PREVALENCE OF MALNUTRITION AND RELATED FACTORS AMONG CHILDREN AGED 6-60 MONTHS ADMITTED AT SIAYA DISTRICT HOSPITAL PAEDIATRIC WARDS

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF MASTER OF PUBLIC HEALTH DEGREE OF THE UNIVERSITY OF NAIROBI

DECLARATION

I declare that the dissertation which I hereby submit at the University of Nairobi for Masters of Public Health degree is my work and has not been submitted by me or any other person to any University or institution of higher learning.

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DEDICATION

This work is dedicated with love, to my parents Mildred Othieno and Prof. Nicholas Othieno who endeavored to educate me and supported me throughout my academic pursuits, and to my son, Christian Baraka Othieno, who lovingly endured my absence and commitments during this pursuit. You give me joy each day.

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ABSTRACT

Background: Malnutrition is a worldwide public health problem that affects the growth and development of children under the age of five years. It is also associated with a high morbidity and mortality in this age group. Furthermore, it reduces child immunity and this makes children susceptible to a number of infections such as pneumonia, tuberculosis and diarrhea which increases the mortality rate of children. Severe malnutrition is a common condition among children admitted to hospitals in East Africa. Previous studies conducted have also shown that in the hospital setting, especially the pediatric medical wards, children under five years old with malnutrition have occupied nearly all the beds to the extent that other patients with acute and chronic illnesses suffer as a result.

Objectives: To determine the prevalence of malnutrition and related factors among children aged 6-60 months admitted at the Siaya district hospital pediatric ward.

Design: This was a descriptive cross sectional study.

Study Area: The study was conducted at the Siaya District Hospital pediatric ward.

Subjects: Children admitted to the Siaya District Hospital pediatric medical ward and a sample of 115 children was arrived at using the prevalence of acute malnutrition in Kenya which is currently at 7%.

Sampling methods: Systematic sampling using the admission register was employed in each of the subdivisions in the pediatric ward that was visited. Purposive non probability and systematic probability sampling was utilized.

Instruments: Questionnaires, direct observation and key informant interviews

Tools: Anthropometry screening tools were used for nutritional assessment. Salter scales were used for weighing the children and length mats were used for taking length/height of the children.

Descriptive statistics was used to summarize the data. Frequencies of all the variables were generated and used for checking the outliers. The World Health Organization, (WHO)Anthro statistical programme was employed to convert raw anthropometric measurements of weight and height /length of the children into anthropometric measurements of weight for age Z

scores,(WAZ) weight for height Z scores, (WHZ), and height for age Z scores (HAZ) and was compared with the WHO reference data.

Results:

Morbidity: The top five illnesses responsible for study children's admissions were malaria, respiratory tract infections, pneumonia and bronchitis, anaemia, malnutrition mainly kwashiorkor, marasmic kwashiorkor, diarrhoea and vomiting.

Prevalence of malnutrition: Stunting prevalence of 14.2% for severe stunting and 27.4% for moderate stunting indicates that these children were subjected to long term chronic malnutrition. The prevalence of underweight was 11.3% for severe underweight and 24.3% for moderate underweight which is a composite index for both wasting and stunting. The prevalence of severe wasting was 14.2% and 18.4% for moderate wasting.

Quality of food: The meals served were inadequate and did not meet the standards of a balanced diet, and it was also noted that meals had inadequate micro and macronutrients. The study also found that meals served were not diverse and also not served frequently.

Per capita allocation: Each patient admitted to the pediatric wards is allocated 39 Ksh and 50 cents per day.

Conclusion: The prevalence of severe wasting was 14.2% and 18.4% for moderate wasting this was higher than that of a similar study done in Siaya District Hospital; (Bern et al, 1997) which stood at 11%.In the current study severe underweight prevalence was 11.3% and 24.3% for moderate underweight. This was equal to a similar one done in Siaya District Hospital which had a prevalence rate of 25%,(Bern et al,1997).In the current study, the findings for severe stunting was 14.2% and 27.4% for moderate stunting among the study children. This too was higher compared to the study done in Siaya District Hospital which had a prevalence of 18%,(Bern et al,1997).

There was a highly significant increase in wasting with children's age, ($P<0.001$) for both boys and girls in the study. Most of the stunted, wasted and underweight children were from homes that had two or more cows as compared to those who came from homes that had none. This could be because the cows found in that area are local breeds with verypoor yields that the poor people chose to cling to.

Malaria was the highest cause of morbidity among the study children. The study established that the only factor that had linear correlation with the nutritional status of children was morbidity.

The overall quality of the diet of children in this study was inadequate. Apart from the low energy and protein intake; children also had undesirable intakes of essential vitamins and minerals. The inadequacy in quality could be due to inadequate budget for patient food and low priority for nutrition as part of medical treatment and failure to adhere to the hospital menu.

The per capita consumption for patients in the pediatric ward was 39ksh and 50 cents per patient per day. The study also found that hospital staff and the DHMT have their tea breaks, monthly meetings and other guests foods catered for under patient's budget.

Recommendations: The trained medical staffs should be involved in sensitizing the population on the basis of integrated management of childhood illnesses (IMCI).

There is need for the District Health Management Team (DHMT) to involve a quality assurance team consisting of a clinician, nurse, nutritionist and community health worker in identification and management of malnutrition among children admitted at the facility. Feeding of sick children should also be in line with the recommended guidelines.

There is need for more qualified nutrition personnel at the facility who will be involved in assessment of nutritional status of children on admission during hospitalization and upon discharge. The nutritionist should also be actively involved in supervision of meal preparation and service.

The DHMT should have a separate budget for their staff teas/ meals and should also increase the funds they allocate to food and nutrition during budgeting to increase the per capita day allocation for children admitted in the paediatric ward.

All children aged 6-60 months admitted in the pediatric ward should be provided with the recommended toto diet, (K.N.H 2012). Feeding frequency should also be increased in line with the MOPHS guidelines for feeding sick children.

LIST OF ACRONYMS

AIE	Authority to incur expenditure
AIDS	Acquired Immunodeficiency Syndrome.
ANC	Antenatal care
ART	Antiretroviral therapy
BMI	Body Mass Index
CBS	Community Based Services
CPI	Consumer price index
HMT	Health Management committee
ENT	Ear, nose and throat
FAO	Food and Agricultural Organization
FIF	Facility improvement fund
HAZ	Height for age Z score
HIV	Human Immunodeficiency virus
IMCI	Integrated management of childhood illnesses
KDHS	Kenya Demographic and Health Survey
KNH	Kenyatta National Hospital
MCH	Maternal and child health
MUAC	Mid Upper Arm Circumference
NCHS	National Centre for Health Statistics
PAHO	Pan American Health Organization
PEM	Protein Energy Malnutrition
RTI	Respiratory tract infection
SD	Standard deviation
UNICEF	United Nations International Children's Education Fund
WAZ	Weight for age Z score
WHZ	Weight for height Z score
WHO	World Health Organization
VCT	Voluntary counseling and testing

LIST OF OPERATIONAL DEFINITIONS

Capital/fixed costs: These are investment costs that are not used up over one year and only need replacement over time. In this study they include the kitchen building, the store and kitchen utensils used to prepare the food.

Consumer price index: The changes in consumer price index, (CPI) was used to assess price changes associated with the cost of living during the time the study was done. The CPI was calculated by taking price changes for each of the costs and averaging them.

District commissioner: The head of the revenue administration of a Kenyan District who is in charge of governmental assets in the district of jurisdiction.

Direct costs: These are costs that can be traced directly to a cost object. In this study, direct costs were food costs and personnel directly involved in meal preparation.

Food frequency: In this study, food frequency was used to assess individual dietary intake of foods and nutrients.

Indirect costs: Shared costs of personnel and other resources mainly electricity and water, which are incurred for some time in ensuring patients food needs in the hospital, are met.

Malnutrition: In this study malnutrition was defined using anthropometric indicators of height-for- age, weight- for- age and weight- for- height Z scores. Moderate malnutrition was defined using the cut off points of less than minus 2 Z scores while severe malnutrition was defined using cut off points of less than minus 3Z scores.

Micro costing: This is a valuation method in economics that attempts to measure costs and benefits of service as accurately as possible, by including all fixed and variable costs of care at local prices, given the institutional structure within which care is being given and also attempts to account for unobserved costs such as patient time foregone, opportunity costs of relatives' work time lost, etc., using shadow prices or interpolating costs by other means.

Weight for Age Z score: This compares the weight of child with the weight of a healthy child of the same age in the reference population. All children in this study with weight for age of minus

2SD were considered moderately malnourished/ underweight and those with minus 3SD were considered severely underweight.

Weight for Height Z score: This compares the weight of a healthy child with the reference weight of a child of the same height in the reference population. It reflects recent weight loss or gain and is an indicator of wasting. All children in this study with weight for height of minus 2SD were considered moderately malnourished/wasted and those with minus 3SD were considered severely wasted

Height for Age Z score: This compares the height or length of a child to the reference height of a child of the same age in the reference population. It is a measure of stunting due to chronic malnutrition. All children in this study with height for age less than minus 2SD and minus 3SD were considered moderately and severely stunted respectively.

Health management committee: At the time of the study, the team comprised of the medical superintendent, the hospital administrators, the nursing officer in charge, and the pharmacist in charge who plans on management of the facility improvement fund (F.I.F) and authority to incur expenditure (A.I.E)in the district health facility.

Morbidity: In this study, morbidity was defined as ill health thus resulting in admission to the ward.

Mortality: In this study, mortality referred to the number of children who die before the age of five years.

Food palatability: This referred to food that is acceptable and agreeable to the palate for the study children.

Per Capita: In this study, per capita referred to the amount of money allocated to food for each person admitted in the pediatric ward

1.0 INTRODUCTION

1.1 Background information

Malnutrition is the greatest single threat to the world's public health. (WHO, 2009) and is associated with morbidity and mortality, particularly under-nutrition for the poor and the marginalized groups who suffer discrimination, displacement and poverty. (WHO,2009).More than one third of child deaths are attributed to malnutrition and about 178 million children globally are stunted as a result of not having enough food, vitamin and mineral deficiency, as well as poor diet and disease (maternal and child under nutrition study group, 2008). Malnutrition contributes to half of the deaths of children under five years of age in the world, with Asia having a death rate of 41%, Africa 51% and the rest of the world at 8%, (UNICEF, 2007). In developing countries, 1 out of every 4 children (roughly 146 million) is underweight and 10.9 million children under five years die each year. Malnutrition and hunger-related diseases cause 60 percent of the deaths (UNICEF, 2007). According to KDHS (2008/09), in Kenya, 35 percent of children under five are stunted (low height-for age), while 7 percent of children are wasted (low weight-for-height) and 16 percent are underweight (low weight-for-age).

The immediate causes of child malnutrition manifest themselves at the individual, family and household level, and they include dietary intake and disease. The degree of an individual's or a household's access to these preconditions affects how well they are nourished. A child with inadequate dietary intake is more susceptible to diseases in turn; disease depresses appetite, inhibits absorption of nutrients in food and competes for the child's energy. Other causes of malnutrition include underlying causes such as inadequate access to food, inadequate care for mothers and children, insufficient health services and an unhealthy environment. A study conducted in Limpopo province in South Africa to investigate risk factors for severe childhood malnutrition in a high HIV prevalence found that despite the increasing contribution of HIV to the development of severe malnutrition, traditional risk factors such as poor nutrition, parental disadvantage and illness, poverty, and social inequity remain important contributors to the prevalence of severe malnutrition (Saloojee, 2007).

Food security exists when, at all times, everyone has access to and control over sufficient quantities and quality of food needed for an active and healthy life. For a household this means

the ability to secure adequate food to meet the dietary requirements of all its members, either through their own production or through food purchases. Food production depends on a wide range of factors, including access to fertile land, availability of labour, appropriate seeds and tools and climatic conditions. Some of the factors affecting food purchases include household income and assets as well as food availability and food prices in local markets. In emergency situations, other factors may come into play, including physical security and mobility, the integrity of markets and access to land (WFP and CDC; 2005)

Access to good quality health services including affordability, safe water supplies, adequate sanitation and good housing are preconditions for adequate nutrition. Inadequate sanitation and hygiene is a major contributing factor for anaemia due to the link with intestinal worm infection. The social and care of the environment within the household and local community can also directly influence malnutrition. Appropriate childcare, which includes infant and young child feeding practices, is an essential element of good nutrition and health.

Cultural factors and resources such as income, time and knowledge also influence the nutritional status as well as attitudes to modern health services, water supplies and sanitation. The other basic causes of malnutrition are the actual resources and control, human economic organization, political, cultural and social system as captured in the UNICEF conceptual framework for child survival, growth and development, (Levitt, 2011).

Health and nutrition are closely related in a “malnutrition-infection cycle” in which diseases contribute to malnutrition, and malnutrition makes an individual more susceptible to disease. Malnutrition is the result of inadequate dietary intake, disease or both. Disease contributes through loss of appetite, malabsorption of nutrients, and loss of nutrients through diarrhoea or vomiting and if the body's metabolism is altered the greater the risk is of malnutrition.

Malnutrition is associated with increased illness and death, reduced educational achievements, productivity and economic capacity, and is one of the principle mechanisms behind the transmission of poverty and inequality from one generation to the next. Malnutrition manifests itself in the form of micronutrient deficiencies, stunting (also known as chronic malnutrition), and/or acute malnutrition. Acute malnutrition is caused by a decrease in food consumption and/or illness resulting in sudden weight loss or oedema. (Action against hunger, 2010).

HIV and nutrition are intimately linked. HIV infection can lead to malnutrition, while poor diet can in turn speed the infection's progress and in children, HIV and AIDS are frequently linked to growth failure. One large European study found that children with HIV were on average around 7 kg lighter and 7.5 cm (3 inches) shorter than uninfected children at ten years old (Arpadi, 2003). A study done in the paediatric wards of Mulago hospital in Uganda to describe the clinical features, hematological findings and $CD4^+$ and $CD8^+$ cell counts of severely malnourished children in relation to human immunodeficiency virus (HIV) infection found that, the $CD4^+$ percentages in both HIV-positive and HIV-negative children without oedema were lower than those in children with oedema. These observations appear to imply that the development of oedema requires a certain degree of immune competence, which gives clue to the patho-physiology of oedema in severe malnutrition. Another study in Nigeria found that the severe metabolic demands made during acute measles infection further deteriorated the condition of malnourished children, leading to further weight loss, wasting, and reduced serum levels of essential amino acids (Philips, 2004). Increased energy consumption due to immune responses may also affect the efficacy of live attenuated vaccines in populations ridden with PEM.

1.2 Problem statement

Malnutrition in children below five years is a devastating and costly public health problem associated with high morbidity and mortality in the developing world. Malnutrition impairs growth and development in children, delays recovery from disease and injury, predisposes to infections and also reduces wellbeing (Stratton, 2007).

Globally, 148 million under-fives in developing regions are underweight for their age (UNICEF, 2010). In children under five years of age, just over 2 million deaths are directly attributed to stunting, severe wasting, and restricted intrauterine growth, and about 1 million to vitamin A and zinc deficiencies. And again about one-third an estimated 178 million children under age 5 living in developing countries have stunted growth. Nearly all of these children live in Asia (111.6 million) and Africa (56.9 million). Africa is the only continent in which malnutrition among children is rising, but child malnutrition remains most pervasive in Asia. (Black, 2008). In 2010, 7.6 million children under five died, down from 8.1 million in 2009, 8.8 million in 2008 and 12.4million in 1990.About half of the child deaths occur in Africa and according to UNICEF,

most of these deaths result from one or a combination of infections diarrhea, measles, malaria and malnutrition.

A recent analysis on malnutrition clearly indicates deteriorating nutritional situation for young children in Sub-Saharan Africa. The under nutrition burden contributed to 1.1 million deaths in children under-five years. (Horton, 2010).About 40% of the children under five years are stunted and 22% are underweight. Worldwide, 36 countries account for 90% of stunted children of these, 21 countries are in Africa. (Grantham et al, 2007). In comparison to other regions in the world, the prevalence of malnutrition in Sub Saharan Africa has not decreased in the last 20 years, (UNICEF, 2008). In Kenya, malnutrition rates are critical with a quarter of all children in some districts mainly Nyanza being acutely malnourished (KDHS, 2008/09). Survey data shows that the nutritional status of children under five has improved only slightly in the past few years. At the national level, 35 percent of children under five are stunted (low height-for age), up from 33% in the 2003 survey while 7% of children are wasted (low weight-for-height) up from 1% 2003 and 16 percent are underweight (low weight-for-age) down from 20% in 2003. (KDHS, 2003) (KDHS, 2008/9). Severe malnutrition is also a major problem in Siaya community, with rates estimated at 2.5 to 5% in children less than 36 months of age.

Severe malnutrition predisposes affected children to various infections, which worsens hence complicating their management and outcome (Sunguya et al, 2006). Children who are poorly nourished suffer up to 160 days of illness each year, (UNICEF, 2008). Under nutrition magnifies the effect of every disease, including measles and malaria. The estimated proportions of deaths in which under nutrition is an underlying cause are roughly similar for diarrhea (61%), malaria (57%), pneumonia (52%), and measles (45%) (Black 2003, Bryce 2005). Malnutrition also worsens infections, such as those that cause diarrhea, by reducing the body's ability to convert food into usable nutrients and is worse for children because unlike adults who have limited energy reserves, children have a high energy need per unit of body mass and furthermore, children have a need for growth, which puts them at a particularly high risk of malnutrition because of these higher demands. The likelihood of developing serious nutritional deficiencies is therefore high and increases when the child is admitted to the hospital for longer periods of time (Koen&Hulst, 2008).

The adverse effects of malnutrition include physical and developmental manifestations. Poor weight gain and slowing of linear growth occur. Impairment of immunologic functions in these children mimics those observed in children with AIDS, predisposing them to opportunistic and other typical childhood infections. Malnutrition also delays recovery from disease and injury, predisposes children to infections, poor wound healing and also reduces well-being, independence and impairs bodily functions. (Stratton, 2007).

1.3 Research questions

1. What is the prevalence of malnutrition among the children aged 6-60 months admitted at Siaya District Hospital pediatric ward?

2. What illnesses are responsible for admissions of children admitted in the pediatric wards?

3. What is the quality of food given to children admitted in the pediatric ward?

4. What is the per capita allocation for children admitted in the pediatric ward?

1.4 Broad objective

To determine the prevalence of malnutrition and related factors among children aged 6-60 months admitted to the Siaya district hospital pediatric ward.

1.5 Specific objectives

1. To determine the prevalence of malnutrition in children aged 6-60 months admitted at the Siaya District Hospital pediatric ward.

2. To determine causes of child morbidity in the pediatric ward.

3. To describe the quality of diets provided to children in the pediatric wards.

4. To determine the socio-economic and socio-demographic characteristics of the parents of children admitted at the Siaya District Hospital pediatric ward.

5. To estimate the per capita day allocation for food in the pediatric ward.

1.6 Study variables

Dependent variable

Nutritional status as measured by nutritional status indicators of weight for age (WAZ), weight for height (WHZ) and height for age (HAZ). The cut off points used to define malnutrition was below-2 Z scores for moderate malnutrition and -3Z scores for severe malnutrition

Independent variables

The independent variables which were investigated in this study included: Parental socio demographic characteristics (level of education, marital status and occupation) and the socioeconomic status of the parents/caregivers. Other factors investigated were the illnesses responsible for the admission of study children at the Siaya District Hospital, the quality of food provided to the children admitted at the hospital including food prepared at the hospital and that which is brought from home and the per capita day allocation in the pediatric ward.

1.7 Justification of the study

Malnutrition has devastating consequences for the growth and development of the children. It reduces a child's immunity making them susceptible to a number of infections for example pneumonia, tuberculosis and diarrhea which further increases the probability of getting those conditions. Under nutrition also plays a major role in the premature deaths of millions of children in developing countries (Black, Morris, & Bryce, 2003).Those it does not kill, it renders vulnerable to infection and disease, blighting the lives of hundreds of millions (WHO & World Bank, 2002). The mothers and fathers who stay in the wards with their admitted children are between the ages of 18 -30 years, which is the productive age group in the societies.

There is an apparent lack of awareness on need the need to assess nutritional status of children at discharge. This is based on a recent study on nationwide prevalence studies on malnutrition in hospitals in the Netherlands in May 2009 where only 60% of the patients admitted were screened at discharge (Wensier et al, 2009).

Analysis of literature reveals that malnutrition is an independent risk factor in many disease processes and that treatment of malnutrition can indeed improve the patient's prognosis. Such an analysis has to address several questions mainly the prevalence and diagnosis of malnutrition and its impact on the patient's prognosis. (Theresa et al, 2006)

The study offers knowledge on the prevalence of malnutrition as well as identifying related factors in the hospital. The information derived in this study will be useful to the SiayaDistict Hospital for sensitizing the health workers at the hospital on the importance of malnutrition in morbidity and action that can be taken at the facility level to reduce the prevalence.

The study will enable policy makers in Siaya county to develop guidelines for malnutrition screening in the hospital because clinically significant malnutrition in the hospitalized patient is not well defined and also because some children are discharged from the hospital back to the community with malnutrition and with malnutrition they are more susceptible to disease and the malnutrition infection cycle continues. Early detection of patients at risk for or at an early stage of malnutrition provides an opportunity to avoid the more complex and costly interventions required as nutrition deficiencies reach an advanced stage.

The study will also advocate for support in the Siaya District Hospital and other district hospitals in Kenya for nutrition screening programs by providing data to hospital administrators that demonstrate their benefits. Nutrition screening that identifies malnutrition at an early stage may reduce hospital stay to provide its own cost justification and improve outcomes.

2.0 LITERATURE REVIEW

2.1 Introduction

Malnutrition is the insufficient, excessive or imbalanced consumption of nutrients. A number of different nutrition disorders may arise depending on which nutrients are under or over abundant in the diet. Malnutrition is to blame for more than half of all the deaths of children around the world including deaths caused by diarrhea, pneumonia, malaria and measles, (Better nutrition could save millions of kids study, 2004).Poor nourishment leaves children weakened and vulnerable to infections that do not have to be fatal.

Malnutrition remains a significant contributor to morbidity and mortality among children worldwide in spite of global efforts at achieving adequate nutrition. The World Health Organization estimated that malnutrition was associated with over 50% of all childhood deaths in developing countries. (WHO, 2009).In Kenya, the nutritional status of children under 5 years of age has not significantly changed over the past decade. An estimate of the prevalence of malnutrition indicates that about 35% of the Kenyan children are stunted or too short for their age, this indicates chronic malnutrition, stunting is more common in rural 37% than in the urban areas 26%. Stunting is least common among children of more educated mothers and those from wealthier families. Wasting which is a sign of acute malnutrition far less common, 7% and sixteen percent of Kenyan children are underweight or too thin for their age (KDHS, 2008/09).

District hospitals have an important role in reducing mortality (Snow, 2000), but resources are often limited and care may be of limited quality. (Nolan, 2001). Proper nutrition in childhood can reinforce lifelong eating habits that contribute to a child's overall wellbeing and help them to grow up to their full potential and a healthy life. Under nutrition in children mostly occurs between the ages of 1 and 3 years when the diet is grossly deficient in protein. The condition often develops in association with the weaning period when the child is taken from the breast and is placed mainly on a starchy diet. This may be a staple food like cassava or rice, wheat and maize which have very low protein content (Mugyambusa, 1996). Children's appetites begin to diminish around one year, consistent with the slowing growth. Thereafter, children spontaneously vary their food intakes to coincide with their growth patterns; they demand more food during periods of rapid growth than during slow growth. Individual children's energy needs vary widely, depending on their growth and physical activity. (Whitney and Rolfes,

2002).Portion sizes are also very important as, a one year old child needs about 1000kcalories a day; a three year old needs only 300kcalories more. By age ten, a child needs about 2000 calories a day. A balanced diet of nutritious foods can meet children's needs for vitamins and minerals with the notable exception of iron. To prevent iron deficiency, children's foods must deliver approximately 10 milligrams of iron per day (Whitney and Rolfes, 2002). Studies in low income communities demonstrate that nutritional support for malnourished children reduces mortality, in addition to resulting in weight gain during the hospital stay irrespective of the disease responsible for admission. (Geila, 2006).

Hospital stay also has an impact on the nutritional status of children. A study done in Asia in the city of Fortaleza to evaluate the nutritional status of children at hospital admission and again at hospital discharge found that prolonged hospitalization and pneumonia was linked with weight loss in hospital. Children who had malnutrition on admission were still malnourished at discharge. (Geila, 2006). The greatest frequency of weight loss was observed among children with pneumonia, 76.27% of 59 children and despite the majority of them presenting adequate nutritional status on admission this was probably because of long periods of fasting prior to tests, failure to recognize the increased energy requirements because of infection and primarily because of the lack of routines at health services for indicating nutritional therapy as an obligatory medical prescription irrespective of the prior nutritional status of the patient. (Geila, 2006).

A study done in Gambia on the nutritional status of children admitted to the pediatric wards with different diseases found that malnourished children are more susceptible to several infectious diseases frequently seen in developing countries and nutritional interventions, as well as standard treatment, may improve outcome.(Man, 1998). And yet another study done in rural Kenya on the nutritional status of hospitalized children suggested that malnutrition is still a major contributor for the major causes of childhood death in rural Kenya, despite recent global improvements in health because most of the direct causes for admission that were attributable to malnutrition were infectious diseases which were then recorded as the primary diagnoses by clinicians. The mechanisms by which malnutrition predisposes children to infections were recently reviewed it is possible that associated micronutrient deficiencies were important. (Bejon, 2008). A study done at the Siaya District Hospital in 2006 found that 1,202 children under five years old admitted to the hospital were diagnosed with the presence of severe wasting

and oedema and that severe malnutrition is a common condition among children admitted to hospitals in East Africa (Sunguya, Koola, and Atkinson, 2006). A different study done in the coastal region of Kenya reported a prevalence rate of severe malnutrition at 16% at Kilifi District Hospital. (Berkley, 2002). Another study done in the central hospital paediatric wards of Maputo aimed at describing and comparing the patients on the malnutrition ward in 2001 and back in 1983 found that malnutrition is the fourth commonest reason for hospital admission to the paediatric hospital and has the second highest death rate of 20 percent.

2.2 Child feeding practices

The period from birth to 2 years is widely recognized as the critical period, during which growth faltering and micro nutrient deficiencies can occur. Nutritional vulnerability during this period results from poor breastfeeding and complementary feeding practices, coupled with high rates of infectious diseases. The nutritional quality of foods offered is often poor relative to nutritional requirements. (PAHO/WHO, 2003).

From birth to 6 months, breast milk is adequate, appropriate and recommended feed for infants (WHO, 2011).However, from 6 months, breast milk is no longer sufficient to meet the nutritional needs of infants and therefore other foods and liquids along with breast milk are needed. It is recommended that adequate frequency of feeds by age with sufficient amount of nutrient dense foods are given. Other foods like margarine, milk, eggs or meat should be appropriately added to increase the nutrient density and palatability of food (MOPHS, 2009)

Feeding variation by age with nutritious snacks in between the feeds is recommended to meet the increasing nutrient demand due to rapid growth (MOPHS, 2009). Food colorings can be used to improve the visual appearance of the food making it appear more appetizing and fun looking for children (Whitney and Rolfes, 2002)

2.3 Feeding practices at the health facility

The provision of hospital meals is a complex and difficult operation within the health care industry. Catering systems can have a major effect on the nutritional intake of hospitalized patients where the potential for malnutrition is well recognized. The public generally view hospitals as institutions and institutional catering that are poor in patient satisfaction. The hospital food service is multifactorial and difficult to assess particularly because each patient has his/her own expectations. Some studies have shown that food quality is the most important

indicator whereas others suggest that interpersonal or service aspects are the most pertinent (Hartwell, 2007). Unfortunately hospital food service has an image problem and even before tasting any food, patients generally expect poor quality (Hartwell & Edwards, 2006). Even the diets of hospital dietitians were found to contain inadequate amounts of vitamin B6 even when measured by the already low RDA standard for that vitamin. (Erasmus, 1993).

Malnutrition during hospital admission is a risk factor for unfavorable outcome, prolonged hospital stay, increased costs and delayed recovery. In addition, a significant proportion of patients have sub-optimal nutritional intake compared with their needs during hospitalization. In these patients, the incidence of complications such as nosocomial infections, poor ventilator function, and prolonged bed rest is increased. Mortality has been shown to be up to 8 times higher and dependency at discharge up to 3 times more frequent (Campanozzi, 1998).

Hospital stay also has an impact on the nutritional status of children affected by mild clinical conditions. Children already malnourished on admission are found at risk for further nutritional deterioration during their hospital stay and in all groups of children identified by their BMI Z-scores at admission, nutritional status declines progressively (Campanozzi, 1998).

2.4 Nutrient Deficiencies

Inadequate dietary intake of both macronutrients (fat, protein, carbohydrates) and micronutrients (vitamins and minerals) has serious implications for health and well-being. Micronutrients play a large role in immune function. Insufficient macronutrient intake can result in growth stunting (in children) as well as weight loss. Micronutrients such as vitamin A, zinc and a large number of others are essential to a number of immune responses, and deficiencies can lead to suppressed immunity, which in turn increases risk of acquiring infections. In addition, inadequate dietary intake can also weaken immune response through changes in mucus membranes of the body; mucosa linings are an essential part of our defense against infection and damage increases susceptibility to infection. Also deficiency in these macronutrients such as protein, carbohydrates and fat provoke protein-calorie malnutrition (PCM), and when combined with micronutrient deficiencies, they are among the most important nutritional problems with hundreds of millions of pregnant women, elderly and young children particularly affected. In South Africa, poor households are known to spend a disproportionate portion of their income on staple foods,

primarily maize meal. Fruits and vegetables are generally considered less essential and are more expensive. This may increase the risk of micronutrient deficiencies (Arimond and Ruel, 2004).

According to the World Health Organization, the most important micronutrients in terms of health consequences for poor children in developing countries like Kenya are: Vitamin A without which deficiency can cause night blindness and reduces the body's resistance to disease. In children Vitamin A deficiency can also cause growth retardation. Between 100 and 140 million children are vitamins A deficient. An estimated 250,000 to 500 000 vitamin A-deficient children become blind every year, half of them dying within 12 months of losing their sight.(WHO, 2009).

Iron deficiency is a principal cause of anemia. Two billion people-over 30 percent of the world's population-are anemic, mainly due to iron deficiency, and, in developing countries, frequently exacerbated by malaria and worm infections. (WHO, 2011). For children, health consequences include premature birth, low birth weight, infections, and elevated risk of death. Later, physical and cognitive development is impaired, resulting in lowered school performance. For pregnant women, anemia contributes to 20 percent of all maternal deaths (WHO, 2011). Iodine deficiency disorders (IDD) jeopardize children's mental health– often their very lives. Serious iodine deficiency during pregnancy may result in stillbirths, abortions and congenital abnormalities such as cretinism, a grave, irreversible form of mental retardation that affects people living in iodine-deficient areas of Africa and Asia. IDD also causes mental impairment that lowers intellectual prowess at home, at school, and at work. IDD affects over 740 million people, 13 percent of the world's population. Fifty million people have some degree of mental impairment caused by IDD (WHO, 2011).

2.5 Malnutrition and Infections

Infection and malnutrition have always been intricately linked. Malnutrition is the primary cause of immunodeficiency worldwide and more is being discovered about the pathogenesis of this interaction (Katona and Katona, 2008). Micronutrient deficiencies have effects such as poor growth, impaired intellect, and increased mortality and susceptibility to infection. (Katona and Katona, 2008) The worldwide magnitude of parasite infection is enormous. It is understood that parasites may lead to malnutrition, but the extent to which malnutrition causes increased parasite infestation is not known; thus the conditions need to be addressed together. (UNICEF, 2006).

Malnutrition is also the cause of immunodeficiency worldwide with infants, children, adolescents, and the elderly most affected. There is a strong relationship between malnutrition, infection and infant mortality, because poor nutrition leaves children underweight, weakened, and vulnerable to infections, primarily because of epithelial integrity and inflammation. Five infectious diseases-pneumonia, diarrhea, malaria, measles, and AIDS-account for more than one-half of all deaths in children aged less than 5 years. It is therefore important to remember that a decreased immune function is not always a defective one, and many indicators of nutritional status are not reliable during infection. (UNICEF, 2006).

Children with severe malnutrition are more prone to infections than well-nourished children. This is due to nutritionally acquired immune dysfunctions syndrome, in which a child becomes immune compromised and is likely to suffer from bacterial fungal and other infections. (Ibtisam, 1998). A study done in Kibera slums in Nairobi, found that nearly half of the study children in Kibera were found to be infested with gastro-intestinal parasites, with the prevalence of the *Ascaris lumbricoides* being the highest. Infestation of *Ascaris lumbricoides* was found to affect the nutritional status of the study children significantly (Ibtisam, 1998). Reduced food intake during the period when calories and proteins are required most, due to increased depletion of body nutrients stores by increased metabolism such as fever, loss of appetite and reduced nutrient intake can lead to moderate and severe PEM. There is increased demand of nutrients and direct loss through vomiting, diarrhoea, mal-absorption and altered metabolism. Therefore the interaction between malnutrition, poor feeding practices and infections are closely linked (WHO, 1998).Malnutrition is one of the most important underlying causes of child mortality in developing countries, particularly during the first 5 years of life the major causes for this are poverty, world conflicts, lack of education, natural disasters and poor access to health care. Protein calorie malnutrition PCM usually manifests early in children between 6 months and 2 years of age and is associated with early weaning, delayed introduction of complementary foods, a low-protein diet and severe or frequent infections. (Kwena et al, 2003).

The nutritional status of children often declines after admission to the hospital resulting in early and serious consequences such as slowing of growth and increased susceptibility to various infections. Although hospital acquired malnutrition is usually associated with a risk of adverse clinical events and a longer hospital stay leading to higher health care costs, it is a problem that remains largely underestimated and often unrecognized by health care workers (Campanozzi,

2009). For many infections, malnourished subjects are more likely to develop severe clinical manifestations, are at greater risk of complications and take much longer to recover than well-nourished persons). The vicious circle of malnutrition in hospital shows; increased morbidity, increased major complications, increased mortality, increase in care prolongation, return to compromised home food supply prolongation/ Aggravation of malnutrition, increased length of stay and decreased access to services (Cunningham, 2007).

The interrelationship between under nutrition and child morbidity is in such a way that on one hand, nutritional deficiencies increase the susceptibility of the child to infectious diseases such as diarrhea, fevers, and malaria, and on the other hand, illness can suppress a child's appetite leading to under nutrition. (Esendi et al, 2006). The consequences of this pattern are poor physical and mental development, and possibly death. Child morbidity and malnutrition have similar determinants which include poor maternal health during pregnancy, poorly-resourced health systems, food insecurity, inadequate and inappropriate feeding practices, lack of hygiene, and poor access to safe water. At a distal level, these determinants may be influenced a range of factors such as female literacy, early marriage and childbearing, food taboos, and proximity to essential health and social services and yet little research has been done indicating the effects of these issues, on child malnutrition and morbidity. (Esendi et al, 2006).

Malaria and under-nutrition are the two major causes of childhood mortality in sub-Saharan Africa. Each year, malaria kills more than 800,000 people annually, of which 91% of them reside in Africa and 85% of them are under five children. On the other hand, under-nutrition is considered to be the underlying cause for more than 50% of deaths of under-five children. In Ethiopia, malaria and malnutrition are the top causes of morbidity and mortality in under-five children. (WHO, 2008). In Kenya, 8% of children under five have symptoms of an acute respiratory infection (ARI) and of these, 56% receive treatment at a health facility or from a health provider. (KDHS, 2008/09).

Malaria deaths may also be attributed to other co-infections; the actual number of deaths due to malaria may be as high as three million. The majority of malaria deaths occur among young children. About 85 percent of malaria deaths occur in children under the age of five, mostly in Africa. (WHO, 2009). The relationship between malaria and under-nutrition is debatable. Although a number of observations have indicated a deleterious effect of malaria on nutritional

status, it is still unclear whether and how nutritional status influences malaria-related morbidity. Earlier observational studies provided some evidence of protective effect of under-nutrition against malaria However; more recent studies have presented inconsistent findings. Dean and colleagues in Gambia and Friedman and colleagues in Kenya reported that under-weight was not associated with infection with malaria. Another study in Gambia showed that nutritional status was not associated with the occurrence of malaria. (WHO, 2008).

Malaria remains a major cause of morbidity, anemia and mortality worldwide. It has long been acknowledged that populations living in malaria's areas generally live under conditions that lead to poor nutritional status. The groups at highest risk for the adverse effects of malaria are children and pregnant women and are most affected by poor nutrition. It has also been suspected that nutrition might influence susceptibility to infection by the malaria parasite or modify the course of disease. (Anuraj and Shankar, 2000).

Diarrhea also ranks with acute respiratory infection as one of the top five causes of childhood death in developing countries. Acute respiratory infection (ARI) is also one of the leading causes of childhood morbidity and mortality throughout the world. Early diagnosis and treatment with antibiotics can prevent a large number of deaths caused by ARI. (KDHS, 2008-09).

Each year, there are more than 150 million cases of childhood pneumonia and nearly two million children under five lose their lives to an acute bout of pneumonia or another acute respiratory infection. Pneumonia is the leading cause of death for children under the age of five – more than AIDS, malaria and measles combined. (UNICEF, 2010). Ninety-five percent of all pneumonia infections in children under the age of 5 occur in developing countries. Most deaths due to pneumonia will occur in developing countries where poor children's immune systems are already weakened by malnutrition and other diseases, including malaria, measles, or HIV/AIDS. (Wardlaw et al, 2006).

Most episodes of childhood diarrhea last one to seven days and are characterized by frequent, loose, or watery stools. Deaths associated with this type of diarrhea result from dehydration and the excessive loss of fluid from the body. The relationship between diarrhea and malnutrition is bidirectional, diarrhea leads to malnutrition while malnutrition aggravates the course of diarrhea. A longitudinal study from Egypt found that diarrhea was unlikely to have a major impact on the prevalence of malnutrition. Childhood infections are frequently associated with reduced dietary

intake. This effect is most prominent in children with diarrhoea. (Wierzba et al, 2001). Another study from Gautemala has found that diarrhoea was associated with a reduction of daily dietary intake of 160 calories and 3 g of protein for children between the ages of 12 and 60 months. The reduction in children with respiratory infections was considerably less (67 calories and 1 g of protein per day). (Brown, 2003).

Diarrhea and malabsorption are important complications of HIV infection that contribute to the high morbidity and are a common complication in young HIV infected children with diarrhea disease mortality. Episodes of diarrhea are often complicated by severe malabsorption. Lactose malabsorption Thirty to sixty percent of these children has evidence of lactose malabsorption. In the presence of persistent diarrhea disease, it is advisable to use low lactose feeds. In the absence of diarrhea however lactose containing feeds are usually tolerated. (Brown, 2003).

Most deaths are caused not by the diarrhea itself but by the fluid losses and nutritional effects that accompany diarrhea. The most important interventions during diarrhea are, therefore, the replacement of fluid losses and continued feeding during the episode, and increased catch-up feeding following the episode. Feeding during diarrhea not only supports nutrition but also shortens the diarrhea episode. Caregivers have trouble feeding a child with decreased appetite during diarrhea and in this case, the best strategy may be to encourage larger and more frequent feedings when the appetite returns and the child starts to get better, (Brown, 2003).

Children with diarrhea often lose their appetites and may lose weight. However, a study done in the city of Fortaleza in children with diarrhea exhibited a lower percentage of weight loss despite having an increased prevalence of malnutrition on admission and despite the condition being one that causes alterations to the integrity and permeability of the intestinal mucosa, leading to malabsorption. This is probably due to the nutritional support given these children with special high-energy diets during their hospital stays. (Geila, 2006). Persistent diarrhea (lasting 14 days or more) or recurrent diarrhea can lead to death through negative effects on nutrition status. Several studies have shown that children with persistent diarrhea are more likely to die than children with diarrhea of shorter duration. A strong relationship exists among persistent diarrhea, malnutrition, and mortality. (Geila, 2006).

An estimated 2.1 million children under age 15 are infected with HIV; more than 200,000 young children become infected with HIV each year. More than 95 percent of HIV-infected infants

acquired their infection in utero (before birth), during delivery, or through breast milk. About one-third of infected infants die within one year and more than half die before age two years unless they receive treatment. In 2008, about 200,000 children under the age of five died from AIDS-related causes and nearly all lived in sub-Saharan Africa. (UNICEF, 2007).

Globally, infectious diseases manifested as either acute or chronic illnesses are responsible for high morbidity and mortality. Poor nutritional status can influence the incidence and severity of infectious diseases. It is common to find malnourished hospital patients for whom other clinical problems dominate the view of doctors and nurses who fail to recognize it due to lack of training in this matter.

The WHO has developed Integrated Management on Childhood Illnesses (IMCI) guidelines to help health workers in first level facilities in developing countries to identify and manage sick children. These rely on several key symptoms and clinical signs. Length or height is not usually measured in primary level clinics because it is time consuming and difficult to do accurately. The IMCI guidelines recommend that health workers identify severe PEM by the presence of visible severe wasting and bipedal oedema. If these signs are present, admission to a specialist centre is recommended. If these signs are not present, nurses then assess weight for height using a growth chart. Children with very low weight are given nutritional advice and outpatient follow-up (Hammer, 2004).

2.6 Child mortality

The child mortality rate or under five mortality rate is the number of children who die by the age of five per thousand live births per year. In 2009, the world average was 60, (6.0%) down from 68, (6.8%) in 2007, (UNICEF, 2010).The level of under-five mortality in Kenya was found to be 74 deaths per 1,000 births during the five-year period before the survey, implying that at least 1 in every 14 children born in Kenya during the period died before reaching their fifth birthday. Mortality rates also differ by province, The under-five mortality rate for the 10 year period before the survey ranges from 51 in central province to 149 in Nyanza province.(KDHS, 2008/09). The infant mortality rate recorded in the survey was 52 deaths per 1,000 live births. According to UNICEF, most of these child deaths are from developing countries and are preventable and result from the following causes or combinations of acute respiratory infections, diarrhea, measles, malaria and malnutrition (UNICEF, 2008). According to WHO, the main

causes of the deaths are, Pneumonia, diarrhea, malaria, measles and HIV. Malnutrition is estimated to contribute to more than one third of childhood deaths .A study done in a Chad hospital to evaluate the nutritional status of children less than 5years showed that mortality was significantly higher in severely malnourished children. (Renaudin, 1997).

2.7 Cost allocation in health care

Direct and indirect costs

Costs in health economic evaluations are commonly classified into direct medical costs (or direct health care costs), direct non-medical costs (or direct non-health care costs), and indirect costs (or productivity losses). Direct costs refer to the resource consumption in the provision of health care interventions. They encompass the entire current resource use and, depending on the timeframe under direct costs are further split into direct medical and direct non-medical costs. Direct medical costs refer to the resource consumption in the health care sector associated with the provision of health care interventions. Resource consumption includes, for example, the costs of hospital stays, outpatient visits, drugs, medicinal substances and devices. Direct non-medical costs refer to resources supporting the medical services delivered in the health care sector. Depending on the perspective, these can be, for example, travel costs to medical interventions or the valuated time spent by patients and their family caregivers in relation to their illness. Indirect costs denote the production losses due to incapacity for work (in the case of illness); occupational disability (in the case of long-term illness or disability); and premature death. (Quality and efficiency in health care, 2009)

Economic costing: Societal, patient and provider perspective

Economic costing can be calculated from 3 perspectives: The three broad components of cost comprise the socio-economic costs of health care associated infections (HAI) are: direct medical costs, the indirect costs related to productivity and non-medical costs, and intangible costs related to diminished quality of life. The vast majority of economic and cost analyses of HAI focus primarily on direct medical costs as these costs directly impact hospital finances. (Scott, 2009)

The societal perspective is the broadest perspective. All costs are included, regardless of who will incur them: health insurance, other social insurance schemes, patients and their family's time and travel expenses or employers' productivity losses. The perspective of social insurance schemes considers only the costs directly involved, in other words, neither the costs that the insurants have to pay themselves nor any indirect costs resulting from productivity losses. A cost analysis from the perspective of the provider uses data from the provider, based on costs generated by the specific program. This information can guide and inform decisions based on true program operational costs and actual program funding needs. From the perspective of the provider, indirect costs refer to the costs of operating and of maintaining the facility (Rusell, 1999). Indirect costs are commonly referred to as overhead costs. This is because indirect costs can add a substantial amount to program costs, it is important to include these costs in an analysis based on the provider's perspective. From the patient perspective, patient out of pocket expenditure (OOPE) covers an important part of total health care costs. (Hulsemman, 2005).

3.0 STUDY METHODOLOGY

3.1 Study design

This was a descriptive cross sectional study aimed at establishing the prevalence of malnutrition and related factors among children aged 6-60 months admitted at Siaya District Hospital, pediatric ward.

3.2 Study area

Siaya District Hospital is a level four (4) facility situated in Siaya County about 80km west of Kisumu town. The facility serves a large population of rural people and it is run by the Ministry of Medical Services (MOMS). The hospital was put up by the government in 1975 to be a referral hospital for the larger Siaya district. The hospital is situated on a 20 acre piece of land and has a bed capacity of 202 beds distributed as follows, Male ward- 42 beds, Female ward-42 beds, Pediatric ward-52 beds, Maternity ward- 32 beds, Amenity ward- 35 beds and Psychiatric ward- 9 beds. The Siaya District Hospital is a resource constrained setting with limited health management service fund (HMSF).

Although there are many development initiatives in Siaya district, poverty is still a major challenge. Patients in Siaya District Hospital are disadvantaged because of the current state of Siaya in terms of food security, limited government funding and the burden of disease itself. Regular food shortages in this area are mainly attributed to low agricultural productivity partly due to the effect of HIV/AIDS which has produced large numbers of orphans, widows and widowers.

The hospital has an annual outpatient workload of 99,232 and annual inpatient workload of 100, 95 admissions and an estimated catchment population of 49,831 as per 2009/2010. (Siaya District Medical records, 2008/09). The monthly average number of patients admitted in the paediatric wards is 280. A number of services are provided: Outpatient clinics- casualty department, VCT for HIV/AIDS, ART clinics, chest clinics, maternal and child health (MCH) clinics, antenatal (ANC) clinics, diabetes clinic, eye unit, dental unit, Ear, Nose and throat (ENT) clinic, immunizations and psychiatric consultations. Inpatient Wards- medical, surgical, orthopedics, pediatrics, obstetrics and gynecology, maternity, imaging, physiotherapy, occupational therapy, laboratory, theatre and pharmacy.

The pediatric department admits and reviews children who are 12 years and below. In the pediatric ward, infants and young children of 12 years and below with various medical problems are admitted. Pediatrics outpatient and child welfare clinic have specialists that review children five years and below with various conditions, monitor their growth and developments and provide immunization to them.

The top ten causes of morbidity in Siaya District Hospital are: malaria, acute respiratory infections, skin diseases, gastroenteritis, eye infections, pneumonia, ear infections, urinary tract infections and sexually transmitted infections and the top five causes of morbidity in the pediatric ward are: malaria, pneumonia, gastroenteritis, anemia and malnutrition. (Siaya District Hospital medical records, 2008/09).

3.3 Study population

The study population comprised of

1. All children admitted at the Siaya District Hospital pediatric medical ward.

2. Hospital staff (medical superintendent, nutritionist, nurse in charge and the cateress).

3.4 Inclusion criteria

1. Children aged 6- 60 months.
2. Children who were admitted in the Siaya District pediatric ward6.
3. Children whose mothers/caregivers gave consent to participate in the study.
4. Hospital staff who gave consent to participate in the study.

3.5 Exclusion criteria

1. Children whose mothers did not provide consent and assent were excluded from the study.

3.6 Sample size determination

The following Fisher's formula was used to determine the sample size.

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

Where,

n - Minimum sample size.

Z - is the table value for standard normal deviate corresponding to 95% significance level (= 1.96).

p – Prevalence of characteristic being estimated (in this case, prevalence of acute malnutrition, = 7%) (WHO Guidelines for Integrated Management of Acute Malnutrition in Kenya, 2009).

d – Margin error, set at ± 0.05

$$n = \frac{1.96^2 \times 0.07 \times 0.93}{0.05^2}$$

$$= 100$$

100+ 15 allowance for spoilt data= 115

3.7 Sampling Procedure

Simple random sampling using the admission register was employed in this study in each of the subdivisions in the pediatric ward that was visited. Purposive non probability and systematic probability sampling was then be utilized. The eligible children were those aged 6 to 60 months and those who met the inclusion criteria. The selection was done as follows:

Stage 1: Selection of hospital and ward

Siaya District Hospital was purposively selected, since it is one of the poorest districts in Kenya and other problems within the community include low farm productivity, high rates of unemployment, and most strikingly, resource-constrained health facilities due to poverty. In addition to being one of the poorest districts in Kenya, Siaya District also has one of the highest rates of morbidity and mortality in the country due to infectious diseases, (KDHS 2008/09).Paediatric ward was purposively selected since this is where children aged 6- 60 months are admitted.

Stage 2: Selection of the children from the ward

In the ward, systematic sampling was utilized to select eligible children who met the inclusion criteria. Admission books in the pediatric ward were utilized. The interval was every 2nd child in the admission books in the pediatric ward. The first two children in the register books and admission books in the ward were selected at random by balloting to determine the starting point. Data was collected until the required number of eligible (115) children in the ward was reached. It took 12 days to get the sample of 115 children admitted in the pediatric ward.

3.7.1 Sampling Interval

To determine the interval for systematic sampling, the sample size was divided by the total population of children aged 6- 60 months who met the inclusion criteria and were admitted at the pediatric ward.

3.7.2 Sampling Frame

A sampling frame was used because all the units from the sampling frame could have an equal chance to be drawn and to occur in the sample.

The sampling frame was all the children aged 6-60 months together with their caregivers in the study area and those whose caregivers gave consent for the study.

3.7.3 Sampling unit

The sampling unit included all mothers with eligible children and mothers who gave consent for the study.

3.8 Study methods

3.8.1 Key informant interview

Interview with the medical superintendent on how the money comes and that which is allocated to food in the pediatric wards to calculate the per capita. Interview with the nutritionist on the content of the hospital menu and specifically the pediatric ward menu to analyze the quality of food.

3.8.2 Direct observation

Observation of the hospital menu to assess the quality of foods served using the main food groups, micro and macronutrients present in the foods. A review of the hospital budgets and the

store keeper's records over the last l year to estimate the per capita allocation per patient per day. A direct observation of food service to the pediatric ward and measured all foods served at the pediatric wards for two weeks. I also reviewed the admission registers and patients files for morbidity patterns.

3.8.3 Questionnaire

Questionnaires were administered and they comprised of the parental and child's demographic characteristics, the parent's age, the child's age, sex, date of birth, weight, and height, marital status of the parents, maternal education and occupation, paternal education and occupation was also present in the structured questionnaire. The questionnaire also provided information on social and economic factors, the assets owned by the family mainly livestock and land. Social factors provided information on feeding practices in the hospital.

3.9 Data collection tools

3.9.1 Anthropometry Assessment

The instruments for assessment of anthropometric measurements of weight and height/length were: Salter scales for weighing the children and length mats for taking length/height of the children.

3.9.2 Anthropometric assessment procedure

Weight

The weight measurements were taken upon discharge. Each research assistant was equipped with a Salter scale with a maximum capacity of 25 kilograms with demarcations at every 100 grams. Children were weighed without clothes, suspended in plastic pants their feet were off the ground. Two readings that did not differ by more than 0.1 kilograms were taken and the average of the two computed later.

Height/length

The heights were taken upon discharge. A plastic length mat was used to take the recumbent length of children who were less than five years old. Two research assistants correctly positioned the child and ensured accurate measurement of height. Two readings that did not differ by 0.5 cent-meters were taken and their averages computed. Height measurements were taken using a

length mat for children who were over 24 months and are bed ridden. The heights were taken upon discharge.

3.10 Process of cost estimation

The average unit cost for each procedure of the economic costing (per capita day methods) was calculated from the provider perspective of the economic costing methods based on costs generated specifically from kitchen services.

Cost estimation was based on a four-step process: Identification of resource consumption, measuring resource consumption, valuation of resource units and calculating total costs of intervention options. In principle, all four steps could were integrated and total costs derived in a single step. However, the four-step process is recommended because executing separate steps is more likely to support comprehensive cost estimations (although collecting cost data sometimes is easier than separating it into quantification of resource use and valuation of unit costs).

Per capita day costing formula

Direct costs (x) + Indirect costs(y) = Operational costs

3.11 Recruitment and training of research assistants

Two research assistants who were Bsc food and nutrition interns were recruited from the Siaya District Hospital to collect data. They were frequently available in the hospital, were not fully involved in the hospital duties, had competency in carrying out interviews and taking the anthropometric measurements. Both the research assistants were trained by the investigator prior to data collection and the following areas were covered during the training: Sampling techniques, interview technique for collecting data, basic medical ethics, and taking of anthropometric measurements weight and height.

The objective of the training was to familiarize the research assistants with skills and knowledge of all the aspects of the study. The training also involved them doing some exercises and tasks to ensure a comprehensive understanding of the logistical and practical issues involved in implementation of the study.

3.12 Data collection, Cleaning and Entry

The data collection tools were pre tested at the Mbagathi District Hospital in the month of April 2010 to check for validity. Data for the main study was collected in the month of July-September 2010. The data was collected within 1 month and was cleaned on each day of collection by going through the questionnaires to check for completeness and then entered into the excel computer data sheet. The trained research assistants used standardized and internationally described methodology and anthropometrically examined each subject.

3.13 Data analysis and presentation

The data was analyzed using the statistical package for social sciences (SPSS). Descriptive statistics was used to summarize the data. Frequencies of all the variables was generated and used for checking the outliers. The anthropometric statistical programme (WHO anthro) was employed to convert raw anthropometric measurements or data (weight, height or length of the children) into anthropometric indices of WAZ, WHZ, and HAZ and was compared with the WHO reference data. The frequencies and the variables generated from SPSS were then cross tabulated with the nutritional status of the children to generate p values and chi squares.

3.14 Ethical considerations

Permission to carry out the research was sought from the KNH/ UON ethics and research committee. Consent was sought from respondents who were requested to sign the consent form. Since children are not able to make decisions on informed consent, authorization was sought from the next of kin, the child's primary caregiver during admission. All actions undertaken regarding the child in this study were part of the normal service delivery actions that would be done under normal circumstances in the hospital setting.

3.15 Data quality control

To ensure quality data, the research assistants were trained on how to collect data to standardize the procedure, supervision of data collection and ensuring informed consent and confidentiality.

Project monitoring and evaluation to ensure completeness and internal consistency of data was carried out. All measuring equipment was checked periodically during the study period to prevent instrumental errors that could arise due to faulty equipment.

3.16 Study limitations

About 5 caregivers declined to participate in the study out of the fear of participating in the CDC projects and having biological samples drawn from them.

Although the food frequency in this study concentrated on the qualitative and not on the quantitative aspects of the diet, the findings of the study gave some useful information that can be built upon in another study.

Data collection in the kitchen was not very successful especially when it came to weighing foods to be taken the pediatric wards and also weighing the leftover foods as planned.

3.17 Dissemination plan

The results of the study are presented as a dissertation to the University of Nairobi and thereafter to the Siaya District Hospital management. Copies of the report will also be kept in the University of Nairobi main library for references. The study will also be published in scientific peer reviewed journals for public access.

4.0 RESULTS

4.1 Introduction

The results presented in this chapter are derived from data obtained from the structured questionnaires from115 respondents, direct observation and key informant interviews with the medical superintendent and the nutritionists. The chapter has 10 subsections. Section1 is introduction. Section 2 describes the demographic profile of the study respondents and the socioeconomic profile of the respondents and sections 3 to 10 contain the results of the study as captured for each of the six study objectives. Univariate statistics were used to describe the respondents' characteristics. Further inferential statistics is highlighted showing how nutritional indicators, WAZ WHZ and HAZ scores interacts with the independent variables.

Out of the 115 children participating in this study, 6 died while still in the study. From these mortality cases, 66.6% were of children aged 6-12 months and again of the 6 cases, 66.6% all had a component of malnutrition in them diagnosed as follows, malaria and severe malnutrition, severe kwashiorkor in immuno suppression, marasmic kwashiorkor asthma and malaria, anaemia diarrhoea cases all had a component of malnutrition. All the six children who died were girls.

4.2 Demographic characteristics of the parents

This section describes the parent's socio demographic characteristics. The questionnaire was completed by 115 respondents.

4.2.1 Maternal and paternal age

The ages of the mothers covered in the study ranged from 16 to 49 years. The mean age of the mothers was 25.43 with a mode of 19 and standard deviation of 7.0. Most of the mothers, 62 (53.9) % were aged between 15-24 years thus representing over half of the entire sample. Only 14 mothers were over 35 years.

More than half of the fathers in the study were over 35 years. The ages of the fathers ranged from 20 to 69 years old. The fathers had a mean age of 36.05 years, a mode of 27 and a standard deviation of 9.8. Only 9 (10.5%) were less than 24 years and 31(36.7%) were between ages 25-35.

4.2.2 Maternal and paternal education level

More than 80% of the study mothers had attained only primary education. 7 (6.1%) had no formal education and only 17(15%) had post-secondary education.

At least 39 (45.3%) of the fathers in this study had attained post-secondary education. Only 6(6.9%) had no formal education while 41(47.6%) had only attained primary education.

4.2.3 Maternal and paternal occupation

Almost half, 43 (40.1%) of the study mothers were housewives. 15(14%) were self-employed, 39(36.4%) were cash crop farmers and only 4(5.6%) had formal employment.

At least 23(38.3%) of the study fathers were cash crop farmers. 10(16.6%) were casual employees and 19(31.6%) were self-employed. 5(8.3%) of the fathers had formal employment and only 3(5%) had no form of employment.

4.2.4 Marital status

More than 70% of the mothers interviewed were married (72.1%). About 20% of the study mothers were single, never married while less than 10% were widowed or divorced.

Table 1: Demographic characteristics of the parents

Socio-demographic characteristics	No	%
Maternal age		
< 24 years	62	53.3
25- 35 years	39	33.9
>35 years	14	12.1
Total	**115**	
Education level		
No formal education	7	6.1
Primary education	89	78.6
Post-secondary education	17	15.0
Total	**113**	
Maternal Occupation		
Cash crop farming	39	36.4
Formal employment	4	5.6
Casual employment	6	3.7
Self-employment	15	14.0
Housewives	43	40.1
Total	**107**	
Marital status		
Single		
Married	83	72.1
Divorced/widowed/separated	25	21.7
Total	7	6.0
	115	
Paternal age		
< 24 years	9	10.5
25-35 years	31	36.7
>35 years	45	52.9
Total	**85**	
Education level		
No formal education	6	6.9
Primary education	41	47.6
Post-secondary education	39	45.3
Total	**86**	
Paternal Occupation		
Cash crop farming	23	38.3
Formal employment	5	8.3
Casual employment	10	16.6
Self-employment	19	31.6
No employment	3	5
Total	**60**	

4.2.5 Socio economic characteristics

The study used proxy indicators of wealth rather than the actual income due to the difficulty in the economic status of this rural study population. The economic status of the population was determined using only land and livestock ownership.

4.2.5.1 Land and Livestock ownership

More than 50% (74%) of the care givers households had land, while 15% had never had any land. The median of land ownership was 1acre per person.

About 74% of the respondents owned livestock (cows, goats, sheep and chicken). Only 3 households did not have any chicken. The mean of chicken was 7 per household which was the main livestock owned. Less than half of the respondents, 26% did not own any livestock.

4.3 Demographic characteristics of the study children

The ages of the children in the study ranged from 6 months to 59 months. The mean age of the children was 18 months with a mode of 6 months and SD of 14.0. The ratio of male to female children in the study was 1:1.

Table 2: Distribution of study children by age and sex

Age(months) **All =115**	**Boys**		**Girls**		**Total**	
	no.	**%**	**no.**	**%**	**no.**	**%**
6-11	27	47.4	30	51.7	57	49.6
12-23	7	12.3	12	20.7	19	16.5
24-35	13	22.8	5	8.6	18	15.7
36-47	6	10.5	6	10.3	12	10.4
48-60	4	7.0	5	8.6	9	7.8
Total	**57**	**100.0**	**58**	**100**	**115**	**100.0**

4.4 Nutritional status of the children

The nutrition status of children was assessed using the indicators of weight -for age Z score, (WAZ), weight- for- height Z score, (WHZ) and height- for -age Z score HAZ. The girls were 58 (50%) and boys were less than girls by one, 57 (49.5%). Anthropometric measurements of weight and height were collected upon discharge from the hospital.

4.4.1 Prevalence of acute malnutrition

Wasting or acute protein energy malnutrition indicates the failure to receive adequate nutrition during the period immediately before the survey due to recent episodes of illness by study children or from acute food shortage. In this study, this was assessed using WHZ indicator.

The prevalence of moderate acute malnutrition WHZ -2SD was 18.4% (95% CI: 18.4- 36%). The children aged 24-35 months were the most affected with a prevalence of 44.4%, (95%CI: 18.7-70%). The prevalence was lowest among the children aged 6-11 months with a prevalence of 19.6%, (95% CI: 7.7-31.55). The prevalence of acute severe malnutrition WHZ<-3SDamong the children, both sexes combined was 14.2% (95% CI: 7- 21.3%) This was highest among the children aged 24-35 months whose prevalence was 33.3% (95% CI: 8.8-57.9%). The children aged 48-60 months followed closely with a prevalence of 28.6%, (95% CI 0-69.2%). The prevalence was lowest among children aged 6-11months.

Table 3: Prevalence of Acute malnutrition both sexes

Age groups All =115	**N**	**Weight-for-length/height (%) z scores**	
		% < -3SD(95% CI)	% < -2SD(95% CI)
	106	14.2(7,21.3)	18.4(18.4,36)
6-11	51	7.8(0,16.2)	19.6(7.7,31.5)
12-23	19	10.5(0,27)	21.1(0.1,42)
24-35	18	33.3(8.8, 57.9)	44.4(18.7, 70)
36-47	11	9.1(0, 30.6)	36.4(3.4,69.3)
48-60	7	28.6(0, 69.2)	42.9(0, 86.7)

The prevalence of severe acute malnutrition was higher among the boys 17.6% than the girls, 10.9 %. Boys in the 48-60 age group were the most affected at 33.3% followed by the boys aged 24-35 months with a prevalence of 30.8% (CI: 1.8, 59.3%). The girls aged 24-35 months were most affected with a prevalence of 40% (CI: 0- 92.9%). The prevalence of moderate acute malnutrition was also higher among the male than female children, the male children reported a prevalence of 33.3% (CI:19- 47%) as compared to their female counterparts whose prevalence was 21.8% (10-33.6%). The male children aged 24-35 years reported a higher prevalence of 30.8%, (1.8, and 59.3%) and this also applied to the female children aged 24-35, whose prevalence was 40% (95% CI: 0%, 92.9%).

Table 4: Prevalence of wasting by Sex

Males				**Females**			
Age groups	N	Weight-for-length/height (%)		Age groups	N	Weight-for-length/height (%)	
		% < -3SD (95% CI)	% < -2SD (95% CI)			% < -3SD (95% CI)	% < -2SD (95% CI)
All =115	51	17.6(6.2,29.3)	33.3(19.4, 47%)	All	55	10.9(1.8,20)	21.8 (10,33.6)
6-11	25	8(0,20.6)	20 (2.3, 37.7)	6-11	26	7.7(0,19.9)	19.2 (2.2, 36.3)
12-23	5	20(0,65.1)	40 (0,92.9)	12-23	14	7.1(0,24.2)	14. 3 (0, 36.2)
24-35	13	30.8(1.8, 59.3)	46.2 (15.2,77)	24-35	5	40(0, 92.9)	40 (0,92.9)
36-47	5	20(0, 65.1)	60(7.1,100)	36-47	6	0(0, 8.3)	16.7 (0, 54.8)
48-60	3	33.3(0,100)	33.3 (0, 100)	48-60	4	25(0, 79.9)	50 (0, 100)

The divorced, separated and widowed mothers had the highest proportion of wasted children with 28.6% severely malnourished and 14.3% moderately malnourished. Married mothers followed with 18.8% of the children severely malnourished and about 12.5% moderately malnourished. Statistical tests indicated no statistical significance between mother's marital status and stunting. X^2 = 3.254, (P=0 .776). Children of the youngest mothers in the study were more severely and moderately malnourished, 21.3% and 14.8% respectively. The older mothers in the study, more than 35 years had 16.7% children with severe malnutrition and 16.7% with moderate malnutrition. Test of significance indicated no statistical significant association between maternal age and stunting.X^2 = 3.864, (P= 0.695). The prevalence of wasting was highest among children whose mothers had only attained primary education at 19.5% for severe wasting and 13.8% for moderate wasting. Mothers who had attained secondary and post-secondary education had 12.5% with severe malnutrition and 6.3% with moderate malnutrition.

The youngest fathers in the study, less than 24 years had the highest proportion of wasted children with 26.7% severely malnourished. The oldest fathers in the study had 11.9% of children severely malnourished. There was no correlation in paternal age and wasting. X^2 = 10.482, (P=0 .106). Most of the severely wasted children belonged to the fathers who had no formal education, 33.3% followed by those who had attained post-secondary education at 24.3%.

Most of the wasted children were from homes which had one or more cows. At least 17.1% children coming from homes which had at least one or more cows were severely malnourished

and 29.8% children from homes that had 1 or more cattle were at risk of malnutrition and none of the children who came from homes that did not have cows was severely wasted while 16.7% were moderately wasted. Test of significance indicated no significant association between presence of cows and nutritional status of the children.X^2 =4.468 (p=0.215).

4.4.2 Prevalence of Underweight

The prevalence of underweight WAZ <-2SD was 24.3%, (95% CI:16.1,32). The most affected were children aged 12-23 months with a prevalence of 40.9%,(95% CI 18.1,63%). The least affected were children aged 6-11 months with a prevalence of 22.2%, (95% CI 10.2, 34%). The prevalence of acute malnutrition, underweight, WAZ% < -3SD was 11.3% (95% CI: 5.1-17.5%). Children aged 12-23 months were the most affected with a prevalence of 27.3% (95% CI 6.4-48.2%).

Table 5: Prevalence of underweight sexes combined

Age groups All =115	**N**	**Weight-for-age (%)**	
		% < -3SD (95% CI)	% < - 2SD (95% CI)
	115	11.3 (5.1, 17.5)	24.3 (16.1, 32)
6-11	52	5.6 (0, 12.6)	22.2 (10.2, 34)
12-23	21	27.3 (6.4, 48.2)	40.9 (18.1, 63)
24-35	17	11.1(0, 28.4)	22.2 (0.2, 44.3)
36-47	11	16.7 (0, 41.9)	25 (0, 53.7)
48-60	8	0 (0, 5.6)	0 (0, 5.6)

The male children had a higher prevalence of severe underweight 12.3%, (95% CI: 2.9- 21.1%) as compared to the female children who had a prevalence of 10.3% (95% CI: 1.6-19%). The children aged 36-47 months were most affected among the girls with a prevalence of 16.7% (95% CI: 0- 54.8%). The male children aged 12-23 months were the most affected with a prevalence of 42.9%, (95% CI: 0, 86.7%).

The prevalence of underweight WAZ %<-2SD was also higher among the boys 29.8% than girls 19%. Both boys and girls aged 12-23 years had the highest prevalence of 57.1% (95% CI: 13.3 - 100%) and 33.3% (95% CI: 6.1- 60.5) respectively.

Table 6: Prevalence of Underweight by Sex

Males				**Females**			
Age groups All=115	N	Weight-for length/height (%)		Age groups	N	Weight-for-length/height (%)	
		% < -3SD (95% CI)	% < - 2SD (95% CI)			% < -3SD (95% CI)	% < - 2SD (95% CI)
	57	12.3(2.9,21.1)	29.8(17.1, 42)	All	58	10.3 (1.6, 19)	19 (8, 29.9)
6-11	27	3.7 (0, 12.7)	33.3 (13.7, 53)	6-11	27	7.4 (0, 19)	11.1 (0, 24.8)
12-23	7	42.9 (0, 86.7)	57.1(13.3,100)	12-23	15	20 (0,43.6)	33.3 (6.1,60.5)
24-35	13	15.4 (0, 38.8)	23.1 (0, 49.0)	24-35	5	0(0, 10)	20 (0, 65.1)
36-47	6	16.7 (0, 54.8)	16.7 (0, 54.8)	36-47	6	16.7 (0, 54.8)	33.3 (0, 79.4)
48-60	4	0 (0, 12.5)	0 (0, 12.5)	48-60	4	5 (0, 10)	25 (0, 10)

There was no significant association between maternal age and underweight status of the children. None of the children belonging to the youngest fathers, less than 24 years was severely malnourished compared to their older counterparts in the study with 11.1% severely malnourished, 11.1% moderately malnourished and 26.7% at risk of malnutrition. Test of significance indicated no statistical significant association between paternal age and underweight. $X^2 = 4.424$, (P= 0 .619) .The highest proportion of underweight children was most prevalent among mothers who were less than 24 years with 12.9 % children severely malnourished and 8.1% moderately malnourished. Among the older mothers more than 35 years only 7.1% children were severely malnourished and 7.1% were moderately malnourished. Statistical tests found no significant association between maternal age and underweight $X^2 = 3.514$, (P=0 .742).

The single mothers had the highest proportion of underweight children with 20% severely malnourished and 18.2% moderately malnourished. The divorced, widowed and separated mothers followed with 14.3% severely malnourished. Married mothers also had the lowest proportion of underweight children. Test of significance indicated no statistical significant association between mother's marital status and underweight. $X^2 = 4.123$, (P=0.660). Like wasting, mothers who had only attained primary education had the highest proportion of underweight children with 13.5% severely wasted and 7.9% moderately wasted.

The older fathers in the study more than 35 years had the highest proportion of underweight children at 11.1% for severe underweight and 11.1% for moderate underweight. None of the

children belonging to the youngest fathers in the study had severe underweight. Test of significance showed no statistical significance between underweight and the father's age. X^2= 4.424, (p= 0.619).

Children from homes which had at least one or more cows had a higher proportion of underweight children as compared to children from households that did not have any cows with 12.1 children severely malnourished compared to none of children from households with one or more cows. Almost half, 44.4% of children from homes that had no cows were at risk of malnutrition and 27.6% from homes which had at least one or more cows were underweight. X tests showed no statistical significance between presence of cows in the home stead and stuntingX^2= 7.233, (p=0 .065).

4.4.3 Prevalence of Stunting

The prevalence of stunting % <-2SD was 27.4% (95% CI: 18.4 - 36%). The most affected were children aged 24-35 months with a prevalence of 44.4 % (95% CI: 18.7%, 70%). The prevalence of stunting% <-2SD was 14.2%, (95% CI: 7- 21.3%). Children aged 6-11 months were the most affected with a prevalence of 7.8 % (95% CI: 0- 16.2 %).

Table 7: Prevalence of Stunting sexes combined

Age groups All =115	**N**	**Length/height-for-age (%)**			
		% < -3SD	(95% CI)	% < -2SD	(95% CI)
	108	14.2	(7, 21. 3)	27.4	(18.4, 36)
(6-11)	51	7.8	(0, 16.2)	19.6	(7.7, 31.5)
(12-23)	19	10.5	(0, 27)	21.1	(0.1, 42)
(24-35)	18	33.3	(8.8,57.9)	44.4	(18.7,70)
(36-47)	11	9.1	(0, 30.6)	36.4	(3.4,69.3)
(48-60)	7	28.6	(0, 69.2)	42.9	(0, 86.7)

More boys than girls were stunted. The male children had a stunting prevalence of 15.1% (95% CI: 4.5- 25.3%) and the female children had a prevalence of 14.5 % (95 CI: 4.3 – 24.2%). Both boys and girls aged 6-11 months were most stunted with a prevalence of 20.8%, (95% CI: 2.5, 39.2%) and 26.9%, (95% CI: 8, 45.9) respectively.

Table 8: Prevalence of stunting by Sex

Males				**Females**			
Age groups All=115	N	Weight-for-length/height (%)		Age groups	N	Weight-for-length/height (%)	
		% < -3SD (95% CI)	% < -2SD (95% CI)			% < -3SD (95% CI)	% < -2SD (95% CI)
	53	15.1 (4.5,25.3)	32.1 (18.6, 45)	All	55	14.5 (4.3, 24.2)	29.1 (16.2, 42)
6-11	24	20.8 (2.5,39.2)	45.8 (23.8, 67)	6-11	26	26.9 (8, 45.9)	38.5 (17.8, 59)
12-23	7	14.3 (0, 47.4)	57.1 (13.3, 100)	12-23	14	0, 3.6 (0, 10)	0 (0, 10)
24-35	13	15.4 (0, 38.8)	15.4 (0, 38.8)	24-35	5	10 (0, 10)	0 (0, 10)
36-47	5	0, 10 (0, 10)	0 (0, 10)	36-47	6	16.7 (0, 54.8)	33.3 (0, 79.4)
48-60	4	0 (0, 12.7)	25 (0, 12.5)	48-60	3	0 (0, 12.5)	50 (0,100)

Most of the stunted children belonged to the youngest mothers in the study, less than 24 years with 17.7% of children severely stunted and 11.3% moderately stunted. The oldest mothers in the study over 35 years did not have any stunted child. The proportion of stunting among children of mothers in different marital status differed greatly. Single mothers had the highest proportion of stunted children with 24% severely stunted and 8% moderately stunted. The divorced, widowed and separated mothers followed with 14.3% of the children severely stunted and 28.6% of the children moderately stunted. The married mothers had the least number of stunted children. Test of significance indicated no statistical significant association between mother's marital status and stunting. $X^2 = 5.188$, (P= 0.520). Like in wasting and underweight, the highest proportion of stunted children belonged to the mothers who had only attained primary education with 16.9% severely stunted and 9.0% moderately stunted. Only 5.9% of children whose mothers had secondary and post-secondary education were severely stunted.

The older fathers in the study who were above 35 years had the highest number of stunted children as compared to their younger counterparts. Fathers in this age group had 13.3%, 4.4% and 31.1% children with severe, moderate and at risk of malnutrition respectively. The youngest fathers in the study less than 24 years had the least number of children with stunting. Test of significance indicated no statistical significant association between paternal age and stunting. $X^2 = 12.221$, (P= 0.057).More stunted children belonged to the fathers with primary education

17.1% children were severe, 12.2% were moderate and 19.5% were at risk of stunting. X^2 tests showed no statistical significance between paternal age and stuntingX^2= 3.008, (p= 0.808)

Almost half of the children, 44.4% from households that did not have any cows were stunted and 12.1 from households that had at least one or more cows were stunted.

4.5 Child morbidity and mortality

The most common illnesses reported for the study children admitted at the Siaya District Hospital were malaria (62.6%), respiratory tract infections (27.3%), and anaemia (23%), malnutrition mainly kwashiorkor, marasmus and marasmic kwashiorkor (22%), diarrhoea and vomiting 12%, convulsions and meningitis (9%) and other illnesses as reported in (table 9).

Table 9: Child Morbidity pattern

Disease/ Illness	**Frequency**	**(n=115) %**
Malaria	72	62.6
RTI, Pneumonia and Bronchitis	30	27.3
Anemia	26	22.6
Malnutrition	25	21.7
Diarrhea and vomiting	14	12.1
Convulsions	10	8.7
Meningitis	10	8.7
Fever	5	4.3
ISS/HIV	4	3.5
Dehydration	4	3.5
TB	3	2.6
Sepsis	2	1.7
Dysentery	1	1
Delayed milestones	1	1
Dermatitis	1	1
Helminthic infection	1	1
Diabetes	1	1
Congestive cardiac failure	1	1

The top five illnesses were malaria, respiratory tract infections pneumonia and bronchitis, anaemia, malnutrition mainly kwashiorkor, marasmic kwashiorkor, diarrhoea and vomiting. More than half 62.6% of the study children were admitted with malaria. On analysis, there was a

high statistical significance between malaria and wasting. χ^2 = 16.729, p= .001.There was also a correlation between malaria and stunting, χ^2 = 10.489, p= .015.The prevalence of upper respiratory tract infections was also high with 27.3% of the study children affected.

Anemia ranked third with 22.6% of the children diagnosed with Anemia. However, none of the children was admitted with anemia as a single diagnosis, all the 26 children were admitted with anemia either as anemia and malaria or anemia and kwashiorkor.

Clinical assessment of malnutrition was mainly done by the clinical officers and nurses in the hospital using clinical signs of malnutrition at the point of admission. Kwashiorkor was reported in 14% of the study children and marasmic kwashiorkor was reported in 7% of the children. There was no correlation inkwashiokor, marasmus and marasmic kwashiorkor.

Diarrhea and vomiting was the fifth most common illness among the study children with 12.1% of the children affected. Further analysis showed no statistical significance between diarrhea and vomiting with underweight, stunting or wasting.

Child Mortality

Out of 115 children recruited in the study, 6(5.2%) deaths were recorded at the time of the study. Four out of six of these cases were of children aged 6-12 months. Out of the 6 cases, 66.6% were diagnosed with malaria and severe malnutrition, severe kwashiorkor in immuno suppression, marasmic kwashiorkor asthma and malaria, anaemia diarrhoea cases all had a component of malnutrition. All the six children who died were girls.

4.6 Food consumption in paediatric ward

4.6.1 Quality of food and menu

The food consumption pattern of the children admitted at the Siaya District Hospital pediatric ward indicated that both the food provided in the hospital and that brought from home was not balanced because it mainly consisted of carbohydrate foods. The same meals were served every day. It was also observed that the meals were irregular. Breakfast would be served between 7.30am and 8.00am, while lunch would be served between 12.00 noon and 1.00pm. Similarly, dinner was served at different times between 5.30pm and 6.30pm. As indicated in Appendix 5 and pictures 1-4.

The children admitted at the hospital consumed food from either home or provided at the hospital as indicated in appendix 5. At the paediatric ward and other wards in the hospital the same meals were served every day for breakfast, lunch and supper. This brings about monotony and some children therefore would consume food brought from home or from the local food vendors neighboring the hospital.

The meals served in the pediatric ward were also limited in variety. Millet Porridge was provided every day for breakfast at 7.30 am. Toto diet comprised a mixture of beans with rice was served for lunch at 12.30 noon. The rice and beans that was mixed to make the toto diet was the same as that served for all the other patients in the hospital, the only difference was that the children's was mixed together in the kitchen before serving. When potatoes were available, the beans were mixed together with the potatoes. Dinner was served between 5.30 and 6.00 pm, ugali was served with kales for all the patients.

A review of the hospital menu indicated that on Wednesdays, beef was served with kales and ugali. During the research, beef was not available and was substituted with potatoes and beans in (Appendix 5). From home, children received foods mainly *mandazi, chapatti, chips, bread, ripe bananas and cakes, tea with milk and fresh cow's milk* which they consumed at the time of their choice.

4.6.2 Appearance and palatability of food

The finger millet porridge prepared for breakfast was thin, prepared with minimal flour than expected in the water and had little sugar added to it for taste. The beans were boiled overnight and wilted in onions, some fat and tomatoes the following day after preparing the breakfast. A direct observation indicated the beans were only boiled but not fried with any onions and tomatoes as indicated in the menu. The beans looked dry and did not have any soup in them.

For dinner, ugali was served with kales. Ugali was prepared in the early afternoon and by the time it was served at 5.30 pm, it was almost cold. The kales were cut up in large shreds. The kales also looked dry and sometimes were overcooked until the colour changed from grass green to olive green.

4.6.3 Types of food consumed

Proteins

For breakfast and midmorning, children were provided with foods consisting over diluted tea with very little milk in it. Other children consumed whole milk brought from home by the caregivers. During lunch time and mid afternoon, the children ate beans prepared in the hospital, 8% of the study children received milk and some yoghurt from home. For dinner the children were served with beans prepared in the hospital and some of the children drank milk brought from home. (Table 10).

Carbohydrates

For breakfast, children ate carbohydrate rich foods mainly consisting of millet porridge served in the hospital, bread, *chapatti*, *mandazi*, chips from home and polished rice from the hospital. For dinner, the children were served with *Ugali* prepared in the hospital.

Table 10: proportion of children consuming food from different food groups

Meal (N=115)	**Foods groups and number of children who ate food from each of the 3 food groups**							
	Proteins (n=51) %	Carbohydrates (n=91) %	Vitamins (n=0) %	proteins & carbohydrates (n=70) %	proteins & vitamins (n=3) %	Carbohydrates & Vitamins (n=18) %	Protein, carbohydrates &vitamins (n=1) %	Nothing (n=111) %
Breakfast	21	54	0	15	0	0	0	25
Lunch	11	17	0	39	0	5	0	43
Supper	19	20	0	16	3	13	1	43

Micronutrients

For breakfast, midmorning and lunch, none of the children received any source of vitamin either from the hospital or brought from home. Only 1(0.8%) of the 115 children ate a balanced diet consisting of the required macro and micronutrients. (Table 9).

4.6.4 Nutritionist's views on quality of food in the wards

There was a general observation by both nutritionists, the intern nutritionist and the facility nutritionist interviewed that the food prepared in the pediatric ward was not adequate, was of poor quality and could not aid in the quick recovery of sick children. The only nutritionist employed in the facility complained about her futile attempts to try change the pediatric ward menu during DHMT meetings. She also complained about being left out during the planning and budgeting process for food done monthly during DHMT meetings. *I don't know the last time I went to the kitchen, I gave up long time, the kitchen staff is not cooperative and they will neither listen nor take up my suggestions on improving food. I wish trained personnel would be employed to run the diet kitchen; it would be easier to work with trained kitchen staff.* Both nutritionists also agreed that the quantity of food prepared is inadequate. *I don't understand why the food is never enough, it looks like they never get the patient numbers right. Some patients even miss food; Back in 2003 the patients were given fruits at least once a day either at lunch or supper time I don't know what changed. You have been going to the kitchen for over a week now, have you seen the foods prepared during DHMT meetings and many other meetings, they eat such nice food compared to what patients eat at their expense.*

The medical superintendent did not have issues with the quality of food served in the pediatric ward but said they could do better, He said, *we are doing our best, only 41ksh is allocated for each patient per day for food. We could probably serve a variety of foods and also improve the quality as recommended but not much is available around here, we also have limited funds.* However, he thought that if more funds were to be allocated by the government, they would improve the food and other services in the hospital.

4.7 Food and nutrition funds and per capita allocation for food in the pediatric ward

4.7.1 The procurement process

Regional (Siaya county) tenders are published in the daily papers annually. An open tender process is used which involves publishing the request for tender and receiving all submissions delivered by the deadline date. All the tenderers interested apply to be pre-qualified by a panel that constitutes the hospital administrators, the nursing officer in charge, the pharmacist in charge and the procurement officers from the district. All the tenderers' offers are negotiated and then the preferred (best) tenders are pre-qualified. Funding is then confirmed by the finance

department, and then a contract of approval is made. The selected tenderers are informed to accept or reject the tender and execute contract.

4.7.2 Per capita allocation in the paediatric ward

Source of money for food rations

Money for food rations comes from the Ministry of medical services under the Hospital Management Services Fund (HMSF) headquarters and facility improvement fund (F.I.F) which is cost sharing money derived from patient fees of which patients in the pediatric ward pay Kshs 80 per day. From the Ministry, money is sent every quarter as Authority to incur expenditure (A.I.E). The money is sent to the hospital account and payment is done through the district treasury. The signatories to the hospital account are the medical superintendent, the hospital administrator and the district accountant.

Fund allocation for food and nutrition activities in the health facility

The Ministry of Health does not allocate funds for the special needs of children with different nutritional needs. This study found that all the children receive the same diet on the same budget as other patients in other wards regardless of their nutritional status.

Per capita allocation

In this study, it was estimated that the per capita day cost for patients admitted at the pediatric ward was thirty nine shillings and fifty cents per patient per day. This included both direct and indirect costs which together gives the operational costs. The direct costs for the per capita day costing for food in the pediatric ward was the total costs of food and the per capita costs for employees involved directly in food production at the hospital, (appendix 7). The indirect costs consisted of water and electricity and the staff involved indirectly in food purchasing and production processes like in the tender process, budgeting, purchasing and supervising food production.

Direct costs (x) + Indirect costs(y) = Operational costs

X= 37ksh+ 2ksh 50 cents y= 39ksh 50 cents

At the health facility, it was also observed that some foods are purchased within the patient's budget but not consumed by the patients. The patient's food budgets also cater for guests, staff teas and lunches.

Table 11: Food rations that should have an independent budget from patients food rations budget

Food item	Persons consuming	Quarterly cost (ksh)
Chicken	HMT/ HMC(board) meetings	5,250
Eggs	Researchers	8,400
Milk	Staff tea	18,720
Beef	Board/ HMT meetings	11,250
Sugar	Staff tea	12,000
Rice	HMT/HMC(board) meetings	5000

Other food items used with unknown consumption cost and were used by the hospital personnel were found to be, cooking fat, food spices and condiments

5.0 DISCUSSION

5.1 Introduction

This chapter presents a discussion of the main findings of the study on the prevalence of malnutrition and related factors among children aged 6-60 months admitted at the Siaya District Hospital pediatric ward.

5.2 Morbidity and Mortality

The morbidity findings reflected UNICEF reports that most child illnesses, 70% in developing countries are as a result of five causes or a combination of acute respiratory infections, diarrhea, measles, malaria and malnutrition. (UNICEF, 2008). This explains why malaria, acute respiratory tract infections, diarrhea vomiting and malnutrition were the top on the morbidity list. However, most of the children were admitted with malnutrition as an underlying cause of disease which was evidenced by the analyzed nutrition indices.

Variations in early childhood morbidity and mortality exist across the provinces, with Nyanza province having the highest levels of both under-five and infant mortality rates. Almost one in seven children in Nyanza dies before attaining his or her fifth birthday compared with one in 20 children in Central province (51 deaths per 1,000), which has the lowest rate. Thus, the risk of dying before age five is almost three times higher in Nyanza than in Central province. Infant mortality is also highest in Nyanza province (95 deaths per 1,000) and lowest in Eastern province (39 deaths per 1,000). (KDHS, 2008/9)

The study also found that mortality was higher among female than male children. This is contrary to the recent KDHS, 2008/9 findings that mortality rates are generally higher for male than for female children across all childhood mortality indicators. The largest absolute difference occurs in the under-five category (90 for males and 77 for females); however, the largest relative difference occurs in the neonatal period. Boy babies are about 36 percent more likely to die in the first month of life than girl babies.

5.2.1 Malaria

Malaria was the leading cause of morbidity among the study children. There was a significant association between malaria, wasting and underweight in children; this is in support of findings of a study done in Ghana that found a moderate association between malaria and under nutrition

in children, (Crookston et al, 2010) and a study done in Kenya that found a significant overall relation between malaria and stunting in children, (Nyakeriga, 2004) this is because, under nutrition has been shown to impact both the manifestation of and susceptibility to malaria. Not all research, however, agrees that malaria and under nutrition have a relationship (Za, 2007). For example, a hospital-based study suggests a protective effect against malaria for children experiencing protein energy malnutrition. Another study has shown similar protective effects against malaria for other forms of under nutrition, (Nyakeriga, 2005). A different study though indicated that under nutrition worsens malaria morbidity and mortality (Verhoef, 2002).

5.2.2 Acute respiratory tract infections

The study found no significant association between respiratory tract infections and underweight, wasting and stunting in children. This is contrary to reports by Christie et al in 2009 on systematic search of existing literature using a variety of databases in developing countries in Africa which universally showed that children with pneumonia and moderate or severe malnutrition are at higher risk of death. The study findings are also contrary to a longitudinal study in Brazil which suggested that hospitalization, pneumonia and subsequent stunting and underweight are significantly associated with acute respiratory infections and had a negative impact on weight gain. (Silvio et al, 2008).

Acute respiratory illnesses have also been associated with a 10-20% reduction in the child's food intake. (Brown et al, 2005). This could be due to a reduction in the child's appetite as documented in a study in Peru. (Brown et al, 2005).Few studies have focused on the impact of respiratory diseases on nutrition and growth of children.

5.3 Nutritional status of the children admitted in the pediatric ward

This study established varying degrees of malnutrition at 14.2% for severe wasting and 18.4% for moderate wasting this was higher than a similar study done in Siaya District Hospital; (Bern et al, 1997) which stood at 11%.In the current study severe underweight prevalence was 11.3% and 24.3% for moderate underweight. This was comparable with the study done in Siaya District Hospital which had a prevalence rate of 25%,(Bern et al,1997).In the current study, the findings for severe stunting was 14.2% and 27.4% for moderate stunting among study children. This too was higher compared to the study done in Siaya District Hospital which had a prevalence of 18%,(Bern et al,1997).

The prevalence rates for stunting, wasting and underweight in Kenya are also high with about 35% of the Kenyan children stunted or too short for their age. Stunting is more common in rural areas at 37% than in the urban areas 26%, (KDHS, 2008/09).Wasting which is a sign of acute malnutrition was far less common at 7%.

According to KDHS, 16% of Kenyan children are underweight or too thin for their age (KDHS, 2008/09). Underweight is a composite index of both stunting and wasting and thus does not distinguish between acute malnutrition (wasting) and in Nyanza province, 15.6% of children under five years are underweight, (KDHS, 2008/09), 34% of under-fives in Kwale county are underweight and 51% are stunted, (Adeladaza, 2009) Specifically 7.3% are wasted, 33.7 are underweight, 9.3% severely underweight, 51.3% stunted and 21.7% severely stunted. (Adeladaza, 2009). In the current study, 24.3% of the children were severely underweight. The high levels of underweight, wasting and stunting among the study children may reflect food stress and the low socio economic status of the study population.

The findings of the study also support a study done by Berkley on severe malnutrition among hospitalized children in Kilifi District hospital in Kenya that found severe malnutrition to have a high mortality rate among hospitalized children in sub Saharan Africa. (Berkley, 2005). The world health organization (WHO) gives clear guidelines for the management of children with severe malnutrition and where standardized, management protocols have been followed and mortality has been reduced. (WHO, 2000).

5.4 Quality of food served in the pediatric ward and per capita allocation

5.4.1 Quality of food served

In this study, children were fed on monotonous diets. A study has shown that at around one year of age children fed on monotonous diets are still apparently satisfied with small, infrequent feedings.(Myers, 2006). During their frequent infections, they are more obviously anorectic and lose weight often. However, they do not catch up in weight between infections; their appetites seem to be inappropriately low. (Myers,2006). Lack of variety in foods consumed has been found to result in long term sensory specific satiety. By continuing to eat the same foods, one ends up reducing their overall food intake (Raynor, 2006). This could explain why 50% of the

children never ate any meals served in the hospital besides the illness also played a role in reducing appetite.

Studies have also shown that calorie consumption is higher when the meal consists of variety of foods compared with a single food type. When the food is more palatable and when it is presented in more energy-dense formulations, it will result in greater weight as well as food composition. Cues such as the sight or smell of food can stimulate appetite and promote higher consumption. Responsiveness to cues for eating has been hypothesized to prepare the body for food intake, allowing more rapid digestion when the food is consumed. (Wardle, 2003). This could also explain why the children were not very keen on eating the foods served besides the illness.

Millet porridge is rich in calcium, iron and fiber. (Lawler, 2009) However, preparing the porridge with minimal flour than expected in the water reduces the nutrient density ability to meet the child's requirements. The young children did not get enough energy from thin porridges as the nutrient density per volume of the porridge was reduced. (Luhila, 1987). The energy and nutrient content of porridge is also often too low to meet the needs of under-fives fully. This is due to the high starch content of staple foods. During cooking, the flour absorbs much water, which makes them bulky and thick. If water is added to make the porridge less thick and easier for young children to eat, its energy and nutrient content is further decreased. Children would need to eat large quantities of such diluted porridge in order to meet their energy and nutrient needs, but because of their small stomachs it is difficult for young children to consume large quantities. (FAO, 2001), thus such porridge is not adequate to meet the nutritional needs of the hospitalized children

Polished rice is a good source of energy, phosphorous and Iron. (Lawler, 2009) However, most of the nutrients and minerals in rice are concentrated in the husk and germ which is not present in polished rice which is prepared at the hospital. Ugali is also a staple starch made from maize flour as the main ingredient. It is not very nutritious because it is prepared using refined flour but is rich in energy.

Kales are nutritious vegetables with high levels of vitamin C, vitamin K, beta carotene and quite high in calcium levels too and thus it helps to boost the general immune system. However,

improper preparation and cooking of kales as observed at the hospital makes the vegetable rubbery and enhances loss of the vitamins A, K and phytonutrients present.

As WHO (2010) observes, few children receive nutritionally adequate and safe complementary foods. In many countries, only a third of breastfed infants and children aged 6-23 months meet the criteria for dietary diversity and feeding frequency that are appropriate for their age. The same proportion of children also uses fortified complementary foods or vitamin-mineral supplements as needed and increase fluid intake during illness. The feeding practice is also contrary to the Ministry of Health and Sanitation infant and young child feeding guidelines that recommends that under five year children be fed frequently on soft, favourite foods by gradually increasing food consistency and variety, increasing the number of times that the child is fed, 2-3 meals per day for infants 6-8 months of age, and 3-5meals per day for infants 9-23 months of age, with 1-2 additional snacks. Also of importance is feeding a variety of nutrient rich foods, use of fortified complementary foods or vitamin-mineral supplements as needed and increasing fluid intake during illness including more breastfeeding.

The findings are also contrary to the WHO/PAHO recommendations that children 6 months of age and older need energy-rich and nutrient-rich foods during and after illness to regain strength. These foods include meat, poultry, fish, eggs, and milk when possible. In some countries complementary foods are watery and lacking in calories and nutrients. (PAHO, 2003).

The toto diet served in the hospital must be balanced, nutritious and made soft by blending. It should also be enriched with fat/oil and milk to increase the nutrient density and energy.

Recommended sample toto diet (K.N.H diet kitchen, 2012)

Boiled beans
Boiled potatoes } blended with margarine and milk
Grated carrots

Boiled green grams
Boiled potatoes } blended with margarine and milk
Grated carrots

5.4.2 Per capita allocation

The ministry of medical services does not allocate funds for the children with different nutritional needs admitted in the paediatric ward. The health management committee budgets quarterly for the entire hospital from the facility improvement fund, (F.I.F) and authority to incur expenditure, (A.I.E), (Ministry of Health, 2002) but do not allocate any funds on nutrition. It is therefore difficult to prepare nutritious, therapeutic and adequate diets on 39 Ksh and 50 cents per patient per day when most of the patients actually need therapeutic feeding to aid in quick recovery. This per capita allocation explains why the diet was not balanced, monotonous and was limited in variety.

5.5 Social demographic factors related to malnutrition in the study children

5.5.1 Maternal characteristics

Maternal characteristics investigated in this study were age, education, occupation and marital status. Most of the mothers were young with over 50% of mothers below 24 years. This kind of age distribution was expected since only mothers with children aged between 6 – 60 months were included in the study. Age-specific fertility rates have been found to be higher within the age range of 20 – 24 in the rural areas and 25-29 in the urban areas. (KDHS, 2008/09). It is thus possible that most mothers in the current study had their children in this age range and hence were the majority.

Though there was no significant association between maternal age and the nutritional status of the children, a higher proportion of children with malnutrition belonged to the youngest mothers in the study. In underweight, 12.9 % children were moderately underweight and 8.1% were severely underweight. In stunting, 17.7% of children were severely stunted and 11.3% moderately stunted and in wasting 21.3% were severely stunted and 14.8% were moderately stunted. This findings support previous studies done in Uganda and Nairobi that showed no significant association between maternal age and nutritional status of children however, stunting and wasting were higher among children of younger mothers as compared to those of the older mothers (Efata, 2000 and Ibtisam, 1998). The fact that there was a higher proportion of children with underweight, stunting and wasting among the younger mothers less than 24 years is also similar to findings from a study done in Mbarara Uganda (Mehangye, 1999). This could be

attributed to the fact that younger mothers do not have more experience in child care as the older mothers. Younger mothers also lack the basic resources which older mothers have.

Maternal marital status

The percentage of married mothers in the study was high (83%), being 20% higher than the National level of 60%. The 21% of mothers who were single (never married at all) in the current study was lower than the national level of 30% (KDHS 2003). In the current study, no association was found between maternal marital status and nutritional status of the children. This is contrary to findings of a study carried out in Makuyu Division, MaraguaDistrict (Maina, 2006). Children, whose mothers were divorced/separated/widowed and single showed higher rates of wasting and underweight respectively than those whose mothers were married,. This is in support of a study done in Tanzania that found a higher proportion of undernourished children among unmarried mothers and divorced mothers than among the married ones, (Mugyambuso, 1996) and another study done in Kenya Mwea irrigation scheme, showed that children of married mothers were rarely chronically malnourished compared to those of single or separated mothers, (Mwadime, 1995). In yet another study in Kenya done in Brooke Bond tea estate of Limuru, found that there was high proportion of stunted children among households of single and divorced mothers than among the households of married or widowed mothers, (Kinyingi, 1988).

Maternal education

The maternal education level in the study population was relatively low with only 15% of the mothers attaining secondary education. The gap observed on prevalence of stunting, wasting and underweight from uneducated mothers or mothers who have a primary school education compared with those from mothers with secondary and post-secondary education, remains high. Education could make a difference by empowering the mother's decision on the type of nutrition.

The findings that the mother's education level had no influence on the child's nutritional status were surprising but not unexpected in a study conducted within a rural setting. A study in Uganda (Kikafunda and Tumwine 2006) found similar results. Results of the study showed no statistical significance between maternal education and malnutrition in the study children but

similar to KDHS findings that found the mothers educational level to have an inverse relationship with the three nutritional indicators WAZ, HAZ, WHZ because the prevalence of underweight, wasting and stunting was highest among mothers with only primary education. Children of mothers with secondary education were found to have the lowest levels of stunting and underweight, (19.3%) and 10.6% respectively while (34.2%) and (34.5%) of children whose mothers had no education at all were also found to have children with the highest proportion of wasting (12.8%) compared to (2.8%) of wasting among children whose mothers had primary education, (KDHS, 2008/2009).

The study findings were also contrary to a study done in lower Nyakach region in Kisumu where the prevalence of stunting was higher among children of educated mothers than among those not educated. (Opiyo, 1993).

The prevalence of underweight and wasted children was higher among mothers with primary education. This is also similar to findings from several other studies, example being the study conducted in Makuyu Division, Maragua District by (Maina, 2006). The above results could be explained by the fact that less educated mothers earn less or have no income at all. Most of them were in fact casual laborers and house wives. Maternal education is said to increase the mothers' ability to earn income. The low level of maternal education could explain why most of the mothers are either housewives or casual laborers Also their ability to appreciate the importance of child care is low due to lack of knowledge.

Maternal occupation

The small number of mothers who were engaged in formal employment (5%) could be explained by the fact that maternal education levels were quite low with only 15% of the mothers having attained secondary and post-secondary education. This low level of education could explain why 40% of mothers in the study are housewives.

The study found no significant association between maternal employment and the nutritional status of children this is in support of a previous study in Kibera slums Nairobi (Ibtisam, 1998). The study findings are contrary to a study done in lower Nyakach, Kisumu district where there was a high significant relationship between wasting and maternal occupation. (Opiyo,1993) . The study findings can be attributed to the fact that non employed mothers earn no income and thus they depend on either the husbands, friends or relatives for their daily living, making the

household food security non reliable. The findings are also contrary to the findings of a study done in rural Iran where the nutritional status of children of mothers working outside the home was found to be poorer than that of children of non-working mothers (Fatimeh, 2000).

5.5.2 Paternal characteristics

The fact that fathers in the study were much older than the mothers can be supported by scientific studies done early where women have been found to have a higher mental capability than men, and only this age difference in the family can bring mutual understanding between the two (KDHS, 2003).

Although there was no significant association between nutritional status among the study children and paternal age, the prevalence of malnutrition was higher among children of the older fathers over 35 years than the younger fathers. This can be attributed probably to large household size since the older fathers also had more children than the younger ones because of high productivity rate as partners continue to live together. Hence the children have to share food with the other household members and this reduces the quantity and quality of food therefore access.

Level of education

The paternal education level in the study population was relatively higher with 33% of the fathers having access to secondary and post-secondary education. Paternal education is reported to increase the fathers' ability to earn income. The higher level of paternal education could explain why most of the fathers had employment in this study.

Although the findings of the study showed no significant association between paternal education level and nutritional status in the study children, the prevalence of malnutrition was higher among children of fathers who had only attained primary education. These findings are conflicting with studies done in Kenya and rural Bangladesh where there was a positive relationship between paternal education and nutrition status of children (KDHS 2003, Menon& Haddad, 1997).

Employment status

The proportion of fathers who were not gainfully employed (29%) and the low proportion of fathers who had formal employment (5%) could be explained by the fact that the study population was residing upcountry, which is a rural area with fewer job opportunities.

Although no significant association was found between paternal employment status and malnutrition in the study children, significant association has been reported in studies done in Moi teaching and referral hospital (MTRH) Eldoret and lower Nyakach, Kisumu district (Ayaya, 2004 and Opiyo, 1993).

The prevalence of stunting was higher in the current study among fathers with employment than fathers without employment. These findings are contrary to findings from others studies done in Kibera slum, Nairobi and lower Nyakach, Kisumu district (Ibtisam, 1998 and Opiyo,1993).

Among the underweight, wasted and stunted children the prevalence was higher among children whose fathers had employment. These findings support a study done in Uganda (Efata, 2000). This is because fathers who are employed are involved so much in economic activities in the expense of children welfare, leaving most of the child care activities to mothers who are low educated and do not have adequate knowledge in child care. Also these fathers have a large household size and being most of them were casual labourer their income was less and could not sustain adequate food supply.

5.5.3 Resource ownership

Amount of land owned is a measure of wealth especially in traditional societies which still depends heavily on subsistence farming for a livelihood. Most of the farmers in Siaya own poor quality land thus food produced does not depend on land owned or the size of land owned, (Kasese et al 1983). It is also acknowledged in many studies that, an increase in household income/wealth is expected to reduce child malnutrition (Alderman, 2004). In richer households, often children are well fed and cared for and provided with a safe and stimulating environment through which they are most likely to survive, to have fewer diseases and illnesses but in poorer households, most children are affected by the resurgence of kwashiorkor. This is certainly due to the increasing poverty among parents who cannot afford to buy protein foods for their children.

The study being conducted in the rural area supports findings of a majority of households (74%) owning livestock and land. This is in support of the KDHS 2008/9 that rural households are far more likely to own agricultural land or farm animals. This could be attributed to the fact that most respondents were living in the rural area and thus had enough area for grazing the livestock. It was also found that the highest proportion of respondents (53.4%) owned land with a median of 1 acre however; the highest proportion of children with malnutrition was from the families

who owned both land and livestock. These findings are contrary to the findings of a study done in MTRH, Eldoret (Ayaya, 2004).

The study also found that most of the wasted, underweight and stunted children were from homes with 2 or more cattle compared to children from homes that had none. This could be explained by the fact that cows found in that part of Nyanza are not very productive or because the parents and caregivers chose to sell the milk they get from the cows to buy foods that are less nutritious for the children

Despite the fact that resources (land and livestock) are available among these study population, women are rarely involved in the control of the resources and in decision making. A study done in rural Bomet&Muranga districts showed that although women were the main workers in the farms, they were rarely involved in the selling of produce. The study also showed that women especially those in the rural areas face many problems including gender inequality, illiteracy, legal and political discrimination. These constraints seriously limit women's involvement in all the spheres of life including childcare and access to quality of food through purchase as quality healthcare services. (Nyagawa, 1997).

5.6 Children's characteristics

Children's age

The youngest children in the study were more underweight and stunted than older children in the study. This could be explained by the fact that younger children's immunity is still immature and these increase their chances of contracting infections (UNICEF, 1998).

Children aged 24-35 months were at a higher risk of wasting, stunting and underweight as compared to children in the other age groups. This is contrary to KDHS 2008/09 findings that wasting is highest (11%) in children aged 6-8 months and lowest (4%) in children age 36-47 months.Other studies conducted earlier in Kenya have revealed high prevalence of stunting among older children than among younger children. For example, in Vihiga Division of Kakamega district, malnutrition was found to be more advanced in older children than younger children while in a study done in Lower Nyakach, Kisumu, older children were found to be significantly more underweight and stunted than younger children (Ettyang, 1988 and Opiyo, 1993). There was no correlation between nutritional status and children's age.

Children's sex

More boys than girls were suffering from underweight, wasting and stunting and the prevalence of all the three types of malnutrition was higher among boys than girls although these differences did not reach statistical significance. These findings are similar to findings done in Lower Nyakach, Kisumu (Opiyo, 1993).

These findings can be accounted for through physiological and sociological reasons. Physiologically, girls grow more precociously than boys. Sociologically, in the African context, and specifically in rural areas, the mothers, who have the responsibility of taking care of children; pay more attention to girls than to boys. This can be explained by the fact that during the process of socializing the girl-child, the mother in her concern to teach her from an early age the role of a woman will wittingly or unwittingly keep her daughter close to herself. Thus during the mother's daily domestic chores, the daughter is always beside her while the boy is somewhere else busy playing. Because the girl is always with her mother, she gets more food from the mother than the boy does. Besides, considering the fact that the coefficients are statistically more significant in the rural than the urban area, one can deduce that the care given to girls could be explained by the specific nature of rural societies, where far fewer girls go to school, and where girls help their mothers in their domestic chores from early childhood. They are more likely to enjoy special care from their parents, notably their mother.(Abalo, 2009).

Some studies also show that girls are genetically more robust than boys are. There is also some evidence that there is an increment of fat in preparation for the growth spurt. This increase of fat is greater for girls than boys (Whitney, 2002).

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents conclusions and recommendations of the study on Prevalence of malnutrition and related factors among children aged 6-60 months admitted at Siaya District Hospital pediatric ward.

6.2 Conclusions

The prevalence of severe wasting was 14.2% and 18.4% for moderate wasting which was higher than that of a similar study done in Siaya District Hospital, (Bern et al, 1997) which stood at11%.In the current study, the prevalence of severe underweight was 11.3% and 24.3% for moderate underweight. This was equal to the study by (Bern et al ,1997) with a prevalence rate of 25%. And in the current study, the finding for severe stunting was 14.2% and 27.4% for moderate stunting among the study children. This too was higher compared to the similar study done in Siaya District Hospital which had a prevalence of 18 %,(Bern et al, 1997).

Most of the stunted, wasted and underweight children were from homes that had two or more cattle as compared to those who came from homes that had none this could be because of local cows with very poor yields that the poor in that area cling to.

The top five illnesses responsible for children's admissions were malaria, respiratory tract infections, anaemia, malnutrition, diarhoea and vomiting. Malaria was the highest cause of morbidity among the study children and was found to be significantly associated with the nutritional status of the children.

The overall quality of the diet of children in this study was inadequate. Apart from the low energy and protein intake; children also had undesirable intakes of essential vitamins and minerals. The inadequacy in quality could be due to inadequate budget for patient food and low priority for nutrition as part of medical treatment and failure to adhere to the hospital menu.

The per capita consumption for patients in the pediatric ward was 39ksh and 50 cents per patient per day. The study also found that hospital staff and the DHMT have their tea breaks, monthly meetings and other guests foods catered for under patient's budget.

6.3 Recommendations

1. The DHMT should also select a quality assurance team consisting of a clinician, nurse and a nutritionist to actively participate in identification and management of children with malnutrition admitted in the facility and the trained medical staffs should be involved in sensitizing the study population on the basis of integrated management of childhood illnesses (IMCI).

2. The MOMS should deploy more qualified nutrition personnel to this facility who will be involved in taking anthropometric measurements for the children on admission, regularly after admission and upon discharge from the hospital this will enable them capture malnourished children in the hospital. The qualified nutrition personnel should also be involved in supervising food preparation and service in the kitchen and also ensuring that the hospital menu is adhered to strictly.

3. The DHMT should have a separate budget for their staff teas/ meals and should also increase the funds they allocate to food and nutrition during budgeting to increase the per capita day allocation for children admitted in the paediatric ward.

4. All children aged 6-60 months admitted in the pediatric ward should be provided with the recommended toto diet, (K.N.H 2012). Feeding frequency should also be increased in line with the MOPHS guidelines for feeding sick children.

6. There is need for further studies among the same study population to compare the nutritional status of children in homes with different livestock size. A study looking at the quantitative aspect of the children’s diet would also be useful.

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8.0 APPENDICES

Appendix 1 - Consent Form for caregivers Participation in the Study

Study title.

I Cecilia Abinya (Researcher) wish to carry out a study on prevalence of malnutrition and related factors among children aged 6-60 months admitted at the Siaya District Hospital Pediatric Wards under the supervision of Mrs. Rose Opiyo – Internal Supervisor, Lecturer School of Medicine, University of Nairobi and Dr. Richard Ayah – Internal Supervisor, Lecturer School of Medicine, University of Nairobi.

As the researcher, I am therefore kindly requesting you and your child to participate in this research study. The purpose of this consent form is to give you information to help you decide whether to participate in the study. You may ask questions on the risks and benefits of the study on your child and yourself.

Introduction

Malnutrition is a worldwide public health problem affecting the growth and development of our children who are under five-year-old and it also leads to high mortality rate in this age group. The prevalence of malnutrition is higher in developing countries, Kenya being one of them, hence the need to carry out a study on this issue affecting our society. You will be interviewed by research assistants on various socio-economic factors and institutional factors predisposing the under five-year-old children to malnutrition and the child will be weighed, height and mid upper arm circumference will also be taken to assess their nutritional status. The researcher will be available to answer any questions that arise during the study and afterwards.

The benefits of the study will help the researcher and policy makers develop specific nutritional guidelines and nutritional interventions to reduce malnutrition in under five-years-old children and develop policies and guide program managers

The risks of the study

The equipment that will be used to take weight and height of the children are not invasive and thus will cause no harm to your child. However, they may feel some discomfort during the measurements.

Information about confidentiality

All the information obtained will be held in strict confidentiality. No information of any kind will be released to any other person or agency without your permission expressed in writing. We will not publish or discuss in public anything that will identify your child and you. You are free to withdraw from the study if you so wish without any penalty.

Do you have any questions? Yes ---------- No ----------

Do you agree to participate? Yes --------- No ----------

--- --- ---

Investigator signature Investigator name Date…….

Subject statement (mother)

The study described above has been explained to me. I agree to have my child and l participate in the study. I have had a chance to ask questions about the research, to which satisfactory answers have been given. I have further been assured that if I have future questions about the research or my rights and those of my child, l can ask the investigator. I understand l can withdraw from the study at my wish without any penalty.

--- --- ---

Mother signature/ Printed name of the mother. Date

Left thumb print of the mother.

--- --- ---

Witness's signature (or left thumb print) Date: …….

Printed name of the witness. …….. Date: ……

Incase you have any questions related to the study please contact, Cecilia A Abinya, Department of community Health, University Of Nairobi, P.O Box 2621, K.N.H

OR Prof A.N, Guantai, Secretary, KNH/UON-ERC, P.O Box 20723, Nairobi.

Appendix 2 - Consent form for staff participation in the Study

Study title.

I Cecilia Abinya (Researcher) wish to carry out a study on prevalence of malnutrition and related factors among children aged 6-60 months admitted at the Siaya District Hospital Pediatric Wards under the supervision of Mrs. Rose Opiyo – Internal Supervisor, Lecturer School of Medicine, University of Nairobi and Dr. Richard Ayah – Internal Supervisor, Lecturer School of Medicine, University of Nairobi.

As the researcher, I am therefore kindly requesting you to participate in this research study. The purpose of this consent form is to give you information to help you decide whether to participate in the study.

Introduction

Malnutrition is a worldwide public health problem affecting the growth and development of our children who are under five-year-old and it also leads to high mortality rate in this age group. The prevalence of malnutrition is higher in the hospital setting hence the need to carry out a study on this issue affecting our society.

The benefits of the study will help the researcher and other stakeholders i.e. patients, health care workers, policy makers and the government develop specific nutritional guidelines and nutritional interventions to reduce malnutrition in under five years old children and develop policies that will guide the health care givers and program managers.

Information about confidentiality

All the information obtained will be held in strict confidentiality. No information of any kind will be released to any other person or agency without your permission expressed in writing. We will not publish or discuss in public anything that will identify you. You are free to withdraw from the study if you so wish without any penalty.

Do you have any questions? Yes ---------- No ----------

Do you agree to participate? Yes --------- No ----------

---------- ---------- ----------

Investigator signature Investigator name Date…….

Subject statement (staff)

The study described above has been explained to me. I agree to participate in the study. I have had a chance to ask questions about the research, to which satisfactory answers have been given. I have further been assured that if I have future questions about the research or my rights and those of my child, l can ask the investigator. I understand l can withdraw from the study at my wish without any penalty.

---------- ---------- ----------

Staff signature/ Printed name of the staff Date

Left thumb print of the staff

---------- ---------- ----------

Witness's signature Printed name of the witness. Date

(or left thumb print)

I Incase you have any questions related to the study please contact, Cecilia A Abinya, Department of community Health, University Of Nairobi, P.O Box 2621, K.N.H

OR Prof A.N, Guantai, Secretary, KNH/UON-ERC, P.O Box 20723, Nairobi.

Incase you have any questions related to the study please contact,

Appendix 3 – Letter of approval KNH/UON ethics committee

Appendix 4 – Questionnaire

1. Date of data collection (dd_ /mm_ /yy-)
2. Name of the respondent(initials)----------
3. Age of the mother(in completed years)----------
4. Marital status. ( )

   1=Married monogamous. 2=Married polygamous. 3=Single (never married). 4=Divorced/separated. 5=Widowed 6= others (specify) ---------
5. Age of the father if a member of the house-hold---------- years (in completed years).
6. Religion. ( )

   1=Catholic. 2=Protestant 3=Muslim 4= others (specify) ----------
7. Maternal educational level. ( )

   1=No formal education. 2= Primary education-not completed 3= Primary education-completed 4=Secondary education-not completed 5= Secondary education-completed. 6=College/university education. 7= others (specify) ----------
8. Paternal educational level. ( )

   1= No formal education 2=Primary education-not completed 3=Primary education-completed 4=Secondary education-not completed. 5=Secondary education-completed 6=College/university education 7= others (specify) ----------
9. Maternal occupation. ( )

   1=Cash crop farming. 2=Subsistence farming. 3= Formal employment 4=Casual labourer. 5=Self employed. 6=House-wife. 7=others (specify) ----------

10. Paternal occupation. ( )

1=Cash crop farming. 2=Subsistence farming. 3= Formal employment
4=Casual labourer. 5=Self employed. 6= No employment
7=others (specify) ----------

11. What can you tell me about your state of health? (if not sure) What do you think you might be suffering of?

12. Does the house-hold own any acreage of land? ( )

1= Yes. 2= No.

13. What is the total acreage of the farm? ----------acres

14. Does your house-hold own any of the following? If yes, how many?

1= Yes. 2= No.

LIVESTOCK	YES/NO	NUMBER
1. Cows		
2. Goats		
3. Sheep		
4. Poultry		
5. Donkeys		

15. Has the child been feeding well? YES/NO

16. List the foods eaten by the child in the last 24 hrs. (24 hr recall)

MEALS	TIME	FOODS EATEN
Breakfast		
Mid Morning		
Lunch		
Mid Afternoon		
Supper		

17. Is the child fed on food brought from home or on the food prepared in the Hospital?

18. Does the child receive a similar diet eaten in the hospital at home? YES/NO

19. How much of the food served in the hospital is consumed by the child?

    i. All the food on the plate

    ii. Half of the food on the plate

    iii. Quarter of the food on the plate

    iv. None of the food on the plate

Name of child……Sex…….Date of Birth…….Age in months…….

	On admission	
Weight (kgs)	1streading ----------	2nd reading ----------
Height (cm)	1st reading ----------	2nd reading ----------

Appendix 5- Observation checklist

1. Observation of the pediatric ward menu to assess the quality of food using the main food groups and in terms of micro and macronutrients present in the foods.
2. Analysis of the hospital budget over the last 1 year to determine the pa capita allocation.
3. Observation of the admission registers for morbidity patterns at the Siaya District Hospital Pediatric wards?

Key informant interview

With the medical superintendent on the per capita allocation.

1. How does the money come in?
   i) How often?
   ii) What is the process of purchasing the food?
   iii) How often are the foods purchased?
   iv) From where?
   v) Where are they stored?
   vi) For what period?

Key informant interview with the cateress and the nutritionist to analyze the quality of foods served in the pediatric ward.

2. To make an assessment of the menu served in the pediatric wards?
   i) Are the meals balanced having all the food groups in them?
   ii) Is there variety?
   iii) Are the meals adequate?
   iv) What are the challenges?
   v) If any, what can be done to improve?

Appendix 6 -The Siaya District Hospital menu

Meals prepared and served at the Siaya District Hospital Pediatric ward

Picture 1: Millet porridge

Picture 2:Polished rice with beans wilted in fat with onions and tomatoes

Rice with beans is served everyday for lunch.

Picture 3:Ugali with kales wilted in fat with onions and tomatoes

Ugali served with kales for dinner, Mon, Tue, Thur, Fri, Sat and Sun.

Wednesday's dinner menu

Ugali, potatoes with kales served for dinner on Wednesday. The hospital menu indicates beef is served for dinner once a week on Wednesdays with ugali and kales but when not available it is substituted with potatoes and beans as shown in picture 4.

Picture 4:Ugali, kales, potatoes and beans

Appendix 7 -Children's Diet at the Hospital

Table 11: Children's Diet at the Hospital

Meals	Foods	Food Category	Frequency
BREAKFAST	MILK	Protein	14.8%
	MILK(breast)	Protein	.9%
	PORRDGE	Carbohydrate	20.9%
	PORRIDGE	Carbohydrate	25.2%
	SODA	Carbohydrate	.9%
	TEA		1.7%
	TEA & BEANS	Proteins	.9%
	TEA & BREAD	Protein & Carbohydrate	4.3%
	TEA & CHAPATI	Protein & Carbohydrate	2.6%
	TEA & MANDAZI	Protein & Carbohydrate	5.2%
	Nothing		21.7%
LUNCH	BEANS & RICE	Protein & Carbohydrate	.9%
	BEANS & UGALI	Protein & Carbohydrate	3.5%
	BEANS& SOUP	Proteins	.9%
	BREASTFEEDING	Protein	.9%
	CHAPATI & BEANS	Chapati& Protein	.9%
	MILK	Protein	6.1%
	PORRIDGE	Carbohydrate	13.9%
	RICE & BEANS	Carbohydrate & Protein	12.2%
	Milk TEA	Protein	1.7%
	TEA & BREAD	Protein & Carbohydrate	1.7%
	TEA & MANDAZI	Protein & Carbohydrate	1.7%
	TEA&RICE	Protein & Carbohydrate	.9%
	UGALI & BEANS	Carbohydrate & Proteins	4.3%
	UGALI & CABBAGE	Carbohydrates & Vitamin	.9%
	UGALI & EGGS	Carbohydrate &Protein	.9%
	UGALI & FISH	Carbohydrate & Protein	1.7%
	UGALI &KALES	Carbohydrate & vitamins	1.7%
	UGALI & MEAT	Carbohydrate & Protein	.9%
	UGALI & PORRIDGE	Carbohydrate	.9%
	UGALI & SUKUMA	Carbohydrate & Vitamin	.9%
	UGALI & MBOGA	Carbohydrate & Vitamins	.9%
	UGALI BEANS	Carbohydrate & Proteins	4.3%
	Nothing		37.4%
SUPPER	BANANA & TEA	Vitamin & protein	.9%
	BREAST MILK	Protein	.9%
	BREAST MILK	Protein	.9%
	MILK	Protein	13.0%
	MILK & PORRIDGE	Protein & Carbohydrate	.9%
	PORRIDGE	Carbohydrate	17.4%
	RICE & BEANS	Carbohydrate & Protein	4.3%
	RICE & MEAT	Carbohydrate & Protein	.9%
	RICE &BEANS	Carbohydrate & protein	.9%
	TEA	Protein	1.7%
	TEA & BREAD	Protein & Carbohydrate	.9%
	TEA & CHAPATI	Protein & Carbohydrate	1.7%
	UGALI & BEANS	Carbohydrate & Protein	.9%
	UGALI & CABBAGE	Carbohydrate & Vitamins	7.0%
	UGALI & CABBAGE & MEAT	Carbohydrate, Vitamins and Protein	.9%
	UGALI & EGGS	Carbohydrate & Protein	1.7%
	UGALI & KALES	Carbohydrate & Vitamins	.9%
	UGALI & MEAT	Carbohydrate & Protein	1.7%
	UGALI & MILK	Carbohydrate & Protein	.9%
	UGALI & SOUP	Carbohydrate & Vitamins	.9%
	UGALI &SUKUMA	Carbohydrate & Vitamin	2.6%
	UGALI MATUMBO	Carbohydrate & Protein	.9%
	Nothing		37.4%

Appendix 8- Direct food costs for per capita day methods

Table 12: Direct food costs for per capita day methods

Meals	**Food: Quantity per meal**	**Monthly cost of food/kg**	**Daily cost= Monthly cost of food/kg multiplied by no of kgs served to pediatiric ward divided by no of children+ caregivers consuming=100**
Breakfast	Wimbi 8kg	300kg by 40ksh= 12,000	40 by 8=320/100=3.2ksh
	Sugar 2kg	5500ksh for 50kg bag =33,000 for 300kg	2kg=220/100= 2.2ksh
Lunch	Beans 10kg	7500ksh for each 90kg bag. 5bags= 37,500	10kg= 1100/100=11ksh
	Rice 12kg	5570ksh for each 350kg bag.5 bags= 27,850	12kg=191/100= 2ksh
	Cooking fat 1kg	3200ksh for each 17kg carton 5 cartons= 16000	1kg=188/100=2ksh
	Tomatoes 2kg	17500ksh	2ksh
	Onions 2kg	3200ksh	0.3ksh
	Roicko 500g	6400ksh	0.71ksh
	Salt 20g	2200	0.2ksh
Supper	Maize flour 9kg	49,000ksh for 35bales= 840kg	9kg=525/100=5ksh
	Kales 7kg	30,000ksh for 600kg	7kg=350/100= 3.5ksh
	Tomatoes 2kg	17,500	2ks
	Onions 2kg	3200ksh	0.3ksh
	Salt 20g	2200ksh	0.2ksh
Total:			**X= 34.61ksh**

Table 13: Other direct costs (Personnel)

Resource	**Quarterly pay**	**Quarterly cost (Ksh)**	**Per capita day cost (Ksh)**
1 store keeper	21,000	2.1	0.7
6 kitchen staff	108,000	3.0	1.0
Firewood	30,000	3.0	1.0

Indirect costs for per capita day methods

Table 14: **Indirect costs**

Resource	**Quarterly pay**	**Quarterly cost (Ksh)**	**Per capita day cost (Ksh)**
Electricity and water	393,989		0.1
2 hospital administrators	300,000	3.0	1.0
Nursing officer in charge	120,000	0.75	0.25
Pharmacy in charge	300,000	1.25	0.50
Medical superintendant	360,000	2.0	0.70

Direct costs (x) + Indirect costs(y) = Operational costs

X= 37ksh+ 2ksh 50 cents= 39ksh 50 cents

The per capita per day cost= 39ksh 50 cents for patients admitted in the paediatric ward to get the food below:

Diagram of patient's plate with food

Picture 1: Polished rice with beans wilted in fat with onions and tomatoes

Rice with beans is served everyday for lunch.

Table 15: **Comparison of dollar and CPI rates in June 2010 and April 2012**

Cost type	**Per capita day costs**	**Dollar rate in June 2010**	**Dollar rate in April 2012**	**CPI rate in June 2010**	**CPI rate in April 2012**
Direct costs (food)	34.61	0.42887	0.41599	97	97
Direct costs: (personnel and energy)	2ksh 7 cents	0.02565	0.02488	97	97
Indirect costs: personnel, water and electricity	2ksh 50 cents	0.03098	0.03005	97	97

Sources (Standard chartered bankYaya centre)

Appendix 9- Procedure for taking anthropometric measurements