FACTORS ASSOCIATED WITH ANAEMIA MANAGEMENT AMONG CHILDREN UNDER FIVE IN KISUMU COUNTY HOSPITAL

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Factors Associated with Anaemia Management among Children under Five in Kisumu County Hospital

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

Signature …… Date……

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This thesis has been submitted for examination with our approval as the university supervisor.

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DEDICATION

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ABBREVIATIONS AND ACRONYMS

ADR	Adverse Drug Reaction
CDC	Centre for Disease Control and Prevention
CHMT	County Health Management Team
GLUK	Great Lakes University of Kisumu
Hb	haemoglobin
HDSS	Health and Demographic Surveillance System
HF	Health facility
HIS	Health Information System
HMIS	Health Management Information System
HW	Health Worker
ID	Iron deficiency
IDA	Iron Deficiency Anaemia
IDE	Iron deficient erythropoiesis
IMCI	Integrated Management of Childhood Illness
KDHS	Kenya Demographic and Health Survey
KNBS	Kenya National Bureau Of Statistics
MA	Malarial Anaemia
MO	Medical Officer
MOH	Ministry of Health
NACOSI	National Council for Science, Technology, and Innovation
NGO	Non-Governmental Organization
PMA	Presumptive Malarial Anaemia
QA	Quality Assurance
RBCs	Red Blood Cells
SCD	Sickle Cell Disease
SMA	Severe Malarial Anaemia
SPSS	Statistical Package for Social Scientists
USAID	United States Agency for International Development

WHO World Health Organization

DEFINITION OF TERMS

Anaemia management	Refers to all health interventions offered to the patient in the hospital.
Cognitive development	This is the process of acquiring intelligence and mental skills from infancy to adulthood.
Genetic haemoglobinopathies	This is a congenital abnormality in the structure of haemoglobin.
Health status	Refers to a child who has received all necessary vaccination, deworming, and free from illnesses
Metabolism	This is the chemical process of nutrient breakdown by cells to provide energy to sustain life.
Myelination	This is the change or maturation of specific nerve cells whereby a layer of myelin forms around the axon, which allows the nerve impulses to travel faster.
Psychomotor development	This refers to the advanced skills acquisition in motor and mental activities.
Under-five	Refers to children aged from 0- 59 months.

ABSTRACT

Anaemia is one of the severe public health problems affecting both developing and industrialized countries. In developing countries, an estimated 3.5 billion people are anaemic. Anaemia in children is of particular interest since it impairs their mental, physical, and social development and causes adverse behavioural and cognitive effects resulting in poor school performance and work capacity in later years. The study's objective was to determine factors associated with anaemia among children under-five in Kisumu County Hospital. Methodology; the study utilized a descriptive cross-sectional study involving 362 caregivers of children under five admitted at Kisumu County Hospital. Systematic selection of the 362 participants and enrolment into the study. Data was collected by administering 392 questionnaires with a response rate of 99.2% response rate. The data was analysed using SPSS version 20 and presented inform of tables, pie charts, and graphs. Results indicate that 51.8% of caregivers were males while 48.2% were females. Anaemia types found were; moderate anaemia 154 (42.9%), severe anaemia 117 (32.6%) and mild anaemia 88 (24. 5%).Majority of the children were aged 0-12 months (30.6%), followed by 13-24 months (28.4%) while least 49-60 months (9.2%). Most of the caregivers (n=169 ,72.8%) had primary education as their highest level of education. In terms of their occupation, most of the caregivers had personal business (55.2%), followed by those in formal employment (15.6%) farming (10.6%) and informal employment (5.2%). Factors associated with poor anaemia management were sickle cell trait (cPR=0.3; 95%C. I [0.15,0.73], p=0.07), iron deficiency (cPR=0.7, 95%C. I [0.46-0.95] p=0.023) and being poor (cPR=0.1, 95%CI; 0.0--; p-value<0.0001). Having more than two children aged less than 5 years (cPR=1.9; 95%C. I [1.33-2.71], p<0.001) and delay in admission to the health facility (cPR=9.9; 95%CI, 5.89-16.74; P-value<0.0001) were associated with good anaemia management. In Conclusion and Recommendation, anaemia causes a high economic burden in children under five in Kisumu County. There is a need to control the comorbidities such as malaria and sickle cell disease and other factors associated with Anaemia such as iron rich food intake. There is also a need to, improve caregiver knowledge on Anaemia management, blood transfusion services, drugs availability and enhance social protection programs through economic empowerment and social insurance cover such National Social Health Insurance Fund for the indigent.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Pediatric Anaemia refers to a haemoglobin or hematocrit level lower than the age-adjusted reference range for healthy children. Physiologically, Anaemia is a condition in which reduced hematocrit or haemoglobin levels lead to a diminished oxygen-carrying capacity that does not optimally meet the body's metabolic demands. Pediatric Anaemia refers to a haemoglobin or hematocrit level lower than the age-adjusted reference range for healthy children (Powers et al., 2021). Physiologically, Anaemia is a condition in which reduced hematocrit or haemoglobin levels lead to a diminished oxygen-carrying capacity that does not optimally meet the body's metabolic demands. According to World Health organisation anaemia statistics of 2021, the global prevalence of anaemia was 29.9% in 2019 among women of reproductive age and 29.6% among non-pregnant women aged 15-49. The prevalence among children aged 6-59 months was 39.8, with the highest prevalence among these children recorded in Africa, where the prevalence was 60.2% (WHO, 2021).

Reduced red blood cell quantity and quality is a sign of anaemia, which is defined as a hemoglobin (Hb) concentration that is two standard deviations well below average for the patient's age (Li et al., 2019). The basic physiology of Anaemia is the lack of sufficient circulating haemoglobin to deliver oxygen to tissues. In tropical regions, malaria is a primary contributor of anaemia. Infection with malaria impairs the ability to recover from anaemia quickly by causing haemolysis of both infected and uninfected erythrocytes and bone marrow dyserythropoiesis. Majority of the newborns and young children, and several older children and adults, have lower haemoglobin concentrations in areas with significant malaria transmission (White, 2018). Anaemia has serious negative consequences, including increased mortality in children, decreased capacity to learn, impaired physical development, and reduced productivity in all individuals.

It's devastating effects on health, physical, and mental productivity affect the quality of life and translates into significant economic losses for individuals and nations with high Anaemia prevalence. Anaemia is one of the world's most widespread health problems (Chaparro & Suchdev, 2019).

Infants aged 6–12 months are at an elevated risk of anaemia because they are developing and growing rapidly and because the stored iron from the mother may be deficient (Li et al., 2019). Globally, the prevalence of anaemia in children is about 39.8% (WHO, 2021).

A study was conducted in Beijing to determine the prevalence of anaemia among women in reproductive age and among fewer than 5 children. In this study, a total of 1,127 6-months-old infants were enrolled at a Beijing based hospital. The study found out that the prevalence of anaemia in under-fives in Beijing was 11.8%. Compared to full-term infants, premature infants had a greater rate of anaemia. Autumn and winter births increased the incidence of anaemia in newborns. Baby anaemia rates were unaffected by birth weight. Compared to infants who were fed formula, exclusively breastfed babies had greater anaemia rates (Li et al., 2019).

Childhood anaemia is considered a severe public health problem in Sub-Saharan Africa, reaching 60.1% prevalence in 2019 (WHO, 2021), with some of the countries such as Burkina Faso exceeding 80% prevalence (Moschovis et al., 2018). Anaemia affects more than 60% of the paediatric population in several of the continent's nations (Lemoine & Tounian, 2020). An analysis of 993 children between the ages 6-59 months in Cape Verde, West Africa, with the goal of assessing the incidence of anemia and related variables, revealed a prevalence of 51.8 percent. The risk factors for anaemia included children who resided within poor household conditions, children below 24 months of age and those who had recently experienced diarrhoea (Semedo et al., 2014). Three national surveys conducted in South Africa, revealed the prevalence of anaemia in children at 28.9%, 10.7%, and 61.3%, respectively.

Anaemia was more common among 1-year-olds (52.0 percent) than the other age groups overall among children under the age of five (Turawa et al., 2021). In

Ethiopia, the prevalence of anaemia among fewer than 5 children was found to be 44.4% with the highest prevalence being among those aged 6-12 months (Sorsa et al., 2021).

The causes of Anaemia are multifactorial. Its direct causes can be broadly categorised as deficient, insufficient, or abnormal red blood cell production; excessive red blood cell destruction; and excessive red blood cell loss (Chaparro & Suchdev, 2019). Contributing causes include poor nutrition related to dietary intake leading to deficiency in iron plus deficiencies in folate, vitamins B and B12, and certain trace elements involved with red blood cell production, dietary quality, sanitation, and health behaviour; adverse environmental conditions; lack of access to health services; and poverty (Chan & Mike, 2014). Iron deficiency causes 50 percent of all Anaemia worldwide. In turn, it is mostly due to an inadequate dietary intake of bioavailable iron, increased iron requirements during rapid growth periods (such as pregnancy and infancy), and increased blood loss due to hookworm or schistosome infestation. Supplementing dietary iron with iron tablets, syrups, drops, or elixirs, and fortifying processed foods and condiments with iron is the best defence against this cause of Anaemia (Turawa et al., 2021).

Although there are many different factors that contribute to anaemia, in Africa, the frequent cause of anaemia in children under the age of five are the high rate of poverty and insufficient household food security (Turawa et al., 2021).

Other than the direct causes, there are also risk factors associated with anaemia in children. In sub-Saharan Africa, some of the risk factors for anaemia among children aged 6–23 months include lower maternal education, being male, smaller size at birth, belonging to a poor household, having less than 4 ANC visits and being born to a relatively younger mother (Seifu & Tesema, 2022).

Where fortification has been evaluated in specific populations, it has improved iron status and reduced Anaemia prevalence. In most developing countries, however, food industries are not well developed.

Where they are set, most people cannot afford to buy fortified foods. Supplementing dietary iron can meet the iron needs of vulnerable groups who do not consume fortified foods (Moustarah & Mohiuddin, 2022). Indeed, children admitted to hospital with severe Anaemia (Hb<8 g/dl) are more likely to die than children admitted without Anaemia. Anaemia is among the largest killers of children admitted to hospital in sub-Saharan Africa (Haque, 2013).

The World Health Organization (WHO) is implementing new strategies for integrating the sick child's integrated management in the primary care setting, including algorithms based on clinical signs detected by trained professional health care workers (Gera et al., 2016). As part of this algorithm, Palmer pallor is used to evaluate the presence of severe Anaemia in the absence of normal haemoglobin (Hb) measurements (Santra, 2015). The WHO's initial focus has been on using the algorithm by health care workers in health facilities. However, early recognition of moderate to severe Anaemia by the primary caregiver is essential to ensure that these children are brought to the formal health care system. Early diagnosis and appropriate treatment are necessary to reduce morbidity and mortality related to Malaria in children (White, 2018). The choice of therapy is influenced by accessibility, disease type, severity, patient's gender, and parents' educational level (Chaparro & Suchdev, 2019).

Naturally, caregivers play a pivotal role in the provision and care for childhood diseases. Since most children cannot fend for themselves, the time of intervention and quality of care received depend on the caregiver's actions and ultimately determine the outcome of a disease (Warner et al., 2017). The use of health care options has a direct influence on the outcome of severe malarial anaemia. Older children rarely get Severe Malarial Anaemia, but with the possibility of shifting ages of severe malaria attack, older children may start to present with this disease.

It will be critical to have early recognition of moderate to severe Anaemia by the primary caregiver to ensure that these children are brought to the formal health care system. The current study will assess the healthcare-seeking behaviour among

caregivers of sick children who had severe Anaemia and are ten years and below in western Kenya.

1.1.1 Etiology of Anaemia

Only three causes of Anaemia exist Blood loss, increased destruction of

RBCs (hemolysis), and decreased RBCs production. Each of these cases includes several disorders that require specific and appropriate therapy (Chaparro & Suchdev, 2019). Genetic etiologies include haemoglobinopathies, thalassemias enzyme, glycolytic pathways abnormalities, RBC cytoskeleton defects, congenital dyserythropoietic Anaemia, Rh null disease, hereditary xerocytosis, abetalipoproteinemia, and Fanconi Anaemia (Koralkova et al., 2014).

Nutritional etiologies include iron deficiency, Vitamin B-12 deficiency, Folate deficiency, Starvation, and generalized malnutrition (Bahizire et al., 2017; Tabi et al., 2019).

Physical etiologies include Trauma, Burns, Frostbite, and Prosthetic valves and surfaces. Chronic disease and malignant etiologies include renal disease, Hepatic disease, chronic infections, Neoplasia, and Collagen vascular diseases. Infectious etiologies include Viral – Hepatitis, infectious mononucleosis, cytomegalovirus, Bacterial – Clostridia, gram-negative sepsis, and Protozoal – Malaria, leishmaniasis, toxoplasmosis (Maakaron et al., 2022).

Thrombotic thrombocytopenic purpura (TTP) and hemolytic-uremic syndrome may be a cause of Anaemia (Stanley et al., 2022). Hereditary spherocytosis may either present as severe Anaemia or maybe asymptomatic with compensated hemolysis (Zamora & Schaefer, 2022). Similarly, glucose-6-phosphate dehydrogenase (G-6-PD) deficiency may manifest as chronic hemolytic Anaemia or exist without Anaemia until the patient receives an oxidant medication.

Immunologic etiologies for Anaemia may include antibody-mediated abnormalities. In the emergency department (ED), acute bleeding is the most common aetiology for Anaemia.

Drugs or chemicals commonly cause the aplastic and hypoplastic group of disorders. Certain types of these causative agents are dose-related, and others are idiosyncratic. Any human exposed to a sufficient dose of inorganic arsenic, benzene, radiation, or the usual chemotherapeutic agents used to treat neoplastic diseases develops bone marrow depression with pancytopenia (Maakaron et al., 2022).

Conversely, only an occasional human exposed to these drugs has an untoward reaction among the idiosyncratic agents, resulting in suppressing one or more of the formed elements of bone marrow (1:100 to 1:millions). With certain types of these drugs, pancytopenia is more common, whereas suppressing one cell line is usually observed with others. Thus, chloramphenicol may produce pancytopenia, whereas granulocytopenia is more frequently observed with toxicity to sulfonamides or antithyroid drugs. Current evidence, such as the fact that these patients respond to immunosuppressants, now points to an immune mechanism (Manos, 2022).

The Idiosyncratic causes of bone ”arro’ suppression include multiple drugs in each category that can be prefixed with anti- (e.g., antibiotics, antimicrobials, anticonvulsants, antihistamines). The other idiosyncratic causes of known aetiology are viral hepatitis and paroxysmal nocturnal haemoglobinuria. In approximately one-half of patients presenting with aplastic anaemia, a definite aetiology cannot be established, and the Anaemia must be regarded as idiopathic. Rare causes of Anaemia due to hypoplastic bone marrow include familial disorders and the acquired pure red cell aplasia. The latter is characterized by a virtual absence of erythroid precursors in the bone marrow, with standard numbers of granulocytic precursors and megakaryocytes. Rare causes of diminished erythrocyte production with hyperplastic bone marrow include hereditary orotic aminoaciduria and erythemmyelosis. A study of 2688 patients undergoing cardiac surgery in the United Kingdom from 2008-2009 found that 1463 (54.4%) met the World Health Organization definition for Anaemia.

This prevalence was much more significant than previously reported, although the reason for this association is unclear (Maakaron et al., 2022).

1.1.2 Epidemiology of Anaemia in children

1.1.3.1 Prevalence of anaemia

The World Health Organization (WHO) is implementing new strategies for integrating the sick child's integrated management in the primary care setting, including algorithms based on clinical signs detected by trained professional health care workers (Gera et al., 2016).

Anaemia is a disease that affects approximately 1.6 billion people worldwide and is more prevalent in children and women in the reproductive age (Li et al., 2019). Infants aged 6–12 months are at an elevated risk of anaemia because they are developing and growing rapidly and because the stored iron from the mother may be deficient (Li et al., 2019). Globally, the prevalence of anaemia in children is about 39.8% (WHO, 2021).

A study done in India found that the prevalence of anaemia to be 58.7% among children aged 6 to 59 months (Ghosh & Desai, 2021). In India, infants born to mothers who are young or old are more likely to be anaemic; in particular, mothers who are between the ages of 15 and 25. The risk of childhood anaemia then begins to decline around age 25 and continues until around age 37, when it then once more begins to rise (Chungkham et al., 2021). In Europe, the annual incidence of iron deficiency anaemia is between 7.2 and 13.96 per 1000 person-years. Spain and Germany have almost similar incidence rates (Levi et al., 2016).

In underprivileged countries, limited studies of purportedly healthy subjects show anaemia's prevalence to be 2-5 times greater than that in the United States. Although geographic diseases, such as sickle cell Anaemia, thalassemia, malaria, hookworm, and chronic infections, are responsible for a portion of the increase, nutritional factors with iron deficiency and, to a lesser extent, folic acid deficiency play significant roles in the increased prevalence of Anaemia. Populations with little meat

in the diet have a high incidence of iron deficiency anaemia because iron is better absorbed from food than inorganic iron (Maakaron et al., 2022).

Sickle cell disease is common in regions of Africa, India, Saudi Arabia, and the Mediterranean basin. The thalassemias are the most common genetic blood diseases found in Southeast Asia and in areas where sickle cell disease is common. The prevalence of Anaemia in population studies of healthy, non-pregnant people depends on the Hb concentration chosen for the lower limit of typical values (Hu et al., 2019). In the United States, limits of 13.5 g/dl for men and 12.5 g/dl for women are probably more realistic. Using these values, approximately 4% of men and 8% of women have values lower than those cited. A significantly greater prevalence is observed in patient populations (Zafar, 2021). Less information is available regarding studies using RBC or Hct.

In a study conducted in Ghana, the overall prevalence of anaemia among under-five children in was 78.4%, where 7.8% of the children had severe anaemia, 48.0%, moderate anaemia and 22.6% had mild anaemia (Ewusie et al., 2014). A household survey conducted among children aged 6 months to 5 years in November 2016 in Sudan found a prevalence of 49.4% of anaemia. The mean haemoglobin concentration among the children was 108.1. Younger children below 2 years had a higher risk of anaemia compared to those older than 2 years (Elmardi et al., 2020).

The distribution of Anaemia in Kenya corresponds to Malaria's distribution in Kenya, mostly affecting the malaria-endemic zones. The global iron deficiency ranks number 9 and is responsible for about 60% of all Anaemia cases among preschool children. In Africa, iron deficiency is 43-52%, while in Kenya, children under five years constitute the highest-burden, with 69% of them being deficient (Kisiangani et al., 2015).

1.1.3.2 Prognosis of anaemia

Usually, the prognosis depends on the underlying cause of the Anaemia. However, the severity of anaemia, aetiology, and the rapidity with which it develops can play a

significant role in the prognosis. Similarly, the age of the patient and the existence of other comorbid conditions influence the outcome (Turner et al., 2022).

Chances of survival are lower for patients with idiosyncratic aplasia caused by chloramphenicol and viral hepatitis and better when paroxysmal nocturnal haemoglobinuria or insecticide toxicity is probable aetiology (Hartung et al., 2013). The prognosis for idiopathic aplasia lies between these two extremes, with an untreated mortality rate of approximately 60-70% within two years after diagnosis.

The 2-year fatality rate for severe aplastic Anaemia is 70% without bone marrow transplantation or a response to immunosuppressive therapy (Maakaron et al., 2022).

Among patients with hyperplastic bone marrow and decreased production of RBCs, one group has an excellent prognosis, and the other is unresponsive, refractory to therapy, and has a relatively poor prognosis.

The former includes patients with disorders of relative bone marrow failure due to nutritional deficiency. Identifying the etiology and treatment with vitamin B-12, folic acid, or iron leads to a correction of Anaemia once the appropriate etiology is established. Drugs acting as an antifolic antagonist or inhibitor of DNA synthesis can produce similar effects.

The second group includes patients with idiopathic hyperplasia that may respond partially to pyridoxine therapy in pharmacologic doses but more frequently does not.

These patients have ringed side roblasts in the bone marrow, indicating an inappropriate use of iron in the mitochondria for hemesynthesis. Individual patients with marrow hyperplasia (see the image below) may have refractory Anaemia for years, but some eventually develop acute myelogenous leukaemia (Maakaron et al., 2022).

Hemolytic-uremic syndrome carries significant morbidity and mortality if untreated.

As many as 40% of those affected die, as many as 80% develop renal insufficiency.

The purpose of establishing Anaemia's aetiology is to permit the selection of specific and effective therapy. For example, corticosteroids are useful in the treatment of autoimmune hemolytic anaemia. Therapy and medical care vary considerably in the group of hereditary disorders. Splenectomy has been advantageous in hereditary spherocytosis and hereditary elliptocytosis, in some unstable haemoglobinopathies, and individual patients with pyruvic kinase deficiency. It has little value in most other genetic hemolytic disorders. Drugs and chemicals capable of producing aplasia or a maturation arrest of erythroid precursors should be discontinued or avoided. Similarly, diseases known to be associated with Anaemia should be appropriately treated. Guidelines for the treatment of chemotherapy-associated Anaemia are available. Surgery is useful to control bleeding in patients who are anaemic. Most commonly, bleeding is from the GI tract, uterus, or bladder. Patients should be hemodynamically stable before and during surgery. A blood transfusion may be needed.

1.1.3 Management of Sickle Cell Anaemia and Thalassemia, beta-thalassemia major and significant haemoglobinopathies

Sickle cell beta-thalassemia refers to an inherited condition that impacts haemoglobin. People with the condition have different changes in each copy of their haemoglobin gene. One causes red blood cells (RBCs) to form a sickle shape and another reduces the amount of haemoglobin. Sickle cell beta-thalassemia is a type of RBC disorder known as hemoglobinopathy (Soliman & Santhakumar, 2022).

Sickle cell anaemia is the most commonly found hemoglobinopathy. It can be combined with thalassemias or haemoglobin C variety producing a more complicated blood picture (Bharati et al., 2011). Diagnosis and management of the β-thalassemias and sickle cell disorders both in adults and in newborns using appropriate approaches and uniform technology are important (Ghosh & Desai, 2021). Screening and identification of α thalassemia Carriers of α thalassemia can be identified at birth by screening cord bloods for the presence of Hb Bar''s, a fast-moving Hb on cellulose acetate electrophoresis. Newborn screening is particularly relevant for sickle cell disorders. Either dried blood spots can be used by taking a heel prick sample on

Guthrie cards between 1 and 7 days after birth or cord blood samples can be collected at birth in EDTA (Ghosh & Desai, 2021). In a case study of a 14-year-old female patient admitted to the surgical department of Midnapore Medical, the patient was treated conservatively for the initial episodes of jaundice. The patient was instructed to have an open cholecystectomy because of the sickle + thalassemia diagnosis and the likelihood of significant adhesions (Bharati et al., 2011).

The most serious of the thalassaemia syndromes is thalassaemia major: This syndrome isanagementedd by a severe anaemia which is transfusion dependent, and complicated by iron overload, which is the result of repeated blood transfusions. If no treatment is provided, patients with thalassaemia major will not survive beyond 5-10 years (Angastiniotis, 2013). Treatment options for sickle cell beta-thalassemia may include hydroxyurea, blood transfusions and bone marrow transplantations. People may require hydroxyurea if they experience frequent periods of pain. Hydroxyurea is a drug that makes RBCs bigger and changes their shape to the typical round and flexible composition. Hydroxyurea increases the level of fetal hemoglobin (HbF) in the body.

Some people with sickle cell beta-thalassemia may require blood transfusions. This is when a healthcare professional infuses healthy donor blood into the body of a person with sickle cell beta-thalassemia via a tube. A person with dysfunctional bone marrow, such as in sickle cell beta-thalassemia, may receive hematopoietic stem cells from a healthy donor. This may help improve bone marrow function and reduce the symptoms of sickle cell beta-thalassemia (Soliman & Santhakumar, 2022).

1.1.4 Consultations and surgical intervention, Transfusion and follow up.

Surgical consultation is indicated to control bleeding, for splenectomy when necessary, and for biopsies to establish the presence of neoplasia.

Consultation with gastroenterologists is frequently sought to identify a bleeding site in the gut. Urologic consultation may be needed to investigate hematuria (Maakaron et al., 2022). Patients with chronic Anaemia can usually be cared for on an outpatient basis. Follow-up care is necessary to ensure that therapy is being continued and to

assess the efficacy of treatment. Transfusion of packed red blood cells (RBCs) should be reserved for actively bleeding patients and patients with severe and symptomatic Anaemia. The transfusion is palliative and should not be used as a substitute for specific therapy (Jimenez et al., 2015).

A study in Uganda on inappropriate transfusion of severe anaemia patients in admission wards showed that 25.2% of the children admitted in the two hospitals were assigned a diagnosis of SA. However 95.9% of children assigned a diagnosis of SA received a blood transfusion, accounting for 98.4% of the blood transfusions in the pediatric wards. Of the blood transfusions in SA children, only 44.5% was given appropriately per criteria while 55.5% was given inappropriately. Severe Anaemia children transfused appropriately per Hb criteria had lower inpatient mortality compared to those transfused inappropriately. Major issues identified by health workers as affecting use of blood transfusion included late presentation of SA children to hospital and unreliable availability of equipment for measurement of Hb (Opoka et al., 2018). Adherence to the guidelines is variable, and transfusion recommendations vary between countries (Kiguli et al., 2015).

1.1.5 Iron Supplementation and Nutritional Therapy and Dietary Considerations

The appropriate treatment of Anaemia due to blood loss is the correction of the underlying condition and oral administration of ferrous sulphate until the Anaemia is corrected and several months afterwards to ensure that body stores are replete with iron. Relatively few indications exist for the use of parenteral iron therapy, and blood transfusions should be reserved for the treatment of shock or hypoxia. Although the regular dosage of ferrous sulphate is 325 mg (65 mg of elemental iron) orally three times a day, lower doses (e.g., 15-20 mg of essential iron daily) may be useful because they cause fewer side effects. To promote absorption, patients should avoid tea and coffee and take vitamin C (500 units) with the iron pill once daily. If ferrous sulphate has unacceptable side effects, ferrous gluconate, 325 mg daily (35 mg of elemental iron), is a possible alternative for patients who cannot tolerate ferrous sulphate (Maakaron et al., 2022).

A study in Iran demonstrated that once-weekly, low-dose iron supplementation could be usefulin improving iron status and in treating iron-deficiency Anaemia. In this study, 193 adolescent girls aged 14-16 were randomly selected and assigned to receive either 150 mg ferrous sulfate once weekly for 16 weeks or no iron supplementation. Before and after the intervention, the percentage of Anaemia, iron deficiency Anaemia, and iron deficiency were measured in both girls' groups. Although the parameters measured before the intervention were not significantly different, at the end of 16 weeks, the group that received the ferrous sulphate had significant improvement in the same parameters.

Besides, all cases of iron deficiency Anaemia were resolved in the group receiving the low-dose iron supplementation. Adults with iron deficiency Anaemia cannot tolerate oral iron or unsatisfactory response and- can be treated with ferric carboxymaltose injection (Injectafer). The agent is given in two intravenous infusions one week apart.

Nutritional therapy is used to treat deficiencies of iron, vitamin B-12, and folic acid. Pyridoxine may help treat individual patients with sideroblastic Anaemia, even though this is not a deficiency disorder.

A strict vegetarian diet requires iron and vitamin B-12 supplementation.

Iron deficiency Anaemia is prevalent in geographic locations where little meat is in the diet. Many of these locations have sufficient dietary inorganic iron to equal the iron content in persons residing in countries where meat is eaten. However, heme iron is more efficiently absorbed than inorganic food iron. Folic acid deficiency occurs among people who consume few leafy vegetables. The coexistence of iron and folic acid deficiency is common in developing nations.

1.2 Statement of the problem

Approximately 1.6 billion people worldwide are affected by anaemia and the disease is more prevalent in children and women in the reproductive age (Li et al., 2019). According to studies, infants below two years are at an even elevated risk of anaemia

because they are developing and growing rapidly and because the stored iron from the mother may be deficient (Elmardi et al., 2020; Ghosh & Desai, 2021; Li et al., 2019; White, 2018). Recent data from the World health organization shows the prevalence of anaemia in children to about 39.8% (WHO, 2021). Sub-Saharan Africa is the most affected region in terms of anaemia registering a high prevalence rate of 60.1% in 2019 (WHO, 2021). Anaemia affects more than 60% of the paediatric population in several of the continen''s nations (Lemoine & Tounian, 2020). In East Africa, anaemia continues to be a serious public health problem, especially among children under 5 years of age and recent estimates from countries such as Tanzania and Kenya range from 20% - 56% in rural and urban areas (Liyew et al., 2021).

The distribution of Anaemia in Kenya corresponds to Malaria's distribution in Kenya, mostly affecting the malaria-endemic zones. The global iron deficiency ranks number 9 and is responsible for about 60% of all Anaemia cases among preschool children. In Africa, iron deficiency is 43-52%, while in Kenya, children under five years constitute the highest-burden, with 69% of them being deficient (Kisiangani et al., 2015).

The prevalence of anaemia among children aged 6–59 months in Kenya in 2019 was 57% (Awuor et al., 2021). Anaemia is among the diseases that have also affected children within Kisumu County. The prevalence in Kisumu East district is about 50% (Andago, 2014).

Anaemia has serious negative consequences, including increased mortality in children, decreased capacity to learn, impaired physical development, and reduced productivity in all individuals.

It's devastating effects on health, physical, and mental productivity affect the quality of life and translates into significant economic losses for individuals and nations with high Anaemia prevalence. (Chaparro & Suchdev, 2019). Other major consequences include growth retardation, impaired motor and cognitive development, and increased morbidity and mortality (Melku et al., 2018). In order to avert the disease

burden and reduce the risk of foreseeable consequences, it is important for anaemia to be managed.

No known study done in Kisumu has focused on factors associated with anaemia management among children under five children. This study aims to fill this gap by identifying these factors that are associated with anaemia management in Kisumu County Hospital.

1.3 Justification

In Kisumu County, where malaria transmission is high, and there are various interventions explicitly targeting children under five years and pregnant women, it is still unclear whether there is a shift in Severe Malarial Anaemia attacks from younger children to older children. The current study will determine Severe Malarial Anaemia infection age patterns in children five years and below resident in Kisumu County, Kenya. Kisumu County referral hospital is one of the hospitals in the county where referral services are made with a large number of residents attending the hospital for outpatient and ANC services.

Since this research was done in the hospital, it aimed at providing an overview of the prevalence and management factors for anaemia among children under 5 years in the county. Not only would the results of this study be important to the management of the hospital, it will also help the ministry of health to identify the management practices used in the county and their effectiveness in reducing the burden of the disease and limiting the consequences that may result from the disease. The study would also help to design feasible anaemia screening and management programs and as well design safe, efficient and cost-effective anaemia intervention programs.

Studying anaemia management associated factors was thus necessary as findings would benefit the health sector, implementing partners and stakeholders. Finally, the study was important since it will help in information in academia by contributing to literature, aid in formation of policies and enhance resource mobilization for anaemia management through partnership and collaboration.

1.4 Objectives of the study

1.4.1 Broad Objective

To determine factors associated with management of Anaemia among children under-fives in Kisumu County Hospital.

1.4.2 Specific Objectives

i. To determine the socio demographic factors of under 5 anaemic children and their caregivers at Kisumu County Referral Hospital.
ii. To determine the Anaemia factors among children under-five in Kisumu County hospital.
iii. To determine the factors influencing Anaemia management in Kisumu County Hospital.

1.5 Research Question

i. What are the socio demographic factors of under 5 anaemic children and their caregivers at Kisumu County Referral Hospital?
ii. What are the Anaemia factors among children under-five in Kisumu County hospital?
iii. What are the factors influencing Anaemia management in Kisumu County Hospital?

1.6 Limitations of the study

The study had limited time as the time of data collection approval period was very short. The study assistants had to be present throughout the wards to ensure that all the cases meeting criteria were enrolled in the study. The study investigator had difficulty in obtaining information from some uncooperative respondents for whatever reason.

1.7 Delimitation of the study

The research assistants were properly train on ethical issues in research and the best way to be professional in obtaining information from the caregivers without making them feel that they are rushed. The research assistants were also encouraged to be positive and in cases where a respondents refused to provide information; they were not included in the research. Data management was done also to ensure that any missing data was imputed accordingly.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on reviewing the literature relevant to Anaemia management. The review is based on the study's specific objectives, followed by an analysis of the topic's research gaps. The review is also structured to depict what is known globally, regionally, and locally.

Anaemia is one of the most severe public health problems affecting people in both developing and industrialized countries (Chaparro & Suchdev, 2019). In developing countries, it is reported that an estimated 3.5 billion people are anaemic. Globally, about 1.6 billion are affected by anaemia (Li et al., 2019) and children aged 0-5 years at an elevated risk of anaemia (Ghosh & Desai, 2021). Recent data from the World health organization shows the prevalence of anaemia in children to about 39.8% (WHO, 2021). Sub-Saharan Africa is the most affected region in terms of anaemia registering a high prevalence rate of 60.1% in 2019 (WHO, 2021). Anaemia affects more than 60% of the paediatric population in several of the continent's nations (Lemoine & Tounian, 2020). In East Africa, anaemia continues to be a serious public health problem, especially among children under 5 years of age and recent estimates from countries such as Tanzania and Kenya range from 20% - 56% in rural and urban areas (Liyew et al., 2021).

The distribution of Anaemia in Kenya corresponds to Malaria's distribution in Kenya, mostly affecting the malaria-endemic zones. The global iron deficiency ranks number 9 and is responsible for about 60% of all Anaemia cases among preschool children. In Africa, iron deficiency is 43-52%, while in Kenya, children under five years constitute the highest-burden, with 69% of them being deficient (Kisiangani et al., 2015). The prevalence of anaemia among children aged 6–59 months in Kenya in 2019 was 57% (Awuor et al., 2021). Anaemia is among the diseases that have also

affected children within Kisumu County. The prevalence in Kisumu East district is about 50% (Andago, 2014).

2.2 Sex and Age-related demographics

Previously, severe, genetically acquired anaemia (e.g., sickle cell disease, thalassemia, Fanconi syndrome) were more commonly found in children because they did not survive adulthood. However, with improvement in medical care and breakthroughs in transfusion and iron chelation therapy, in addition to foetal haemoglobin modifiers, the life expectancy of persons with these diseases has been significantly prolonged. Acute Anemias a bimodal frequency distribution, affecting mostly young adults and persons in their late fifties. Causes among young adults include trauma, menstrual and ectopic bleeding, and problems of acute hemolysis. During their childbearing years, women are more likely to become iron deficient.

In people aged 50-65 years, acute Anaemia is usually the result of acute blood loss in addition to a chronic anaemic state. It is the case in uterine and GI bleeding. Neoplasia increases in prevalence with each decade of life. It can produce Anaemia from bleeding, from the invasion of bone marrow with a tumour, or the development of Anaemia associated with chronic disorders. The use of aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), and warfarin also increases with age and can produce GI bleeding.

2.2.1 Sex-related demographics

Anaemia is twice as prevalent in females as in males. This difference is significantly more significant during the childbearing years due to pregnancies and menses. Approximately 65% of body iron is incorporated into circulating Hb. One gram of Hb contains 3.46 mg of iron (1 ml of blood with a Hb concentration of 15 g/dL = 0.5 mg of iron). Each healthy pregnancy depletes the mother of approximately 500 mg of iron. While a man must absorb about 1 mg of iron to maintain equilibrium, a premenopausal woman must absorb an average of 2 mg daily.

Further, because women eat less food than men, they must be more than twice as efficient as men in the absorption of iron to avoid iron deficiency. Women have a markedly lower incidence of X-linked Anaemia s, such as G-6-PD deficiency and sex-linked sideroblastic Anaemia s, than men do. Besides, in the younger age groups, males have a higher incidence of Anaemia from traumatic causes. Previously, severe, genetically acquired Anaemia (e.g., sickle cell disease, thalassemia, Fanconi syndrome) was more commonly found in children because they did not survive adulthood. However, with improvement in medical care and breakthroughs in transfusion and iron chelation therapy, in addition to fetal haemoglobin modifiers, the life expectancy of persons with these diseases has been significantly prolonged. Acute Anaemia has a bimodal frequency distribution, affecting mostly young adults and persons in their late fifties. Causes among young adults include trauma, menstrual and ectopic bleeding, and problems of acute hemolysis (Maakaron et al., 2022).

During their childbearing years, women are more likely to become iron deficient. In people aged 50-65 years, acute Anaemia is usually the result of acute blood loss in addition to a chronic anaemic state. It is the case in uterine and GI bleeding (Solovyova et al., 2017). Neoplasia increases in prevalence with each decade of life. It can produce Anaemia from bleeding, from the invasion of bone marrow with a tumour, or the development of Anaemia associated with chronic disorders. The use of aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), and warfarin also increases with age and can produce GI bleeding. Anaemia in children is of particular interest since it impairs their mental, physical, and social development; it causes adverse behavioural and cognitive effects resulting in poor school performance and work capacity in later years. Iron deficiency is the most common cause of Anaemia in under-five children with a smaller proportion due to other micronutrient deficiencies such as folate, Vitamin A, and B12.

A cross-sectional study was done in the U.S on the trends in prevalence and treatment rate of anemia in the U.S. population. Data from 32,372 participants from seven cycles of data from NHANES, beginning 2005 to 2018 was used. Anaemia prevalence in women was significantly higher than that in men. Although both had a

significant increasing trend, anaemia prevalence in men slightly decreased since 2011 while the prevalence in women dropped in 2017–2018 (Wang & Wang, 2022).

2.2.2 Race-related demographics

Individual races and ethnic groups have an increased prevalence of genetic factors associated with certain Anaemia. Diseases such as haemoglobinopathies, thalassemia, and G-6-PD deficiency have different morbidity and mortality in other populations due to differences in the genetic abnormality producing the disorder. For example, G-6-PD deficiency and thalassemia have less morbidity in African Americans than in Sicilians because of differences in the genetic fault. Conversely, sickle cell Anaemia has more significant morbidity and mortality in African Americans than in Saudi Arabians.

Race is a factor in nutritional Anaemia and Anaemia associated with untreated chronic illnesses to the extent that socioeconomic advantages are distributed along racial lines in a given area; socioeconomic benefits that positively affect diet and healthcare availability lead to a decreased prevalence of types of Anaemia.

In the US, a study was conducted on the prevalence of anaemia and moderate-severe Anaemia in the US Population. Anaemia and moderate-severe anaemia, which were based on serum haemoglobin levels (Hb) in accordance with World Health Organization (WHO) standards, were assessed using data from five National Health and Nutrition Examination Surveys (NHANES) from 2003 to 2012. Among the risk factors for anaemia was race of the participant. Pregnant women, the elderly, women of childbearing age, non-Hispanic blacks, and Hispanics were among the high-risk groups. Black women between the ages of 80 and 85 had a prevalence of anemia of 35.6%, which is 6.4 times higher than the population average (Le, 2016).

With the changing evidence of shifting the burden of Malaria to older children, it would be interesting to know Severe Malarial Anaemia's outcomes in older children. The illness's duration before presenting to a hospital affects the disease's outcome. Like herbal concoctions before showing to a health facility, some practices may lead to a poor prognosis (Eseigbe et al., 2012). Cases of Severe Malarial Anaemia often

require hospitalization and blood transfusion. Any delay in getting this treatment or an otherwise practice performed by the caretaker on the sick child may produce adverse outcomes (Eseigbe et al., 2012)

2.3 Socioeconomic factors of Anaemia management per family.

Even though care for children under five years is officially free of charge in Kenya, households frequently pay for the hospital stay and drugs and supplies (henceforth all termed ‘user fees’). These payments made by poor families directly to service providers are high and continue to grow higher. Besides, older children above five years have to meet the full costs of Anaemia treatments.

Lack of enough food in the households contributes to anaemia.

A study done in India on factors that contributed to anemia by Caballero et al. (2013) found out that non-availability of food of which most people could afford only one meal a day was one of the major causes of anaemia. They quoted that protein-energy malnutrition (PEM) and micronutrient deficiencies were the major contributors to anaemia among children under 5 years and child morbidity and mortality (Caballero et al., 2013).

Another factor that impacts management of anaemia is the knowledge and skills on the management of anaemia during pregnancy. This was shown by a study conducted in Yenepoya Medical Hospital in India aimed at determining the knowledge of antenatal mothers regarding management of anemia during pregnancy.

50 pregnant women made up the sample size, which was chosen using non-probability purposive sampling, and information was gathered using a pretested structured knowledge questionnaire. Findings of the study indicated that a majority of the antenatal mothers (54%) had satisfactory knowledge regarding anaemia during pregnancy. This implied that knowledge and skill informed the management and prevention strategies for anaemia with knowledgeable women having better management practices (Baby et al., 2014).

In South Korea, the relationship between socioeconomic status and anaemia prevalence in adolescent girls based on the fourth and fifth Korea National Health and Nutrition Examination Surveys was determined through research. Findings showed that girls with greater incomes ingested more iron and vitamins and had reduced anaemia prevalence. Anaemia prevalence exhibited a decreasing tendency as household income rose, according to a logistic regression analysis. The results of a correlation analysis showed a connection between family income and the levels of serum ferritin and haemoglobin. It was determined that in Korean teenage girls, anaemia and iron deficiency anaemia are less common when SES is higher. This might be because people with higher SES levels eat more iron and vitamin C (Kim et al., 2014).

In a study conducted in Namibia to assess the socioeconomic determinants of anaemia, it was revealed that poor socioeconomic class, male gender and lower age were associated with poor management of anaemia and thus increased risk of management of anaemia. In total, 1,383 children aged 6–59 months had complete data and included in the analyses. Children from poorer households had a statistically significant higher risk of anaemia than those from the richest quintile. Additionally, statistical evidence suggested that boys were more likely than girls to have anaemia. High prevalence and poor management of anaemia among the poor class was attributed to a poor access to nutritious meals in poor households, thus increasing the risk of anaemia.

In a similar way, poor people do not have sufficient funds for purchasing dietary supplements (Shimanda et al., 2020).

From November 2019 to October 2021, a prospective analytical study on all pregnant women with haemoglobin levels less than 10.5 g/dl in the second and third trimesters and less than 10.5 g/dl in the first trimester was carried out at the Minia University Hospital in Egypt for gynaecology and obstetrics. Rural abode, low levels of education, low income, and multipara, reduced pregnancy interval, inadequate meals per day, inadequate meat intake, inadequate vegetables intake, inadequate egg intake, inadequate milk intake, and parasite infestation were among the factors linked to iron

deficiency anemia. The prevalence of iron deficiency anaemia was considerably greater in those who consumed fewer than three times daily, less than two servings of meat per week, less than two servings of vegetables, less than two servings of eggs and milk per week, and did not take an iron supplement. Having more meals with a variety of vegetables, meat, eggs, milk and iron supplements was one of the ways of managing anaemia. The study indicated that those with high income were in a better position of managing anaemia owing to their ability to purchase iron supplements (Mostafa et al., 2022).

These studies have clear indications that anaemia management and infection depends on socioeconomic factors of the caregivers. While it has been seen that the poor class have struggles in management and prevention of anaemia, this study will seek to contextualise socioeconomic factors of anaemia management in the context of Kisumu County, and establish if whatever has been discovered globally and in sub-Saharan Africa coincides with Kisumu patients.

2.4 Health seeking behaviour of caregivers of Anaemia patients.

Caregivers often play a pivotal role in the provision and care for childhood diseases. Since most children cannot fend for themselves, the time of intervention and quality of care received depend on the caregiver's actions and ultimately determined the outcome of a disease. A study done in Northwestern Nigeria by Eseigbe et al. (2012) on children who had cerebral Malaria revealed that of the 33 cases in the study, 24 (72.7%)utilized more than one healthcare option before presenting to the health facility. Some of the health care options used were patient medical services (PMS), i.e., individuals licensed to sell a limited number of drugs. The health facility's presentation time was also delayed, with 25 (75.8%) presenting to the health facility two days after the onset of the symptoms.

A focused group discussion in a study conducted in rural Sudan also revealed that the caretakers could correctly identify a child with severe illness and the need to be attended to by a health care worker.

Still, on the other hand, any condition including severe Anaemia, Malaria irrespective of its severity if it begins at night, had to wait till morning, thus causing a delay in initiation of treatment (White, 2018). In a similar study done among caregivers of under-five children in Nigeria, the findings indicated there was poor health seeking behaviour among these caregivers. Most caregivers offered primary care of children at home, with few others at a chemist shop. Only 24.6% of the caregivers said that a health facility was where primary care was offered to their children. Cost and long waiting time were major reasons for not seeking care in health facilities (Aigbokhaode & Isara, 2021).

In a previous study poor knowledge causes caretakers to be unaware of both the vulnerability of children to malaria disease and how to practice appropriate home-based treatment (which they prefer)compared to seeking treatment at the nearest health institution (Birhanu et al., 2017). In Ethiopia, a study revealed that caregivers had poor health seeking behaviour for febrile children. The study made use of data from the most current Ethiopian Demographic and Health Survey (EDHS 2016). Information from 1,354 children under the age of five who experienced a fever in the two weeks before to the survey was gathered. Only 491 caregivers (36.26 percent) reportedly sought medical attention for their feverish children, according to this survey.

Living in a metropolitan area or a small peripheral location, attending medical appointments, falling into the poorer, medium, or upper wealth quintiles, and having a kid with diarrhoea, a cough, short, quick breathing, or wasting were all related with caregiver'' willingness to seek treatment (Liyew et al., 2022).

An analytical, descriptive cross-sectional study conducted at University Teaching Hospital of Kigali. The study aimed to describe the caregiver's delay in seeking healthcare during the acute phase of a childhood illness among under-five children admitted in a tertiary hospital, Rwanda. Among 275 admitted children under age five, care-seeking delay occurred in 97 cases (35%). The most significant predictors of delay in seeking care were use of traditional healers, the recognition of illness as mild, use of unprescribed medicine at home, use of special prayers provided by

ministers of God before seeking healthcare and first consultation at public institutions (Umuhoza et al., 2018)

Health seeking behaviour of caregivers for Malaria has also been studied in the context of western Kenya. The outcome of severe malaria is directly influenced by the usage of healthcare choices.

This study was conducted at Jaramogi Odinga Oginga Teaching and Referral Hospital (JOOTRH) between September 2014 to July 2015.

When a child first became ill, caregivers were questioned about their alternatives for medical care and whether they had taken the kid to another health facility, pharmacy, or private hospital before visiting JOOTRH. The majority of the caregivers (32.5%) administered some leftover medications before presenting to a health facility. 27.7 percent of people made drug purchases via pharmacies or pharmacy stores. None went to a conventional healer. Few people used herbs. Caregivers who decided to feed their sick children herbs took longer to decide whether to take them to the hospital. There was no discernible difference between caregivers with just primary education and those with at least a secondary education in the length of time it took for a kid to be admitted at JOOTRH (Gondi et al., 2019).

The use of health care options has a direct influence on the outcome of Anaemia. Therefore, it is essential to offer improvement in the management through alternative health care options administered by the caretakers before presentation to the health facility. While, these previous studies have focused on Malaria and other diseases generally, the focus is still on the health seeking behaviour of caregivers, which is still applicable to this study. The current study will assess the healthcare-seeking behaviour among caregivers of sick children who had Anaemia in children five years and below in Kisumu County hospital.

2.5 Health Facilities factors of anaemia management

There is a high hospital cost involved in Anaemia management in children, especially when there is a complication. The underlying causes have to be eliminated

and when blood transfusion is required beside no readily available blood for donations.

In an Indonesian study, there were some health facilities related barrier that affected the management of iron deficiency anaemia. The study used a qualitative method approach in data collection and analysis. Nine out of 28 public health centres were randomly selected for the study. The study recruited 18 health workers to participate in the study.

One of the questions asked aimed at assessing the health centre programs related to the management of anaemia in pregnant women. Availability and impact of a counselling program in management of anaemia was also assessed. The results indicated that the facilities and infrastructure in anaemia prevention management were inadequate and that the area was not appropriate for counselling on anaemia management among pregnant women. In addition, there were no funds specifically for the treatment of iron deficiency anaemia, and collectively these factors were serious obstacles in ensuring good management practices.

Additionally, lack of sufficient knowledge by health care providers on anaemia management also stood out as a key factor in the management of anaemia (Darmawati et al., 2020).

Prevalence of anaemia in public hospitals was found to be higher than that in private hospitals in a cross-sectional study conducted in Bangladesh. The results of this study imply that private hospitals are well developed and well prepared to prevent and manage anaemia among children under 5 years (Azhar et al., 2021).

A study was done in Nigeria to establish whether antenatal care played a role in preventing anaemia among pregnant mothers at term. The aim of the research was to estimate the prevalence of anaemia at first antenatal visit and determine if antenatal attendance prevents anaemia at term among prenatal Nigerian women. The prevalence of anaemia for the two timespans was examined in a retrospective comparison involving 3442 expectant women in a mission hospital in South-South Nigeria from 2009 to 2013. Venous blood haematocrit was determined from each

woman at booking and at term. The results indicated a prevalence of 33% among the women. At term or delivery at term 21.4% of the 1052 subjects that fulfilled the study criteria had their anaemia corrected, a 69.9% prevention, while only 9.2% persisted despite their antenatal attendance. This suggested that even while anaemia during pregnancy was still common, high-quality ANC proved to be a helpful prophylactic measure that should be made widely available, easy to get, and affordable for all pregnant women (Ikeanyi & Ibrahim, 2015). This was similar to a study done in Ethiopia which found out that anaemia visiting ANC was very key in prevention of anaemia among newborns and management of anaemia among pregnant women (Melku et al., 2018).

A wide range of health care factors such as presence of adequate health care personnel, queues, counselling sessions, well improved and organized ANCs all have an impact on the management of anaemia. This study will seek to investigate how these factors play a role in the management.

2.6 Social factors influence Anaemia management.

Certain cultural beliefs, such as considering Anaemia disease as a curse and offering to cleanse to heal, do not go to hospitals for treatment. In contrast, other people religiously believe in prayers to recover from Anaemia. The unavailability of the right foods, food taboos, eating and cooking customs all play a part in anaemia.

In Indonesia, social factors influencing anaemia management among pregnant women included behaviour of the pregnant women, lifestyle and society's view towards pregnant women. The majority of participants disclosed that it is particularly difficult for health workers to ensure that pregnant women and their families heed the advice given by health professionals because of the behaviour of these groups. Pregnant women and their families had extremely strong opinions on this social aspect. They were unwilling to take iron supplements because they had false beliefs about doing so. The majority of participants also reported that pregnant women continue to eat the inappropriate foods during pregnancy, in addition to their opinions on iron supplements.

The study's participants also claimed that society had the wrong idea about how to view a woma''s pregnancy. Many expectant mothers experience shame if others find out about their pregnancies, and the husband often experiences guilt when accompanying a pregnant wife to a pregnancy check-up.

This affected their attitude towards attending counselling sessions on anaemia management. In terms of lifestyle, it was revealed that some families would choose to buy foods not rich in iron since they were more cherished by the society. An example given by a respondent was about a fisherman earning money and using it to buy "indomie" (noodles) rather than spend on iron supplements for the wife (Darmawati et al., 2020).

Taboos on some food stuff also makes some significant contributions to anaemia. A well-nourished and healthy population is a central tenet of sustainable development. In South Africa, cultural beliefs and food taboos followed by some pregnant women influence their food consumption, which impacts the health of mothers and children during pregnancy and immediately afterwards. We documented food taboos and beliefs amongst pregnant isiXhosa women from five communities in the Kat River Valley, South Africa. A mixed-methods approach was used among 94 Xhosa women indicating availability of food taboos which influenced management of anaemia and other diseases directly related to diet management. In total, 37% of the women reported having one or more culinary customs influenced by regional cultural taboos or beliefs. Meat products, fish, potatoes, fruits, beans, eggs, butternut, and pumpkin were the items that were most frequently avoided despite being high in protein, carbs, and necessary micronutrients (Chakona & Shackleton, 2019).

In Tanzania, a study was done to investigate the knowledge, attitudes, beliefs, and practices of select mothers on anaemia and linked these with known factors for anaemia. Between December 2014 and April 2015, the case study was carried out in the paediatric ward of the Mkuranga District Hospital.

A convenience sample of 40 moms whose kids had a verified anaemia diagnosis was gathered using a cross-sectional design. The study population had a significant

prevalence of severe anaemia, which was consistent with their hospitalization status. The results suggested that there may be gaps in the care and control of childhood anaemia due to a lack of awareness of or inaccurate understanding of the connection between maternal and paediatric anaemia. Witchcraft, home cures (such as herbal medicines), and the avoidance of particular foods were some of the cultural ideas articulated in relation to the causes of anaemia (Ngimbudzi et al., 2016).

2.7 Conceptual Framework

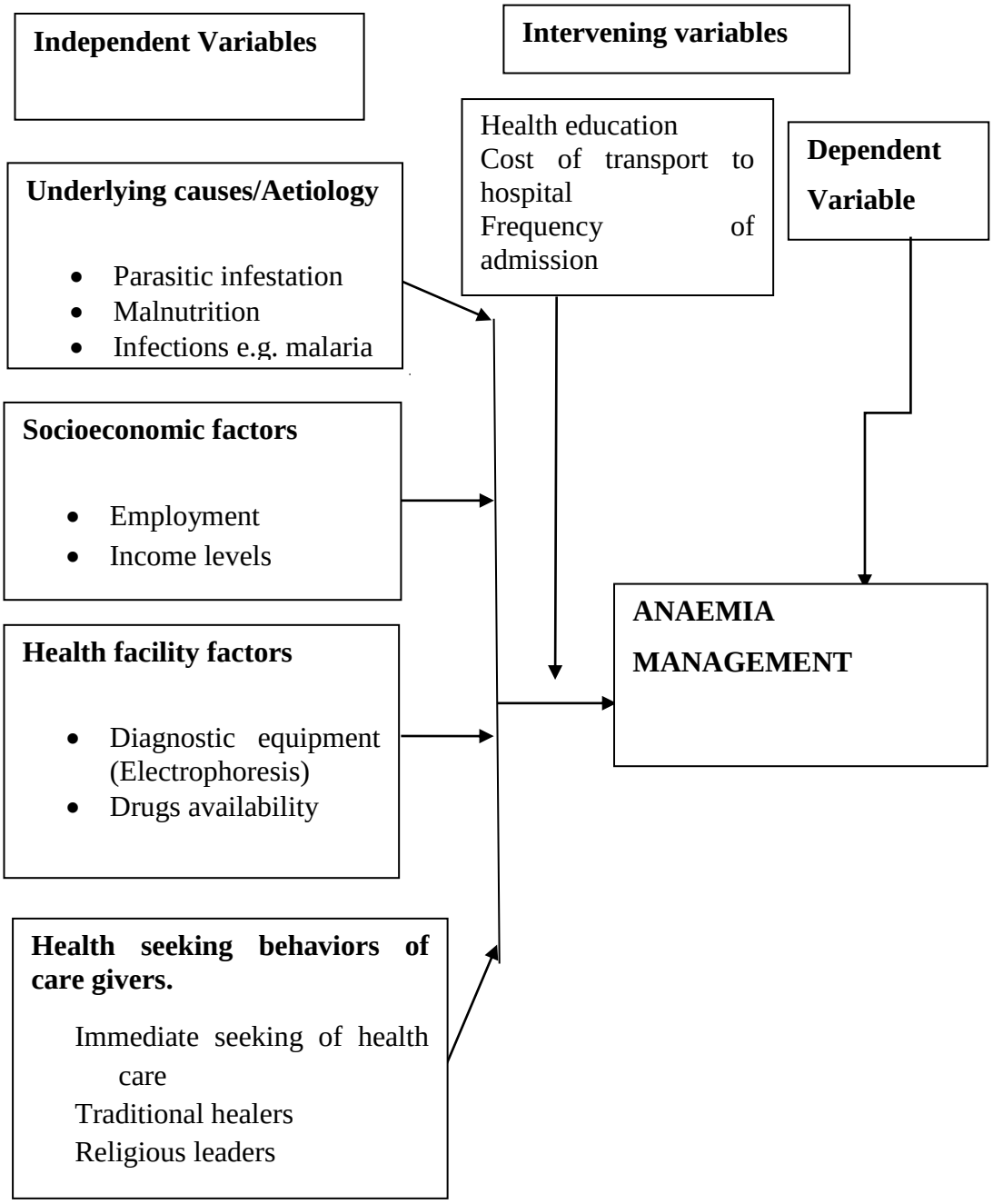

Figure 2.1: Conceptual Framework

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Kisumu County Hospital.

3.2 Study Design

The study was a descriptive cross-sectional study design. A descriptive cross-sectional health facility based study conducted among 362 children under five. Systematic random sampling technique was used to include the participants. Pretested and structured questionnaires were used to collect socioeconomic and demographic characteristics of the family and child.

This study design was used since this study is non-experimental, and it enables the collection of accurate information within a short time at a minimal cost. Cross-sectional studies a phenomenon at one point in time, and it is mostly used to describe attitudes, opinions, behaviour, or characteristics of a population (Burns & Grove, 2005).

3.3 Study variable

3.3.1 Dependent variables

Anaemia management among children under five in Kisumu County Hospital

3.3.2 Independent variables

Socio-demographic factors, socio-economic factors, caregiver factors, and health facility factors associated with Anaemia management among children under five in Kisumu County Hospital.

3.4 Study Population and sample

The study's targeted population were caregivers with anaemic children under the age of five years old, while the accessible population was derived from caregivers with children under five years old at Kisumu County hospital pediatric ward. Anaemic children meeting the criteria but with caregivers who are not mentally stable, and children meeting inclusion criteria but not giving consent were excluded from the study.

3.4.1 Inclusion and Exclusion Criteria

***Inclusion criteria*;** Anaemic children under five years attending in Kisumu County hospital with haemoglobin below 11g/dl.

***Exclusion criteria*;** Anaemic children meeting the eligibility criteria, but their caregivers have not consented to participate.

3.5 Sampling Criteria

The study employed convenient sampling strategy to identify and interview caregivers of anaemic children under five years in Kisumu County Hospital. Convenient sampling strategy is a sampling strategy where participants are enrolled based on their availability at the time of the study. Since the total number of anaemic children may not be known, while putting into consideration incidence of anaemia, and being that data was collected at the hospital from patients who visited the hospital during the study period, this method was preferred.

3.6. Sample Size Determination

Fisher *et al.* (2007) statistical Formula was used to determine the sample size

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n=desired sample size when the population is more than 10000.

z=normal standard deviation set at 1.96, which corresponds to 95% confidence level.

p= proportion on the target population estimated to have characteristics (69% Multiple indicator surveys by KNBS 2011 (KHDS 2019).

d= the level of statistical significance set at 0.5

q= 1-p

Therefore:

$$n = \frac{1.96^2 * 0.69 * (1 - 069)}{0.05^2} = 329\ Participants$$

There was a 10% non-response rate catered for bringing the total participants to 362.

3.7 Data Management

3.7.1 Data Collection process

Information on anaemia among children under five admitted at Kisumu County Hospital was collected using questionnaires. Systematic random sampling was used to obtain the study subjects. An arbitrary starting point was selected by the researcher writing numbers 1, 2, and 3 on three papers, randomly assigned number one, which was to be the first study subject every day. The rest were chosen systematically, taking every 3rd caregiver-child (0-59 months old) pair until the expected numbers were attained.

The researcher collected data on factors associated with Anaemia management in Kisumu County hospital using a structured questionnaire. Information on Anaemia management was collected by reviewing the clinician desk review charts to ascertain the management levels. The study used a questionnaire since it is a reliable instrument for data collection distributed to many people within a brief period at minimal costs.

Data was collected through interviews with the caregivers of the anaemic children under five years within the hospital paediatric ward through questionnaire administration; thus, the following procedure were followed:

i. ***Random selection of the first participant*:** Selection was based on the first Anaemia patient meeting the first bed criteria based on the hospital bed arrangement from bed number one to the bed number last in the ward.The first client was selected through simple random sampling by selecting papers with written numbers 1,2,3.
ii. ***Systematic random selection of other participants*:** After a successful interview, the interviewers skipped the next two clients (sampling interval was 2) and targeted the next client for interviewing. However, if the interview was unsuccessful, then the team approached the client in the next bed.

3.7.2 Data collection tools

Data were collected from respondents using questionnaires and clinician desk review charts. The research assistants interviewed the caregivers of sampled participants.

3.7.3 Recruitment and training of research assistants and their supervisors

Research assistants were recruited from a pool of applicants with research experience following advertisement and successful interview of the applicants. The training was provided before the data collection process. During the training, they were briefed on the study and taken through the data collection tools.

3.7.4 Validation and reliability processes.

The data collection tools were pre-tested at JOOTRH Obama ward to ensure that they were valid and reliable. A group of at least five selected research assistants was used. They were asked to complete the questionnaire one at a time, and they were required to complete it the same way it was completed in the study. Once they had finished, areas where there were problems were identified and improvements made.

3.7.5 Data Analysis plan

Data collected using questionnaires were checked for accuracy and completeness before they were entered into a computer. Data entry, management and analysis of this data was done by the use of Statistical Package for Social Sciences Version (SPSS) version 20. Missing and invalid responses were excluded from the final data analysis. Descriptive statistics, i.e., mean and frequencies, were used to analyze the sample and the study variables. Associations were done by use of Chi-Square. Multivariate logistic regression was used to calculate adjusted odds ratios and the corresponding 95% confidence intervals. P-values of less than 0.05 indicated significant results. sData analyzed were presented by the use of tables, graphs, as well as discussion of findings.

3.8 Data presentation/ dissemination plan

Following data analysis, the study results were shared through publishing in journals or dissemination of any forum within the community i.e staff sensitization, staff feedback presentation, community dialogue days.

3.8.1 Quality of data

To ensure the quality of data collected for the study, the following steps were undertaken:

i. Data collection tools were developed and pre-tested to ensure that they were systematic and well understood by the potential participants. The pre-tests

were done at JOOTRH Obama children ward, during which twenty questionnaires were filled.

ii. Research assistants were duly trained and supervised by the investigator and provided with questionnaires.

iii. Each questionnaire collected within the quantitative survey was checked for completeness, coherence, and accuracy on the same day of the interview.

iv. After secondary checks, the questionnaires were recorded and handed over to the data entry team on receipt of the field questionnaires.

v. All questionnaires were double entered into an excel worksheet, then transferred into SPSS v. 20.0 and compared for accuracy. Anomalies in data entry were verified using the actual questionnaires.

vi. After data entry, quantitative data were transferred into SPSS v.20.0 to compare the two data sets. After confirming the similarity of data sets, a single final one was retained for data cleaning procedures.

3.9 Ethical Consideration

An introduction letter was requested from JKUAT to inform relevant authorities to seek permission from the ministry of health through the medical superintendent of Kisumu County Hospitals where the study was conducted. The consent to conduct the study was obtained from the Great Lakes University of Kisumu Ethics Committee who reviewed the proposal and issued a letter of implementation approval. Data collected was used for research purposes and were accorded strict confidentiality. Permission was also obtained from the participants using a signed and dated informed consent form after being briefed about the study. Clients were assured of their privacy and gave consent requested from them. Some precautions that the researcher undertook to ensure the success of the study were to follow some Ethical Consideration.

a) Voluntary participation

No respondent was forced or coerced to give input into the research. No form of bribery or promises were used. The participants were informed that participation was voluntary and could willingly participate or withdraw from the study.

b) Identity disclosure

The research assistants identified themselves to the respondents and explained the study's purpose before getting information from them.

C) Informed consent

The researchers got consent from respondents before enrolling the participants into the study and embarking on data collection from the pediatric ward's respondents.

Confidentiality was maintained as the data collected was only being disclosed to the relevant and authorized people. No names were used as the respondents were not allowed to write their names anywhere. The participants were identified using unique identity numbers (Unique ID).

The interviewers worked until the entire sample of 362 complete interviews

d) Withdrawal from the study

Participants were free to decline to participate in the study or withdraw from participation at any time.

i. Participation in the study was voluntary, and verbal informed consent was obtained from the participants.
ii. During the consenting process, participants were assured that the process was non -judgemental and that there were no wrong or right answers. Instead, interest was on their genuine opinions on the questions asked.
iii. The research protocol was subjected to the GLUK Ethics Review Committee clearance process.

iv. Administrative approval was obtained from the County Government of Kisumu, the Health Department, and the Kisumu County Hospital administration.

CHAPTER FOUR

RESULTS

4.1 Introduction.

This chapter presents the results of the study based on the information obtained from the field. The aim of this study was to determine factors associated with anaemia management among children under five in Kisumu County Hospital. Data collected was analyzed and reported, the results obtained were presented in the form of frequency tables, pie charts and bar graphs. This was followed by a brief interpretation and a discussion on research findings. Data analysis was based and guided by the research objectives.

4.2 Response Rate

A total of 362 questionnaires were distributed, and 359 of the questionnaires were correctly filled, resulting in a 99.2 % response rate of the recruited study population while 3questionaires were not filled, none response of 0.8%.According to Saunders et al, (2003); Mugenda and Mugenda (2003), a response rate of 50% and above is considered acceptable.

Table 4.1: Response Rate

Response rate	Frequency	Percentage
Response	359	99.2
None response	3	0.8
TOTAL	362	100

4.3 Socio-demographic characteristics of Caregivers of Children

141 Caregivers (39.2%) were between 25-29 years, 113 caregivers (31.5%) were aged between 20-24 years. The least number of caregivers were aged between 45-49 years (1.1%, n=4).The average age of caregivers was 27 years.

In terms of level of education, close to half of the caregivers had primary education (47.0%, n=169), followed by secondary education (35.7%, n=128), and the least percentage of caregivers attained a tertiary level of education (17.3%, n=62).

In terms of occupation, the highest number of caregivers had personal businesses (55.2%, n=198),56 caregivers (15.6%) had formal employment, 38 caregivers (10.6%) were farmers, and those with other professions were (18. 6%) (see Table 4.2).

Table 4.2: Socio-demographic Characteristics of the participants

Variable	N	%	Variable	N	%
Age of children	Mean±SD= (24.29±16.80)		Education Level		
0-12 months	111	30.9	Primary	169	47
13-24 months	102	28.4	Secondary	128	35.7
25-36	58	16.2	Tertiary	62	17.3
37-48	55	15.3	Religion		
49-60	33	9.2	African traditional	10	2.8
Sex of Children			Christianity	343	95.5
Male	186	51.8	Islam	6	1.7
Female	173	48.2	Malnutrition status		
Age of Caregiver	Mean±SD= (27.04±5.09)		Yes	75	20.9
15-19	11	3.1	No	284	79.1
20-24	113	31.5	Type of food fed to the child		
25-29	141	39.2	Iron rich	205	57.1
30-34	69	19.2	Non-Iron rich	134	37.3
35-39	16	4.5	Other	20	5.6
40-44	5	1.4	Anaemia factors (causes)		
45-49	4	1.1	Iron deficiency	154	42.9
Maternal Health Status			Sickle-cell Disease	64	17.8
Yes	42	11.7	Parasitic infections	13	3.6
No	317	88.3	Malaria	117	32.6
Occupation			Others	11	3.1
Formal employment	56	15.6	Children under five years		
Farming	38	10.6	1 and Below years	167	46.5
Personal Business	198	55.2	2-5 years	192	53.5
Other	67	18.6	Frequency of Deworming		
Type of Anaemia			3 Monthly	116	32.3
Mild	88	24.5	6 monthly	111	30.9
Moderate	154	42.9	Yearly	34	9.5
Severe	117	32.6	Others	98	27.3

In terms of religion, majority of the caregivers (n=343, 95.5%) were Christians, 10(2.8%) were from africantraditional religion while 6(1.7%) professed Islam religion.

The study also revealed that 111 Caregiver's children (30.9%) were between age category 0-12 months,102 (28.4%) were aged 13-24 months, 58 (16.2%) were aged 25-36 months, 55 (15.3%) were aged 37-48 months. With regard to the sex of the children, 186 (51.8%) of the children were male while female children were 173 (48.2%).

On Occupation; Formal employment 56(15.6%), Farming 38(10.6%), personal business 198 (55.2%) and others 68 (18.6%).

4.4 Anaemia factors in children under-fives in Kisumu county hospital.

4.4.1 Descriptive Statistics for type of Anaemia

Anaemia was measured based on decreased concentration of hemoglobin and RBC mass compared with that in age matched controls. This is based on age specific Hb reference: 6 months is 12.6 g/dl,6 months to 24 months is 12.0g/dl,24 -60 months is 12.5g/dl while 72 months to 144 months is13.5g/dl.

The anaemic children were as follows: Moderate anaemia 154 (42.9%), Severe anaemia, 117 (32.6%) while mild anaemia least 88(24.5%).

4.4.1.1 Age distribution of Anaemia children

Children between 0-12 months accounted for the highest percentage (30.9%), followed by children between 13-24 months (28.4%), and the least were children between 49-60 months (9.2%)of the total number of children. Male children were the highest participants (51.8%) in comparison to the female (48.2%).

4.4.1.2 Gender distribution of the anaemic child

The results as indicated in figure 4.3 shows that among the children sampled,186 children (51.8%) were male, while 173 (48.2%) were female.

4.5 Relationship between Socio-Demographic factors and anaemia management

Respondents with sickle cell trait were 0.3 times less prevalent to good anaemia management compared to those who had iron deficiency at 5% level of significance. (cPR=0.3; 95%C.I[0.15,0.73], p=0.07). Children also with other factors apart from those listed in table 4.3 were 1.9 times more prevalent to good anaemia practice compared to those who had iron deficiency at 5% level of significance (cPR=1.9; 95%C.I [1.05,3.46),p=0.033). There was also a relationship between number of children less than 5 years and management of anaemia. Respondents with two or more children aged less than 5 years were 1.9 times more prevalent to good anaemia management compared to those who had one or no child less than 5 years old. (cPR=1.9; 95%C.I[1.33-2.71], p<0.001). There was also a relationship between type of food and management of anaemia. Children who used non-rich type of food were 0.7 times less prevalent to good anaemia management than those who used iron rich type of food at 5% level of significance (cPR=0.7, 95%C.I[0.46-0.95]p=0.023).

The findings also shows that anaemia is common among caregivers of young ages,ages 20-25 years contributed 113 (31.5%) while 25-29 years were 141(39.2%).

Table 4.3: Relationship between Socio-Demographic factors and anaemia management

Variable	Overall N (%)	Anaemia management n (%)		cPR (95%CI)	P-value
		Poor	Good		
Age of Caregiver	**Mean±SD (27.04±5.09)**				
15-19	11 (3.1)	10 (90.9)	1 (9.1)	ref	
20-24	113 (31.5)	83 (73.4)	30 (26.6)	2.9 (0.44-19.46)	0.268
25-29	141 (39.3)	87 (61.7)	54 (38.3)	4.2 (0.64-27.69)	0.134
30-34	69 (19.1)	56 (81.2)	13 (18.8)	2.1 (0.29-14.34)	0.46
35-39	16 (4.5)	12 (75.0)	4 (25.0)	2.8 (0.35-21.48)	0.335
40-44	5 (1.4)	3 (60.0)	2 (40.0)	4.4 (0.51-38.08)	0.178
45-49	4 (1.1)	3 (75.0)	1 (25.0)	2.8 (0.21-34.46)	0.433
Occupation					
Formal employment	56 (15.6)	40 (71.4)	16 (28.6)	ref	
Farming	38 (10.6)	27 (71.1)	11 (28.9)	1.0 (0.53-1.94)	0.968
Personal Business	198 (55.2)	135 (68.2)	63 (31.8)	1.1 (0.70-1.77)	0.648
Other	67 (18.6)	52 (77.6)	15 (22.4)	0.8 (0.43-1.44)	0.433
Education Level					
Primary	169 (47.0)	123 (72.8)	46 (27.2)	ref	
Secondary	128 (35.7)	89 (69.5)	39 (30.5)	0.3 (0.65-1.34)	0.543
Tertiary	62 (17.3)	42 (67.7)	20 (32.3)	0.1 (0.69-1.69)	0.457
Religion					
African traditional	10 (2.8)	6 (60.0)	4 (40.0)	ref	
Christianity	343 (95.5)	244 (71.1)	99 (28.9)	0.7 (0.33-1.57)	0.411
Islam	6 (1.7)	4 (66.7)	2 (33.3)	0.8 (0.21-3.26)	0.793
Malnutrition Status					
Yes	75 (20.9)	54 (72.0)	21 (28.0)	0.9 (0.63-1.41)	0.791
No	284 (79.1)	200 (70.4)	84 (29.6)	ref	
Anaemia Factors					
Iron deficiency	154 (42.9)	110 (71.4)	44 (28.6)	ref	
Sickle cell disease	64 (17.8)	58 (90.6)	6 (9.4)	0.3 (0.15-0.73)	**0.007**
Parasitic infections	13 (3.6)	10 (76.9)	3 (23.8)	0.8 (0.29-2.25)	0.683
Malaria	117 (32.6)	71 (60.7)	46 (39.3)	1.4 (0.98-1.92)	0.063
Others	11 (3.1)	5 (45.4)	6 (54.6)	1.9 (1.05-3.46)	**0.033**
Number of children <5 years					
<1	167 (46.5)	134 (80.2)	33 (19.8)	ref	
02-May	192 (53.5)	120 (62.5)	72 (37.5)	1.9 (1.33-2.71)	**<0.0001**
Type of food					
Iron rich	205 (57.1)	133 (64.9)	72 (35.1)	ref	
Non-Iron rich	134 (37.3)	103 (76.9)	31 (23.1)	0.7 (0.46-0.95)	**0.023**
Other	20 (5.6)	18 (90.0)	2 (10.0)	0.3 (0.08-1.08)	0.064

****Statistically significant if p-value <0.05, CPR; Crude Prevalence rates, ref; Reference category****

4.6 Socio-economic factors influencing anaemia management

239 (66.6%) obtained their income through business, and of these,77 (32.2%) practised good management of Anaemia. 75 (20.9%) got a salary, whereby 17 (22.7%) practised good management of Anaemia. 37 (10.3%) obtained their income through farming, of which 9 (24.3%) practised good management of Anaemia. 161 (44.9%) earned between 11000-30,000, whereby 40 (24.8%) practised good management of Anaemia. 114 (31.8%) earned less than 10,000, of which 48 (42.1%) exercised good control of Anaemia. 68 (18.9%) made between 31,000-50,000, of which 51 (75%) practised good management of Anaemia.

Of the earnings,288 (80.2%) spent earnings on the food, of which 102 (35.4%) practised good management of Anaemia. 45 (12.5%) spent their earnings on health whereby 0 (0%) practised good management of Anaemia,117 (32.6%) saved between 1100-3000 per month of these, 28 (23.9%) practised good management of Anaemia. 126 (35.1%) saved less than 1000, 50 (39.7%) practised good management of Anaemia. 65 (18.1%) saved between 3100-5000 shillings, and among them, 15 (23.1%) practised good management of Anaemia. During the Anaemia case, 257 (71.6%) lost less than 1000, of which 62 (24.1%) practised good management of Anaemia. 59 (16.4%) lost between 1100 and 3000 shillings of these, 27 (45.8%) practised good management of Anaemia.

There was a relationship between source of income and management of anaemia. Participants who relied on donations as source of income were less likely (cPR=0.1, 95%CI; 0.0--; p-value<0.0001) to have good Anaemia management as compared to participants who were farmers. Monthly earning of a family was also associated with management of anaemia. Participants who earn 11000-30000,31000-50000 and 51000-100000 per month were less likely (cPR=0.6;95%CI,0.41-0.83; p-value=0.003), (cPR=0.6;95%CI,0.37-0.95; p-value=0.028) and (cPR=0.0;95%CI,0.0--; p-value<0.0001) respectively to practice good Anaemia management compared to those who earn less than 10000 per month.

Participants who valued food as a critical expenditure were more likely (cPR=3.1;95%CI;1.05-9.02; p-value=0.041) to have good Anaemia management as compared to those who value education, and those who loved health were less likely (cPR=0.0;95%CI,0.0--; p-value<0.0001) to practice good Anaemia management as compared to those who valued education.

Family save per month was also associated with management of anaemia. Families who save between 1100-3000 Ksh and 3100-5000Ksh per month were less likely (CPR=0.6; 95%CI, 1.33-2.70; p-value= 0.011) and (cPR=0.0; 95%CI, 0.0--; p-value<0.0001) respectively to practice good Anaemia management as compared to their counterparts.

There was a relationship between family save per month and management of anaemia. Families who lose around 3100-5000 Ksh and 5100-10000 Ksh during Anaemia were more likely to practice good Anaemia management than those who release less than <1000Ksh, given that they had higher odds of good Anaemia management as shown in the table below.

Table 4.4: Socio-Economic factors influencing Anaemia management

Variable	Overall N (%)	Poor Anaemia management n (%)	Good Anaemia management n (%)	cPR (95%CI)	P-value
Source of Income					
Farming	37 (10.3)	28 (75.7)	9 (24.3)	Ref	
Salary	75 (20.9)	58 (77.3)	17 (22.7)	0.9 (0.46-1.89)	0.845
Business	239 (66.6)	162 (67.8)	77 (32.2)	1.3 (0.73-2.41)	0.357
Donations	4 (1.1)	4 (100.0)	0 (0.0)	0.1 (0.0---)	<0.0001
Others	4 (1.1)	2 (50.0)	2 (50.0)	2.1 (0.66-6.39)	0.213
Monthly income of family					
<10000	114 (31.8)	66 (57.9)	48 (42.1)	Ref	
11000-30000	161 (44.9)	121 (75.2)	40 (24.8)	0.6 (0.41-0.83)	0.003
31000-50000	68 (18.9)	51 (75.0)	17 (25.0)	0.6 (0.37-0.95)	0.028
51000-100000	16 (4.5)	16 (100.0)	0 (0.0)	0.0 (0.0---)	<0.0001
Key expenditure areas					
Education	26 (7.3)	23 (88.5)	3 (11.5)	Ref	
Food	288 (80.2)	186 (64.6)	102 (35.4)	3.1 (1.05-9.02)	0.041
Health	45 (12.5)	45 (100.0)	0 (0.0)	0.0 (0.0---)	<0.0001
Family save per month					
<1000	126 (35.1)	76 (60.3)	50 (39.7)	ref	
1100-3000	117 (32.6)	89 (76.1)	28 (23.9)	0.6 (0.041-0.89)	0.011
3100-5000	65 (18.1)	50 (76.9)	15 (23.1)	0.6 (0.36-0.95)	0.031
5100-10000	36 (10.0)	28 (77.8)	8 (22.2)	0.6 (0.29-1.07)	0.08
>10000	15 (4.2)	11 (73.3)	4 (26.7)	0.7 (0.28-1.60)	0.369
Family lost during Anaemia case					
<1000	257 (71.6)	195 (75.9)	62 (24.1)	ref	
1100-3000	59 (16.4)	32 (54.2)	27 (45.8)	1.9 (1.33-2.70)	<0.0001
3100-5000	31 (8.6)	17 (54.8)	14 (45.2)	1.9 (1.19-2.92)	0.006
5100-10000	10 (2.8)	8 (80.0)	2 (20.0)	0.8 (0.24-2.992)	0.771
>10000	2 (0.6)	2 (100.0)	0 (0.0)	NA	NA

**Statistically significant if p-value <0.05, cPR; Crude Prevalence rates, ref; Reference category*

4.7 The caregiver's factors influencing Anaemia management in Kisumu county hospital

4.7.1 Caregiver's opinion of Anaemia

Figure 4.5 reveals that out of (359) participants, 287 (79.94%) thought that anaemia is being associated with paleness, and 23 (6.41%) argued that anaemia is associated with tiredness. In contrast, 17 (4.74%) of the caregivers argued that Anaemia is associated with other things apart from the ones listed, 13 (3.62%) thought that Anaemia is associated with a child vomits. Only 7 (1.95%) of the caregivers felt that Anaemia is associated with coughing.

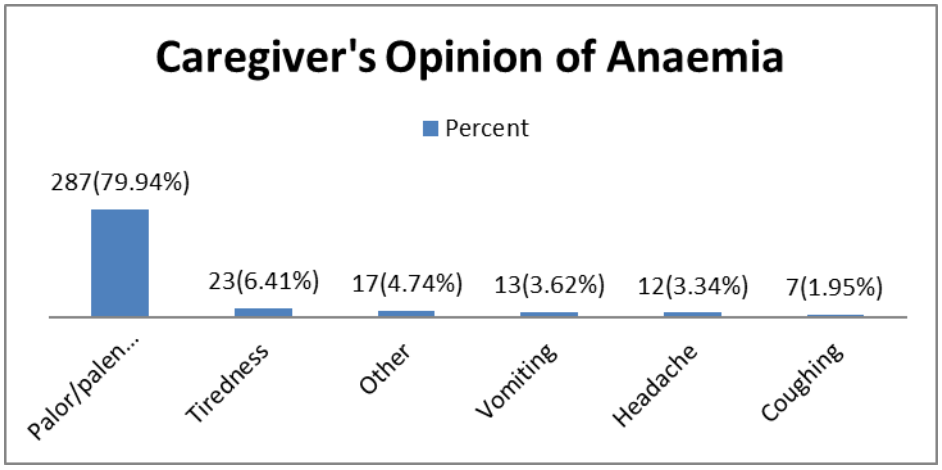

Figure 4.1: Caregiver's opinion of Anaemia

4.7.2 Sources of information on Anaemia signs and symptoms

98 (60.12%) of the respondents obtained their information about anaemia signs/symptoms from health care providers, 58 (35.58%) of the participants got their information from friends, 4 (2.45%) of the respondents obtain their input on television, and 1 (0.61%) of the participants obtain their information on Radio.

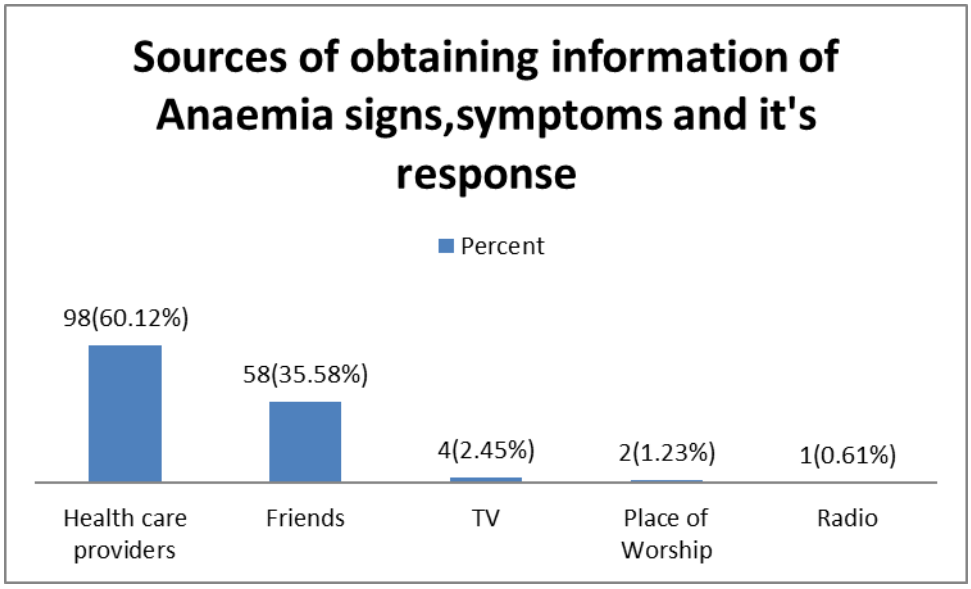

Figure 4.2: Sources of information on Anaemia signs and symptoms

4.7.3 Caregivers' factors influencing anaemia spread

144 (40.6%) of Anaemia cases were caused by iron deficiency, of which 46 (31.9%) practiced good management of Anaemia. 104 (29.2%) were caused by malaria, whereby 43 (41.3%) practiced good management of Anaemia. 77 (21.7%) were caused by sickle cell disease, and 10 (13%) practiced good Anaemia management. Among the prevention measures of Anaemia, 237 (66%) mentioned good eating habits of these, 77 (32.5%) practised good management of Anaemia. 42 (12.8%) had no idea on Anaemia prevention of which 19 (41.3%) practised good management of Anaemia. Two-hundred and eighty-one (78.3%) said that when a child is suspected to be anaemic, they go to the hospital, and of these, 86 (30.6%) practised good management of Anaemia. 71 (19.7%) opted to buy drugs at the nearby shop or chemist, and of these, 19 (26.8%) practised good management of Anaemia. 56 (15.6%) have ever participated in Anaemia management, of which 7 (12.5%) practised good management of Anaemia. 133 (39.5%) wished to be involved in Anaemia management of these, 70 (52.6%) practised good management of Anaemia.

The results again reveal that children who had sickle cell disease were less likely (cPR=0.4; 95%CI; 0.21-0.76; p-value=0.005) to practice good Anaemia management

as compared to those who had iron deficiency and children who had other Anaemia causes were less likely to practice good Anaemia management as compared to those who had iron deficiency.

Participants who use to pray only as a method of preventing Anaemia were less likely $p<0.0001$ to practice good Anaemia management as compared to those who go to the hospital. And participants who go to a witch doctor, religious leaders were less likely to practice good Anaemia management than those who go to the chemistry to buy drugs, as shown in the table below.

Participants who had ever participated in Anaemia management were less likely to practice good Anaemia management than those who had not.On the other hand, participants who had wished to get involved in Anaemia management were more likely to practice good Anaemia management as compared to their counterparts (cPR=0.4; 95%CI, 0.19-0.79; p-value=0.009), (cPR=3.9; 95%CI, 2.70-5.86; p-value<0.0001) respectively.

Table 4.5: Caregiver's factors influencing anaemia management

Variable	Overall N (%)	Poor Anaemia management n (%)	Good Anaemia Management n (%)	cPR (95%CI)	P-value
Causes of Anaemia					
Iron deficiency	144 (40.6)	98 (68.1)	46 (31.9)	ref	
Sickle cell disease	77 (21.7)	67 (87.0)	10 (13.0)	0.4 (0.21-0.76)	0.005
Parasitic infections	19 (5.4)	17 (89.5)	2 (10.5)	0.3 (0.09-1.25)	0.103
Malaria	104 (29.2)	61 (58.7)	43 (41.3)	1.3 (0.93-1.80)	0.127
Others	11 (3.1)	11 (100.0)	0 (0.0)	0.0 (0.0---)	<0.0001
Prevention of Anaemia					
Prayer only	1 (0.3)	1 (100.0)	0 (0.0)	0.0 (0.0---)	<0.0001
Good eating habits	237 (66.0)	160 (67.5)	77 (32.5)	2.3 (0.79-6.59)	0.131
Consulting a witch doctor	12 (3.3)	11 (91.7)	1 (8.3)	0.6 (0.07-5.02)	0.624
Observing hygiene	42 (11.7)	37 (88.1)	5 (11.9)	0.8 (0.22-3.16)	0.789
No idea	46 (12.8)	27 (58.7)	19 (41.3)	2.9 (0.96-8.72)	0.06
Going to hospital	21 (5.9)	18 (85.7)	3 (14.3)	ref	
Do when a child is suspected to be Anaemic					
Go to A witch doctor	5 (1.4)	5 (100.0)	0 (0.0)	0.0 (0.0---)	<0.0001
Go to hospital	281 (78.3)	195 (69.4)	86 (30.6)	1.1 (0.75-1.74)	0.535
Go to a religious leader	2 (0.6)	2 (100.0)	0 (0.0)	0.1 (0.0---)	<0.0001
Buy drugs at a nearby shop/chemist	71 (19.7)	52 (73.2)	19 (26.8)	ref	
Ever participated in Anaemia management					
Yes	56 (15.6)	49 (87.5)	7 (12.5)	0.4 (0.19-0.79)	0.009
No	303 (84.4)	205 (67.7)	98 (32.3)	ref	
Wish to be involved in Anaemia management					
Yes	133 (39.5)	63 (47.4)	70 (52.6)	3.9 (2.70-5.86)	<0.0001
No	204 (60.5)	177 (86.8)	27 (13.2)	ref	

******Statistically significant if p-value <0.05, cPR; Crude Prevalence rates, ref; Reference category******

4.8 Health facilities factors influencing Anaemia management in Kisumu County Hospital

254 (70.8%) pointed out delay in admission; 51 (20.1%) practiced good Anaemia management. 254 (70.8%) said that the test was done in time of which 224 (88.2%) practiced good Anaemia management.

254 (70.8%) got all drugs prescribed, of which 141 (55.5%) practiced good management of Anaemia. 254 (70.8%) said that drugs were affordable; 4 (1.6%) practised good Anaemia management. 254 (70.8%) were satisfied with services, of which 226 (89%) practised good management of Anaemia.

The results further reveal that using the Crude Prevalence ratio, participants who delay in admission from the health facility were 9.9 times more likely (cPR=9.9; 95%CI, 5.89-16.74; P-value<0.0001) to have good Anaemia management compared with those who had no delay in admission while at the facility. Participants who had their test done in time were 2.9 times more likely (cPR=1.98; 95%CI, 1.98-4.48; p-value<0.0001) to have good Anaemia management than their counterparts.

Participants who could afford Anaemia drugs had 1.9 times higher odds (cPR=1.9; 95%CI, 1.05-3.57; p-value=0.032) of practicing good Anaemia management as compared to their counterparts. Those who were satisfied by the health facility's services had (cPR=2.9;95%CI,1.93-4.61; p-value<0.0001) times higher odds of practicing good Anaemia management than those who were unsatisfied.

Table 4.6: Health facility factors influencing Anaemia management

Variable	Overall N (%)	Poor Anaemia managementn (%)	Good Anaemia managementn (%)	cPR (95%CI)	P-value
Delay in admission					
Yes	254 (70.8)	203 (79.9)	51 (20.1)	9.9 (5.89-16.74)	<0.0001
No	105 (29.2)	14 (13.3)	91 (86.7)	ref	
The test was done in time					
Yes	254 (70.8)	30 (11.8)	224 (88.2)	2.9 (1.98-4.48	<0.0001
No	105 (29.2)	0 (0.0)	105 (100.0)	ref	
Got all Drugs prescribed					
Yes	254 (70.8)	113 (44.5)	141 (55.5)	1.1 (0.74-1.41)	0.906
No	105 (29.2)	46 (43.8)	59 (56.2)		
Affordability of Drugs					
Yes	254 (70.8)	250 (98.4)	4 (1.6)	1.9 (1.05-3.57)	0.032
No	105 (29.2)	100 (95.2)	5 (4.8)	ref	
Satisfied with services					
Yes	254 (70.8)	28 (11.0)	226 (89.0)	2.9 (1.93-4.61)	<0.0001
No	105 (29.2)	0 (0.0)	105 (100.0)	ref	

Statistically significant if p-value <0.05, cPR; Crude Prevalence rates, ref; Reference category

4.8.1 Clinical Desk Review charts guide on Anaemia management

On the diagnosis, 157 caregivers (78.11%) of the participants reported that their children were diagnosed through the full hemogram test, and 31 caregivers (15.42) of the participants said that their children were diagnosed through the haemoglobin test.

On causes of Anaemia, 87 caregivers (44.16%) of the participants reported that malaria was the cause of Anaemia in their child and 30 caregivers (15.23%) of the participants said that sickle cell was the cause of Anaemia in their child.

On the drugs used in Anaemia management, 107 caregivers (58.79%) reported that they used ranferon and 25 caregivers (13.74%) of the participants reported using saferon.

On other Anaemia management, 127 caregivers (67.91%) of the participants reported blood transfusion, and 39 (20.86 %) caregivers reported the use of nutritional supplements.

On action taken by the caregiver, 182 caregivers (94.79) of the participants stated that they brought the child to the hospital. Eight caregivers (4.17%) of the participants said that they bought over the counter drugs.

On whether the anaemic child is malnourished; 43 children (22.87%) of the participants were underweight, and 25 children (13.3%) of the participants were not malnourished.

Table 4.7: Clinical desk review chart guides on Anaemia management

Variable	**n**	**%**	**Variables**	**N**	**%**
Diagnosis			**Malnourished**		
FHG	157	78.11	No	25	13.3
HB	31	15.42	Some	120	63.83
SCD	5	2.49	Yes	43	22.87
ST	8	3.98	Drugs Used		
Causes of Anaemia			Albendazole	4	2.2
Familial chronic diseases	1	0.51	Amikacin	1	0.55
Haemorrhage	28	14.21	Blood	7	3.85
Inadequate Food Intake	4	2.03	Brustan	2	1.1
Iron Deficiency	24	12.18	Ceftriaxone	5	2.75
Known Sickler	1	0.51	Folate	5	2.75
Malaria	87	44.16	Haematocin	12	6.59
Malnutrition	1	0.51	Hydroxyurea	3	1.65
Parasitic Infection	16	8.12	Morphine	2	1.1
Rheumatic HeartDisease	2	1.02	Proguanil	8	4.4
Sickle Cell	30	15.23	Ranferon	107	58.79
Tropical Infection	3	1.52	Saferan	25	13.74
Anaemia management			transeximic acid	1	0.55
Blood transfusion	127	67.91	The caregiver took the action		
Deworming	1	0.53	Asymptomatic	2	1.04
IV hydration	16	8.56	Bought over the counter drugs	8	4.17
Nutritional Supplements	39	20.86	Brought child to the hospital	182	94.79
Prophylaxis Drugs	4	2.14			

4.9 Multivariable analysis of risk factors influencing anaemia management

The participants' children who had other Anaemia factors were more likely (aPR=2.8; 95%CI, 1.41-6.78; p-value<0.0001) to practice good Anaemia management as compared to those whose children were suffering from Iron deficiency.

Participant's children who ate non-iron-rich foods were less likely (aPR=0.8;95%CI,0.67-0.99;p-value=0.044) to have good Anaemia management compared to those who eat iron-rich food and also those who eat other foodstuffs apart from iron-rich food and non-iron rich foods.

Participants who earn less than 10000 Ksh and between 11000-30000 Ksh were less likely to give their children acceptable anaemia management practices than those who make 31000-50000 Ksh per month.

Participants who valued food and health as crucial expenditure areas were more likely to offer their children acceptable anaemia practices than those who loved education.

Participants dependent on donations for help when their children suffer from Anaemia diseases were more likely to practice acceptable Anaemia management practices than farmers.

When faced with Anaemia, a parent who goes to religious leaders to pray for their children is less likely to practise good Anaemia management. Parents who also consulted witch doctors as a means of Anaemia prevention were less likely to practice good Anaemia management. Those who go to the hospital were more likely to practice good Anaemia management than buying drugs from nearby chemistry.

Parents who could afford all drugs, get their tests done in time, and get all drugs prescribed were more likely to practice good Anaemia management than their counterparts. Participants who were satisfied with services offered at the health facilities were less likely to practice good Anaemia management.

Table 4.8: Multivariate Prevalence ratios of factors influencing Anaemia management

Variable	Overall N (%)	Poor Anaemia management n (%)	Good Anaemia management n (%)	aPR (95%CI)	P-value
Anaemia Factors					
Iron deficiency	154 (42.9)	110 (71.4)	44 (28.6)	Ref	
Sickle cell disease	64 (17.8)	58 (90.6)	6 (9.4)	0.9 (0.19-4.82)	0.954
Parasitic infections	13 (3.6)	10 (76.9)	3 (23.8)	0.9 (0.18-5.43)	0.992
Malaria	117 (32.6)	71 (60.7)	46 (39.3)	0.6 (0.24-1.36)	0.204
Others	11 (3.1)	5 (45.4)	6 (54.6)	2.8 (1.41-6.78)	<0.0001
Number of children <5 years					
<1 years	167 (46.5)	134 (80.2)	33 (19.8)	1.1 (0.89-1.13)	0.96
2-5 years	192 (53.5)	120 (62.5)	72 (37.5)	Ref	
Type of food					
Iron rich	205 (57.1)	133 (64.9)	72 (35.1)	Ref	
Non-Iron rich	134 (37.3)	103 (76.9)	31 (23.1)	0.8 (0.67-0.99)	0.044
Other	20 (5.6)	18 (90.0)	2 (10.0)	0.1 (0.08-1.04)	<0.0001
Source of Income					
Farming	37 (10.3)	28 (75.7)	9 (24.3)	Ref	
Salary	75 (20.9)	58 (77.3)	17 (22.7)	1.6 (0.82-3.13)	0.172
Business	239 (66.6)	162 (67.8)	77 (32.2)	1.5 (0.78-2.98)	0.223
Donations	4 (1.1)	4 (100.0)	0 (0.0)	1.7 (3.81-7.92)	<0.0001
Others	4 (1.1)	2 (50.0)	2 (50.0)	0.9 (0.23-3.23)	0.826
Monthly Earning of family					
<10000	114 (31.8)	66 (57.9)	48 (42.1)	0.3 (0.12-0.68)	<0.0001
11000-30000	161 (44.9)	121 (75.2)	40 (24.8)	0.1 (0.01-0.23)	<0.0001
31000-50000	68 (18.9)	51 (75.0)	17 (25.0)	Ref	
51000-100000	16 (4.5)	16 (100.0)	0 (0.0)	NA	NA
Key expenditure areas					
Education	26 (7.3)	23 (88.5)	3 (11.5)	Ref	
Food	288 (80.2)	186 (64.6)	102 (35.4)	3.9 (2.20-6.79)	<0.0001
Health	45 (12.5)	45 (100.0)	0 (0.0)	8.8 (7.07-10.6)	<0.0001
Family save per month					
<1000	126 (35.1)	76 (60.3)	50 (39.7)	0.5 (0.20-1.03)	0.061
1100-3000	117 (32.6)	89 (76.1)	28 (23.9)	1.2 (0.99-1.39)	0.053
3100-5000	65 (18.1)	50 (76.9)	15 (23.1)	1.1 (0.55-2.33)	0.737
5100-10000	36 (10.0)	28 (77.8)	8 (22.2)	0.4 (0.16-1.12)	0.084
>10000	15 (4.2)	11 (73.3)	4 (26.7)	Ref	
Family lost during Anaemia case					
<1000	257 (71.6)	195 (75.9)	62 (24.1)	0.7 (0.26-1.79)	0.443

Variable	Overall N (%)	Poor Anaemia management n (%)	Good Anaemia management n (%)	aPR (95%CI)	P-value
1100-3000	59 (16.4)	32 (54.2)	27 (45.8)	0.4 (0.17-1.09)	0.077
3100-5000	31 (8.6)	17 (54.8)	14 (45.2)	0.4 (0.17-0.92)	**0.032**
5100-10000	10 (2.8)	8 (80.0)	2 (20.0)	Ref	
>10000	2 (0.6)	2 (100.0)	0 (0.0)	NA	NA
Causes of Anaemia					
Iron deficiency	144 (40.6)	98 (68.1)	46 (31.9)	Ref	
Sickle cell disease	77 (21.7)	67 (87.0)	10 (13.0)	1.1 (0.23-5.07)	0.928
Parasitic infections	19 (5.4)	17 (89.5)	2 (10.5)	0.6 (0.10-3.32)	0.547
Malaria	104 (29.2)	61 (58.7)	43 (41.3)	1.6 (0.65-3.91)	0.304
Others	11 (3.1)	11 (100.0)	0 (0.0)	NA	NA
Prevention of Anaemia					
Prayer only	1 (0.3)	1 (100.0)	0 (0.0)	NA	NA
Good eating habits	237 (66.0)	160 (67.5)	77 (32.5)	0.2 (0.07-3.25)	0.367
Consulting a witch doctor	12 (3.3)	11 (91.7)	1 (8.3)	0.3 (0.01-0.41)	**<0.0001**
Observing hygiene	42 (11.7)	37 (88.1)	5 (11.9)	0.3 (0.09-1.65)	0.432
No idea	46 (12.8)	27 (58.7)	19 (41.3)	0.3 (0.29-1.34)	0.561
Going to hospital	21 (5.9)	18 (85.7)	3 (14.3)	Ref	
What to do when the child is suspected to be Anaemic					
Go to A witch doctor	5 (1.4)	5 (100.0)	0 (0.0)	NA	NA
Go to hospital	281 (78.3)	195 (69.4)	86 (30.6)	1.6 (1.23-1.87)	**0.005**
Go to a religious leader	2 (0.6)	2 (100.0)	0 (0.0)	0.1 (0.02-0.48)	**0.032**
Buy drugs at a nearby shop/chemist	71 (19.7)	52 (73.2)	19 (26.8)	Ref	
Ever participated in Anaemia management					
Yes	56 (15.6)	49 (87.5)	7 (12.5)	1.6 (0.76-3.51)	0.21
No	303 (84.4)	205 (67.7)	98 (32.3)	Ref	
Wish to be involved in Anaemia management					
Yes	133 (39.5)	63 (47.4)	70 (52.6)	1.8 (0.83-3.51)	0.129
No	204 (60.5)	177 (86.8)	27 (13.2)	Ref	
Delay in admission					
Yes	254 (70.8)	203 (79.9)	51 (20.1)	1.2 (0.99-1.54)	0.055
No	105 (29.2)	14 (13.3)	91 (86.7)	Ref	
The test was done in time					
Yes	254 (70.8)	30 (11.8)	224 (88.2)	7.6 (6.56-9.34)	**<0.0001**
No	105 (29.2)	0 (0.0)	105 (100.0)	Ref	
Got all Drugs prescribed					
Yes	254 (70.8)	113 (44.5)	141 (55.5)	7.9 (1.27-8.98)	**0.003**
No	105 (29.2)	46 (43.8)	59 (56.2)	Ref	
Affordability of Drugs					
Yes	254 (70.8)	250 (98.4)	4 (1.6)	6.6 (4.11-11.34)	**<0.0001**
No	105 (29.2)	100 (95.2)	5 (4.8)	Ref	
Satisfied with services					
Yes	254 (70.8)	28 (11.0)	226 (89.0)	0.3 (0.13-0.74)	**0.008**
No	105 (29.2)	0 (0.0)	105 (100.0)	Ref	

4.10 Management of Anaemia

According to Figure 4.4, 71% of the respondents indicated that there was poor management of anaemia compared to 29% of the respondents who indicated that there was good anaemia management.

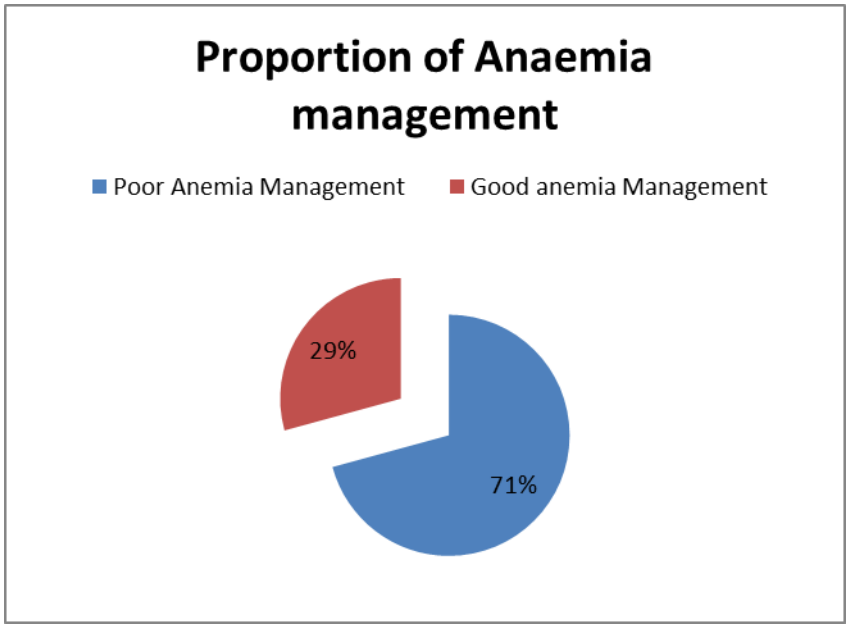

Figure 4.3: Prevalence of Anaemia management

CHAPTER FIVE

DISCUSSION, SUMMARY AND CONCLUSION

5.1 Introduction

This chapter entails discussions of the findings, conclusions from the findings and finally recommendations made based on the findings of the study.

5.1.1 Discussion of the study findings

5.1.2 Anaemia factors in children under five in Kisumu County Hospital

The common anaemia factors were; iron deficiency 42.9%, malaria (32.6%), sickle cell disease (17.8%) and parasitic infestation least (3.6%). This shows that iron deficiency anaemia and malaria contributes to the majority of anaemia cases in children under five in Kisumu County which is consistent with previous study by Foote et al. (2013) which found that malaria and iron deficiency were the characteristics that were most strongly associated with anaemia plausible for rural, western Kenya. Recurrent malaria infections and a diet deficient in iron are common in this community. Though in their findings neither condition was associated with a majority of cases of anaemia, which may challenge the estimation that 50% of cases of anaemia in malaria-endemic areas is caused by iron deficiency.

In previous studies in Kenya, malaria was common, and as a result we were able to determine the strength of association between anaemia and malaria, as well as the strength of association between anaemia and iron deficiency and other previously documented factors. In our study, the highest number of children suffered moderate anaemia (42.9%), while mild anaemia least affected them (24.5%).

This is inconsistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that the prevalence of anaemia under five children, 112 (67.5%) had mild anaemia,

52(31.3%) had moderate anaemia, and 2(1.2%) had severe anaemia. However, the result is consistent with a study in Volta Regional Hospital of Ghana which showed high moderate anaemia.

The majority of the children suffered from malnutrition 43 children (22.87%) and 20.9 % of the participants were underweight, and 25 children (13.3%) of the participants were not malnourished. This is consistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that the prevalence of anemic under five children is associated with malnutrition especially Underweight. Nutritional status also associated with anemia among children under five years. Underweight children (20.9%) are likely to be anemic than children with normal weight.

Several factors have been found to be contributing to the occurrence of anaemia and nearly half of the anaemia cases in childhood are due to iron deficiency. The deficiency may result from inadequate dietary intake of iron, malabsorption of iron, and increased iron demand during rapid growth in children and chronic blood loss. Other causes of anaemia include Malaria, intestinal helminths, viral infections, chronic disease, hemoglobinopathies, hemolysis, and bone marrow disorders. Different studies also claimed that factors such as age, sex, residence, early initiation of complementary food, under-nutrition, maternal health status, maternal education, and poor socioeconomic status are significantly associated with anaemia (Ngesa & Mwambi, 2014).

5.1.3 Socio-demographic characteristics

Most of the children whose caregivers were interviewed had 0-12 months (27.37%), 13-24 months (25.26%), while the least number of caregivers interviewed (4.21%) were those whose children had 49-60 months. In terms of the gender of the children whose caregivers were interviewed 51.8% were males and 48.2% were females implying that they were equally distributed. This was contrary to findings by the Kenya Demographic survey that showed that anaemia is twice as prevalent in

females as in males (KDHS, 2014). The higher prevalence of anaemia among children under two years old and it decreased as the age of the children increased could also be as a result of high iron demands associated with rapid growth rate and erythropoiesis, diets poor in bio-available iron, and low maternal iron reserve during pregnancy.

In the caregiver age, anaemia is common among caregivers of young ages, ages 20-25 years contributed 113 (31.5%) while 25-29 years were 141(39.2%) and least among 45-49 years 4(1.1%). This is consistent with a study done in rural part of Kisumu by Awuor et al. (2021)which found that majority of caregivers 91 (52.0%) of caregivers/mothers of the children were aged between 18–27 years old, followed by 81 (46.3%) age 28-38 years and lastly 3 (1.7%) age 39-40 years.

On the education level of caregivers, most of them 49.5% had attained primary education, 36.8% had secondary education,12.6% had tertiary education, this is consistent with Awuor et al. (2021) which showed that anaemia decreases with increase in education of care givers and as well consistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that mothers (AOR = 7.05; 95% CI: 2.93–17.01) and primary education mothers (AOR = 3.26; 95% CI: 1.29–8.24), are more likely to be anaemic.

Children of mothers with low educational levels were more likely to be anaemic than children of a mother with secondary and above education level. This may be explained by the fact that education enhances the mother's knowledge needed for their children’s health and an appropriate feeding practice, which helps to improve their children nutritional and anaemia status. The caregiver's occupations were as follows; personal business (57.9%), farming (25.3%), formal employment (11.6%), and while other sectors (5.2%) specified as a housewife and everyday work. Caregivers' source of income, business (58.3%), farming (24.5%), Salary (11.7%) while the rest (4.3%) indicated other sources such as church leader, informal employment, Jua kali and washing clothes for other people.

The age distribution of anaemic children was highest at 0-12 months (30.9%), 13-24 months (28.4%) with the least at 49-60 months (9.2%). Higher prevalence of anaemia among children under twenty-four months old and it decreased as the age of the children increased. This was in agreement with studies by Li et al. (2019) which found out that infants aged 6–12 months are at an elevated risk of anaemia, it was also in accord with the done in India which found that the prevalence of anaemia to high among children aged 6 to 59 months (Ghosh & Desai, 2021).

Similarly it agreed with findings by another study which showed that infants born to mothers who are young or old are more likely to be anemic; in particular, mothers who are between the ages of 15 and 25. (Chungkham et al., 2021).

This might be due to high iron demands associated with rapid growth rate and erythropoiesis, diets poor in bio-available iron, and low maternal iron reserve during pregnancy. It's also consistent with (KDHS, 2014), increase iron uptake increases with age, decrease anaemia and with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that Children who were in the age group of 6–11 and 12–23 months, living in an urban, were more likely to be anaemic.

5.2 Factors associated with anaemia among children

5.2.1 Socio-demographic factors

The results of the study indicated that 154 respondents (42.1%) had children with moderate anaemia, 117 respondents (32.6%) reported severe anaemia while 88 respondents (24.5%) reported mild anaemia. This is consistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that the prevalence of anaemia under five children, mild anaemia 112 (67.5%), moderate anaemia 52(31.3%), and severe anaemia 2(1.2%).

It was found out that there was a relationship between anaemia factors and management of anaemia. Respondents with sickle cell trait were less prevalent to good anaemia management compared to those who had iron deficiency at 5% level of significance. (cPR=0.3; 95%C.I[0.15,0.73], p=0.07). The study showed that among the anaemia factors, the highest percentage, 36.5%, was malaria, sickle cell disease (25%), parasitic infestation (24%), while schistosomiasis (14.6%), poor feeding habits and non-iron fatty food intake (6.3%) while malnutrition was the least (1%) of caregivers.

There was also a relationship between the number of children under 5 years and management of anaemia. Respondents with two or more children aged under 5 years were more prevalent to good anaemia management compared to those who had one or no child less than 5 years old.(cPR=1.9; 95% C.I[1.33-2.71], p<0.001). There was also a relationship between type of food and management of anaemia.

Children who used non-rich types of food were 0.7 times less prevalent to good anaemia management than those who used iron rich types of food at 5% level of significance (cPR=0.7, 95% C. I [0.46-0.95]p=0.023).

Caregivers with primary education or with no formal education had their children more likely to develop anaemia and practice poor anaemia management than those with secondary and tertiary education (17.3%) consistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that mothers (AOR = 7.05; 95% CI: 2.93–17.01) and primary education mothers (AOR = 3.26; 95% CI: 1.29–8.24), are more likely to be anaemic. Found an association between the levels of maternal education and anemia which is in agreement with other studies. Children of mothers with low educational levels were 3.3–7 times more likely to be anemic than children of a mother with secondary and above education level. This may be explained by the fact that education enhances the mother's knowledge needed for their children’s health and an appropriate feeding practice, which helps to improve their children's nutritional status.

A possible explanation for the high prevalence of anaemia might be that families with low income are less likely to purchase nutrient-rich foods such as iron, vitamins etc, secure food availability, and afford health service during illness for their children. This finding was similar to studies conducted in other parts of the world, such as studies by Ngesa and Mwambi (2014) and Woldie et al. (2015) which reported that children from poor families were at risk of anaemia compared to their counterparts. The higher prevalence of anaemia among children with less educated mothers and low-income families indicates that anaemia should be a marker of socioeconomic disadvantage.

5.2.2 Anaemia management factors

The findings of the study showed that most of the respondents (71%) indicated that there was good management of anaemia compared to 29% of the respondents who indicated that there was poor anaemia management. Also in the study, respondents rated anaemia management level to be moderate level (75%); which were the majority, and highest level (20.8%) and the least was Low (4.2%) on anaemia management in the health facility.

5.2.3 Socio-economic factors for management of malaria

The study indicated a relationship between source of income and management of anaemia. Participants who relied on donations as a source of income were less likely (cPR=0.1, 95%CI; 0.0--; p-value<0.0001) to have good Anaemia management as compared to participants who were farmers. Monthly earning of a family was also associated with management of anaemia. Participants who earn 11000-30000,31000-50000 and 51000-100000 per month were less likely (cPR=0.6;95%CI,0.41-0.83; p-value=0.003), (cPR=0.6;95%CI,0.37-0.95; p-value=0.028) and (cPR=0.0;95%CI,0.0--; p-value<0.0001) respectively to practice good Anaemia management compared to those who earn less than 10000 per month.This is consistent with a study done in Ethiopia by Gebreweld et al. (2019) on Prevalence of anaemia and its associated factors among children under five years of age attending at Guguftu health centre, South Wollo, Northeast Ethiopia which found that a family with monthly income of

<750 ETB(AOR = 5.19; 95% CI: 1.24–21.75) and 750–1500 ETB(AOR = 5.89; 95% CI: 1.45–23.98) were more likely to become anaemic.

Children from poor families were at risk of anaemia compared to their counterparts. A possible explanation for the high prevalence of anaemia might be that families with low income are less likely to purchase nutrient-rich foods (like iron, vitamins, and etc.), secure food availability, and afford health service during illness for their children. The higher prevalence of anaemia among children with less educated mothers and low-income families indicates that anaemia is a marker of socioeconomic disadvantage. These findings are consistent with study by Shimanda et al. (2020) in Namibia which found out that the poor socioeconomic class, male gender and lower age were associated with poor management of anaemia and thus increased risk of management of anaemia.

Participants who valued food as a critical expenditure were more likely (cPR=3.1;95%CI;1.05-9.02; p-value=0.041) to have good Anaemia management as compared to those who value education, and those who loved health were less likely (cPR=0.0;95%CI,0.0--; p-value<0.0001) to practice good Anaemia management as compared to those who valued education. Savings per month by the family was a factor linked to management of anaemia according to the study with families who save between Kshs. 1100-3000 and 3100-5000 Ksh being less likely to practise good Anaemia management as compared to their counterparts.

Monthly losses of the family were linked to management of anaemia with families who lose around Kshs.3100-5000 and Kshs. 5100-10000 having a good likelihood of practicing good anaemia management than those who release less than <1000 Ksh, given that they had higher odds of good Anaemia management..

5.2.4 The care giver's factors influencing Anaemia management in Kisumu County hospital

The results revealed that the majority of caregivers (79.9%) thought that Anaemia is being caused by paleness, 6.4%argued that Anaemia is caused by tiredness. About, 4.74% of the caregivers argued that Anaemia is caused by other things apart from the

ones listed, 3.62%thought that Anaemia is being caused whenever a child vomits. Only 1.95%of the caregivers felt that Anaemia is caused by coughing.

As indicated by another study by Eseigbe et al. (2012) caregivers have an important part to play in the provision and care for childhood diseases. In another study, it was found out that poor knowledge causes caretakers to be unaware of both the vulnerability of children to malaria disease and how to practice appropriate home-based treatment (which they prefer) compared to seeking treatment at the nearest health institution.

5.2.5 Health facility factors and anaemia management

Health facility challenges affecting anaemia management response included delaying admission, delaying admission (38.3%), while no delays in admissions (61.7%). Admission delays were found to affect anaemia management ($p<0.0001$) significantly.

Required tests for anaemia had a significant association with anaemia management ($p<0.0001$). Prescribed drugs, availability of prescribed medicines rated low, got prescribed drugs (39.6%) while 58.3% did not get the prescribed medications. Availability of prescribed drugs significantly influenced anaemia management ($p<0.0001$). A high proportion (95.7%) had the tests done and prescribed drugs charged, which had no statistically significant effect on anaemia management. Among the caregivers, 41.4% responded that drugs and tests were affordable, while 58.6% responded that the drugs and trials were not cheap. Drug and test affordability was found to be significantly associated with anaemia management ($p=0.044$).

The majority of the caregivers represented by 74.2% were satisfied with the services they received from the health facilities, while 25.8% were not satisfied. Service satisfaction was also found to be statistically associated with anaemia management ($p<0.0001$). Among the caregivers who responded to challenges they encountered, harshness from staff (24%), long queue in line before admission (22.9%), and 2.1% were not explained by staff's laboratory results.

The average amount paid for lab costs was Ksh. 1,771.24, with the least amount, spent being Ksh. 150, and the maximum amount paid was Ksh. 7200. The average amount of paid forward cost is Ksh. 2400 with a minimum amount of ksh.50 and a maximum of Ksh. 8,300. Drugs treatment cost was Ksh994.75 and a minimum amount of cash. 130 and a maximum amount of money. 3,330. The average total treatment cost is Ksh. 5,165.

The results of this study were in agreement by a study by Darmawati which also showed that when facilities were poor at the health care centre, then the management of anaemia was likely to be poor as well.

5.2.6 Health seeking behaviour among caregivers

The study shows a high knowledge level on anaemia detection among caregivers; most of them (93.8%) suspect Anaemia in their child if they realize paleness, which prompts early management in the hospital. Health seeking behaviour, 92.7% take their child to the hospital while sick, (4.2%) visit nearby chemists/shops for drugs, While 1% each usually visits their religious leader and asks their neighbour for drugs. The primary source of information on anaemia is health care providers (94.8%). In comparison, friends (7.3%). (88.3%). The participants were not affected by maternal health status, while (11.7%) was involved.

Feeding pattern, a high number of children were fed with Iron-rich food (57.1%) while those fed with non-iron rich food were (37.3%), and the least number of children were provided with other types of food (5.6%). Iron deficiency was found to be the highest cause of Anaemia (42.9%), followed by malaria (32.6%) and sickle cell disease was at (17.8%), and the least common others (3.1%). Deworming status, most children were between 2-5 years (53.5%) while (46.5%) were and below years. The highest number of children were dewormed on a 3 month frequency (32.3%), followed closely by a 6 month frequency (30.9%); the least frequency of deworming was yearly (9.5%)

The results of this study were in contrast with other studies which had revealed that health seeking behaviour of patients is poor. Aigbokhaode and Isara (2021) found out

that there was poor health seeking behaviour among caregivers. Most caregivers offered primary care of children at home, with few others at a chemist shop. Only 24.6% of the caregivers said that a health facility was where primary care was offered to their children. Poor knowledge causes caretakers to be unaware of both the vulnerability of children to malaria disease and how to practice appropriate home-based treatment (which they prefer)compared to seeking treatment at the nearest health institution (Birhanu et al., 2017). Similarly in another study in JOOTRH, the majority of caregivers would first administer some leftover medications before presenting the child to a health facility. The probable reason for this contrast could be that caregivers attending Kisumu County hospitals were well informed and thus knowledgeable on anaemia, and thus able to detect early signs leading to seeking of medical care.

5.3 Conclusions and recommendations

5.3.1 Conclusion

Anaemia causes a high economic burden in children under five in Kisumu county. There is a need to control the comorbidities and genetic factors associated with Anaemia, such as malaria and sickle cell disease, and improve caregiver knowledge on anaemia and its management.

Iron deficiency anaemia was the most common. Factors associated with severe anaemia were malaria parasitaemia, sickle cell anaemia and parasitic infections. Socio-demographic factors such as Education and literacy level were significant i.e Literacy level increase with increase education. Socio-economic factors; socio economic class such as Occupation i.e. business being highest contributor while farming least factor and Family savings thus low family savings high significance.

Health facility factors affects anaemia management i.e. Delay in hospital admission or attending to patients, Tests and drugs. Caregiver factors i.e. Poor health seeking behaviour such as delay in health seeking behaviour, visiting traditional healers affects anaemia management negatively. The priority now should be to explore in

detail the health and educational impact of carefully designed integrated infection and nutritional interventions.

5.3.2 Recommendations

Anaemia is a severe public health menace in Kisumu County, interventions should address malaria, iron deficiency, and other factors such as sickle cell disease, parasitic infections etc to decrease the burden of anaemia in this population.

Anaemia factors: Kisumu County Government to enhance Malaria and parasite prevention and control, sickle cell screening and treatment, and health education on improved eating habits. The County to establish Sickle cell screening and couple counselling and screening. Enhance Strategies to identify and manage anaemia and anaemia related factors such as malaria, sickle cell anaemia and parasitic infections. Measures that reduce the prevalence of malaria will consequently reduce anaemia in young children and the need for blood transfusions associated with the risk of HIV-transmission as well as establishing blood collection centres for blood transfusion. There is need for Mass deworming as a strategy for anaemia control.

There is a need to conduct further studies on home and hospital management outcomes for anaemia in children under five in Kisumu County Hospital.

Socio-demographic: Kisumu County Government to enhance health education program on Nutrition i.e Eating habits and farming of food rich in iron ;young children needs proper breastfeeding and iron rich foods.

The County to create awareness and sensitization on prevention and control of anaemia among children under five. Empower and protect the indigens with economic and social insurance /financial protection through social/ solidarity insurance cover and sound economic policies. Farmers were less affected, Kitchen garden or cone gardens for farming iron rich vegetables and women empowerment programs. Kisumu County Government to empower and protect the indigens with robust economic and social insurance /financial protection through social/ solidarity insurance cover and sound economic policies. There is a need to map, register, and

provide support for sickle cell anaemia patients by the Government, especially the county Government.

Health system and facility strengthening: Kisumu County, Department of Health to train and capacity build staffs to ensure effective and efficient anaemia management and stock facilities with drugs and diagnostic commodities with prompt service provision. Train and capacity build staffs to ensure effective and efficient anaemia management and stock facilities with drugs and diagnostic commodities and services as well as prompt service provision.

Kisumu County Government to hire more health care staff, such as nutritionists, to educate and sensitize the patients on various types of anaemia management and prevention strategies. This helps in delivery, quality counselling, and high adherence to anaemia drugs, especially for sickle cell prophylactic drugs. The County to establish a comprehensive Centre for Sickle Cell Disease (SCD), which will help sensitize, mobilize, and encourage more caregivers to seek timely health services for their sick children. The County Government Department of Health to source and stock more anaemia drugs, especially sickle cell anaemia drugs such as hydroxyurea, supply adequate lab reagents, and provide more tests for anaemia, especially electrophoresis, CT scan. Kisumu County Department of Health to establish blood collection centres across the country to support availability of blood for blood transfusion services.

Health seeking behaviour strengthening: Kisumu County Government to create awareness and sensitization on anaemia through community education to ensure early detection, diagnosis and treatment of anaemia and improved health seeking behaviour. Awareness and sensitization on anaemia through community education to ensure early detection, diagnosis and treatment of anaemia and improved health seeking bahaviour. The county to ensure Partners mobilisation and stakeholder engagement for effective anaemia management in the County. Kisumu County to form more patient support groups and allocate finances for running such support groups with refreshers and locally available food demonstrations to support good nutrition.The County Government to educate patients on the need for disclosure,

especially for sickle cell anaemia and its timing, treatment buddy (caregiver), and adherence support items like alarm, clock, calendar, etc.

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APPENDICES

Appendix I: Informed Consent explanation and Consent Form

TITLE: FACTORS ASSOCIATED WITH ANAEMIA MANAGEMENTAMONG CHILDREN UNDER FIVES IN KISUMU COUNTY HOSPITAL.

Institution: Jomo Kenyatta University of Agriculture and Technology (JKUAT)

Box 62000- 00200, Nairobi**.**

Investigator: Fredrick Odhiambo Oluoch

Box 55-40102, Kombewa, Tel, 0724496601

Supervisors: Dr. Daniel Nyamongo

Ethics and review Committee: P.O. Box……. Tel……

Permission is requested from you to enroll in this medical research study. It would help if you understood the following general principles applicable to medical research, whether involving well or patient volunteers.

Your agreement to enroll in this study is entirely voluntary.

You may withdraw from the study at any time without necessarily giving any reason for such withdrawal.

After you read the explanation, please feel free to ask any questions that will enable you to understand this study's nature clearly.

Introduction

In this study, I assess the factors associated with Anaemia managementamong children under five in Kisumu County hospital.

Procedures to be followed

I will request you to read the questions and fill the answers into a questionnaire as appropriately as possible.

Risks

No risks are expected to accrue from this study since all information you will provide will be handled confidentially and used for this study's purposes only. Data leakages are inevitable, and as such, we cannot guarantee 100% confidentiality, but all efforts will be taken to maintain confidentiality. This is questionnaire-based research, and no/minimal risk shall be expected as the respondents only answer questions.

Benefits

No monetary rewards will accrue from this study. However, it is hoped that this study's results will be useful in improving Anaemia managementboth from the policy and practice perspectives. All participants will also be given an information leaflet that will enhance their knowledge in the prevention, diagnosis, and treatment of Anaemia.

Assurance on confidentiality

All information you provide will be kept confidential and used for this study only. After a period of, say 5 years after the results have been published, the information will be destroyed. Your name will not be used during data handling or in any resulting publications. Codes will be used instead.

Contacts If you need to contact me, my supervisors, or my academic department, and, more importantly, the ethical committee with any queries concerning this study, please feel free to use the contacts provided above.

Informed Consent Form

I, the undersigned, willingly agree to participate in this study, the nature and purpose of which have been fully explained to me by the investigator/translator. I understand that the information gathered will only be used for this study, and maximum confidentiality will be maintained.

Participation Response :

ACCEPT:…….

REJECT: …….

Respondent.....

Sign.....Date.....

Witness (investigator).....

Sign.....Date.....

Appendix II: Data collection Instruments

Investigator: Fredrick Oluoch Tel. 0724496601

1A: Questionnaire for the study

Kindly fill in the following questions by placing a tick in the appropriate box provided

A. PATIENT INFORMATION AND SOCIO- DEMOGRAPHIC CHARACTERISTIC

1. a)Age of the child……Sex. .....

b)Age of the caregiver …….

c)Maternal health status/condition, i.e., Sickling□ YES□ NO

2. Where is the area of residence? ……
3. Occupation of the respondent ……

1□ Formal employment2 □ Farming3□ Personal Business4 □ Other (specify)……

4. Highest level of formal education of the respondent

1□No formal education 2□Primary3 □Secondary4 □Tertiary5□University

5. a)Religion of respondent.

1□African traditional 2 □Christianity3□Islam4□Hindu5□Other (specify)…….

b) Child nutrition state/malnutrition status 1. □ YES2. □ NO

c) Type of food fed to the child ……

1 □. Iron rich2. □Non-iron rich 3. □ Other (specify)…….

6. The Anaemiafactors (causes).

1. □Iron deficiency 2. □ Sickle cell Disease3. □ Haemorrhage (Bleeding)

4.□Parasitic infections 5□ Malaria 6. □Malnutrition 7. Others (specify). .....

2. Number of children of the (mother) respondent under 5 years.

1 □1 2 □2-5 3 □>5

3. Type of Anaemia

1 □Mild2 □ Moderate3 □ Severe

8. The frequency of deworming. .....

1 □ 3 monthly2 □6 monthly3 □ Yearly 4.□ Others,specify. .....

2. INCOME AND EXPENDITURE OF THE FAMILY

1. What is the main source of income of the family?

1□Farming2□Salary3□Business4□Donations5□Other (specify)……

2. What is the approximate monthly earning of the family in Kshs?

1□<100002□11000-300003□31000-500004□50000 -1000005□>100000

3. What are the key expenditure areas of the family?

1□Education2 □Food3□Health4□ Other (specify).....

FINANCIAL

4. How much money (in Kshs)is the family able to save per month

□ <10002. □1100-30003□3100-50004□5000-100005□>10000

5. Approximately how much money did the family spend on issues related to paediatric Anaemiain the past one month,

1. □<10002□1100-30003 □3100-50004□5000-100005□>10000

ECONOMIC

6. How much do you think the family lost during Anaemiacase.

1. □<10002. □1100-30003. □3100-5000 4. □5000-100005. □>10000

2 HEALTH SEEKING BEHAVIOUR OF CARE GIVERS (MARTERNAL KNOWLEDGE, BELIEFS AND PRACTICES ON ANAEMIA)

1. In your opinion, what is Anaemia

1□ Palor /paleness/lack of blood2. □Headache3. □ Coughing 4. □Tiredness5. □ Vomiting6.□Other (specify)

2. What causes Anaemia

    1. □Iron deficiency 2. □ Sickle cell disease3. □ Haemorrhage (Bleeding)

4.□Parasitic infections 5□ Malaria 6. Malnutrition7. □Others (specify). .....

1. How can you prevent Anaemia ?

    1. □Prayer only2. □Good eating habits3.□Consulting a witch doctor3. □Observing hygiene4. □No idea5. □Other (specify)

2. What signs/symptoms may prompt you to suspect that your child could be suffering from Anaemia. 1. □ Paleness2.□Vomiting3.□ Convulsions4. □Dullness 5. □No appetite6. □No idea7. □ Other (specify).....
3. What do you usually do when you suspect your child is anaemic (sick).

1. □Go to a witch doctor2.□Go to hospital3. □Go to a religious leader4. □Buy drugs at the nearby shop/chemist5. □ Ask neighbour for drugs6. □Administer herbal drugs

4. Where did you obtain information in 4 and 5 above from?

1. □Radio 2. □ TV3. □Friends 4. □Place of Worship5. □Health care providers

7. Have you ever participated in any Anaemia management ? □ YES□ NO

If Yes, in which way?

8. Would you mind to be involved in Anaemia management ?

□ YES□ NoIf Yes, in which way?

9. Which type of Anaemiadid your child suffer from?

1. □Iron deficiency 2. □ Sickle cell3. □ Haemorrhage (Bleeding)

4.□Parasitic infections 5□ Malaria 6. □Others (specify). .....

D. HEALTH FACILITY FACTORS AFFECTING ANAEMIA MANAGEMENT

1. Was there any delay in admission? □ YES□ NO
2. Did you get all tests required done in time within the hospital? □ YES□ NO
3. Did you get all drugs prescribed? □ YES□ NO
4. Were the drugs and tests charged? □ YES□ NO
5. How much did you use in charges (a)Drugs cost (b)Lab cost (c)Ward cost
6. Are they affordable?□ YES□ NO
7. Are you satisfied with the services? □ YES□ NO
8. How do you rate Anaemia management ?

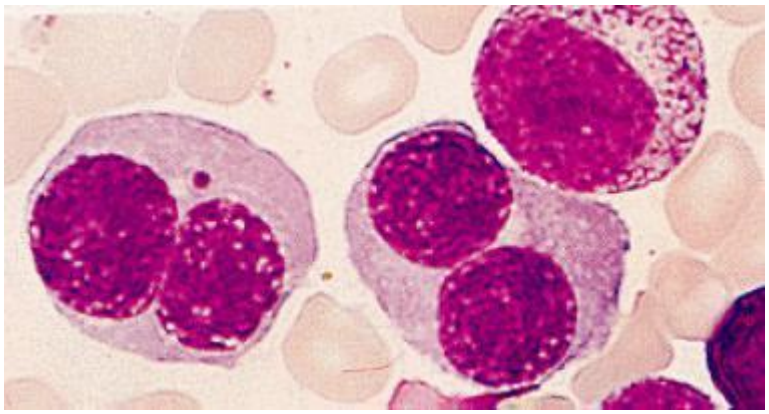
(a.)Low (<49%) (b)Moderate (50 69%) (c)High (> 70%)

9. What facility challenges did you experience?

CLINICAL DESK REVIEW CHARTS GUIDE ON ANAEMIA MANAGEMENT

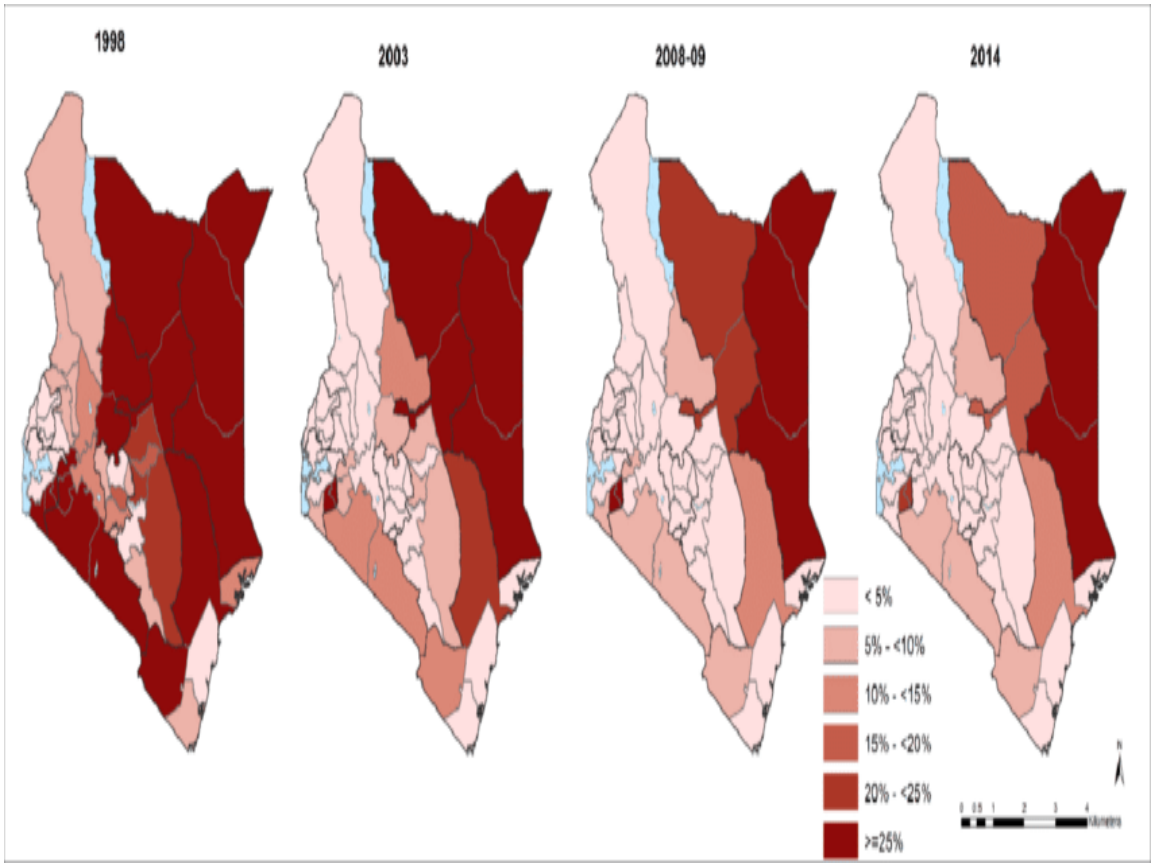
1. What is the common diagnosis method for Anaemia ?Tests done and cost of the tests?
2. What could be the underlying causes of Anaemia ?
3. What are the drugs used in Anaemia managementin the facility? How much do they cost?
4. What are other methods of Anaemia managementin your facility?
5. What is the cost involved in the whole Anaemia management ?
6. What action did the care giver of the child take immediately the child fell sick?
7. Are the anaemic children also malnourished?
8. What are the challenges you experience in management?
9. What are the facility related challenges of Anaemia management ?
10.

Bone marrow aspirate with erythroidprecusors

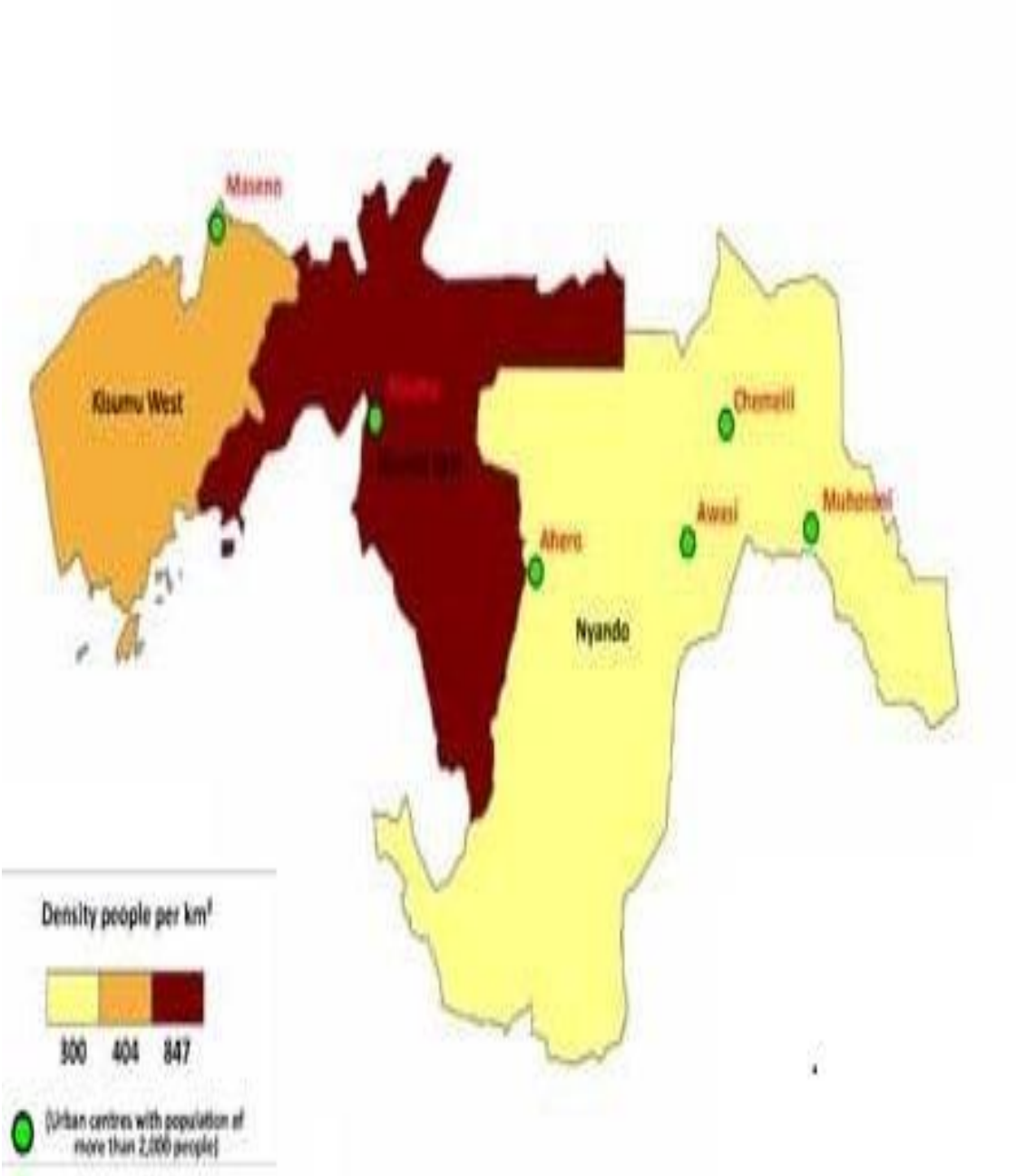


Bone marrow aspirates showing erythroid hyperplasia and many binucleatederythroid precursors.

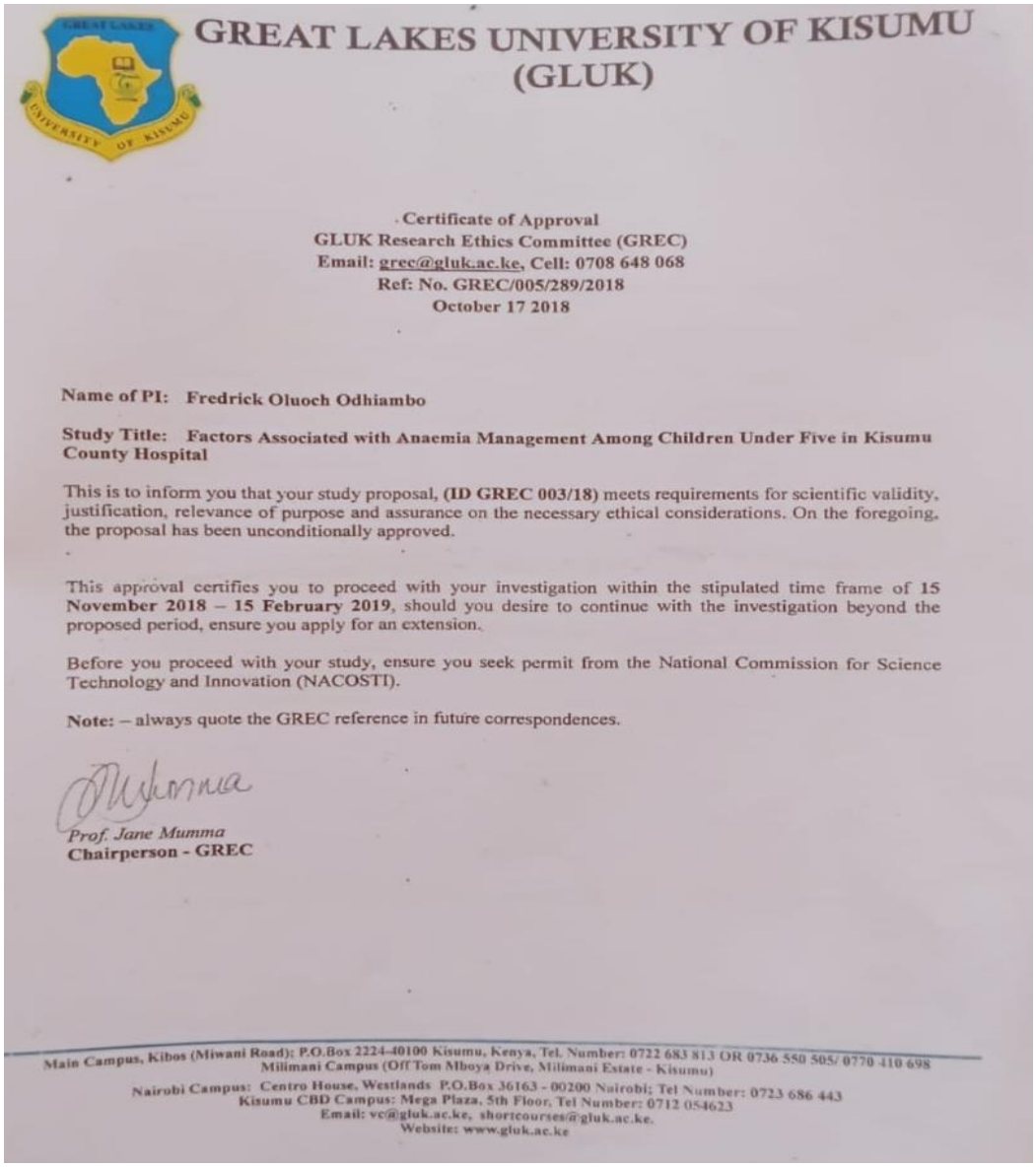
Appendix III: Anaemia distribution in Kenya. Source World Health Organization



Appendix IV: Map of Kisumu County



Appendix V: Ethical Approval



GREAT LAKES UNIVERSITY OF KISUMU
(GLUK)

Certificate of Approval
GLUK Research Ethics Committee (GREC)
Email: grec@gluk.ac.ke, Cell: 0708 648 068
Ref: No. GREC/005/289/2018
October 17 2018

Name of PI: Fredrick Oluoch Odhiambo

Study Title: Factors Associated with Anaemia Management Among Children Under Five in Kisumu County Hospital

This is to inform you that your study proposal, **(ID GREC 003/18)** meets requirements for scientific validity, justification, relevance of purpose and assurance on the necessary ethical considerations. On the foregoing, the proposal has been unconditionally approved.

This approval certifies you to proceed with your investigation within the stipulated time frame of **15 November 2018 – 15 February 2019**, should you desire to continue with the investigation beyond the proposed period, ensure you apply for an extension.

Before you proceed with your study, ensure you seek permit from the National Commission for Science Technology and Innovation (NACOSTI).

Note: – always quote the GREC reference in future correspondences.

Prof. Jane Mumma
Chairperson - GREC

Main Campus, Kibos (Miwani Road): P.O.Box 2224-40100 Kisumu, Kenya, Tel. Number: 0722 683 813 OR 0736 550 505/ 0770 410 698
Milimani Campus (Off Tom Mboya Drive, Milimani Estate - Kisumu)
Nairobi Campus: Centro House, Westlands P.O.Box 36163 - 00200 Nairobi; Tel Number: 0723 686 443
Kisumu CBD Campus: Mega Plaza, 5th Floor, Tel Number: 0712 054623
Email: vc@gluk.ac.ke, shortcourses@gluk.ac.ke.
Website: www.gluk.ac.ke

Appendix VI: Plagiarism Report

Plagiarism Detector v. 1991 - Originality Report 2/28/2023 1:13:48 PM

Analyzed document: Fredrick Oluoch -Anaemia Thesis 28022023.docx Licensed to: Jomo Kenyatta University of Agriculture and Technology

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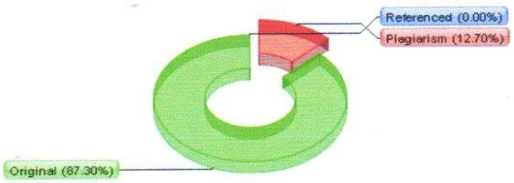

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Appendix VII: Kisumu County Department of Health Approval

REPUBLIC OF KENYA

COUNTY GOVERNMENT OF KISUMU

Telegrams: "PRO (MED)"
Tel: 254-057-2020105
Fax: 254-057-2023176
E-mail: kisumucdh@gmail.com

County Director of Health
P.O. Box 721 – 40100,
Kisumu.

DEPARTMENT OF HEALTH &SANITATION

Our Ref: GN 133 VOL.XI/ (797) **Date:** 20 October, 2018

TO:

Fredrick Oluoch

RE: RESEARCH APPROVAL

The County Department of Health has reviewed and approved your research tittled: ''Factors associated with anaemia management among children under five in Kisumu County Hospital''

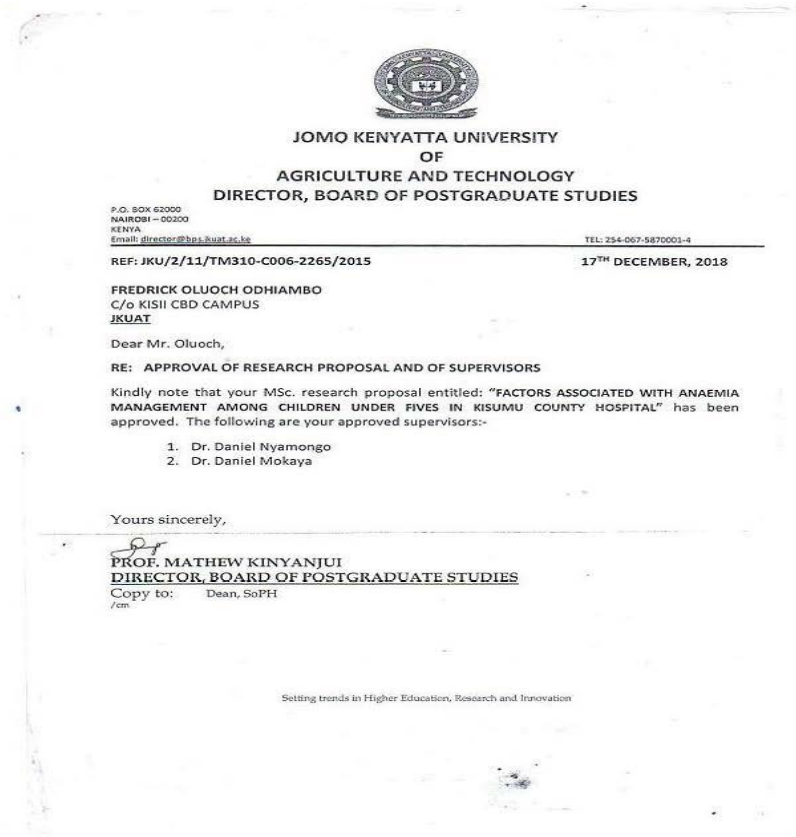
This is therefore to authorize you to proceed and conduct the study for a period of 12 months.
You should work together with county teams and staffs in implementing this project and give feedback of the your findings at the end of the study.

Thank you

Dr. Albert Ng'ong'a
County Director Health
Kisumu County

From the office of County Director of Health

Appendix VIII: JKUAT Research Proposal Approval



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OF
AGRICULTURE AND TECHNOLOGY
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

P.O. BOX 62000
NAIROBI – 00200
KENYA
Email: director@bps.jkuat.ac.ke
TEL: 254-067-5870001-4

REF: JKU/2/11/TM310-C006-2265/2015 17TH DECEMBER, 2018

FREDRICK OLUOCH ODHIAMBO
C/o KISII CBD CAMPUS
JKUAT

Dear Mr. Oluoch,

RE: APPROVAL OF RESEARCH PROPOSAL AND OF SUPERVISORS

Kindly note that your MSc. research proposal entitled: "FACTORS ASSOCIATED WITH ANAEMIA MANAGEMENT AMONG CHILDREN UNDER FIVES IN KISUMU COUNTY HOSPITAL" has been approved. The following are your approved supervisors:-

1. Dr. Daniel Nyamongo
2. Dr. Daniel Mokaya

Yours sincerely,

PROF. MATHEW KINYANJUI
DIRECTOR, BOARD OF POSTGRADUATE STUDIES
Copy to: Dean, SoPH
/cm

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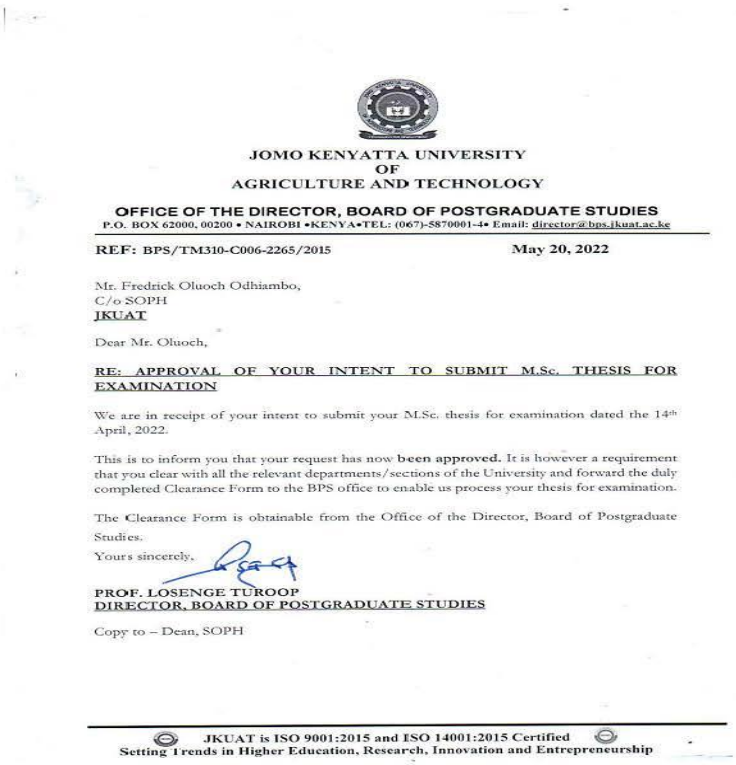
Appendix IX: Approval of Intent to Submit Thesis



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OFFICE OF THE DIRECTOR, BOARD OF POSTGRADUATE STUDIES
P.O. BOX 62000, 00200 • NAIROBI •KENYA•TEL: (067)-5870001-4• Email: director@bps.jkuat.ac.ke

REF: BPS/TM310-C006-2265/2015 **May 20, 2022**

Mr. Fredrick Oluoch Odhiambo,
C/o SOPH
JKUAT

Dear Mr. Oluoch,

RE: APPROVAL OF YOUR INTENT TO SUBMIT M.Sc. THESIS FOR EXAMINATION

We are in receipt of your intent to submit your M.Sc. thesis for examination dated the 14th April, 2022.

This is to inform you that your request has now **been approved.** It is however a requirement that you clear with all the relevant departments/sections of the University and forward the duly completed Clearance Form to the BPS office to enable us process your thesis for examination.

The Clearance Form is obtainable from the Office of the Director, Board of Postgraduate Studies.

Yours sincerely,

PROF. LOSENGE TUROOP
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

Copy to – Dean, SOPH

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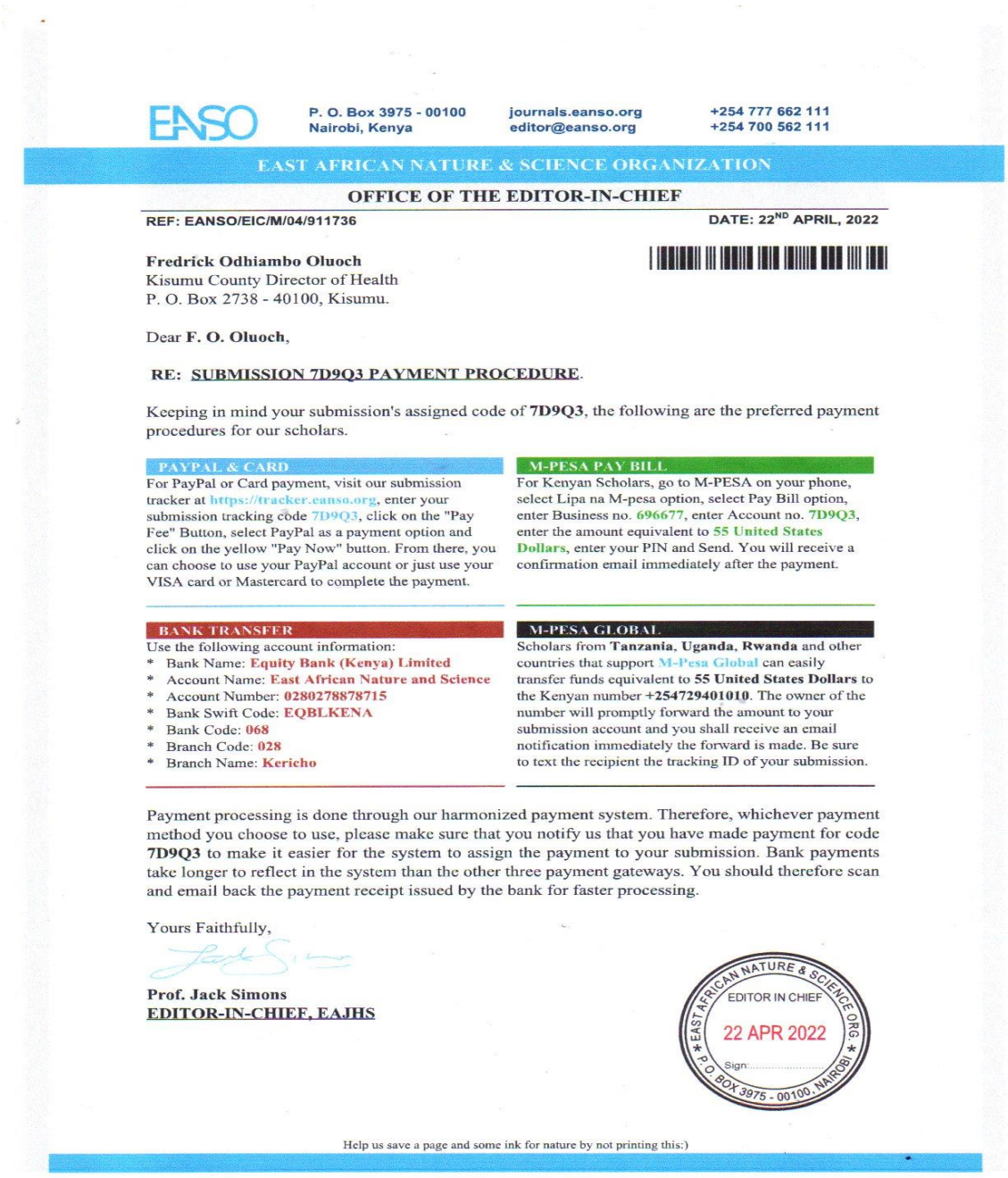
Appendix X: ENSO Publication



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EAST AFRICAN NATURE & SCIENCE ORGANIZATION

OFFICE OF THE EDITOR-IN-CHIEF

REF: EANSO/EIC/M/04/911736

DATE: 22ND APRIL, 2022

Fredrick Odhiambo Oluoch
Kisumu County Director of Health
P. O. Box 2738 - 40100, Kisumu.

Dear **F. O. Oluoch**,

RE: SUBMISSION 7D9Q3 PAYMENT PROCEDURE.

Keeping in mind your submission's assigned code of **7D9Q3**, the following are the preferred payment procedures for our scholars.

PAYPAL & CARD

For PayPal or Card payment, visit our submission tracker at https://tracker.eanso.org, enter your submission tracking code 7D9Q3, click on the "Pay Fee" Button, select PayPal as a payment option and click on the yellow "Pay Now" button. From there, you can choose to use your PayPal account or just use your VISA card or Mastercard to complete the payment.

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* Account Name: **East African Nature and Science**
* Account Number: **0280278878715**
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* Branch Name: **Kericho**

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Yours Faithfully,

Prof. Jack Simons
EDITOR-IN-CHIEF, EAJHS

EAST AFRICAN NATURE & SCIENCE ORG.
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22 APR 2022
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P.O. BOX 3975 - 00100, NAIROBI

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