UNDERSTANDING THE PROBLEM OF ANAEMIA AMONG PREGNANT WOMEN BOOKING FOR ANTENATAL CARE IN LUSAKA DISTRICT ZAMBIA

BY

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements of the degree of master of medicine in obstetrics and gynaecology

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DECLARATION

I, Dr. Mwansa Ketty Lubeya, hereby declare that this dissertation herein presented for the degree of master of medicine in obstetrics and gynaecology has not been previously submitted either in whole or in part for any other degree at this or any other university, nor being currently submitted for any other degree.

SIGNED

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DR.MWANSA KETTY LUBEYA

APPROVED

BY_____

PROF. BELLINGTON VWALIKA

DECLARATION

I hereby state that this dissertation is entirely the result of my own personal effort. The various sources to which I am indebted have been clearly indicated in the bibliography and acknowledgements.

SIGNED

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DR. MWANSA KETTY LUBEYA

CERTIFICATE OF APPROVAL

The dissertation of Dr. Mwansa Ketty Lubeya is approved as fulfilling part of the requirements for the award of the degree of master of medicine in obstetrics and gynaecology by the University of Zambia.

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ABSTRACT

Anaemia is a global public health problem affecting people from different age groups, frequently, pregnant women, especially in the developing. WHO (1996) defines anaemia in pregnancy as haemoglobin (Hb) level below 11g/dl in the first half of the pregnancy and 10.5g/dl in the second half. The study investigated the burden of anaemia and its associations among pregnant women attending antenatal clinic at the University Teaching Hospital, Chelston, Kanyama, Kabwata and Kalingalinga clinics of Lusaka District. A structured questionnaire was administered to all eligible women in these clinics. Out of 216 women, seventy-nine (36.2%) were anaemic. The mean haemoglobin for the group was 11.2g/dl.

Bivariate analysis showed that low family income and low intake of green leafy vegetables were associated with anaemia, with p values of 0.02, and 0.023, respectively. After adjusting for confounders, HIV infection remained significant in the regression model. HIV positive women were 2.7 times more likely to have anaemia (95% CI-1.06-6.70). Anaemia in pregnancy is still prevalent despite the results showing a reduction from 46.9% to 36.6% since the last study 10 years ago. Low intake of vegetables and low family income were significantly associated with anaemia, after adjusting for confounders HIV positive women were 2.7 times more likely to have anaemia. Women need continued education on importance of vegetable intake during pregnancy, involvement in legal income generating activities to boost family income. Women of reproductive age under HIV care should be aggressively managed and educated on anaemia prevention in pregnancy. Micro nutrient supplementation plays a critical role and should be continued.

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ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AIP	Anaemia in Pregnancy
ANC	Antenatal care
CDC	Centre for Diseases Control
CSO	Central Statistics Office
FANC	Focused Antenatal Care
Hb	Haemoglobin
HIV	Human Immune deficiency syndrome
HP	High Parity
IDA	Iron deficiency anaemia
LBW	Low Birth Weight
LMNP	Last normal menstrual period
LP	Low Parity
MCH	Mean corpuscular Haemoglobin
MCHC	Mean corpuscular haemoglobin concentration
MCV	Mean corpuscular Volume
SDGs	Sustainable Development Goals
P.falciparum	Plasmodium falciparum
RDC	Red cell count
RDW	Red cell distribution width
UNFPA	United Nations Food Production Agency
UNICEF	United Nations Child Fund
UTH	University Teaching Hospital
WHO	World Health Organisation
ZDHS	Zambia Demographic Health Survey

DEDICATION

I dedicate this dissertation to my husband Siamulunge Njoolo and our lovely children, Felistus, Britney, Nthibe, Moobola, Ngosa and Princess Pheona

CHAPTER ONE: INTRODUCTION

1.1 Background

Anaemia in pregnancy continues to be a threat to the lives of many pregnant women and their unborn children a global public health problem affecting people from different age groups. WHO (1996) defines anaemia in pregnancy as haemoglobin (Hb) level below 11g/dl in the first half of the pregnancy and 10.5g/dl in the second half. Because of the physiology of pregnancy, a small drop in Haemoglobin is acceptable with the greatest hemodilution occurring during the late second to early third trimester, with lowest haemoglobin typically measured at 28 to 36 weeks (Ueland, 1976) (as cited by Bauer, 2013). It is therefore critical to understand that accurate prevalence is almost impossible to attain as the haemoglobin varies throughout the course of pregnancy. This was found to be true by Scholl (2005), when he conducted a study in the USA and found a variation in prevalence of anaemia in pregnancy of 1.8%, 8.2% and 27.1% in the first, second and third trimesters respectively. Some of the effects of anaemia include but not limited to low birth weight babies, preterm delivery, low productivity, postpartum haemorrhage, postpartum depression and ultimately maternal mortality. Some of the common causes of anaemia in pregnancy are nutritional, infectious, low social economic status and obstetric characteristics. Prevention is clearly of critical importance, yet current coverage with anti-malarial interventions and micronutrient supplementation is poor in many African countries. Ideally severe anaemia could be prevented and pregnancy outcomes improved with nutritional supplementation and infection control measures (WHO, 1998). The global prevalence of anaemia is 24.8% in the general population, with 41.8% being among pregnant women. The highest prevalence of anaemia in pregnancy is experienced in Gambia at 75.1% and lowest in U.S at 5.7% (Bruno et al, 2008). Zambia, like most African countries, is challenged at 46.9%, Nigeria 66.7%, Ghana 64.9% and Kenya 55.1%, making it a severe public health problem in these countries, with Botswana having a relatively lower figure of 21.3%, which is a rare occurrence in Africa (Bruno et al, 2008).

This study is critical as countries under the United Nations reach out for the attainment of sustainable development goals (SDGs), which address maternal and child health. Sadly, like many other developing countries, Zambia did not attain the MDGs (WHO, 2015), the earlier set goals. Some significant improvements have been made though in Zambia, as seen by the reduction in maternal mortality ratio from 729 per 100000 live births in 2001 to 398 per 100,000 live births in 2014, a marked improvement of about 55% (CS0, 2015). The last anaemia in pregnancy prevalence study was undertaken more than a decade ago by Luo (1999); hence the trends could have changed or remained the same. There is a definite need for newer information. Anaemia in pregnancy being a severe public health problem in Zambia, needs frequent reviews for a meaningful contribution to effective control of the disease and ultimately help reduce the maternal mortality ratio from the current 398/100,000 to less than 7/100,000 by 2030 (CSO, 2014; WHO, 2015).

1.2 Statement of the Problem

Zambia's maternal mortality ratio is still high, for every 1000 live births four women die of pregnancy related complications. Anaemia in pregnancy significantly contributes to this number. Maternal haemoglobin less than 6g/dl has been associated with reduced amniotic fluid volume, foetal cerebral vasodilatation; non-reassuring foetal heart rate patterns (Carles et al, 2003). Increased risk of preterm delivery, spontaneous abortion, low birth weight and foetal death has also been reported (Lone, 2004). Additionally, severe anaemia increases the risk of maternal mortality, postpartum haemorrhage, restless leg syndrome, reduced mental performance and generally reduced productivity (Brabin, 2001).

The insidious nature of anaemia in pregnancy presentation means, however, that mild to moderate degrees of anaemia frequently remain undetected and untreated by health care workers and in the community. In Lusaka urban, Zambia, not all facilities are able to carry out routine haemoglobin estimation during ANC, hence women who are asymptomatic may remain untreated and this is compounded by the perpetual stock outs of micronutrient supplements at the point of care and poor compliance by the women due to mainly side effects (Chipaya, 2012).

The current prevalence of anaemia in Lusaka district in the general population is captured using the District Health Information Management System (HIMS) tool. The tool disaggregates the figures according to age but does not indicate number of pregnant women. This implies that the current prevalence of anaemia among pregnant women seems to be unclear.

Below is an extract from the 2014 Lusaka district HIMS tool (i.e. anecdotal data).

Table 1: Distribution of Anaemia in Lusaka District, HIMS

Age	> 5 years	5 years and above	Total
Anaemia	199	1,093	1,292
Population	350,633	1,794,029	2,144,662
Incidence rate	0.57	0.61	0.60
Prevalence	0.06%	0.06%	0.06%

1.3 Research Question

What is the burden of anaemia and its associated factors among pregnant women receiving antenatal care in Lusaka district, Zambia?

1.4 Objectives

1.4.1 General Objective

To investigate the problem of anaemia and its associated factors among pregnant women booking for antenatal care in Lusaka district, Zambia.

1.4.2 Specific objectives

1. To determine the prevalence of anaemia among pregnant women
2. To determine the factors associated with anaemia
3. To identify the common types of anaemia among pregnant

CHAPTER TWO: LITERATURE REVIEW

2.1 Prevalence

The global prevalence of anaemia is estimated to be 24.8%, affecting 1.62 billion people worldwide. Of these, 30.1% are non-pregnant women and 41.8% pregnant women, a staggering 56 million pregnant women ((Bruno et al, 2008). More than 50% of these women live in Africa, which is more than twice as much as the prevalence of anaemia in pregnancy in America and Europe, 24.1% and 25.1% respectively (Bruno et al, 2008).

The prevalence of anaemia as a public health problem is categorised as follows: < 5% no public health problem, 5-19.9% mild public health programme, 20-39.9% moderate public health problem > 40% severe public health problem (WHO, 2001) (as cited by Bruno et al, 2008). According to Luo (1999), Zambia's prevalence is estimated to be at 46.9% and this makes anaemia in pregnancy a severe public health problem in the country. According to the United Nations Food Programme Agency (UNFPA) (2012), some African countries have made some improvements over the past few years.

2.2 Factors associated with anaemia in pregnancy

2.2.1 Nutritional deficiencies

Globally, iron deficiency is the most significant contributor to the onset of anaemia, contributing over 77490 maternal deaths, which translates to 27% of all maternal deaths from indirect causes (Say L et al, 2014). WHO (2002) rates iron deficiency anaemia, (IDA) to be among the most important contributing factors to the global burden of disease especially during pregnancy as the physiological demand for iron increases up to seven times more than the non-pregnant state (Christensen, 2004). An early study conducted at the University Teaching Hospital in Lusaka Zambia, on aetiology of anaemia in pregnancy, showed a prevalence of IDA to be 84.2% for pregnant women with anaemia (O'Dowd et al, 1979).

IDA continues to be a challenge even in developed countries despite the fact that these women have relatively good iron stores and easy access to iron rich foods. For example, a national survey conducted in the United States by Muller (2014) showed that pregnant women had significantly poorer iron status than non-pregnant women. The biomarkers used in the survey demonstrated significantly lower iron levels with increasing parity and those having regular periods, while women who used hormonal contraceptives had iron indicators that suggested increased iron levels (Muller, 2014).

In most regions of the world, pregnant women eat soil or ice (pica), a manifestation of iron deficiency, mostly with no other associated symptoms (Ellis, 2014). In Malatya, Turkey, one in 10 pregnant women were eating soil and anaemia was more prevalent (37%) among soil eaters (Karaogul et al, 2010). Soil eating in most countries is still debatable as to whether soil eating cause anaemia or anaemia leads to soil eating (Muller, 2014; Okcuoglu, 1966). Furthermore, drinking tea or coffee has also been mentioned to cause IDA as it interferes with iron absorption especially if taken immediately after a meal (Muller, 2014; Okcuoglu, 1966). The usual diet in the tropics is mostly grain based, whose high phytate content interferes with absorption of iron (Van den Broek, 1998).

Besides the effects that IDA has on the mother, it also affects the baby, not only in utero but even way after they have grown up. Babies born of anaemic mothers while in utero have been found to develop hypertension in adulthood due to the large placental size and low birth weight (Hindmarsh, 2000). Other consequences of IDA include preterm delivery, perinatal mortality, and postpartum depression. Fetal and neonatal consequences include low birth weight and poor mental/ psychomotor performance.

WHO (1989) recommends iron supplementation to adolescents and women for 2 to 4 months a year, to ensure that women have reasonable iron store when they commence pregnancy. The major obstacle to iron supplementation is compliance to treatment due to side effects and the lack of awareness among women for the real

need for iron during pregnancy (Chipaya, 2011). Women must be convinced of the importance of iron for their health and the health of the baby, giving tablets alone is not enough to ensure success (Demmouch, 2011). A randomised trial in a rural clinic of Pakistan found an iron folate supplement to be associated with higher maternal hemoglobin levels, fewer births before 34weeks, fewer early neonatal deaths (Lone, 2004). Zambia has a national policy on iron supplementation which is distributed during antenatal clinics (ANC) (Mason, 2001).

2.2.2 Infectious causes

Infectious causes of AIP are more common in non-industrialised countries than the industrialised countries (Fleming, 2008). In sub-Saharan Africa, there are approximately 125 million pregnancies at risk of malaria every year, and up to 200,000 babies die as a result (Dellicour S et al, 2007).The severe forms of Malaria are usually caused by plasmodium falciparum (*P. falciparum*), mostly affecting those women entering pregnancy for the first time as they would not have developed any immunity (Chendraui, et al 2013; WHO, 2013). The incidence of malaria varies throughout the year with a peak during the hot/wet seasons when there are plenty breeding sites. Anya (2004) conducted a study at Gambia's main referral hospital during a malaria season and found a shocking increase of maternal mortality by 168% and 3 fold increases in proportion of deaths due to anaemia and a tendency to persist even in the postpartum period. Kalinani et al. (2010) in a cohort study in Malawi found an increased risk of low birth weight babies (LBW) and maternal anaemia in women infected with *P. falciparum*. In Mozambique, a third of malaria related deaths are associated with severe anaemia (Granja, 1998). Fleming (1989) studied the aetiology of severe anaemia in pregnant women of Ndola, Zambia and 84% turned out to have had *P. falciparum* infection.

To reduce the risk of poor outcomes, WHO (2013) recommends intermittent presumptive treatment of malaria in pregnancy (IPTp) with sulphadoxine-pyrimethamine (SP) given without determining parasitemia as it will treat patients with parasites or provide prophylactic effect to non-infected women. Unfortunately

the emergence of SP-resistant *P. falciparum* threatens this strategy (Tan, et al, 2014).

A study done in Enugu, Nigeria showed an increase in prevalence of malaria among pregnant women living with HIV and AIDS, with anaemia being a serious contributing factor (Johnbull et al. (2014). In this study,

2.2.4 Social Demographics/ Obstetric Factors

There are various major factors contributing to anaemia in pregnancy including unemployment, low intake of vegetables, poor compliance to iron-folate supplements poor diet during pregnancy, parity, education levels and inter pregnancy interval (Chipaya, 2007). Studies from various low income countries have suggested the importance of counselling and health education for pregnant women with anaemia to improve their knowledge and awareness about a healthy pregnancy (Sukchan et al. 2010; Abd ElHameed et al., 2012; and Idowu et al. 2005).

Desalegn (1993) found the prevalence of anaemia in Jima town of south western Ethiopia to be 41.9% and distributed as 56.8% for rural and 35.9% urban populations, with the illiterate and those not practicing family planning being more affected. Another study in the southeast of Ethiopia in 2013, found a prevalence of 27.9 % associated with rural residence, intestinal helminths infection and a history of heavy menses (Cyril, 2007).

Most women book for antenatal after the first trimester making prevention of complications and early diagnosis a challenge (Idowu et al., 2005). Antenatal care (ANC), the care that a woman receives during pregnancy helps to ensure health outcomes for the woman and the newborn (WHO/UNICEF, 2003). There are various health messages that are given during each visit that promote good health, appropriate nutrition, prevention and detection of conditions such as malaria, HIV, syphilis and anaemia. The benefit is even more when women book early, unfortunately most women book late into their pregnancies. ANC uptake is generally good in Africa with the young, poor, less educated and rural residents dropping out due to access barriers (WHO/UNICEF, 2003). Zambia reports a good

ANC coverage of 99% (CSO, 2014), despite these women booking late into their pregnancies. For example, at UTH, Lusaka 15% of the women attending ANC in December 2014 booked in the first trimester and 16% in January 2015, 53% and 50% in second trimester, 25% and 26% in the third trimester respectively (ZHEPRS Data, 2015). A study done in Nigeria, taking into account the entire study participants, only 9.8% booked in the first trimester, 63.5% booked in the second trimester and 26.6% in the third trimester of their pregnancies (Idowu et al., 2005). This could be explained in part by a study done by Moore (2002) which showed that women have negative perceptions about the quality of maternity care, caused by nurse midwives' impolite, negligent behaviour and intentional humiliation of the women. Late booking indeed robs women of the much needed care, as they miss out on early treatment and management of any complications that may arise.

High parity (HP) is among the factors with etiological potential in causing anaemia in pregnancy. Having five or more pregnancies with gestation periods of greater or equal to 20 weeks is considered as HP and less than five pregnancies with gestation periods of greater or equal to 20 weeks, low LP (Alivu, 2005). A retrospective cohort study done in Jordan, by Al Farsi, et al. (2011) concluded that HP pregnancies carry about three times higher risk of developing incident AIP than LP due to haemorrhage, which could be secondary to macrosomia babies, multiple pregnancies and reduced elasticity of the uterus. Additionally, a woman loses about 500 mg of iron with each pregnancy, confounded by menstrual losses, ranging from 10-250mls (4-100 mg of iron) per period (Harper, 2014). This clearly explains the extent to which HP increases the risk of AIP. Very few women recover fully from these significant losses. This is consistent with the findings of Kumari and Badrinath (2002). Ozumba and Igwegbe (1992) and Desalegn (1993) had similar findings of AIP being significantly associated with this group of women. On the contrary Chipaya (2007) found no significant association between anaemia in pregnancy and HP in a study conducted in Lusaka, Zambia.

Interpregnancy interval defined as the time from delivery to the time of next woman conception, is highly debatable definition as other schools of thought would want to

consider whether the woman was breast feeding or not during this interval, to make an objective analysis. Dewey (2007) defined it as a nonpregnant, nonlactating interval to be more accurate. A period of at least 36 months is generally acceptable duration as recommended by the Central statistical office (CSO) (2003). Traditionally, most women tend to have children who are closely spaced without giving the body a chance to replenish its nutritional stores. Kilbride (1999) (as cited by Chipaya, 2011) conducted a study in Jordan, which showed significant association between interpregnancy interval and anaemia with more cases (79.5%) than controls (61.5%), consistent with the findings of Lazovic and Pocekovak (1996) (as cited by Chipaya, 2007). On the contrary, Chipaya (2007) and Githinji (2010) found no associations in their studies in Lusaka district, Zambia and Mbagathi hospital, Nairobi Kenya respectively. The issue of interpregnancy interval would decline if women would be more knowledgeable about family planning and make use of the various methods available. For Zambia the contraceptive prevalence rate has increased from 15% in 1992 to almost 50% in 2014, a step in the right direction (CS0, 2014).

From the literature reviewed, it can be seen that a considerable amount of research has been done but AIP still continues to pose a major public health problem globally as well as locally, hence calls for more research.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study Design

This was a cross-sectional study on pregnant women attending antenatal clinic at selected clinics in Lusaka.

3.1.1 Sites:

Participants were recruited from, the University Teaching Hospital antenatal clinic, and selected clinics of Lusaka district as follows: Chelston, Kanyama, Kabwata and Kalingalinga. The clinics were selected based on their ability to do a full blood count at the time of submitting this proposal.

3.1.2 Target population

All pregnant women in Lusaka district

3.1.3 Study population

The study population comprised of pregnant women booking for antenatal clinic at the study sites who met the eligibility criteria.

a) Inclusion criteria

1. Pregnant women aged 15-49 attending antenatal clinic at the study sites for the first time in the current pregnancy regardless of gestation age
2. Known last normal menstrual period or availability of early scan obstetric scan
3. Signed informed consent

b) Exclusion criteria

1. History of per vaginal bleeding in current pregnancy.
2. History of micronutrient supplements in current pregnancy.
3. Acute febrile illness or other acute illness.

3.1.4 Sample size

Sample size was calculated using prevalence formula Stata version 12 and arrived at 216 as shown below.

Assumptions

Test HO p=0.4600, where p is the proportion in the population.

Alpha=0.0500

Power=0.9000

Alternative p=0.3600

Sample size 206

Contingency at 5% =216

3.1.5 Sampling

Systematic sampling was done as follows;
Average number of women booking for antenatal care at the study sites was 50 per week. This translated approximately to 800 pregnant women booking for antenatal over 4 months. Some health facilities attended to women at booking from Monday to Friday, whereas others had specific days.
With a study sample size of 216, the sampling interval was calculated as 4

3.1.6 Study Duration

September 2015 to January 2016

3.2 Data Collection

3.2.1 Data Collection Tool

A structured questionnaire which had both categorical and open-ended questions was administered to the study participants. The questionnaire had the following sections:
1. Socio-demographic and economic data
2. Medical and drug history
3. Reproductive history including the index pregnancy
4. Laboratory investigation results

3.2.2 Data collection Technique

Participants were recruited during working hours on the appropriate days for booking at the antenatal clinic. As principal investigator I was responsible for conducting interviews assisted by research assistants. The research assistants were qualified midwife nurses working in the Mother and Child Health Unit (MCH).

Training on the administration of the questionnaire was carried out before data collection for consistency and accuracy. This ensured that the questionnaire was administered in a standard way by the principal investigator and research assistants. Screening was done in line with exclusion criteria, before informed signed consent was sought and enrolment done.

In an event that the participant was unable to directly give consent for any reason, consent was sought from her surrogate. Medical records were examined and the patients interviewed in a private room. The interviews were conducted in a safe, secure and confidential environment. Information gathered was included in the patient's demographics, comorbid conditions, Reproductive history, and socioeconomic history. A detailed drug history was taken. Bloods for FBC were collected as per routine standard of care for each particular health facility and results were availed to the principal investigator and research assistants. Patients found to be anaemic were referred to their attending clinician immediately for further management.

3.3 Diagnostic Criteria:

Anaemia was considered as Haemoglobin < 11g/dl

3.4 Variables

The dependent variable was Haemoglobin. It was dichotomised as hemoglobin of less than 11g/dl showing the presence of anaemia and hemoglobin of 11g/dl or more its absence. Therefore, there were 2 groups, one anaemic and the other without anaemia.

Table 2: Operational Definitions of Variables

VARIABLE	INDICATORS	SCALE OF MEASURE
Age	19 years and below	Adolescent
	20 years to 35years	Safer reproductive age
	Above 35years	Risky reproductive age
Parity	5 children or less	Low parity
	More than 5 children	High parity
Gestation age	Below 13 weeks (1st trimester)	1ST Trimester
	13 weeks to 28weeks	2nd Trimester
	>28 weeks	3rd Trimester
Interpregnancy interval	<36 months	Short interval
	36 months or more	Safe interval
Contraception	Non use	Risky
	Use of any form	Protective
HIV	Negative	Protective
	Positive	Risky
Haemoglobinopathies	Absent	Unaffected
Frequency of eating fruits and vegetables in 7 days	6 times or more	High intake
	Less than 6 times	Low intake
Education	no education	Uneducated
	Primary ,Secondary, higher learning	Educated (accordingly)
Socioeconomic status (monthly income	<2000 ZMW	Low status
	>2000ZMW	High status

3.5 Ethical Considerations

Ethical approval was sought from the ERES Converge IRB office. Permission was obtained from the Head of Department Obstetrics and gynaecology, office of the Senior Medical Superintendent of the University Teaching Hospital and District Medical Officer for Lusaka District. Consent was obtained from the participants or

their Guardians. Participation in the study was voluntary; patients were not remunerated but received some refreshments. Information obtained was kept under lock and key in the OBGYN Department of the UTH and used for research purposes. Results of investigations were only availed to patients' attending physicians for the purpose of clinical management. Otherwise, access to this information was restricted to the Principal Investigator and the Study Supervisor. A patient identity number was used to ensure strict confidentiality.

Information gathered potentially benefitted other patients by paving way for interventional studies and possibly guiding the strengthening of algorithms for prevention and/or treatment of anaemia in pregnancy

3.6 Data Analysis

Statistical analysis was performed using SPSS software version 22 (SPSS inc, Chicago, USA). The data has been presented into frequencies, cross tabulations and diagrams as necessary. A descriptive analysis including measures of central tendency like the mean, measures of variability like standard deviation, range and bivariate analysis was done. Inferential analysis was carried out using chi square to study association between categorical variables while the T-test was used for continuous variables.

P value of < 0.05 at 95% confidence interval was considered statistically significant

A Backward stepwise logistic regression was done to adjust for confounders. Historical factors known to have a significant association with anaemia whose P values were at least 0.2 to adjust for any confounding factors. The factors were vegetable intake, meat intake, fruit intake, income, residential, gestation age at booking, interdelivery time and HIV status.

CHAPTER FOUR: RESULTS

4.1 Overall baseline characteristics of study population

A total of two hundred and sixteen antenatal women participated in this study. The youngest was 15 years old and the oldest was 40 years old. The mean age for the women was 25.85 with a standard deviation of 5.988 years. Forty-seven (21.8%) were single, one hundred and sixty-nine (78.2%) were married. Four women (1.9%) had completely no education, fifty-seven (26.4%) had primary education with one hundred and eighteen (54.6%) and thirty-seven (17.1%) attaining secondary and tertiary education respectively. One hundred and fifty-three (70.8%) were unemployed and sixty-three (29.2) were either in employment or doing some form of business. These characteristics are summarised in table 3 below.

Table 3. Overall baseline characteristics

Variable	Number (n)	Percentage (%)
Age (Years)		
<20	32	14.8
20-35	169	78.2
>35	15	6.9
Marital status		
Single	47	21.8
Married	169	78.2
Residence		
Low density	49	22.7
Medium density	66	30.6
High density	101	46.8
Education Level		
None	4	1.9
Primary	57	26.4
Secondary	118	54.6
Tertiary	37	17

4.2 Prevalence, severity and aetiology

Overall prevalence of anaemia was found to be 36.6% among antenatal women booking for antenatal in Lusaka district. The mean haemoglobin was 11.2g/dl. Thirty six women (45.6%) had mild anaemia, forty one (51.9%) had moderate anaemia while two (2.5%) had severe anaemia. Twenty seven women (34.2%) had microcytic anaemia, Fifty two (65.8%) had normocytic anaemia and fifty three (67.1%) had hypochromic anaemia.

See Table 4 below.

Table 4: Overall Prevalence of Anaemia and Characteristics

Variable	Number	Percentage (%)
Prevalence of anaemia		
Anaemia < 11g/dl	79	36.6
No anaemia >11g/dl	137	63.4
Severity of Anaemia		
Mild 10-10.9g/dl	36	45.6
Moderate 9.9g/dl-7.1g/dl	41	51.9
Severe < 7g/dl	2	2.5
Aetiological type (MCV)		
Normocytic (80-96 fl)	52	65.8
Microcytic <80 fl	27	34.2
MCH		
Normochromic (28-33pg)	26	32.9
Hypochromic < 28pg	53	67.1

4.3 Factors associated with anaemia in pregnancy

4.3.1 Sociodemographic characteristics

Anaemia was found to be more prevalent in women older than 35years. Eight women (8.9%) had anaemia and 8 (5.3 %) were not anaemic. Comparatively for

the younger women, those less than 20 years, 21 (15.3%) had no anaemia and 11(13.9%) had anaemia, for age group between 20 and 35 years, 108 (78.8%) had no anaemia and 61 (77.2 %) had anaemia. Statistical analysis ruled out age being a factor in predicting anaemia, however there was a trend towards older women being more anaemic. Women coming from low density areas were less likely to have anaemia, of this population, 36 (26%) had no anaemia whereas women coming from high density were more likely to have anaemia 56 (40.9%) vs. 45 (57.0). However this was not statistically significant, P value 0.062.

Marriage was not a factor in determining anaemia in pregnancy as the 2 groups were similar, p value 0.948. Of the single women 30(21.9%) had no anaemia, 17 (21.5%) had anaemia. For married women 107 (87.1) had anaemia 62(78.5%) had anaemia. Level of education had no impact on the presence of anaemia. The table below summarises these findings.

Table 5: Anaemia in Relation to Social Demographics

Variable	**Presence of Anaemia**		Statistics
	No anaemia number (%)	Anaemia number (%)	P
Age (Years)			0.690
<20	21 (15.3)	11 (13.9)	
20 – 35	108 (78.8)	61 (77.2)	
>35	8 (5.8)	8 (8.9)	
Residence			
High density 56(40.9)	56(40.9)	45(57.0)	0.062
Medium density 45 (32.8)	45(32.8)	21(26.6)	
Low density	36(26.3)	13(16.5)	
Marital Status			0.948
Single	30 (21.9)	17 (21.5)	
Married	107 (78.1)	62 (78.5)	
Education			0.575
None	2 (1.5)	2 (2.5)	
Primary	35 (25.5)	22 (27.8)	
Secondary	73 (53.3)	45 (57.0)	
Tertiary	27 (19.7)	10 (12.7)	
Occupation			0.550
Unemployed	99 (72.3)	54 (68.4)	
Employee	7 (5.1)	7 (8.9)	
Business	31 (22.6)	18 (22.8)	

4.3.2 Nutritional characteristics

The two groups showed no association between anaemia and frequency of consumption of meat and meat products, the mean number of days (3.2) was exactly the same for both groups, p value-0.856. Frequency of consumption of fruits also showed no significant association with anaemia in pregnancy p value > 0.05. Women, who consumed vegetables more, were less likely to have anaemia and this was statistically significant with a p value of 0.023. Women with higher income were less likely to have anaemia and this was statistically significant 0.020. See summary table 6

Table 6: Anaemia in Relation to Nutritional and Economic Status

Variable	**No. of women**	**Presence of Anaemia**	**Average days per week**	**SD**	**p**
Consumption of meat					0.856
	137	No	3.2	2.0	
	79	Yes	3.2	2.1	
Consumption of fruit					0.162
	137	No	5.4	2.4	
	79	Yes	5.0	2.5	
Consumption of vegetables					0.023*
	137	No	6.3	1.6	
	77	Yes	5.7	1.9	
Income (ZMW)	127	No	2944.9	3452.9	0.020*
	77	Yes	1926.2	2112.6	

4.4 Infectious causes

In this study, 10 women gave a history of having been treated for malaria and 6.3% had anaemia and 3.7% had no anaemia, however there was no statistical significance. A weak association was found between HIV infection and anaemia, 9.6% of the HIV positive were not anaemic, and 17.7% were anaemic. See table below.

Table 7: Infections in Pregnancy in Relation to Anaemia

Variable	**No anaemia Number (%)**	**Anaemia present Number (%)**	**Statistics (p value)**
Malaria			0.380
No	130 (96.3)	74 (93.7)	
Yes	5 (3.7)	5(6.3)	
HIV infection			
No	122 (90.4)	65(82.5)	0.085
Yes	13(9.6)	14(17.7)	
HIV positive on HAART			
No	10 (62.5)	5 (35.7)	
Yes	6 (37.5)	9 (64.3)	

4.5 Obstetric causes

Eighty-one (37.5%) were primigravidas, one hundred and thirty five were multigravida (62.5%); the mean parity was 2.37 with a standard deviation of 1.5.Tthe majority of clients booked in the third trimester.

These characteristics are summarised in table 5 below**.**

Table 8: Obstetric Characteristics

Variable	**No Anaemia number (%)**	**Anaemia number (%)**	**P value**
Gravida			0.546
Prime gravida	48 (35.0)	33 (41.8)	
Multigravida	81 (65.0)	43 (54.4)	
Grand multiparity	8 (5.8)	3 (3.8)	
Inter delivery time			0.167
< 36 months	44 (49.4)	17 (37.0)	
>36 months	45 (50.6)	29 (63.0)	
Gestation age			0.21
1st Trimester	15 (10.9)	5 (6.3)	
2nd Trimester	114 (83.2)	65 (82.3)	
3rd Trimester	8 (5.8)	9 (11.4)	
Family planning			0.398
Yes	68 (49.6)	34(46.3)	
No	69 (50.4)	44 (56.4)	

4.6 Stepwise logistic regression

Logistic regression was used for Historical factors known to have a significant association with anaemia whose P values were at least 0.2 to adjust for any confounding factors. The factors were vegetable intake, meat intake, fruit intake, income, residential, gestation age at booking, interdelivery time and HIV status. Using backward stepwise regression, the model that was obtained is summarised below. At each step, the variable with the highest p value was dropped. In step one, Low density residential area was protective, with residents being 0.67 times less likely to have anaemia at a confidence interval of 0.1156 -0.9641. see tables 9, 10, 11 below.

Table 9: Step 1 of Logistic Regression

Anaemia	**Odds ratio**	**P value**	**95% CI**
Residence (Density)			
Medium	0.59	0.29	0.22-1.55
Low	0.33	0.04	0.12-0.96
Income	1.00	0.75	0.10-1.00
Days ate meat	1.06	0.58	0.87-1.28
Days ate fruit	0.94	0.49	0.80-1.11
Days ate vegetable	0.81	0.13	0.61-1.07
Inter delivery >36	2.16	0.07	0.95-4.89
HIV Positive	2.54	0.07	0.94-6.88
Gestation			
2nd Trimester	1.75	0.72	0.38-7.98
3rd Trimester	3.56	0.18	0.55-7.97

Table 10: Step 3 of Logistic Regresson

Variable	Odds ratio	P value	95% CI
Residence (Density)			
Medium	0.56	0.230	0.22-1.44
Low	0.42	0.092	0.16-1.15
Days ate fruit	0.96	0.622	0.82-1.12
Days ate vegetable	0.84	0.200	0.65-1.09
Interdelivery >36	1.94	0.101	0.87-4.29
HIV Positive	**2.69**	**0.045**	**1.02-7.06**
Gestation			
2nd Trimester	1.93	0.365	0.46-8.08
3rd Trimester	4.07	0.120	.69-23.89

HIV positivity remained a significant factor; HIV positive women were 2.7 times likely to have anaemia at a confidence interval of 1.060081-6.70878 with a p value of 0.037. See final table below (11)

Table 11: Step 6 (Final) of Logistic Regression

Variable	Odds ratio	P value	95% conf. interval
Residence (Density)			
Medium	0.56	0.241	0.24-1.42
Low	0.42	0.060	0.15-1.04
Interdelivery >36	1.94	1.832	0.85-3.91
HIV Positive	2.69	0.037	1.06-6.70

CHAPTER FIVE: DISCUSSION

5.1 Prevalence of anaemia

This study found a prevalence of anaemia of 36.6%. Research from different parts of the world report that 19 to 50% of pregnant women are anaemic. The global prevalence of anaemia is estimated to be 24.8% affecting 1.62 billion people worldwide, 30.1% non-pregnant women, 41.8% pregnant women. There is a large variation between countries as well as within the same country. The findings of this study show an improvement of anaemia from a severe to a moderate public health problem, which could be attributed to overall improvement of healthcare in the population studied. The population studied was urban based which could mean easier access to health care facilities. In primary health care, services are free for all pregnant women including micronutrient supplementation i.e. folate and ferrous. There are also a number of health messages and strategies developed by the government and cooperating partners aimed at improving maternal and child health. For instance, the traditional birth attendants who earlier would conduct deliveries in homes have been sensitised to encourage women to attend ante natal clinics and give birth from health facilities and at times to the extent of escorting women to health facilities. These findings are consistent with the findings in a Kenyan study conducted in western Nairobi at Mbagathi Hospital. This study included 381 pregnant women at booking and found anaemia prevalence of 36.2%, with a reduction from previous studies.

A cross sectional study in Bangladesh, Dhaka city including 224 women attending antenatal clinic found a prevalence of 37%, similar to the findings of this study.

5.2 Factors associated with anaemia in pregnancy

5.2.1 Socio demographic characteristics

Studies from various low income countries have suggested the importance of counselling and health education for pregnant women with anaemia to improve their knowledge and awareness about a healthy pregnancy (Sukchan et al. 2010; Abd

ElHameed et al., 2012; and Idowu et al. 2005). There are various major factors contributing to anaemia in pregnancy including unemployment, low intake of vegetables, poor compliance to iron-folate supplements poor diet during pregnancy, parity, education levels and inter pregnancy interval (Chipaya, 2007). Desalegn (1993) found the prevalence of anaemia in Jima town of south western Ethiopia to be 41.9% and distributed as 56.8% for rural and 35.9% urban populations, with the illiterate and those not practicing family planning being more affected.

5.2.2 Maternal age

This study found a weak association between anaemia in pregnancy and maternal age. The women who were older than 35 years were more likely to have anaemia.

Other studies have found different age groups to have more anaemia, Kaur (2006) found the highest prevalence of anaemia, among women less than 30 years of age. Older women are more predisposed to anaemia as most times they are of higher parity and are more prone to pregnancy related complications.

5.2.3 Socio economic status

This study considered employment status of the woman, her spouse, whether or not the woman is doing some income generating activities (Business) and overall family income to assess the socio-economic status.

There was no significant association and employment status of either spouse with presence of anaemia. This is not a unique result as very few women were in employment. Besides they could be employed with long working hours with a very low income. Hence being in employment does not necessarily translate into a good social economic status.

The findings of this study revealed that the low income group comprised a significantly higher proportion of women with anaemia. This is consistent with the findings of a Pakistan study Rukhsana (2009) and Chowdhury (2015). A good social economic status gives family a chance to have balanced diet, easier access to health facilities and make healthier choices generally.

Education was not a factor in this study because most women had some education, except for about 2% who completely had no education. Marriage was not a factor.

5.3 Nutritional Deficiencies

Anaemia is one of the main nutritional deficiency disorders affecting a large proportion of the population, not only in developing countries but also in the industrialized countries.

5.3.1 Iron deficiency anaemia

This study found that 35% of the women had microcytic anaemia and 65% had normocytic anaemia. O'Dowd et a (1979) in a study conducted at the University Teaching Hospital in Lusaka, Zambia, on the aetiology of anaemia in pregnancy, showed that of all the women with anaemia, 84.2% had microcytic anaemia.

This study found that there was no association between anaemia and frequency of consumption of meat and meat products, actually, Monsens ER(1988) had similar findings after adjusting for confounders and concluded that in the presence of dietary intake of meat prior to pregnancy, dietary intake of meat during pregnancy is

intake of meat and meat products rich in haem iron. The mean frequency of consumption of meat in the anaemic and non-anaemic groups was exactly the same with a mean of 3.2 days in a week. This could imply that the anaemia found in this study could be more dilutional than nutritional, largely due to physiological changes in pregnancy. The other reason would be that some of the participants could have had chronic anaemia and entered pregnancy while already anaemic.

5.3.2 Other Nutritional deficiencies

Frequency of consumption of fruits also showed no significant association with anaemia in pregnancy p value > 0.05. Monsen (1988) found that consumption of fruit two or more times per week was associated with a decreased risk of anaemia. Given the fact that a large percentage of the iron in these diets is from non haeme sources, the decreased risk may be attributed to the presence of vitamin C, which is known to enhance the absorption of non haeme iron.

There was a significant association between frequency of consumption of vegetables and presence of anaemia, similar to the case control study done by Chipaya (2009) in Lusaka urban district and Ma *et al* (2002) in Chinese pregnant women. During univariate analysis, consumption of vegetables was a statistically significant factor for developing anaemia, however after adjusting for confounders; this was no longer statistically significant.

The findings of this study could be due to the fact that the length of pregnancy is too short for an improved diet to have a significant impact on nutritional status among women who are already anaemic before conceiving, additionally the women are not having a balanced diet as traditionally, consumption of vegetables maybe seen as an indicator of poverty. Some women could have been experiencing taste aversion hence consume less vegetable.

Furthermore, current nutritional recommendations for improving the outcome of pregnancy emphasize the importance of ensuring that women are in good nutritional status prior to conception; therefore hence, the focus needs to be shifted from diet during pregnancy to diet for the childbearing years, especially in developing countries where adolescent pregnancies are common and access to health care may be limited. (Kurz et al, 2000)

5.4 Infectious causes

Infectious causes of AIP are more common in non-industrialised countries than the industrialised.

Anaemia is a common complication of malaria in pregnancy, with almost 60% of pregnant further indicates that after delivery, women who have both malaria and HIV infections are at increased risk for anaemia compared to the non-HIV infected with or without malaria infection

In the bivariate analysis, Malaria and HIV infections showed a non-significant association with Anaemia in pregnancy, both had p values > 0.005. However, HIV infection was statistically significant after logistic regression, meaning it's independently associated with anaemia. HIV positive women were 2.7 times more likely to have anaemia. A study done in Enugu, Nigeria showed an increase in prevalence of malaria among pregnant women living with HIV and AIDS, explained

by the finding that HIV infection is associated with lower serum folate and serum ferritin in pregnancy (Cyril, 2007). Studies conducted by Meda *et al* (1999) in Burkina Faso and Ayisi *et al* (2000) as quoted by Chipaya, showed that HIV infection was also significantly associated with anaemia in pregnancy

The findings of this study on malaria should be taken with caution as malaria in Lusaka district has been said to have been eradicated. The diagnosis of malaria was based on the patient's report with no accompanying laboratory result for confirmation. This on its own has the potential to dilute the result. The other explanation is that the women, who were asymptomatic for malaria, were not captured as we relied on only those that were symptomatic and treated for malaria. This study was conducted during the rainy season, a peak season for malaria; this could have affected the overall prevalence of anaemia especially in the context of subclinical placental disease.

5.5 Reproductive characteristics

5.5.1 Gravidity/ parity

Gravidity was an important variable in this study, with a trend towards more prime Gravidas having anaemia than the multigravida. This is consistent with the findings of Kumari and Badrinath (2002). Ozumba and Igwegbe (1992) and Desalegn (1993) had similar findings of AIP being significantly associated with this group of women. On the contrary Chipaya (2007) found no significant association between anaemia in pregnancy and HP in a study conducted in Lusaka, Zambia. The findings of this study have been interpreted in such a way that this group is of low parity as the mean parity was found to be 2.37 hence protected from risk factors that predispose high parity women to anaemia.

The issue of inter pregnancy interval would decline if women would be more knowledgeable about family planning and make use of the various methods available.

5.5.2 Gestation age (Trimester)

The risk of developing anaemia increases with the age of pregnancy (trimester). This risk was higher in third trimester when compared with those in the first and second trimesters. This finding is consistent with studies done in Saudi Arabia and India, which found that the prevalence of anaemia is higher in the third trimester in comparison with first trimester Elzahrani (2012) and Vivek, et al (2012) respectively. Additionally, studies conducted in Malaysia, Vietnam, and Nepal found that increased gestational age at booking is significantly associated with the risk of developing anaemia.

The p value of > 0.05 in this study could be explained by the fact that there were very few women booking for antenatal in the third trimester.

5.5.3 Interdelivery interval

Interpregnancy interval is defined as the time from delivery to the time of next conception. A period of at least 36 months is generally acceptable duration as recommended by Central statistical office (CSO) (2003). Traditionally, most women tend to have children who are closely spaced without giving the body a chance to replenish its nutritional stores. Kilbride (1999) (as cited by Chipaya, 2007) conducted a study in Jordan, which showed significant association with interpregnancy interval of less than 36 months. This study found no such association consistent with Chipaya (2007) and Githinji (2010) in their studies in Lusaka district, Zambia and Mbagathi hospital, Nairobi Kenya respectively; in fact the trend is more towards those with an interdelivery time of 36 months being more at risk of anaemia. These women were generally coming from high density areas with low socioeconomic status.

5.6 Conclusion

Anaemia remains a public health problem in Lusaka with about a third of the pregnant women being anaemic, low socioeconomic status and poor intake of vegetables and HIV infection were significantly associated with anaemia in pregnancy.

5.7 Study limitations

1. The study did not differentiate between incident and prevalent cases as our clients rarely do pre pregnancy haemoglobin
2. This study was urban based and only conducted at health facilities which were able to conduct full blood count test, this is a possible source of bias
3. Different laboratories were used during examination of Full blood count; there could have been some differences in the calibration from facility to facility

5.8 Recommendations

1. Families should be encouraged to have backyard gardens where they can grow green leafy vegetables for home consumption and as well as for economic gain. In high density areas where there is limited space, sack farming and dish/bucket farming is a practical way of mitigating this. Relatively cheap vegetable like cassava leaves, pumpkin leaves and sweet potato leaves can be planted affordably.
2. Reproductive health providers need to encourage women to participate in legal income generating activities to boost family income.
3. The government and it's cooperating partners to continue with the current strategies aimed at preventing anaemia in pregnancy such as iron an1.d folate supplementation, deworming, presumptive treatment of malaria and HIV testing to all whose status is unknown.
4. National study for national and international notification

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APPENDICES

Appendix 1a

PARTICIPANT INFORMATION SHEET

Understanding the problem of anaemia among pregnant women booking for antenatal in Lusaka district Zambia

Introduction

I, Mwansa Ketty Lubeya, an MMED student in Obstetrics and Gynaecology of the School of Medicine at the University of Zambia, kindly ask for your participation in the above study. The purpose of the study is in partial fulfilment of the requirements for the award of a Master of Medicine in Obstetrics and Gynaecology. Before you decide whether to participate in the study or not, I would like to explain to you the purpose of the study and what is expected of you. If you agree to take part, you will be asked to sign or put your thumb print on this consent form in the presence of a witness.

Purpose of the study

This study is being conducted to determine the prevalence of anaemia in pregnant women and factors associated with it. This is important because it will help us identify patients at risk of developing serious complications of anaemia in pregnancy and deal with the associated factors appropriately.

Study procedure

If you agree to participate in this study, we will put your information on a data entry sheet; your name will not be included. We will ask for information regarding the history of your current pregnancy, previous pregnancies if any, family planning, if you suffer from any chronic condition and some questions about yourself. If you agree to participate, we shall administer a questionnaire to you and request for your antenatal card to check your results for any further information that may be there. Blood will be drawn from you by your clinician or lab technologist just like any other woman booking for antenatal today as it is part of the standard of care during a booking visit. .The interview will last approximately 20-30 minute

Risks and discomforts

You will not be exposed to any risks when participation in this study. Results considered for haemoglobin will be the ones that your attending clinicians would have already requested for.

Benefits

This study will help us identify various factors associated with anaemia in pregnancy and as a participant you will gain more knowledge on how you can actually prevent it. Furthermore, it will help us set up measures that will help reduce exposure to the risk factor and hence prevent anaemia in pregnancy and its consequences.

Confidentiality

All information will be kept strictly confidential. Your name will not be used, but you will be given a study number. Therefore any data obtained will not be traced back to you.

Consent

Participation in this study will be voluntary, with no expectation of payment. Should you decide to withdraw from the study for any reason, you will not suffer any consequences.

Thank you for considering participating in this study. For any questions or concerns, please feel free to contact me, Dr. Mwansa Ketty Lubeya or ERES converge IRB

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Appendix 1b

SURROGATE INFORMATION SHEET

Understanding the problem of anaemia among pregnant women booking for antenatal in Lusaka district Zambia

Introduction

I, Mwansa Ketty Lubeya, an MMED student in Obstetrics and Gynaecology of the School of Medicine at the University of Zambia, kindly ask for your relative's participation in the above study. The purpose of the study is in partial fulfilment of the requirements for the award of a Master of Medicine in Obstetrics and Gynaecology. Before you decide whether your relative should participate in the study or not, I would like to explain to you the purpose of the study and what is expected of you. If you agree for her to take part, you will be asked to sign or put your thumb print on this consent form in the presence of a witness.

Purpose of the study

This study is being conducted to determine the prevalence of anaemia in pregnant women and factors associated with it. This is important because it will help us identify patients at risk of developing serious complications of anaemia in pregnancy and deal with the associated factors appropriately.

Study procedure

If you agree for your relative to participate in this study, we will put her information on a data entry sheet; her name will not be included. We will ask for information regarding the history of her current pregnancy, previous pregnancies if any, family planning, if she suffers from any chronic condition. If you agree that she participates, we shall administer a questionnaire to her and request for her antenatal card to check any further information that may be there. Blood will be drawn from her by her clinician or lab technologist just like any other woman booking for antenatal today as it is part of the standard of care during booking. The interview will last approximately 20-30 minutes.

Risks and discomforts

Your relative will not be exposed to any risks when participation in this study. The results considered for haemoglobin will be the ones that her attending Doctors would have already requested for.

Benefits

This study will help us identify various factors associated with anaemia in pregnancy and as a participant your relative will gain more knowledge on how she can actually prevent it. Furthermore, it will help us set up measures that will help reduce exposure to the risk factor and hence prevent anaemia in pregnancy and its consequences.

Confidentiality

All information will be kept strictly confidential. Her name will not be used, but you will be given a study number. Therefore any data obtained will not be traced back to you.

Consent

Participation in this study will be voluntary, with no expectation of payment. Should your relative decide to withdraw from the study for any reason, she will not suffer any consequences.

Thank you for considering participating in this study. For any questions or concerns, please feel free to contact me, Dr. Mwansa Ketty Lubeya or the Chairperson ERES converge IRB.

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Appendix 2a

Participant Consent Form

I, _____ (Full Names of Participant) hereby confirm that the nature of this clinical study has been sufficiently explained to me. I am aware that my personal details will be kept confidential and I understand that I may voluntarily, at any point, withdraw my participation without suffering any consequences. I have been given sufficient time to ask questions and seek clarifications, and of my own free will declare my participation in this research.
I have received a signed copy of this agreement

_____	_____	_____
Name of Participant (Print)	Participant's Signature or thumbprint	Date
_____	_____	_____
Name of Witness (Print)	Witness (Signature)	Date

Appendix 2b

Surrogate Consent Form

I, _____ (Full Names of surrogate) hereby confirm that the nature of this clinical study has been sufficiently explained to me. I am aware that my relative's personal details will be kept confidential and I understand that he/she may voluntarily, at any point, withdraw their participation without suffering any consequences. I have been given sufficient time to ask questions and seek clarifications, and of my own free will declare my relative's participation in this research.

I have received a signed copy of this agreement

_____	_____	_____
Name of Participant (Print)	Surrogate's Signature or thumbprint	Date
_____	_____	_____
Name of Witness (Print)	Witness (Signature)	Date

Appendix 3

STUDY QUESTIONNAIRE

Title: Understanding the problem of anaemia among pregnant women attending antenatal in Lusaka district, Zambia.

Facility name:

Questionnaire Number:

Date:

Interviewer's Name:

Section 1: Social Demographic Data			
No	**Question and filters**	**Coding categories**	**Skip to**
Q101	How old are you?	**Age in completed years.....**	
Q102	What is your marital status?	**Single.....0** **Married.....1** **Divorced.....2** **Separated.....3** **Widow.....4**	
Q103	Where do you stay?		
Q104	What is the highest Level of education?	**None.....0** **Primary.....1** **Secondary.....2** **Tertiary.....3**	
Q105	What is your occupation?	**Unemployed.....0** **Student.....1** **Employee.....2** **Business.....3**	

Q106	What is your husband's occupation?	**Unemployed.....0** **Employee.....1** **Student.....2** **Business.....3**	
Q107	What is your family's average total income per month?	**ZMK.....**	
Q108	How many days in the past week did you consume meat and meat products?	**.....**	
Q109	How many days in the past week did you consume fruits?	**.....**	
Section 2: Obstetric Characteristics			
Q201	What number of pregnancy is this one? (Only consider pregnancies that reached at least 20weeks)	**.....**	
Q202	How many children do you have?	**.....**	**Primigravidae →205**
Q203	How many months did it take you, from the time you gave birth to the time you conceived?	**1st child to 2nd pregnancy.....** **2nd child to 3rd pregnancy.....** **3rd child to 4th pregnancy.....** **4th child to 5th pregnancy.....** **Others.....**	

Q204	How many months did it take from the time you stopped breast feeding to the time you conceived?	**1st child to 2nd pregnancy.....** **2ndchild to 3rd pregnancy.....** **3rdchild to4th pregnancy.....** **4thchild to 5th pregnancy.....** **Others.....**	
Q205	When was your last normal menstrual period?	**Calculate gestational age, if unsure, use early scan if available** **LMNP.....** **Gestation age (in weeks).....**	
Q206	Did you plan to get pregnant in this pregnancy?	**Yes.....0** **No.....1** **No response.....2**	
Q207	Have you ever been on any method of family planning?	**Yes.....0** **No.....1**	**→Section 3**
Q208	What methods of family were you on? (More than one response allowed)	**Pill.....0** **Injectable.....1** **Loop.....2** **Implant.....3** **Condoms.....4** **Natural.....5**	
Section 3: Medical and Drug history			
Q301	Have you done an		

	HIV test before?	**Yes.....0** **No.....1** **No response.....2**	**→305**
Q302	What was the result?	**Negative.....1** **Positive.....2** **Indeterminate.....3** **Do not know.....4**	**Confirm on ANC card**
Q303	Are you on Anti retroviral drugs?	**Yes.....0** **No.....1**	**→305**
Q304	How long have you been on HIV treatment?	**.....**	
Q305	Do you suffer from SCD?	**Yes.....0** **No.....1** **Don't know.....2**	
Q305	Have you suffered from malaria (confirmed) in this pregnancy?	**Yes.....0** **No.....1**	**→Section 4**
Q305	Was it treated with anti-malarias?	**Yes.....0.** **No.....2**	
Q306	What medication was given?	**Fansidar .....0** **Coartem.....1** **Quinine.....2** **Artemether.....3** **Other.....4** **Do not know.....5**	
Section 5: Laboratory results			

	Full blood count	**RBC.....** **Hb.....** **HCT.....** **MCV.....** **MCH.....** **MCHC.....** **RDW.....** **Platelet**	

Thank you.