PREVALENCE AND FACTORS ASSOCIATED WITH ANAEMIA AT FOURTEEN WEEKS POST-DELIVERY IN MOTHERS ATTENDING CHILD HEALTH CLINIC AT WEBUYE HOSPITAL

HAJI ABDALLA MUSUKO

A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF MASTER OF MEDICINE, FAMILY MEDICINE [MMED-FM] SCHOOL OF MEDICINE MOI UNIVERSITY.

DECLARATION

Declaration by the Candidate

This thesis is my original work and has not been presented for a degree in any other university /Institution. No part of this thesis may be reproduced without the prior permission of the author and /or Moi University.

HAJI ABDALLA MUSUKO

SM/PGFM/04/15

Sign…… Date…… …... /……/……

Declaration by Supervisors

This Thesis has been submitted to Moi University with our approval as University Supervisors

DR PATRICK M CHEGE

Department of Family Medicine

Sign…… Date…… …... /……/……

DR JAMES AKIRUGA AMISI

Department of Family Medicine

Sign…… Date…… …... /……/……

DEDICATION

I dedicate this work to my lovely wife Joyce, my daughter Grace and my sons Victor, Gift and Moses.

ABSTRACT

Background: Anaemia is a major cause of morbidity and mortality in developing countries. Globally, 29.4 % women of the reproductive age group are anaemic while in Kenya the prevalence was 25% in 2013. Anaemia in the postpartum period has not been widely described as most of the studies have concentrated on anaemia in pregnancy. Our literature search yielded scarce data on prevalence and factors associated with postpartum anaemia for Western Kenya.

Objective: To determine the prevalence and factors associated with anaemia at fourteen weeks post-delivery in mothers attending child health clinic at Webuye County Hospital.

Study Methods: This was a cross-sectional study carried out at the child health clinic at Webuye County Hospital in Bungoma County. Mothers fourteen weeks post-delivery who brought their children for immunizations and fulfilled the criteria were enrolled. Using a systematic random sampling technique, 245 mothers were recruited. Data were collected using a pre-tested interviewer-administered questionnaire. Secondary data were extracted from the mother-child clinic booklet. At the end of the interview, Mission Plus Hemoglobin Testing System device was used to test haemoglobin using a 10 micro-litre blood finger prick sample. Data were verified and cleaned before entry into my personal computer in Microsoft Excel software. The analysis was carried out in STATA version 14. Median, frequencies and proportions were generated. Chi-square test was used to check for associations for categorical variables. Multiple logistic regression was used to adjust for confounders. A paired t-test was used to compare the significance of the mean difference of haemoglobin level during the entire ANC and at 14 weeks post-delivery. The level of significance was $p<0.05$.

Results: The median age was 26 years (IQR 22,31), 86.5% were married. The prevalence of anaemia at 14 weeks post-delivery was 26.94% (95% CI:21.34,32.53. Haematinics use during pregnancy and post-delivery was 63.27 % and 17.6% respectively. Place of delivery was associated with postpartum anaemia with those who had delivered at home having the highest rates of postpartum anaemia (44.4%), $p=0.03$. On multiple logistic regression, adjusting for the place of delivery, age and marital status, women who delivered at home, their odds of developing anaemia was 2.365 times that of women who delivered in a health facility ($p=0.041$;95% CI: 1.036-5.399). The difference in mean haemoglobin at 14 weeks post-delivery and antenatal care was -0.871(95% CI: -1.116, -0.627). The mean haemoglobin at 14 weeks post-delivery was higher than at antenatal care and the difference was statistically significant ($p<0.001$).

Conclusions: The prevalence of anaemia in the postpartum period was 26.94%. This is lower than the global prevalence of 29.4%, however, it is in the same range as the Kenya national prevalence of 25%. The haematinics use of 63.27% during ANC is lower than the National uptake of 68.7%. Haematinics use post-delivery was low at 17.6%. Women who had delivered at home had higher rates of anaemia compared to those who delivered in a health facility. The mean haemoglobin at 14 weeks post-delivery was higher than the entire Antenatal Care Clinic period.

Recommendations: All postnatal mothers should be screened for anaemia during postnatal care visit at 14 weeks post-delivery. Health facility delivery should be encouraged during antenatal care clinic visits. Iron and folic acid supplementation as an intervention to reduce the prevalence of anaemia prevalence should be strengthened during the antenatal and postnatal period.

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to acknowledge the following individuals for their contribution to the success of this study:

My supervisors Dr Patrick Chege and Dr James Akiruga for their guidance and encouragement throughout the research process. Without their professional guidance and leadership, this study would not have been possible.

The administration of Moi University and Webuye County Hospital for permission to conduct this research.

The Faculty of Family Medicine and colleagues for their support and guidance.

My research assistants: Caleb and Atitwa for diligently collecting data and filling the forms correctly.

My family for their patience and understanding during the many days I spent away from them while pursuing this course.

ABBREVIATIONS

ANC	Ante Natal Care
DPT	Diphtheria Pertussis Tetanus
g/dl	Gram per Deciliter
Hb	Haemoglobin
HEP B	Hepatitis B
Hib	Haemophilus influanzae type b
HIV	Human Immunodeficiency Virus
IFAS 90+	Iron Folic Acid Supplementation of greater or equal to 90 tablets during pregnancy
IFAS	Iron Folic Acid Supplementation
IREC	Institutional Research and Ethics committee
KDHS	Kenya Demographic and Health Survey.
KEPI	Kenya Expanded Program on Immunization
MCH	Maternal and Child Health Clinic
MOH	Ministry of Health
MOPHS	Ministry of Public Health and Sanitation
OPV	Oral Polio Vaccine
PNC	Post Natal Care
PPH	Post Partum Haemorrhage

PPPH	Primary Postpartum Haemorrhage
SVD	Spontaneous Vertex Delivery
WHO	World Health Organization

OPERATIONAL DEFINITIONS OF VARIABLES

1) **Anaemia-** Hemoglobin level less than 12g/dl in the women of the reproductive age group who are non-pregnant (WHO 2011).
2) **Antenatal Care-** Is the routine health control of presumed health pregnant women without symptoms (screening), in order to diagnose diseases or complicating obstetric conditions without symptoms and to provide information about lifestyle pregnancy and delivery (NICE clinical guidelines, 2015)
3) **Postnatal Care-**Care given to the mother and the baby after birth up to 6 weeks (42 days) (WHO. 2010).
4) **Postpartum Haemorrhage**–Defined as cumulative blood loss equal to 1000 mL or more along with signs or symptoms of hypovolemia within 24 hours after delivery (including intrapartum loss), regardless of route of delivery (ACOG Bulletins, 2018)

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Anaemia is one of the major contributing factors in maternal morbidity and mortality in the developing countries associated with up to 20% maternal deaths.

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs. In the non-pregnant women, it is defined as a haemoglobin concentration of less than 12.0 g/l (WHO 2011). In the other groups, haemoglobin concentration which anaemia is likely to be present at sea level is usually defined in children 6 months -6 years: 11 g/dl, children 6-14 years: 12 g/dl, adult males: 13 g/dl, pregnant females 11g/dl (WHO 2011).

Anaemia may be due to either a low red cell mass or increased plasma volume as happens in

pregnancy. It may result from reduced production or increased loss of red blood cells which has many causes. Anaemia may be classified morphologically based on the average size of the cells and the haemoglobin concentration in the red cells. This results in the following terms that describe anaemia: macrocytic, normochromic normocytic and hypochromic microcytic. Anaemia may also result from defects at any stage of red cell and haemoglobin production or when an increased rate of red cell destruction (haemolysis) exceeds the capacity of the bone marrow to mount a compensatory increase in production. Changes in physiological states as occurs in pregnancy may also cause anaemia (Longmore and Wilkinson. 2010).

Pregnant, non-pregnant women and children are the vulnerable population groups with a varied prevalence of anaemia (Stevens, Finucane et al. 2013). Anaemia is a

global health problem that affects low, middle and high-income countries with resultant adverse health and socioeconomic effects that lead to easy fatigability and subsequent low productivity of the affected individual (Bodnar, Cogswell, & Scanlon, 2002) (Bodnar, Scanlon et al.2001). There has been a reported downward trend in the prevalence of anaemia in non-pregnant and pregnant women worldwide (Onis, Dewey et al. 2013).

Globally, an estimated 29.4% of women of reproductive age group have anaemia. The African estimated prevalence is high at 37.6 %.The East Africa prevalence is 26 % with Kenyan estimates of 25% of women in the reproductive age group being anaemic (Stevens, Finucane et al. 2013).

Half of the global anaemia prevalence is estimated to be due to iron deficiency in non-malaria areas (Onis, Dewey et al. 2013). Other documented causes of anaemia include folate, vitamin B12 and A deficiencies, chronic inflammation, parasitic infections, and inherited disorders (Stevens, Finucane et al. 2013).

Post-Partum anaemia is one of the problems of abnormal puerperium. Anaemia in the postpartum period needs thorough evaluation as some causes can be traced back to pregnancy and others could be arising from the puerperium. Peripartum anaemia leads to anaemia in the postnatal period and beyond (Bodnar, Scanlon et al. 2001). Most women are already anaemic at the time of conception with an estimated global prevalence of 29% in non-pregnant women. Prolonged or excess vaginal bleeding after delivery of the baby is an important cause of postpartum anaemia. Lactation increases iron demand and this can lead to iron deficiency anaemia. Lactation requires a daily dietary allowance of 10 mg of iron (Grebremedhin and Enquselassie. 2011).

The standard approach to treatment in the majority of institutions is oral supplementation, with blood transfusion reserved for severe and symptomatic cases (Bhandal and Russell. 2006). Oral iron has been found to be unreliable in the treatment of severe anaemia due to its limited absorption and gastrointestinal side effects that affect compliance (Peña-Rosas and Viteri 2009).

The 2013 WHO guidelines on care of mother and newborn recommend administration of oral haematinics for three months post-delivery, however, follow up care of mothers with anaemia after the postpartum period has not been well documented during child welfare clinic visits (WHO 2014).

1.2 Statement of the Problem

Anaemia remains an important cause of morbidity and mortality in the women of reproductive age group (15-49) with a prevalence of 29.4% and 25% globally and Kenya respectively (Stevens, Finucane et al.2013). In addition, it has been associated with adverse health consequences as well as an adverse impact on social and economic development leading to fatigue and low productivity (Bodnar, Scanlon et al.2001). Anaemia in the postpartum period has not been well documented in Sub-Saharan Africa. Most studies have concentrated on the antenatal period. In the Western part of Kenya, a study done in a level five hospital to determine the prevalence and possible risk factors associated with anaemia in pregnancy found anaemia was more prevalent (33.3%-60%) in the second and third trimester (Siteti, Namasaka et al.2014). The challenges of anaemia do not end with pregnancy delivery and therefore more studies in the postpartum period are important. The iron and folic acid supplementation programme implemented through the focused antenatal care by the Ministry of health has a low uptake with only 3% of pregnant women taking 90-day iron-folic acid tablets. (90 + IFA). Nevertheless, current recommendations by the

WHO to give haematinics for at least three months post- delivery is an intervention poorly practiced in Kenya with sub-optimal coverage and low adherence rates (MOH 2013). The prevalence and factors associated with anaemia in the post-delivery period have also not been well documented in rural Western Kenya.

1.3 Justification of the Study

Webuye County Hospital offers a wide range of reproductive health services. The study period corresponds to the time mothers come to the child health clinic for immunizations DPT3-Hep3-Hib3, Oral polio vaccine (OPV3). This period is also two weeks after the twelve weeks recommended for iron and folic acid supplementation of at least three months after delivery by the WHO. Determining the prevalence and associated factors of anaemia at this contact point will have the benefit of assessing this intervention. Previous studies have generally focused on anaemia in the antenatal period while data on post -delivery haemoglobin levels and prevalence of anaemia in this region is scarce. The findings of this study will be used to recommend an early visit around four to six weeks postpartum and later visits at three, and six to nine months after childbirth, which concurs with the immunization schedule in many countries. This will change clinical practice as equal attention to the mother and baby in the postpartum period will occur, unlike the current practice where only mothers who present with symptoms are given attention. The study findings are to be shared with the aim of improving the knowledge on maternal care and influence policy on post-delivery care of mothers in Webuye hospital Western Kenya and other parts of Kenya.

1.4 Research Questions

1. What is the prevalence of anaemia at fourteen weeks post-delivery in mothers attending child health clinic at Webuye County Hospital?
2. What are the factors associated with anaemia at 14 weeks post-delivery in mothers attending child health clinic at Webuye County Hospital?

1.5 Research Objectives

1.5.1 Broad Objective

To determine the prevalence and factors associated with anaemia at fourteen weeks post-delivery in mothers attending child health clinic at Webuye County Hospital

1.5.2 Specific Objectives

1) To determine the prevalence of anaemia at fourteen weeks post-delivery in mothers attending child health clinic at Webuye County Hospital.
2) To determine the factors associated with anaemia at fourteen weeks post-delivery in mothers attending child health clinic at Webuye County Hospital.
3) To compare the ANC mean haemoglobin levels with the mean haemoglobin levels at 14 weeks post- delivery in mothers attending child health clinic at Webuye County Hospital.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview

The postpartum period is a time of increased risk for both mother and newborn. Significant improvement has been made in promoting neonatal health, however similar attention has not been paid to improving maternal health during the postpartum period. It is important to address anaemia in the postpartum period and prenatally because it contributes to maternal deaths both directly and indirectly.

While many studies have assessed the prevalence of anaemia in the antenatal period, very few have assessed it in the postpartum period.

2.2 Prevalence of Anaemia.

The prevalence of anaemia in the postpartum period is different in countries and regions. A study done in Uganda in an Eastern District in postnatal women who delivered within one year found approximately two-thirds (64.4%) of the women were anaemic, with 55 (15.8%) suffering from moderate to severe anaemia (Hb< 10.0 g/dl) and 169 (48.6%) with mild anaemia (10.0-11.9 g/dl). Five (1.4%) women suffered from severe anaemia (Hb< 7.0 g/dl) (Sserunjogi L, 2003)

A study done in India coastal Karnataka found a prevalence of postnatal anaemia of 26.5 %. (Bhagwan D, 2016)

A community-based study done in the early postpartum maternal morbidity among rural women of Rajastan India found 7.4 % and 46% prevalence for severe anaemia and moderate anaemia respectively. In the same study, severe anaemia had a strong correlation with parity of three or more [($p<0.000$, AOR = 2.47 (95% CI 1.83- 3.33) (Iyengar, 2012)

A cross-sectional survey in Myanmar found a prevalence of 60.3 % in lactating mothers, 20.3% had severe anaemia (Ai Zhao, 2014)

2.3 Associated Factors

2.3.1 Age of the Mother.

Pregnancy outcome at an extremely advanced age is associated with increased maternal risk for placenta praevia, caesarian delivery and postpartum haemorrhage with risk increasing for women older than 50 years. (Yogev, Melamed et al. 2010). A retrospective study done in a USA hospital found that childbirth in women younger than 19 years and older than 35 years was associated with increased risk of adverse maternal perinatal outcomes such as postpartum haemorrhage, eclampsia and cephalopelvic disproportion as well as adverse infant outcomes (Cavazos-Rehg, Krauss et al. 2015).

A study done in a level five hospital in Western Kenya found that the prevalence of pregnancy-related anaemia was significantly higher in the lower age groups (Siteti, Namasaka et al. 2014). According to the Kenya Demographic Health Survey 2014, 18 % of women aged 15-19 years are mothers or pregnant with their first child (KDHS 2014). Many health problems are particularly associated with negative outcomes of pregnancy during adolescence. These include anaemia, malaria, HIV and other sexually transmitted infections, postpartum haemorrhage and mental disorders such as depression(WHO 2014).

2.3.2 Utilization of Antenatal Care Services.

The WHO recommends a minimum of four antenatal visits during a woman`s pregnancy, comprising interventions such as tetanus toxoid (TT) vaccination, screening and treatment for infections, and identification of warning signs during pregnancy (Leenstra, Petersen et al. 2004). In Kenya, according to the KDHS 2014, only 58 % made the minimum four visits as recommended by the World Health Organization (KDHS 2014). A study done in Kwale in the Kenyan Coast found women who attended antenatal care were associated with good pregnancy outcomes. Antenatal care visits were associated with behavioural decisions including use of TT and Sulphadoxine-pyrimethamine (SP) doses, use of insecticide-treated mosquito net, use of iron and folic acid, vitamins and decisions regarding delivery in a health care facility (Brown, Sohan et al.2008). A study in a University Hospital in Finland found that pregnancies of non-attenders and under attendees of antenatal care clinic were significantly more often complicated by placenta abruption (Raatikan. Heiskanen. et al. 2007).

2.3.3 Postnatal Care Attendance.

The postnatal period is critical to the health and survival of the mother and the newborn. It is the period where preventive care practices and routine assessment to identify and manage or refer complications for both mother and baby occur (Warren, Daley et al 2013).

Lack of care in this period may result in death or disability as well as missed opportunities to promote health behaviors affecting women, newborns and children. In Africa, 34% of maternal mortality is due to haemorrhage occurring in the early postnatal period. (Warren, Daly et al. 2006). The WHO guidelines of 2013 on

postnatal care recommend at least 24 hours of care in the facility after an uncomplicated vaginal birth for healthy mothers and newborns. The second recommendation, if birth is at home, the first postnatal contact should be as early as possible within 24 hours of birth. At least three additional postnatal contacts are recommended for all mothers and newborns, on day 3 (48–72 hours), between days 7–14, and 6 weeks after birth (WHO 2014). According to the Kenya Demographic Survey 2014 among women age 15-49 who had a live birth in the two years preceding the survey, 51 per cent received a postnatal checkup in the first two days after their last live birth (KDHS 2014).

Not much emphasis is made on the postnatal care visits by healthcare workers in Sub-Saharan Africa to postnatal mothers. An analysis of 23 Demographic and Health Surveys (DHS), revealed that two-thirds of women in sub-Saharan Africa gave birth at home and only 13% of these women received a postnatal visit within two days of birth (Warren, Daly et al 2013). During postnatal care, complications can be identified and addressed early.

2.3.4 Iron and Folic Acid Supplementation

Iron and folic acid supplementation are done in pregnancy during the ANC visits. Available meta-analysis suggests that intermittent iron supplementation during pregnancy increases the mean blood haemoglobin concentration (Fernández-Gaxiola and De-Regil 2011).

According to 2013 WHO recommendations on postnatal care, daily iron and folic acid supplementation should be provided for at least 3 months after delivery (De-Regil, Jefferds et al. 2014).

A study done in Nepal to determine the compliance rate of iron-folic consumption and the factors associated with iron-folic consumption amongst postnatal mothers found

only 20.7% consumed iron throughout the post-natal period for 45 days. The same study found that mothers who had secondary education and higher, had attended four or more antenatal care visits, delivered in the health facility and attended postnatal care were more likely to take iron for 45 days(Calvert, Thomas et al. 2012). A study in Northern Tanzania found a prenatal intake of folic acid and iron supplementation at 17.2% and 22.3% respectively in pregnant women with 16% of women reporting using both (Ogundipe, Hoyo et al. 2012).

A randomized clinical trial conducted in China where perinatal micronutrient supplements other than folate, before conception were not routinely recommended at the time found that iron supplementation in pregnancy increased maternal haemoglobin at or near term by 5.56 g/dl and reduced the risk of anaemia (Zhao, Xu et al. 2016).

In Kenya, all pregnant women are targeted for free supplementation of iron and folic acid supplementation from the first month of pregnancy or on the first contact in the antenatal clinics (MOH 2013).

2.3.5 Postpartum Haemorrhage

Postpartum haemorrhage may be primary or secondary. Primary postpartum haemorrhage results from many causes, the commonest being uterine atony, which is responsible for 80% of the cases (Naghavi, Wang et al. 2015). PPPH was observed to be common in patients who deliver operatively through caesarian section, undergo induction of labour, and those who have an episiotomy(Begley, Gyte et al. 2011).

Globally postpartum haemorrhage results in 44,000 to 86,000 deaths per year making it the leading cause of death during pregnancy (Tazeen, S. and N. Gani Dr 2013).

There is a substantial difference in the complications in postpartum haemorrhage with 0.4 women per 100,000 deliveries and 150 women per 100,000 deliveries who die

from PPH in the United Kingdom and Sub-Saharan Africa respectively (Tazeen, S. and N. Gani Dr 2013).

2.3.6 Increased Maternal Needs During Lactation.

The daily requirement of external iron remains as little as between 1 to 8mg daily. However, more external iron is required to balance increased demand for iron especially with physiological requirements during growth, pregnancy, and lactation (Food and Administration 2001).

There is a significantly increased demand for iron during pregnancy for the development of the fetus and placenta in addition to supporting the mother's blood volume. Furthermore, pregnant women are subject to iron loss during and after delivery (Gebremedhin and Enquselassie 2011).

The total iron loss associated with pregnancy and lactation is approximately 1000 mg. Therefore, the recommended daily dietary allowance for iron in pregnancy is 27mg instead of 8mg in the adult non-pregnant population. Lactation requires a daily dietary allowance of 10 mg (Gebremedhin and Enquselassie 2011).

A study done in Ethiopia found the overall prevalence of anaemia among lactating mothers during 2005–2011 was 22.1% (Vitamins and Board 2004). The prevalence of anaemia among lactating mothers was consistently higher in those in the poor wealth index group, not currently working, with BMI ≥25 kg/m2, with 1 year duration of breastfeeding, never educated, never attended ANC, never used family planning services, no iron tablet supplement during pregnancy, and with higher parity(Bua, Paina et al.2015).

Breastfeeding has been found to increase the risk of anaemia significantly in the postpartum period (Gebremedhin and Enquselassie 2011).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Site

The study was conducted at Webuye County Hospital in Western Kenya at the maternal

and child health clinic (MCHC). Webuye County Hospital is a tier three hospital in

Bungoma County. According to the hospital annual work plan for 2015/2016, it had a catchment population of 98494 with 21669 (15-49) women of reproductive age. It offers maternity, antenatal care, postnatal care and child-welfare services. The economic activity of Webuye County is sugarcane and maize farming, animal husbandry, wholesale and retail shops. The activities of the busy Mombasa – Malaba highway also contributes to Webuye`s economy. Webuye County also has the medical training college and Masinde Muliro University campus where these students contribute a lot to the real estate business.

3.2 Study Design

The study was a cross-sectional study.

3.3 Study Population

Mothers who brought their children for immunizations as per KEPI schedule at 14 weeks (DPT3-Hep3-Hib3, oral polio (OPV3) were studied.

3.3.1 Inclusion Criteria

Mothers who were 14 weeks postpartum and had brought their children to the child health clinic for Pentavalent Vaccine at 14 weeks and who gave consent were included in the study.

3.3.2 Exclusion Criteria

Mothers who were very sick or had sick babies in need of urgent care and those attending the clinic for immunizations before or after 14 weeks postpartum were excluded from the study.

3.4 Sample Size

The formula for estimation of a single population with the assumption of 95% confidence level, margin error of 5% was used to determine the minimum sample size.

$$n=\frac{\frac{z^2\times p(1-p)}{e^2}}{1+\frac{z^2\times p(1-p)}{e^2 N}}$$

z =confidence level Z score =1.96

p=prevalence =0.25[Kenyan prevalence of anaemia in non-pregnant women is 25% (Stevens Finucane et al.2013)]

e=margin error of 0.05

N=954 (Webuye County hospital had about 954 mothers who brought babies for the 3rd pentavalent vaccine in 6 months. Data was collected in 6 months)

Substituted

$$n=\frac{\frac{1.96^2\times 0.25(1-0.25)}{0.05^2}}{1+\frac{1.96^2\times 0.25(1-0.25)}{0.05^2\times 954}}=221.2\sim 222$$

To account for 10% non-response 245 participants were recruited for the study

3.5 Sampling Technique

Since mothers were not booked and came for services at random, the systematic random sampling method was used. This involved a random start and then selected every k^{th} case where k=N/n, N is the population size and n is the sample size. N=954 (Webuye Hospital sees about 954 mothers who bring babies for the 3^{rd} pentavalent vaccine in 6 months. Data were collected in 6 months). The sample size n was 245.The sampling fraction/integer was k=N/n=954/245 =3.894 ~4. The random starting was an integer between 1 and 4. Four different pieces of paper labelled 1-4, folded, put in a box, mixed and dropped on the table, number 1 was selected randomly. The investigator picked every 4^{th} participant until the sample size was attained. For this study, the random starting point was 1. The sequence was therefore 1, 5, 9, 13, …..etc. In case the selected 4^{th} participant declined to participate, the process would start all over again.

3.6 Instruments

A structured interviewer-administered questionnaire was used. The questionnaire was borrowed from a validated questionnaire used in a similar study to suit the local situation. (Bhagwan, D 2016). The questionnaire was pretested by the principal investigator at the Webuye health Centre to mothers who were 14 weeks post-delivery then revised after the pretesting. The questions that were not addressing the study objectives were dropped.

3.7 Data Collection Procedure/ Methods.

A pretested structured questionnaire was administered by the principal investigator or the research assistant. Two research assistants (a nurse and a laboratory technologist) were trained and certified on the study objectives, interview skills, and data collection. Data collection was by interview and review of the mother-baby clinic booklet for secondary data. The mother and baby booklet had information on the antenatal care which included clinical and workup profiles, the gestation at which mother started antenatal care, iron and folic acid given and the pregnancy outcome. Those without the mother-baby booklet were allowed to proceed on with the applicable questions. Demographic data, place and mode of delivery, previous antenatal profile –haemoglobin level and family planning utilization were recorded in the questionnaire.

At the end of the interview, the principal investigator or the two research assistants tested for the haemoglobin level at the study site. A 10micro-litre blood specimen was obtained from the finger prick into a test strip in a Mission plus Hemoglobin Testing Device. This test kit uses reflectance photometry methodology with results read in < 15 seconds. It has a haemoglobin measurement range of 5-25.6 g/dl and an accuracy of Hb 5-10 g/dl, +_ 0.4, 10-25.6g/dl, +_ 4%? Anaemia was classified as mild, moderate or severe based on the WHO haemoglobin levels, No Anaemia -Hb greater than 12 g/dl, Mild 11-11.9 g/dl, Moderate 8.0-10.9g/dl, Severe less than 8.0g/dl (WHO, 2011).

After data collection, each study participant was educated regarding the causes of anaemia and its consequences. They were also educated on the importance of iron-rich diet, and Iron and Folic tablets during the antenatal and postnatal period.

3.8 Validity and Reliability

The questionnaire was pretested at the Webuye Health Centre child health clinic.

The study participants at the Webuye health centre had similar characteristics as the clients visiting Webuye County Hospital. The questionnaire was refined by removing the questions that were not in the study objectives. The research assistants were trained and certified.

3.9 Data Management and Statistical Analysis

3.9.1 Data Management

Daily checking of the questionnaire for completeness and coding was done. The data was verified and cleaned before entry into my personal computer in Microsoft Excel software. The analysis was carried out in STATA version 14. The data was protected by the use of a password.

3.9.2 Data Analysis

Descriptive statistics (frequencies and proportions) were generated for categorical variables and median with interquartile range was used for continuous variables. Chi-square test was used to assess associations between categorical variables. Multiple logistic regression model was used to adjust for confounders.

A paired t-test was used to compare the significance of the mean difference of haemoglobin during ANC and at 14 weeks post-delivery. Tables were used to present data. The level of significance was $p<0.05$. The analysis was carried out in STATA version 14.

3.10 Study Limitations

1) This study was only able to determine the level of haemoglobin and therefore characterizing the type of anaemia was beyond the scope of the study.
2) The fact that the recruitment of participants was done in the hospital child health clinic, mothers whose pregnant outcomes included perinatal and early infancy deaths, those who do not bring their children for immunizations were missed out.
3) This study shared the limitation of a cross-sectional design, which makes it difficult to demonstrate the cause-and-effect relationship.

3.11 Ethical Consideration

Ethical approval was sought from the Institutional Research and Ethics Committee (IREC) of Moi University and approval was granted under approval number **FAN: IREC 0001702**. Permission to conduct the study was also sought and granted by the Webuye County Hospital management team.

Informed consent was sought from the study participants. Those who had low haemoglobin were treated using current clinical guidelines and were also referred for further evaluation at their cost. Any other health condition diagnosed during the study was managed appropriately. Participants' information was treated as confidential and was not used for any other purpose other than the study. The haemoglobin test was done in a secluded place at the study site. Filled questionnaires were kept in a lockable room in a lockable cabinet by the principal investigator in order to ensure that confidentiality was maintained throughout the study. No names were used on the questionnaire and the electronic data was protected by the use of a password.

CHAPTER FOUR: RESULTS

4.0 RESULTS

4.1 Overview

This chapter highlights the key findings on the prevalence and factors associated with anaemia at 14 weeks post-delivery for mothers attending child health clinic at Webuye Sub County Hospital. Two hundred and forty- five mothers met the inclusion criteria and were enrolled in the study.

Table 1: Socio-demographic Characteristics

Variable	**Median**	**IQR**
Age	26	22,31
Marital status	**Frequency**	**Percent**
Married	212	86.50
Single	31	12.70
Divorced	2	0.80
Education	**Frequency**	**Percent**
None	6	2.40
Primary	63	25.70
Secondary	107	43.70
College	55	22.40
University	14	5.70
Occupation	**Frequency**	**Percent**
Business lady	86	35.10
Employed	39	15.90
Farmer	19	7.80
Housewife	90	36.70
Casual	6	2.40
Other	5	2.00
Family Income in KSh/month	**Frequency**	**Percent**
Below 10,000	153	62.40
10,000-19,999	47	19.20
20,000-30,000	21	8.60
>30,000	24	9.80

A total of 245 participants were included in the analysis. The median age of the participants was 26 (IQR 22, 31) years. Majority of the study participants, 212 (86.50) were in a marriage relationship and had at least a secondary education or higher.

Table 2: Medical and Obstetric characteristics of study participants.

Variable	**Median**	**IQR**
Number of children	2	1,3
Spacing in years	**Frequency**	**Percentage**
N/A	86	35.10
1-2	22	9.00
3-4	70	28.60
>4	67	27.30
Attended ANC	245	100
Gestation age at 1st ANC Visit in weeks	**Frequency**	**Percentage**
<12	84	34.30
13-27	147	60.00
>28	14	5.70
Number of ANC visits	**Frequency**	**Percentage**
1	11	4.50
2	25	10.20
3	45	18.40
4	74	30.20
>4	90	36.70
Haematinic use in pregnancy	**Frequency**	**Percentage**
Yes	155	63.27
No	90	36.73
Haematinic duration in months	**Frequency**	**Percentage**
N/A	90	
<1 month	29	18.71
2 months	39	25.16
3 months	27	17.42
4 months	30	19.35
>4 months	30	19.35
Place of delivery	**Frequency**	**Percentage**
Hospital	218	89.00
Home	27	11.00
Mode of delivery		
SVD	213	86.90
CS	32	13.10
Excess blood loss	38	15.50
Blood transfusion	1	2.36

The median number of children was 2 (IQR 1, 3), There was 100 % ANC attendance with 30.2 % attending the required four ANC visits according to 2012 WHO ANC model. The participants who had used haematinics in pregnancy was 63.27 % with 38.7 % using haematinics for more than 3 months. 89% of the deliveries occurred at the hospital while 11% delivered at home.

Table 3: Medical and Obstetric characteristics of study participants.

Variable	Frequency	percentage
Postnatal care		
Yes	99	40.40
No	146	59.60
Postnatal care visits		
N/A	146	59.60
Within 48 hours	10	4.10
1-2 weeks	25	10.20
4-6weeks	58	23.70
1 targeted visit after 6 weeks	6	2.40
Haemoglobin test after delivery (within 14 weeks)	19	7.76
Haemoglobin level results in g/dl		
N/A	226	
Lower than 7	6	31.58
7-9.9	5	26.32
10-11	3	15.79
>11	5	26.32
Haematinics given		
Yes	43	17.60
No	202	82.40
Family planning		
Yes	138	56.33
No	107	43.67
Duration of FP use in months		
N/A	107	
<1 month	27	19.57
2 months	101	73.19
3 months	10	7.25
Breastfeeding	245	100
ANC haemoglobin in g/dl		
Not done	87	35.5
<7	3	1.89
7-9.9	28	17.61
10-10.9	37	23.27
>11	90	57.23
Haemoglobin level at interview in g/dl		
<8	2	0.82
8-10.9	40	16.32
11-11.9	24	9.80
>12	179	73.10

The postnatal care attendance was 40.40 %. Only 17.6 % of those who attended postnatal care reported the use of haematinics. 56.3 % of the participants were using a family planning method at 14 weeks post-delivery.

The prevalence of anaemia during ANC was 42.8 %, 1.89 % had severe anaemia, 17.6 % had moderate anaemia with 23.3% having mild anaemia. A third of the participants ,35.5% had no haemoglobin level test done during ANC.

The prevalence of anaemia at 14 weeks post-delivery was found to be 26.94%**.** Severe anaemia was 0.8% of the subjects, 16.3 % of the subjects had moderate anaemia and mild anaemia was present among 9.8 % of the study participants

Table 4: Factors Associated with Anaemia at 14 Weeks Post-delivery.

	Anaemia		Chi-square p-value
Variable	**No**	**Yes**	
Marital status			
Married	159 (75)	53 (25)	0.083
Single/Divorced	20 (60.6)	13 (39.4)	
Education level			
None	6 (100)	0 (0)	0.263
Primary	44 (69.8)	19 (30.2)	
Secondary	74 (69.2)	33 (30.8)	
College	43 (78.2)	12 (21.8)	
University	12 (85.7)	2 (14.3)	
Spacing			
N/A	64 (74.4)	22 (25.6)	0.355
1-2	16 (72.7)	6 (27.3)	
3-4	46 (65.7)	24 (34.3)	
>4	53 (79.1)	14 (20.9)	
ANC visits			
1	6 (54.5)	5 (45.5)	0.312
2	15 (60)	10 (40)	
3	34 (75.6)	11 (24.4)	
4	56 (75.7)	18 (24.3)	
>4	68 (75.6)	22 (24.4)	
Haematinic use at ANC			
Yes	109 (70.8)	45 (29.2)	0.295
No	70 (76.9)	21 (23.1)	
Place of delivery			
Hospital	164 (75.2)	54 (24.8)	0.03
Home	15 (55.6)	12 (44.4)	
Mode of delivery			
SVD	155 (72.8)	58 (27.2)	0.791
CS	24 (75)	8 (25)	
Postnatal care			
Yes	70 (72.9)	26 (27.1)	0.967
No	109 (73.2)	40 (26.8)	
Family planning			
Yes	101 (72.7)	38 (27.3)	0.872
No	78 (73.6)	28 (26.4)	

Those who had delivered at home had the highest prevalence of anaemia (44.4 %). This was statistically significant (p =0.03). On Bivariate analysis, the other factors were not statistically significant.

Table 5: Factors Associated with Anaemia at 14 Weeks Post-delivery

Variable	Anaemia No	Anaemia Yes	Chi-square p-value
Postnatal care visits			
N/A	96 (65.8)	50(34.2)	0.263
Within 48 hours	8 (80.0)	2 (20.0)	
1 - 2 weeks	15 (60.0)	10 (40.0)	
4 - 6 weeks	47 (81.0)	11 (19.0)	
One targeted visit after 6 weeks	5 (83.3)	1 (16.7)	
Duration of family planning use			
N/A	77 (72.0)	30 (28.0)	0.748
< 1 month	20 (74.1)	5 (25.9)	
2 months	68 (67.3)	33 (32.7)	
3 months	6 (60.0)	4 (40.0)	
Gestation age at 1st ANC visit			
12 weeks or below	65 (77.4)	19 (22.6)	**0.070**
13-27 weeks	99 (67.3)	48 (32.7)	
>28 weeks	7 (50.0)	7 (50.0)	

On Bivariate analysis, postnatal care visits, duration of family planning use and gestation age at ANC visits were found not to be statistically significant for postpartum anaemia.

Table 6: Multivariate logistic regression for factors associated with anaemia

Variable	Odds Ratio	P-value	95% CI	
Age	1.001	0.974	0.948	1.057
Marital status				
Married	1			
Single/Divorced	1.902	0.146	0.8001	4.521
Place of delivery				
Facility	1			
Home	2.365	0.041	1.036	5.399

Adjusting for age and marital status, women who delivered at home, their odds of developing anaemia was 2.365 times that of women who delivered in a facility.

Table 7: Comparison of haemoglobin during ANC and at 14 weeks post-delivery.

Variable	n	Mean	Std. Err.	[95% Conf.	Interval]	p-value
ANC Haemoglobin	158	11.440	0.134	11.175	11.704	0.000
Hb at 14 weeks	158	12.311	0.128	12.059	12.564	
diff	158	-0.871	0.124	-1.116	-0.627	

In this analysis, 87 women (36%) who didn't have haemoglobin test results at ANC were excluded from the analysis. A paired t-test was used to compare the mean Hb at ANC and at 14 weeks. The difference in the mean haemoglobin was -0.871 (95% CI -1.116, -0.627). The haemoglobin at 14 weeks post-delivery is higher than the haemoglobin at ANC and the difference was statistically significant ($p<0.001$).

CHAPTER FIVE

5.0 DISCUSSION

This study was set out to determine the prevalence and factors associated with anaemia at 14 weeks post-delivery in mothers attending child health clinic at Webuye County Hospital.

5.1 Prevalence of Anaemia

The prevalence of anaemia at fourteen weeks post-delivery in mothers attending child welfare clinic at Webuye County Hospital was 26.94 %. This is high considering the impact of postpartum anaemia on the mother and the growing baby. The study replicates previous findings concerning the prevalence of anaemia. The prevalence of anaemia was 26.5% in Coastal Karnataka India among postnatal mothers (Bhagwan D, 2016). This was a community-based cross-sectional study. The study population included all recently delivered mothers between one and a half month to 5 months postpartum.

The overall prevalence of anaemia was 22.1% in Ethiopia, in a study on the prevalence and factors associated with anaemia in postnatal lactating mothers (Lakew, Biadgilign, & Haile, 2015). This was a cross-sectional secondary analysis of data pooled from the demographic and health survey.

A study done in Uganda showed a prevalence of 64.4% (Sserunjogi, Scheutz, & Whyte, 2003). This study was conducted at a district hospital on mothers attending child health clinics at 12 months. Our prevalence was low than that of the Ugandan study, this is explained by the fact that the study population and timing of the study were different .

The prevalence in this study compares well with another study (Innocent 2016) conducted in a regional referral hospital Uganda which found a prevalence of 29.9% at 10 weeks postpartum.

A similar study found a prevalence of anaemia of 16.4% (Maawiya, R A., Gachuno, O., & Machoki, J M,. 2015) lower than the prevalence of 26.94% in this study. This study was done in the Kenyan Coast region at 6 weeks postpartum. The difference in the prevalence could be due to the different study population and the study time, this study looked at the prevalence of postpartum anaemia at 14 weeks.

In this study the prevalence of anaemia was lower compared to a similar study on maternal morbidity in the first year after childbirth in Mombasa Kenya; a needs assessment found over 50% of women had anaemia (<11g/l) with even higher levels of anaemia in those who had a caesarian section or had not used iron supplementation in pregnancy (Mathew F Chersich N. K., 2009) The difference in the prevalence could be due to the time as more interventions have been rolled out since 2009 and also the different population.

5.2 Factors associated with anaemia at 14 weeks post-delivery.

In this study, health facility delivery was found to be associated with lower rates of postpartum anaemia. This finding is replicated in another study (Maawiya, R A., Gachuno, O., & Machoki, J M,. 2015). The lower rates of postpartum anaemia could be due to the fact that deliveries were attended by skilled health workers who do active management of labour and other preventive strategies.

Anaemia was predominantly seen in postnatal mothers who were single/divorced but this finding was not statistically significant. These findings were in conformity with a

study conducted in the Kenyan Coast (Maawiya, R A., Gachuno, O., & Machoki,J M,. 2015).

Those with a primary and secondary level of education had the highest prevalence of anaemia respectively than their counterparts who had college and university. These findings were similar to a study in Coastal Karnataka India (Bhagwan D, 2016).

Those who had spaced their pregnancies for > 4 years had the lowest prevalence of anaemia (20.9) ,This finding was similar to a study in Coastal Karnataka India (Bhagwan D, 2016) which found half of the mothers with inter-pregnancy interval less than two years being anaemic.

Those who had attended < 2 ANC visits had the highest prevalence of anaemia but these findings were not statistically significant. These findings are consistent with the safe motherhood initiative that recommends four comprehensive antenatal care visits which have been associated with good pregnancy outcomes (Bergmann R, 2010).

The mode of delivery, postnatal care and family planning use did not have any bearing to the prevalence of anaemia in this study. These findings are comparable with other studies (Bhagwan D, 2016).

Haematinics use during ANC was 63.27 % with 58.12% using haematinics for 90+days. The haematinics use was in the range of the Kenyan use of haematinics of 69 % (KNBS 2010). Haematinics use in the postpartum period was 17.6%. This finding is in the same range in a study done in Nepal to determine the compliance rate of iron-folic consumption and the factors associated with iron-folic consumption amongst postnatal mothers which found only 20.7% consumed iron throughout the post-natal period for 45 days (Calvert,C., Thomas, SL.,Ronsmans, C., 2012).

5.3 Mean Haemoglobin Level at ANC and at 14 Weeks Post-delivery.

The mean haemoglobin level at 14 weeks post-delivery was higher than the mean haemoglobin level of the entire ANC period. This difference was consistent with available literature that during pregnancy there is an increased demand of iron from the growing foetus and placenta, diminished intake of iron and also the physiological fall in haemoglobin during pregnancy (SIFAKIS & PHARMAKIDES, 2010).

The world health organization recommends iron and folic acid supplementation in ANC and three months postpartum (De-Regil, L., Jefferds ME, Sylvetsky AC., 2014). Available meta-analysis suggests that iron supplementation during pregnancy increases the mean blood haemoglobin concentration (Fernández-Gaxiola and De-Regil 2011). The mean change in haemoglobin in the entire ANC period to 14 weeks postpartum was 0.87gm/dl (95% CI -1.116, -0.627, p< 0.001). This finding shows a rise in the mean haemoglobin in the postpartum period. A similar study demonstrated an increase in the mean haemoglobin, in a study on determinants of postpartum anaemia among women from a rural population in India, on antenatal women at 36-38 weeks to 6 weeks postpartum, the mean haemoglobin at 36 weeks was 11.7+_ 1.43 g/dl and at 6 weeks postpartum was 12.10+_1.27 g/dl, the mean rise in haemoglobin between 36 weeks and 6 weeks postpartum was 0.4g/dl (95%CI 0.21-0.60, P<0.001) (George, K., Jamkhandi, D., Prasad, J. 2014). These studies show that there is an increase in the haemoglobin after delivery.

CHAPTER SIX

6.0 Conclusion and Recommendation

6.1 Conclusions

The prevalence of anaemia at 14 weeks post-delivery is high in Webuye Sub County, Bungoma County, Western Kenya.

Women who had delivered at home had higher rates of anaemia compared to those who delivered in a health facility.

The haematinics use during pregnancy is lower than the National uptake.

Haematinics use in the postpartum period is low.

The mean haemoglobin at 14 weeks post-delivery was higher than the entire antenatal care period.

6.2 Recommendations

All postnatal mothers should be screened for anaemia during postnatal care visit at 14 weeks post-delivery as mothers bringing their children can easily take up the haemoglobin test.

All mothers attending ANC clinic should be assisted to have an individualized birth plan to deliver in a health facility.

Iron and folic acid supplementation as an intervention to reduce the prevalence of anaemia should be strengthened during the antenatal and postnatal period.

REFFERENCES

ACOG Bulletins. (2018). Practice bulletin. *Acog: Practice Bulletin No 183 Postpartum Haemorrhage*, 2016–2019.

Maawiya, R. A., Gachuno, O.& Machoki, J.M,. (2015). Determinants of post-partum anaemia – a cross-sectional study, 27(1), 2–6.

Begley, C. M. Gyte G; Devane D; McGuire W; Weeks A (2011). "Active versus expectant management for women in the third stage of labour." *Cochrane Database Syst Rev11(11).*

Bergmann, R. L., Richter, R., Bergmann, K. E., & Dudenhausen, J. W. (2010). Prevalence and risk factors for early postpartum anaemia. *European Journal of Obstetrics Gynecology and Reproductive Biology*, *150*(2), 126–131. https://doi.org/10.1016/j.ejogrb.2010.02.030

Bhagwan, D., Kumar, A., Rao, C. R., & Kamath, A. (2016). Prevalence of anaemia among postnatal mothers in coastal Karnataka. *Journal of Clinical and Diagnostic Research*, *10*(1), LC17-LC20. https://doi.org/10.7860/JCDR/2016/14534.7086

Bhandal, N. & R. Russell (2006). "Intravenous versus oral iron therapy for postpartum anaemia."

BJOG: An International *Journal of Obstetrics and Gynaecology*113(11): 1248-1252.

Brown, C. A., Sohani, S. B., Khan, K., Lilford, R., & Mukhwana, W. (2008). Antenatal care and perinatal outcomes in Kwale district, Kenya. *BMC Pregnancy and Childbirth*, *8*, 1–11.

https://doi.org/10.1186/1471-2393-8-2

Bodnar, L. M., Scanlon K, Freedman D. (2001). "High prevalence of postpartum anaemia among low-income women in the United States." *American Journal of Obstetrics and Gynecology185(2): 438-443.*

Calvert, C., Thomas, SL; Ronsmans, C; Wagner, KS; Adler, AJ; Philippi, V. (2012). "Identifying regional variation in the prevalence of postpartum haemorrhage: *a systematic review and meta-analysis." PloS One7(7): e41114.*

Cavazos-Rehg, P. A., Krauss, M. J. / Spitznagel, E. L. / Bommarito, K. / Madden, T. / Olsen, M. A. et al. (2015). "Maternal Age and Risk of Labor and Delivery Complications." *Maternal and child health journal19(6): 1202-1211.*

Charlotte Warren, Pat Daly, Lalla Toure, P. M. (2013). Opportunities for Africa's Newborns: Chapter 4- Postnatal Care, (Imci), 80–90. *Retrieved from http://www.who.int/pmnch/media/publications/aonsectionIII_4.pdf*

Chersich, M. F., Kley, N., Luchters, S. M. F., Njeru, C., Yard, E., Othigo, M. J., & Temmerman, M. (2009). Maternal morbidity in the first year after childbirth in Mombasa Kenya; a needs assessment. *BMC Pregnancy and Childbirth*, *9*, 51. https://doi.org/10.1186/1471-2393-9-51

De-Regil, L. M., Jefferds, M. E. D., Sylvetsky, A. C., & Dowswell, T. (2011). Intermittent iron supplementation for improving nutrition and development in children under 12 years of age. *Cochrane Database of Systematic Reviews*, (12).

Fernández-Gaxiola, A. C. & L. M. De-Regil (2011). "Intermittent iron supplementation for reducing anaemia and its associated impairments in menstruating women." *Cochrane Database Syst Rev12.*

Trumbo, P., Yates, A. A., Schlicker, S., & Poos, M. (2001). Dietary reference intakes: vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. *Journal of the Academy of Nutrition and Dietetics*, *101*(3), 294.

Gani, N., & Ali, T. S. (2013). Prevalence and factors associated with maternal postpartum haemorrhage in Khyber Agency, Pakistan. *Journal of Ayub Medical College, Abbottabad: JAMC*,*25*(1–2),81–85. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=medl&AN=25098062

Gebremedhin, S. & F. Enquselassie (2011). "Correlates of anaemia among women of reproductive age in Ethiopia: Evidence from Ethiopian DHS 2005." *Ethiopian Journal of Health Development25(1): 22-30.*

George, K., Jamkhandi, D., Prasad, J., Rakesh, P. S., Manjunath, & Gopichandran, V. (2014). Determinants of postpartum anaemia among women from a rural population in southern India. *International Journal of Women's Health*, 395. https://doi.org/10.2147/ijwh.s58355

Iyengar, K. (2012). Early postpartum maternal morbidity among rural women of Rajasthan, India: a community-based study. *Journal of health, population, and nutrition*, *30*(2), 213.

Determinants of Neonatal Mortality in Kenya: Evidence From Kenya Demographic Health Surveys, 2008 and 2014. (2019). *Journal of Health, Medicine And Nursing*. doi: 10.7176/jhmn/65-06

Innocent Nkonwa. H MD, Godfrey R Mugyenyi MD, Wasswa G.M Ssalongo MD (2016) ``Incidence and Factors Associated with Postpartum Anemia at Mbarara Regional Referral Hospital, southwestern Uganda. *Pan African Medical Journal, 32*. doi: 10.11604/pamj.2019.32.200.12541

Khanal, V., Adhikari M, Karkee R. (2014). "Low Compliance with Iron-Folate Supplementation Among Postpartum Mothers of Nepal: An Analysis of Nepal Demographic and Health Survey 2011." *Journal of Community Health39(3): 606-613.*

Lakew, Y., Biadgilign S, Haile D. (2015). "Anaemia prevalence and associated factors among lactating mothers in Ethiopia: evidence from the 2005 and 2011 demographic and health surveys." *BMJ open5(4): e006001*.

Leenstra, T., Kariuki, S. K., Kurtis, J. D., Oloo, a J., Kager, P. a, & ter Kuile, F. O. (2004). Prevalence and severity of anaemia and iron deficiency: cross-sectional studies in adolescent schoolgirls in western Kenya. *European Journal of Clinical Nutrition*, *58*(4), 681–691. https://doi.org/10.1038/sj.ejcn.1601865

Longmore, M. Wilkinson, I B. Davidson, E H. Foulkes, A. Mafi, A R. (2010). *Oxford Handbook of Clinical Medicine (8th) Oxford University Press.)*

Ministry of Health, Republic of Kenya (2013). "National Iron and folic acid supplementation communication strategy

Abubakar, I. I., Tillmann, T., & Banerjee, A. (2015). Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, *385*(9963), 117-171.

National Institute for Health Care Excellence. (2015). Antenatal care for uncomplicated pregnancies NICE GUIDELINES. *NICE Guidelines*, *1*(March 2008), 47. https://doi.org/10.1017/CBO9781107415324.004

Ogundipe, O.Hoyo, C.Ostbye, T.Oneko, O.Manongi, R.Lie, R T, et al. (2012). "Factors associated with prenatal folic acid and iron supplementation among 21,889 pregnant women in Northern Tanzania: *A cross-sectional hospital-based study." BMC public health12(1): 1*.

De Onis, M., Dewey, K. G., Borghi, E., Onyango, A. W., Blössner, M., Daelmans, B., ... & Branca, F. (2013). The W orld H ealth O rganization's global target for reducing childhood stunting by 2025: rationale and proposed actions. *Maternal & child nutrition*, *9*, 6-26.

Peña-Rosas, J. P., & Viteri, F. E. (2009). Effects and safety of preventive oral iron or iron+ folic acid supplementation for women during pregnancy. *Cochrane database of systematic reviews*, (4).

Raatikainen, K., Heiskanen, N., & Heinonen, S. (2007). Under-attending free antenatal care is associated with adverse pregnancy outcomes. *BMC Public Health*, *7*, 268. https://doi.org/10.1186/1471-2458-7-268

SIFAKIS, S., & PHARMAKIDES, G. (2010). Anaemia in Pregnancy. *Annals of the New York Academy of Sciences*, *900*(1), 125–136. https://doi.org/10.1111/j.1749-6632.2000.tb06223.x

Siteti, M., Namasaka, S. Ariya, O.Wanyonyi,w. (2014). "Anaemia in pregnancy: Prevalence and possible risk factors in Kakamega County, Kenya." *Science Journal of Public Health2: 216-222.*

Sserunjogi, L. (2003). Postnatal anaemia: Neglected problems and missed opportunities in Uganda.*Health Policy and Planning*, *18*(2), 225–231. https://doi.org/10.1093/heapol/czg027

Stevens, G. A., Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F. (2013). "Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data." *The Lancet Global Health1(1): e16-e25.*

Tazeen, S. & N. Gani Dr (2013). "Prevalence and factors associated with maternal postpartum haemorrhage in Khyber Agency, Pakistan." Journal of Ayub Medical College, Abbottabad25(1-2): 81-85.

Vitamins, F. & N. Board (2004). "Dietary reference intakes: recommended intakes for individuals." Bethesda:.Institutes of Medicine, National Academy of Science

Warren, C., Daly, P., Toure, L., & Mongi, P. (2006). Postnatal care. *Opportunities for Africa" s Newborns. Cape Town, South Africa: Partnership for Maternal, Newborn and Child Health*, 79-90.

Weeks, A. (2015). "The prevention and treatment of postpartum haemorrhage: what do we know, and where do we go to next?" BJOG: *An International Journal of Obstetrics and Gynaecology122(2): 202-210.*

World Health Organization. (2014). *WHO recommendations on postnatal care of the mother and newborn*.Geneva: World Health Organization.

WHO (2011). "Haemoglobin concentration for diagnosis of anaemia and assessment of severity. Vitamin and Mineral information system." *World Health Organization. Geneva, Switzerland: World Health Organization*.

WHO (2011). Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva,: World Health Organization,2011(WHO/NMH/NHD/MNM/11.1) (http://www.who.int/vmnis/indicators/haemoglobin).

WHO. (2010). WHO technical consultation on postpartum and postnatal care. *World Health Organization*, 1–56.

Yogev, Y.Meland N. Teneubaum, G.Shitrit, B G.Haroush, B A. (2010). "Pregnancy outcome at extremely advanced maternal age." *American journal of obstetrics and gynecology203(6): 558. e551-558. e557.*

Zhao, A., Zhang, Y., Li, B., Wang, P., Li, J., Xue, Y., & Gao, H. (2014). Prevalence of anaemia and its risk factors among lactating mothers in Myanmar. *American Journal of Tropical Medicine and Hygiene*, *90*(5), 963–967. https://doi.org/10.4269/ajtmh.13-0660

Zhao, G., Xu, G., Zhou, M., Jiang, Y., Richards, B., Clark, K. M., ... & Li, M. (2015). Prenatal iron supplementation reduces maternal anemia, iron deficiency, and iron deficiency anemia in a randomized clinical trial in rural China, but iron deficiency remains widespread in mothers and neonates. *The Journal of nutrition*, *145*(8), 1916-1923.

APPENDICES

Appendix I: Informed Consent

Study No……

STUDY TITLE.

'PREVALENCE AND FACTORS ASSOCIATED WITH ANAEMIA AT FOURTEEN WEEKS POST-DELIVERY FOR MOTHERS ATTENDING CHILD HEALTH CLINIC AT WEBUYE HOSPITAL''

Invitation to participate

You are invited to participate in this research study PREVALENCE AND FACTORS ASSOCIATED WITH ANAEMIA AT FOURTEEN WEEKS POST-DELIVERY FOR MOTHERS ATTENDING CHILD HEALTH CLINIC AT WEBUYE HOSPITAL

Basis for selection

You are eligible to participate in this study as you are fourteen weeks post-delivery.

Purpose of the study

The main aim of this study is to determine the prevalence and factors associated with anaemia at fourteen weeks post-delivery in mothers attending child welfare clinic at Webuye Sub County hospital.

Procedures.

You will be asked some questions about your personal details. Your mother and child booklet will be used to get some information, attendance of antenatal care, place and mode of delivery, postnatal care. At the end of the interview, haemoglobin testing will be done by taking a finger prick specimen. You will be able to know the results of the

haemoglobin testing. In case your haemoglobin is low you will be treated using the current guidelines at your cost. You may be referred for further evaluation if need be.

Potential benefits

There is no financial reward for participation in this study. Knowing the haemoglobin level will help in early diagnosis, appropriate treatment and referral.

Potential risks

There are no risks in this study as no invasive procedures will be used. The haemoglobin level will be done under sterile procedures.

Guarantee of confidentiality

To ensure confidentiality, your name will not appear on any materials or reports of the research findings (including web site postings of the results, conference presentations or publications). Materials associated with this study will be kept under lock and key in a cabinet Your signed consent form will be stored separately from your data to ensure complete confidentiality.

Withdrawal from participation.

Participation in this study is voluntary and your decision to or not to participate will not affect your management at Webuye Sub-county Hospital. If you decide to participate, you are free to withdraw your consent and to discontinue your participation at any time.

Offer to answer any questions.

If you have any questions about the procedures at any time, please do not hesitate to ask. All questions about the procedures and the study, in general, will be answered.

However; some questions may not be answered until after you have completed the procedures to ensure that the answers will not affect your responses.

Participant's statement.

I am voluntarily making the decision to participate and my signature certifies that I have heard and understand the aforementioned information. Also, my questions have all been answered to my satisfaction and signing this document doesn't mean I waive any legal rights.

Participant's signature ……Date…….

Research Investigator's Statement.

In my judgment, the aforementioned participant is voluntarily and knowingly giving informed consent and possesses the legal capacity to do so.

Research Investigator's Name…….

Research Investigator's Signature ……and Date……

0725793961, P.O BOX 3 Eldoret Kenya 30100

Email:musukohaji@yahoo.com

Appendix II: Questionnaire

CODE NO/…../……. /……./
Date of interview …../……/……...

1) How old are you ----------(years) (as recorded in the mother and child booklet)
2) Marital status: (Please tick)

Married	
Single	
Divorced	
Separated	
Widowed	

3) Education level :(Please Tick)

None		Completed	Did not complete
Primary			
Secondary			
College			
University			

4) What is your primary occupation? (Please Tick)

Business Lady	
Employed	
Farmer	
Housewife	
Casual Labourer	
Others (specify)	

5) What is your family`s monthly income?

Below KES 10,000 per month	
Between KES 10,000 and 19,999 per month	
Between KES 20,000 and 30,000 per month	
Over KES 30,000 per month	

6) How many children do you have .....?

7) How old apart are your children?

Number	Date of birth	Age (years)	Number	Date of birth	Age (years)
1			5		
2			6		
3			7		
4			8		

8) Did you attend Antenatal care during the previous pregnancy Yes……No…….

9) If Yes to question 8, at what gestation did you start Antenatal care clinic……

10) How many times did you visit the antenatal clinic during the previous pregnancy? (To be counterchecked in the mother &child health booklet). (Please Tick)

None	
1	
2	
3	
4	
>4	

11) Did you receive any medication to increase your blood level during the previous pregnancy: Yes-------NO--------(countercheck with mother booklet)?

12) If Yes to Question 11, for how long did you use?

<1 Month	
2 Months	
3 Months	
4 Months	
>4 Months	

13) Where did you deliver your last baby? (Please Tick)

Hospital	
Home	
Other (Specify)	

14) What was the mode of delivery in your last delivery?

Spontaneous Vaginal delivery	
Caesarean section	

15) Were you told that you lost excess blood after delivery Yes …... No…

16) Were you transfused with blood after delivery of your baby Yes …...No…...

17) Did you come back to the hospital for a checkup after discharge from hospital? Yes… No…

18) If Yes to question 17, how many visits did you make (Please Tick)?

Within 48 hours	
1-2 Weeks	
4-6 Weeks	
1 Targeted after 6 weeks	
2 Targeted visits after 6 weeks	
3 Targeted visits after 6 weeks	

19) Was haemoglobin tested after delivery of your last baby? Yes…. No

20) If yes to question 19, what was the haemoglobin level……

21) Were you given medication to raise your blood levels after delivery of your last baby?

Yes ….. No…….

22) If Yes to question 21, For how long did you use the medication? (please tick)

<30 days	
60 days	
90 days	
>90 days	

23) Are you on any family planning method: Yes (specify)----------

NO……..

24) If yes to question 23, for how long have you used the family planning method?

< 1 month	
2 months	
3 months	

25) Are you breastfeeding your baby: Yes……? No……

26) For how long did you breastfeed…….

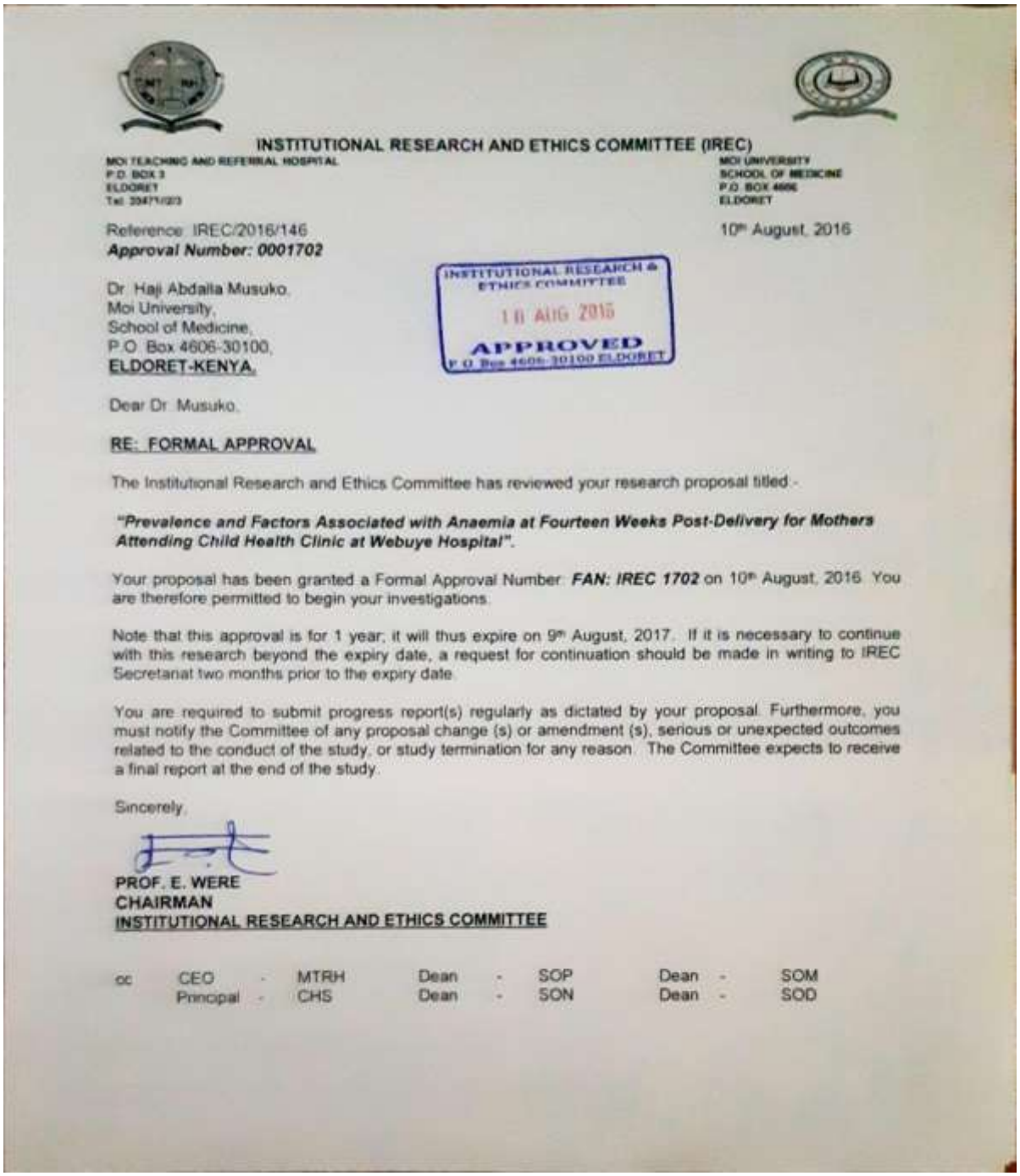
27) What is the haemoglobin level recorded in the mother-baby clinic booklet…….

28) What was the gestation when the haemoglobin testing recorded on the card was done---------?

29) What is the haemoglobin level during this current visit……

END

Appendix III: IREC Approval



INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2016/146
Approval Number: 0001702

10th August, 2016

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
18 AUG 2016
APPROVED
P. O. Box 4606-30100 ELDORET

Dr. Haji Abdalla Musuko,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Musuko,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Prevalence and Factors Associated with Anaemia at Fourteen Weeks Post-Delivery for Mothers Attending Child Health Clinic at Webuye Hospital".

Your proposal has been granted a Formal Approval Number ***FAN: IREC 1702*** on 10th August, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 9th August, 2017. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD