hourly feed volume	Total Feeds in 24 hrs	Min	Max
3.0	390	50	300	40	450	55	80
3.5	455	60	350	45	525	65	95
4.0	520	65	400	50	600	75	110
4.5	585	75	450	60	675	85	120
5.0	650	80	500	65	750	95	135
5.5	715	90	550	70	825	105	150
6.0	780	100	600	75	900	115	165
6.5	845	105	650	85	975	125	175
7.0	910	115	700	90	1050	135	190
7.5	975	120	750	95	1125	140	205
8.0	1040	130	800	100	1200	150	220
8.5	1105	140	850	110	1275	160	230
9.0	1170	145	900	115	1350	170	245
9.5	1235	155	950	120	1425	180	260
10.0	1300	160	1000	125	1500	190	275
10.5	1365	170	1050	135	1575	200	285
11.0	1430	180	1100	140	1650	210	300

Source:

- Pocket book of Hospital care for children; guidelines for the management of common illnesses with limited resources, *WHO*, 2006: page 184-185.
- Basic Pediatric Protocols. *Ministry of Health, Kenya*, 2004: page 24

Appendix 10

WHO/NCHS normalized reference weight – for – length (49- 84 cm) and weight – for – height (85 – 110 cm), by sex

Boys' weight (kg)						Girls' weight (kg)				
-4SD 60%	-3SD 70%	-2SD 80%	-1SD 90%	Median	Length(cm)	Median	-1SD 90%	-2SD 80%	-3SD 70%	-4SD 60%
1.8	2.1	2.5	2.8	3.1	**49**	3.3	2.9	2.6	2.2	1.8
1.8	2.2	2.5	2.9	3.3	**50**	3.4	3	2.6	2.3	1.9
1.8	2.2	2.6	3.1	3.5	**51**	3.5	3.1	2.7	2.3	1.9
1.9	2.3	2.8	3.2	3.7	**52**	3.7	3.3	2.8	2.4	2
1.9	2.4	2.9	3.4	3.9	**53**	3.9	3.4	3	2.5	2.1
2	2.6	3.1	3.6	4.1	**54**	4.1	3.6	3.1	2.7	2.2
2.2	2.7	3.3	3.8	4.3	**55**	4.3	3.8	3.3	2.8	2.3
2.3	2.9	3.5	4	4.6	**56**	4.5	4	3.5	3	2.4
2.5	3.1	3.7	4.3	4.8	**57**	4.8	4.2	3.7	3.1	2.6
2.7	3.3	3.9	4.5	5.1	**58**	5	4.4	3.9	3.3	2.7
2.9	3.5	4.1	4.8	5.4	**59**	5.3	4.7	4.1	3.5	2.9
3.1	3.7	4.4	5	5.7	**60**	5.5	4.9	4.3	3.7	3.1
3.3	4	4.6	5.3	5.9	**61**	5.8	5.2	4.6	3.9	3.3
3.5	4.2	4.9	5.6	6.2	**62**	6.1	5.4	4.8	4.1	3.5
3.8	4.5	5.2	5.8	6.5	**63**	6.4	5.7	5	4.4	3.7
4	4.7	5.4	6.1	6.8	**64**	6.7	6	5.3	4.6	3.9
4.3	5	5.7	6.4	7.1	**65**	7	6.3	5.5	4.8	4.1
4.5	5.3	6	6.7	7.4	**66**	7.3	6.5	5.8	5.1	4.3
4.8	5.5	6.2	7	7.7	**67**	7.5	6.8	6	5.3	4.5
5.1	5.8	6.5	7.3	8	**68**	7.8	7.1	6.3	5.5	4.8
5.3	6	6.8	7.5	8.3	**69**	8.1	7.3	6.5	5.8	5
5.5	6.3	7	7.8	8.5	**70**	8.4	7.6	6.8	6	5.2
5.8	6.5	7.3	8.1	8.8	**71**	8.6	7.8	7	6.2	5.4
6	6.8	7.5	8.3	9.1	**72**	8.9	8.1	7.2	6.4	5.6
6.2	7	7.8	8.6	9.3	**73**	9.1	8.3	7.5	6.6	5.8
6.4	7.2	8	8.8	9.6	**74**	9.4	8.5	7.7	6.8	6
6.6	7.4	8.2	9	9.8	**75**	9.6	8.7	7.9	7	6.2
6.8	7.6	8.4	9.2	10	**76**	9.8	8.9	8.1	7.2	6.4
7	7.8	8.6	9.4	10.3	**77**	10	9.1	8.3	7.4	6.6
7.1	8	8.8	9.7	10.5	**78**	10.2	9.3	8.5	7.6	6.7
7.3	8.2	9	9.9	10.7	**79**	10.4	9.5	8.7	7.8	6.9
7.5	8.3	9.2	10.1	10.9	**80**	10.6	9.7	8.8	8	7.1
7.6	8.5	9.4	10.2	11.1	**81**	10.8	9.9	9	8.1	7.2
7.8	8.7	9.6	10.4	11.3	**82**	11	10.1	9.2	8.3	7.4

7.9	8.8	9.7	10.6	11.5	**83**	11.2	10.3	9.4	8.5	7.6
8.1	9	9.9	10.8	11.7	**84**	11.4	10.5	9.6	8.7	7.7
7.8	8.9	9.9	11	12.1	**85**	11.8	10.8	9.7	8.6	7.6
7.9	9	10.1	11.2	12.3	**86**	12	11	9.9	8.8	7.7
8.1	9.2	10.3	11.5	12.6	**87**	12.3	11.2	10.1	9	7.9
8.3	9.4	10.5	11.7	12.8	**88**	12.5	11.4	10.3	9.2	8.1
8.4	9.6	10.7	11.9	13	**89**	12.7	11.6	10.5	9.3	8.2
8.6	9.8	10.9	12.1	13.3	**90**	12.9	11.8	10.7	9.5	8.4
8.8	9.9	11.1	12.3	13.5	**91**	13.2	12	10.8	9.7	8.5
8.9	10.1	11.3	12.5	13.7	**92**	13.4	12.2	11	9.9	8.7
9.1	10.3	11.5	12.8	14	**93**	13.6	12.4	11.2	10	8.8
9.2	10.5	11.7	13	14.2	**94**	13.9	12.6	11.4	10.2	9
9.4	10.7	11.9	13.2	14.5	**95**	14.1	12.9	11.6	10.4	9.1
9.6	10.9	12.1	13.4	14.7	**96**	14.3	13.1	11.8	10.6	9.3
9.7	11	12.4	13.7	15	**97**	14.6	13.3	12	10.7	9.5
9.9	11.2	12.6	13.9	15.2	**98**	14.9	13.5	12.2	10.9	9.6
10.1	11.4	12.8	14.1	15.5	**99**	15.1	13.8	12.4	11.1	9.8
10.3	11.6	13	14.4	15.7	**100**	15.4	14	12.7	11.3	9.9
10.4	11.8	13.2	14.6	16	**101**	15.6	14.3	12.9	11.5	10.1
10.6	12	13.4	14.9	16.3	**102**	15.9	14.5	13.1	11.7	10.3
10.8	12.2	13.7	15.1	16.6	**103**	16.2	14.7	13.3	11.9	10.5
11	12.4	13.9	15.4	16.9	**104**	16.5	15	13.5	12.1	10.6
11.2	12.7	14.2	15.6	17.1	**105**	16.7	15.3	13.8	12.3	10.8
11.4	12.9	14.4	15.9	17.4	**106**	17	15.5	14	12.5	11
11.6	13.1	14.7	16.2	17.7	**107**	17.3	15.8	14.3	12.7	11.2
11.8	13.4	14.9	16.5	18	**108**	17.6	16.1	14.5	13	11.4
12	13.6	15.2	16.8	18.3	**109**	17.9	16.4	14.8	13.2	11.6
12.2	13.8	15.4	17.1	18.7	**110**	18.2	16.6	15	13.4	11.9

SD= standard deviation score or Z score; although the interpretation of a fixed percent – of – median value varies across age and height, and generally the two scales cannot be compared; the approximate percent-of-the median values for -1 and -2SD are 90% and 80% of median respectively (*Bulletin of the World Health Organization*,1994,**72**:273-283)

Length is measured below 85 cm; height is measured 85 cm and above.

Source of chart: Pocket book of Hospital care for children; guidelines for the management of common illnesses with limited resources, *WHO*, 2006: 365-366

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7th January 2008

Dr. Charles M. Nzioki
Dept. of Paediatrics & Child Health
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University of Nairobi

Dear Dr. Nzioki

RESEARCH PROPOSAL: "AUDIT OF CARE FOR CHILDREN AGED 6 TO 59 MONTHS ADMITTED WITH SEVERE MALNUTRITION AT KENYATTA N. HOSPITAL" (P295/10/2007)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your revised research proposal for the period 7th January 2008 – 6th January 2009.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A N GUANTAI
SECRETARY, KNH-ERC

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