UNIVERSITY OF ZULULAND

THE PROVISION OF MALARIA HEALTH EDUCATION BY NURSES/MIDWIVES TO HIV INFECTED PREGNANT WOMEN DURING ANTENATAL CLINIC VISITS AT LOWER MANYA KROBO DISTRICT OF GHANA

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF NURSING SCIENCE, FACULTY OF SCIENCE, AGRICULTURE AND ENGINEERING, THE UNIVERSITY OF ZULULAND IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF NURSING

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ABSTRACT

Introduction: Malaria infection during pregnancy is a significant public health problem, with substantial risks for the mother, foetus, or neonate. HIV infection and malaria represent a double burden for pregnant women. The prevention of malaria among HIV infected pregnant women through health education by nurses/midwives during antenatal clinic visits presents a strategic opportunity to reduce and possibly eliminate malaria among these vulnerable individuals.

Aim: To investigate the malaria health education nurses/midwives provide to HIV infected pregnant women during antenatal clinic visits at selected hospitals in the Lower Manya Krobo District of Ghana.

Methods: A convergent parallel mixed method within an Interpretivist's methodological design was used to concurrently collect qualitative and quantitative data separately. Quantitative data were collected from 110 HIV infected pregnant women visiting the antenatal clinics through administered questionnaires and analysed with SPSS, IBM version 27. The qualitative data were obtained from three nurses/midwives through interviews and analysed in Nvivo 12. Descriptive statistics, Pearson's chi-square test and Pearson's correlation were used for quantitative analysis. A narrative weaving approach was used to integrate the two data.

Results: The study indicated that the respondents had a high knowledge of malaria. The primary malaria preventive practices include a clean environment, insecticide-treated mosquito net, spray/coils and repellent use. The content of malaria education provided by nurses/midwives included what malaria is, the cause of malaria, the effect of malaria on pregnancy, their susceptibility to and consequences of malaria in pregnancy, and available preventive strategies. The factors affecting the effective delivery of malaria health education were: staff shortage, long waiting time, and noncompliance. An integrated Malaria Health Educational Intervention Framework emerged from the study.

Conclusion: The appropriate malaria health education integration in routine antenatal clinic visits and delivery by nurses/midwives represents a great strategy to prevent malaria among vulnerable HIV infected pregnant women.

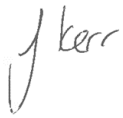
DECLARATION

I, Patricia Agyarewaa Appiah-Kubi, hereby declare that the dissertation titled “The Provision of Malaria Health Education by Nurses/Midwives to HIV-infected pregnant women during antenatal clinic visits at Lower Manya Krobo District of Ghana”, submitted to the Faculty of Science and Agriculture at the University of Zululand for the Degree of Master of Nursing is my own work and has not been previously submitted to any other institution of higher learning and training for any academic purposes. All references in this study have been duly acknowledged.

3OTH APRIL 2021

PATRICIA AGYAREWAA APPIAH-KUBI DATE

(STUDENT)



13/04/2022

PROF JANE KERR DATE

(SUPERVISOR)

DEDICATION

I dedicate this study to my husband, Dr Patrick Appiah-Kubi, my daughter, Akosua Pokuaa Appiah-Kubi and my son, Nana Kwadwo Frimpong Appiah-Kubi. I love you all. You inspire me to move on.

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I acknowledge the support from the family I made in South Africa, the Nhari family, the Hlatshwayo family, the Kunene Family, the Mwaramba family, and those whose names I know.

LIST OF ABBREVIATIONS

AL	Artemether-Lumefantrine
ANC	Antenatal Clinic
AS-AQ	Artesunate-Amodiaquine
DOT	Directly Observed Therapy
GHS	Ghana Health Service
GHS-ERC	Ghana Health Service Ethics Review Committee
HBM	Health Belief Model
HIPW	HIV Infected Pregnant Women
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IMB	Information-Motivation-Behaviour
IPTs	Intermittent Preventive Therapies
IPTp	Intermittent Preventive Treatments in Pregnancy
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
ITNs	Insecticide Treated Nets
LLINs	Long Lasting Insecticidal Nets
MHE	Malaria Health Education
MoH	Ministry of Health
NMCP	National Malaria Control Program
PMI	Presidential Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SP	Sulphadoxine Pyrimethamine
SSA	Sub-Saharan Africa
SPSS	Statistical Package for Social Sciences
UNIZULU	University of Zululand
UZREC	University of Zululand Research Ethics Committee
WHO	World Health Organization

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CHAPTER ONE
OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

This chapter introduces and provides a brief account of the entire research. It gives information on the background of the study, problem statement, the aim of the study, research questions and objectives, significance of the study, delineation and limitations, definition of terms and concept, assumptions of the research, theoretical stance on the use of a framework in mixed method studies (concurrent convergent) and a brief overview of the dissertation chapters.

1.2 BACKGROUND

Malaria is a preventable and treatable disease transmitted by the female Anopheles mosquito and caused by a plasmodium parasite (Ashley, Phyo, & Woodrow, 2018). Malaria infection left untreated can lead to organ failure, impaired consciousness and possibly death. In 2018, an estimated 405 000 malaria deaths were reported globally (WHO, 2019b). Malaria is and continues to be a global public health threat, especially in the World Health Organization (WHO) African and South-East Asia Regions.

Human Immunodeficiency Virus (HIV) is a sexually transmitted disease that causes the immune system of a human to break down, allowing for opportunistic infections such as malaria. At the end of 2020, approximately 37.7 million people globally lived with HIV, and 1.5 million people became newly infected yearly (UNAIDS, 2021). Globally, about 5000 young women, within their reproductive years (15–24 years), become infected with HIV weekly (UNAIDS, 2021). Nigeria's HIV/AIDS infection burden is also the second-highest globally (Awofala & Ogundele, 2018).

Malaria and HIV co-infection have damaging effects on pregnant women, such as severe anaemia, low birth weight babies and maternal death. These diseases overlap in sub-Saharan Africa (Kwenti, 2018). The entire population of Ghana, which is about 28 million, lives in malaria-endemic regions (President’s Malaria Initiative Ghana, 2018). Malaria ranks first as the top cause of hospital admissions and death across all ages. The prevalence of HIV/AIDS in the Lower Manya Krobo District is the highest in Ghana, with a 2.4% rate in 2017. HIV infection continues to increase the risk and severity of malaria, such as maternal anaemia, low birth weight babies, foetal loss,

premature delivery, intrauterine growth retardation and the risk factor of maternal death (Altfeld & Bunders, 2016; Houmsou et al., 2014; Ikpim, Edet, Bassey, Asuquo, & Inyang, 2015).

The Ghana National Malaria Control Strategic Plan (2014-2020), as well as President's Malaria Initiative (PMI) strategy (2015-2020), aim to decrease the spread of malaria. Objective five of the strategic plan (2014-2020), which seeks to achieve 100% malaria knowledge among the population lack information on malaria health education for HIV infected pregnant women. Therefore, this study aims to determine what malaria health education nurses/midwives provide to HIV infected pregnant women during antenatal visits and to assess the factors affecting effective malaria health education to HIV infected pregnant women.

1.3 PROBLEM STATEMENT

Malaria and Human Immunodeficiency Virus (HIV) co-infection are essential public health concerns in Ghana and globally. Malaria and HIV are endemic in Ghana's Lower Manya Krobo District (A. Y. Owusu & Laar, 2018). HIV during pregnancy, coupled with malaria, has been shown to reduce any acquired immunity women may have developed and increase the risk of severe anaemia in women in malaria endemic areas. HIV infected pregnant women are twice as prone to clinical malaria, irrespective of gravidity (Kwenti, 2018). In Western and Central Africa, only 56% of HIV infected pregnant women have access to antiretroviral medicines representing the second-lowest globally (UNAIDS, 2021). Thus, the co-infection of malaria and HIV represents specific complications for pregnant women and foetal growth in Ghana and globally.

Health education involves providing health knowledge to individuals to make informed decisions to take a particular action on their health. Health education serves as an essential tool to educate HIV infected pregnant women about malaria and malaria prevention towards eliminating malaria (Juma et al., 2018). Through malaria health education, HIV infected pregnant women will be empowered to better understand malaria and preventive strategies and cooperate in the disease treatment. Health education on malaria significantly improved knowledge, motivation, and behavioural skills on malaria prevention among pregnant women attending antenatal care than a control group who received health education on breastfeeding (Balami, Said, Zulkefli,

& Audu, 2019; Balami, Said, Zulkefli, Norsa'adah, & Audu, 2021). Increased malaria parasitaemia is associated with inaccurate knowledge of malaria causes and preventive approaches among people living with HIV in Ghana (E. D. A. Owusu, Cremers, Brown, Mens, & Grobusch, 2018). Thus, malaria health education intervention is a valuable tool in the prevention and control of malaria in sub-Saharan Africa with improved knowledge about malaria and reduced maternal mortality (Owusu-Addo & Owusu-Addo, 2014) as well as an enhanced behavioural change toward malaria preventive measures (Balami et al., 2019).

The Ghana National Malaria Control Strategic Plan (2014-2020) aimed to control malaria in high transmission areas to decrease malaria's burden and establish lower transmission areas in Ghana by the end of 2020. However, malaria health education and intervention in high HIV prevalent areas such as Lower Manya Krobo District have been less emphasised. There is a paucity of data from Ghana on malaria health education for vulnerable HIV infected pregnant women. Therefore, the health education on malaria provided to HIV infected pregnant women requires special attention. To combat the spread of malaria and HIV as well as reduce the potential for maternal morbidities and mortalities due to co-infection of malaria and HIV, it is imperative to determine the malaria health information nurses/midwives provide to HIV infected pregnant women during antenatal clinic visits, the preventive strategies employed by HIV infected pregnant women as well as the factors that affect the effectiveness of the education provided.

1.4 AIM OF THE STUDY

The study aimed to investigate malaria health education nurses/midwives provide to HIV infected pregnant women during antenatal clinic visits in selected hospitals in the Lower Manya Krobo District in the Eastern Region of Ghana.

1.5 RESEARCH QUESTIONS

The research questions are:

I. What malaria health education and preventive strategies do nurses/midwives provide to HIV infected pregnant women during antenatal visits?
II. What are the sources of malaria health education and preventive strategies employed by HIV pregnant women?
III. What factors affect effective malaria health education for HIV infected pregnant

women?

IV. What framework for malaria health education for pregnant women diagnosed with HIV could emerge?

1.6 OBJECTIVES

The objectives of this study are:

I. To determine the provision of malaria health education and preventive strategies by nurses/midwives to HIV infected pregnant women.

II. To identify the sources of malaria health education and preventive strategies employed by HIV pregnant women.

III. To determine the factors affecting effective malaria health education for HIV infected pregnant women.

IV. To develop a framework for malaria health education for pregnant women diagnosed with HIV.

1.7 SIGNIFICANCE OF THE STUDY

1.7.1 Nursing Practice

Health education is essential in Primary Health Care (PHC). The outcome of this study may influence the services rendered to HIV infected pregnant women by nurses/midwives during antenatal visits, especially malaria health education/promotion and its preventive strategies. Thus, the health of both HIV infected pregnant women and their unborn children will improve, and malaria transmission may reduce. Furthermore, this study reminds and encourages nurses/midwives of their role as health educators to their clients, notably HIV infected pregnant women.

1.7.2 Nursing Management

The study revealed nurses'/midwives' challenges in educating HIV infected pregnant women during their routine antenatal visits. The outcome of this study further provides nursing managers with the basis for procuring health promotional materials on malaria if they do not procure; to offer skills training for their staff to be well equipped on top issues related to malaria health education/promotion to vulnerable HIV pregnant women. The study also provided evidence for future decision making and the

formulation of policies concerning malaria health education for HIV infected pregnant women.

1.7.3 Nursing Education

The literature and outcome of this study inform nursing and midwifery training institutions of the importance of incorporating health education in nursing and midwifery practice in Ghana.

1.7.4 Research

This study contributed to knowledge about malaria and HIV research. The findings from this study also bring to attention financial commitment from research institutions, the Government, the Ministry of Health (MoH) and the Ghana Health Service (GHS) to massively strengthen malaria health education in Districts with reported higher HIV and malaria prevalence to achieve reduced malaria transmission. This study is also recommended to other researchers who aim to eradicate malaria globally and in Ghana to conduct similar studies in malaria reported regions.

1.8 CONTEXT OF THE STUDY

1.8.1 Location

Ghana is in Africa, on the west coast, with a total land size of 238540 km^2. It shares borders with Cote d'Ivoire, Burkina Faso, Togo to the West, North and East, respectively, and to the South is the Gulf of Guinea and the Atlantic Ocean (Briney, 2019). Ghana is divided into three arms of Government. The executive consists of the chief of state and head of Government; the legislative, which also includes parliament; and lastly, the judiciary, made up of the supreme court (Briney, 2019). Previously, Ghana had ten administrative regions until a recent increase to sixteen (16) in 2019. Geographically, Ghana has five distinct areas; the low plains, the Ashanti uplands, the Akwapim-Togo range, and the Volta Basin. Ghana is a warm and humid country with a mean temperature between 26^oC and 29^0C. The republic has two main seasons: dry and rainy (Briney, 2019).

The Lower Manya Krobo District is one of the 26 administrative Districts located in the Eastern Region of Ghana. It lies between latitudes 6.05N and 6.30N and longitudes 0.08W and 0.20W with altitudes 457.5m above sea level (Ghana Statistical Service, 2014). It covers an area of 304.4 square kilometres. The municipality is bounded on

the North-West by Upper Manya Krobo District, North-East by Asuogyaman District, South-East by North Tongu District, and South by Dangme West District (**Figure 1.1**) (Ghana Statistical Service, 2014).

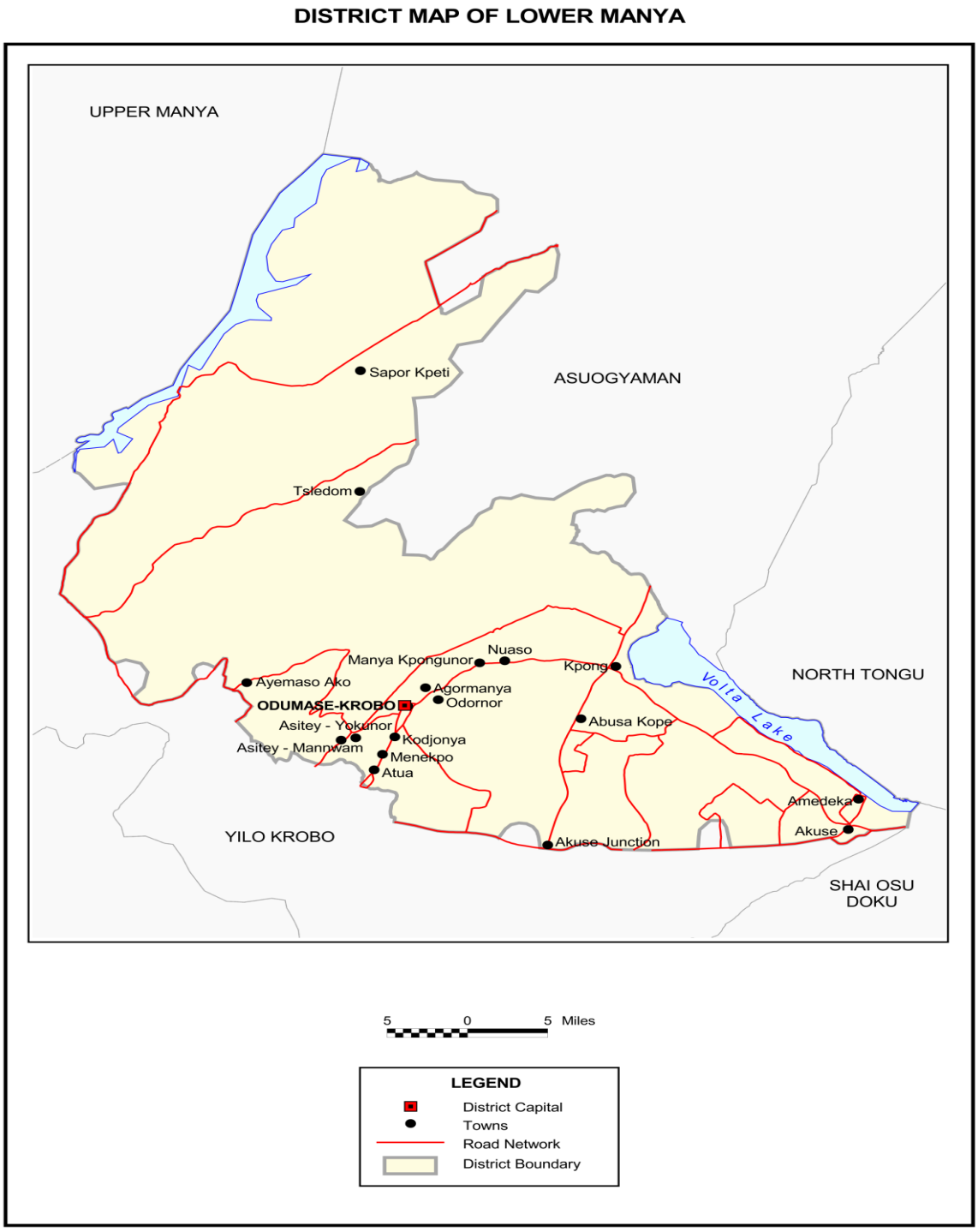

Figure 1.1 Map of the Lower Manya Krobo District (GSS, 2014)

1.8.2 Population

As of 2022, the population of Ghana is approximately 32.4 million people (Ghana Statistical Service, 2021). English is the official language used in Ghana. The highest point in the country is the mountain Afadja at 2 904 feet, and the lowest point is the Atlantic Ocean at zero feet (Briney, 2019). The population of females (53.5%) is higher than males (47.5%) in the Lower Manya Krobo District by sex (Ghana Statistical Service, 2014).

1.8.3 Socio-Cultural Practices

Ghana has a wide diversity of ethnic groups with about 47 languages. The English language was adopted as the official language to minimise ethnic differences. The three main religions in Ghana are Traditional, Muslim, and Christianity (Briney, 2019). The Lower Manya Krobo District has a mixture of tribes ranging from Ewes, Akans, Hausas and others. The Lower Manya Krobo District celebrates the *Ngmayem* festival once a year in the last week of October. The famous traditional rite performed by the Krobos' is *Dipo*.

1.8.4 Health Care System

The health care system in Ghana takes various forms and types: Government hospitals, the Christian Health Association of Ghana (CHAG) and Private facilities (Drislane, Akpalu, & Wegdam, 2014). The health care system can also be divided into four levels. These include a community level, primary health facility level, secondary health facility level and tertiary health facility level. The community health care delivery system includes households, licensed chemical sellers, community-based agents and volunteers. The primary health facility level consists of Community-Based Health Planning and Services (CHPS), health centres, private clinics, pharmacies and polyclinics. On the other hand, the secondary and tertiary health facility levels comprise District hospitals, and Regional/Teaching hospitals, respectively (Ministry of Health, 2015).

The overall percentage of Government total expenditure on health as of 2015 was 5.9% of gross domestic product (GDP) (Ghana Health Service, 2017). Health services in Ghana were based on fee-paying during colonial rule. After independence in 1957, health care delivery was free for all. In 1992, citizens had to pay for health care

services. It was tagged ‘cash and carry’. In 2003, the national health insurance scheme was introduced (Ghana Health Service, 2017).

As of 2017, the Republic of Ghana had 5 421 Community-based Health Planning and Services (CHPS) compounds, 998 clinics, 140 District Hospitals, 1004 health centres, 357 hospitals, 346 maternity facilities, 11 mining hospitals, 38 polyclinics and three psychiatry hospitals (Ghana Health Service, 2017).

As of 2017, the national Doctor-to-population ratio was 7 374. In the Eastern Region that same year, the Doctor-to-population ratio stood at 12 537. The national Nurse-to-population ratio in 2017 was 505, while the Eastern Region Nurse-to-population stood at 573 (Ghana Health Service, 2017).

1.9 A STANDPOINT ON THEORETICAL FRAMEWORK

Proposals and manuscripts submitted to academic boards and journals are rejected because they are considered absent of a theoretical framework or because these boards and journals miss the point as to why or how a theoretical stance is adopted (Onwuegbuzie & Combs, 2011).

A theoretical framework is a theory applied by a researcher to guide a research study, mainly in quantitative research or deductive reasoning. On the other hand, a conceptual framework represents an integrated approach to a problem derived from synthesising related concepts from theories akin to quantitative and qualitative or inductive processes (Imenda, 2014). The use of a theoretical framework as a guide for a study provides several advantages, such as (1) helping design the study and (2) drawing meaning to data collected, interpretation and discussion (Lester, 2005).

Mixed methods research is defined as research in which “the researcher collects and analyses both qualitative and quantitative data rigorously in response to research questions and hypotheses, integrates (or mixes or combines) the two forms of data and their results, organizes these procedures into specific research designs that provide the logic and procedures for conducting the study, and frames these procedures within theory and philosophy” (Creswell & Clark, 2018). Creswell and Creswell (2017) suggest that a researcher should determine if a theory is necessary for their study or research. A researcher who decides to use a theory for a study makes a clear decision to be bounded by the theory, thus, following the theory restrictively

and programmatically. Creswell further opines that researchers should make independent decisions on whether to use a theory or not when considering mixed methods studies.

The general premise that a theoretical framework should precede all mixed methods research is somewhat contentious. In many mixed methods studies, a flexible, naturalistic and individualistic research approach may be adopted in which researchers do not attempt to manipulate the phenomenon of interest (Patton 2014). Such studies begin with research questions that may lead to concepts drawn at different stages of the research process. Specific concepts may emerge during analysis, or findings may confirm or revisit an existing theory.

The three basic approaches in mixed methods research are (Creswell, 2014);

1. Concurrent convergent (convergent parallel) mixed methods: In this form of mixed methods, quantitative and qualitative are collected and analysed simultaneously within one study (**Figure 1.2**).
2. Explanatory sequential mixed methods: This approach first collects and analyses quantitative data, followed by qualitative data collection and analysis. The qualitative process is used to help explain and interpret quantitative findings.
3. Exploratory sequential mixed methods: This approach first collects qualitative data and analyse them, followed by quantitative collection and analysis and integration at the level of interpretation.

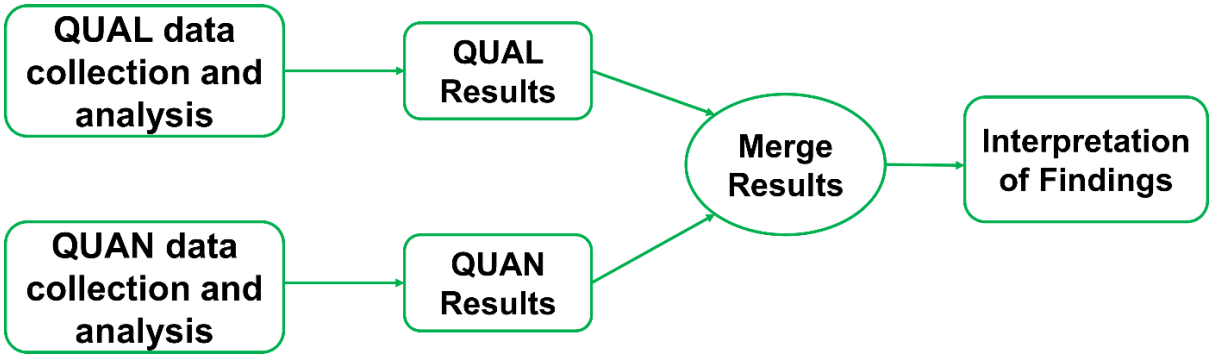

Figure 1.2 A schematic procedural diagram for a concurrent convergent (convergent parallel) mixed methods design (Creswell, 2014).

The advanced mixed methods strategies of the above listed basic mixed methods include transformative, embedded, and multiphase mixed methods.

The table below (**Table 1.1**) provides samples of recent studies where a theoretical framework was or was not applied with their corresponding designs.

Table 1.1 Sample studies on the use and absence of a theoretical framework

Mixed Methods Design	Authors	Paradigm	Priority	Use of theoretical framework
Convergent parallel	(Dalinjong, Wang, & Homer, 2018)	Not specified	Not specified	No
Convergent parallel	(Tomasi et al., 2018)	Naturalistic observation	Not specified	No
Convergent parallel	(Larsson, Westerberg, Karlqvist, & Gard, 2018)	Not specified	Not specified	No
Convergent parallel	(Sattar, Alibhai, Spoelstra, & Puts, 2019)	Not specified	Not specified	No
Explanatory Sequential	(Fu, Yu, McNichol, Marczewski, & Closs, 2018)	Grounded theory	Quantitative	No
Explanatory Sequential	(Xu et al., 2018)	Not specified	Quantitative	Yes
Explanatory Sequential	(Wigander, Öjmyr-Joelsson, Frenckner, Wester, & Nisell, 2018)	Not specified	Not specified	No
Explanatory Sequential	(Steinseth, Høye, & Hov, 2018)	Phenomenography	Not Specified	No
Explanatory Sequential	(Keys, Benzies, Kirk, & Duffett-Leger, 2018)	Not specified	Quantitative	Yes

In this study, Interpretivism as a paradigm and concurrent convergent (convergent parallel) mixed methods as the methodological design was used for data collection and analysis (see section 3.2).

In the initial stage of the study, no theoretical lens guided the study. However, a theoretical framework emerged after analysing the data and integrating both quantitative and qualitative results (see section 5.7).

In conclusion, it is evident from the presented literature that using a theoretical framework in mixed methods research may depend on the priority or emphasis on a methodology (quantitative, qualitative, or mixed), the chosen design and the paradigm.

1.10 THE STRUCTURE OF THE DISSERTATION

This dissertation is presented in six chapters and is structured as an Introduction, Literature review, Methodology, Results, Discussion, conclusion, recommendation and future research perspective. Below is a brief outline of the sections.

1.10.1 Chapter One: Overview of the Study

This chapter focused on introducing the study, research problem in context, problem statement, objectives, research questions, research process, and definition of key terms. It also presented in-depth literature on using a theoretical framework in mixed method studies.

1.10.2 Chapter Two: Literature Review

This chapter presents a review of the literature on the study. The chapter discusses the main points around malaria epidemiology, transmissions, manifestations, diagnosis, and treatment. The section also discusses the effect of malaria and HIV co-infection on pregnancy, sources of malaria education, the impact health education has on health, and the preventive strategies recommended for malaria control.

1.10.3 Chapter Three: Research Methodology

This chapter constitutes the research plan, research setting, sampling technique, data collection techniques, rigour, data analyses, ethical procedures used, and study delimitations. This chapter details the design used, the priority, the sequence, and how both quantitative and qualitative data were integrated. This section of the dissertation also includes the rationale for mixed methods design.

1.10.4 Chapter Four: Presentation of Results and Data Analysis

This chapter presents the results of both quantitative and qualitative data separately. Both quantitative and qualitative data were analysed separately. The quantitative data were presented in tables, charts, and graphs, while qualitative was presented in text. The analysed data were merged to compare and relate. This chapter points out how mixing quantitative and qualitative data was done. Afterwards, interpretation was given to the analysed data.

1.10.5 Chapter Five: Discussion

This section discusses research findings in relation to the objectives.

1.10.6 Chapter Six: Conclusion, Recommendation and Future Research

This final chapter provides the summary and conclusions on the study, recommendations, and future research direction.

1.11 SUMMARY

To conclude, chapter 1 focused on the overall introduction and rationale for the study by outlining the study's background, research problem, problem statement, the purpose of the study, objective of the research study, research question, definition of key terms and organisation of the study. The chapter further elaborated on the reasons for the absence of a theoretical framework in this study. The following chapter 2 introduces and presents the review of the literature.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter introduced the study. This chapter presents a review of the literature. This informs the researcher on several studies (both prior and recent) conducted on malaria education during antenatal clinic visits among pregnant women in Ghana and the world. It gives a little background about malaria and Human Immune Virus (HIV), the number of people infected worldwide, and the estimated death annually.

2.2 BACKGROUND

Malaria represents one of the most common and severe tropical diseases globally, with roughly half the world's population at risk. Though malaria can be prevented and treated, morbidity and mortality due to malaria are significant. During pregnancy in Africa, malaria infection is an important public health threat to the lives of expectant mothers, foetuses, and infants (Mace, Arguin, & Tan, 2018). Human Immunodeficiency Virus (HIV) weakens the immune system, allowing for opportunistic infections such as malaria in malaria-endemic regions. While substantial strides have been made over the past twenty (20) years, advancements against malaria and HIV have shown evidence of slowing down in many countries worldwide, particularly in sub-Saharan Africa (Frank et al., 2019; WHO, 2019b).

Malaria and HIV infection remain two of the most crucial infectious diseases which have gained global health attention, despite the recent changes in their epidemiology and the substantial improvements in their control in populations living in endemic regions. The distribution of malaria and HIV widely overlaps in tropical zones and mostly in sub-Saharan Africa (Flateau, Le Loup, & Pialoux, 2011; Kwenti, 2018). The Roll Back Malaria partnership (RBM), the President's Malaria Initiative (PMI), the Global Fund to Fight AIDS, Tuberculosis, and Malaria, among other organisations, have significantly contributed to reducing the burden of malaria and HIV, especially in sub-Saharan Africa (SSA) (Maharaj, Kissoon, Lakan, & Kheswa, 2019; President's Malaria Initiative Ghana, 2018; WHO, 2019a; Ye & Duah, 2019).

In 2018, there were about 228 million malaria cases compared with the 231 million cases reported in 2017 and 405 000 global deaths from malaria in 2018. Malaria

infection among pregnant women in 2018 was estimated to be 11 million (WHO, 2019c). In addition to malaria, at the end of 2020, approximately 37.7 million people globally lived with HIV, and around 1.5 million people became newly infected yearly (UNAIDS, 2021). Globally, about 5000 young women within their reproductive years (15-24 years) become newly infected with HIV weekly (UNAIDS, 2021). Malaria and HIV co-infection have detrimental effects on pregnant women, such as severe anaemia, low birth weight babies, and maternal death. These diseases overlap in sub-Saharan Africa (Kwenti, 2018). Unstable malaria transmission areas increase the risk of malaria infection among HIV infected persons (Rattanapunya, Chaijaroenkul, Kuesap, Ruengweerayut, & Na-bangchang, 2015). Malaria severity and parasite densities increase in patients with malaria and HIV co-infection (Ashley et al., 2018).

2.3 EPIDEMIOLOGY AND BURDEN OF MALARIA

The number of malaria cases reported globally in 2018 was estimated to be 228 million compared with the 2017 reported cases of 231 million. The estimated global deaths due to malaria in 2018 were 405 000 compared with the 2017 estimated deaths of 416 000. Children below age 5 accounted for 67% of all malaria deaths globally in 2018 (WHO, 2019c). Thus, 2018 witnessed a global decrease in reported new cases and estimated deaths due to malaria. However, of the total international reported malaria cases in 2018, 213 million representing 93%, occurred in the African region, 3.4% of the cases from the South-East Asia Region, and 2.1% occurred in Eastern Mediterranean Region (WHO, 2019c).

In 2015, the World Health Organisation (WHO) in the African Region had an estimated 90% of the global death due to malaria occurring (WHO, 2015); however, an increase in mortality was observed in the WHO African region in 2018, which accounted for 94% of all malaria mortalities worldwide (WHO, 2019c). The global burden of malaria rests on India and nineteen (19) sub-Saharan African countries, which constitute 85% of the worldwide malaria burden (**Figure 2.1**). Six African countries accounted for over 50% of all global cases of malaria in 2018: these countries include Niger (4%), Mozambique (4%), Côte d'Ivoire (4%), Uganda (5%), the Democratic Republic of the Congo (12%) and Nigeria (25%) (WHO, 2019c).

Pregnant women and children less than age five represent the most vulnerable group exposed to malaria infection due to their weaker immune systems. In 2018, 11 million

pregnancies were estimated to be exposed to malaria infection in high and moderate transmission sub-Saharan African countries. Central Africa and the West African sub-region recorded the highest prevalence of pregnancies exposed to malaria infections (35% each) in 2018. In west Africa and Central Africa, Nigeria and the Democratic Republic of the Congo accounted for 39% of pregnant women exposed to malaria (WHO, 2019c).

Ghana and Nigeria were among the top 10 malaria burdened countries in Africa that reported the highest absolute cases of malaria increase of 8% (0.5 million more) and 6% (3.2 million more) in 2018 compared with 2017, respectively (WHO, 2019c).

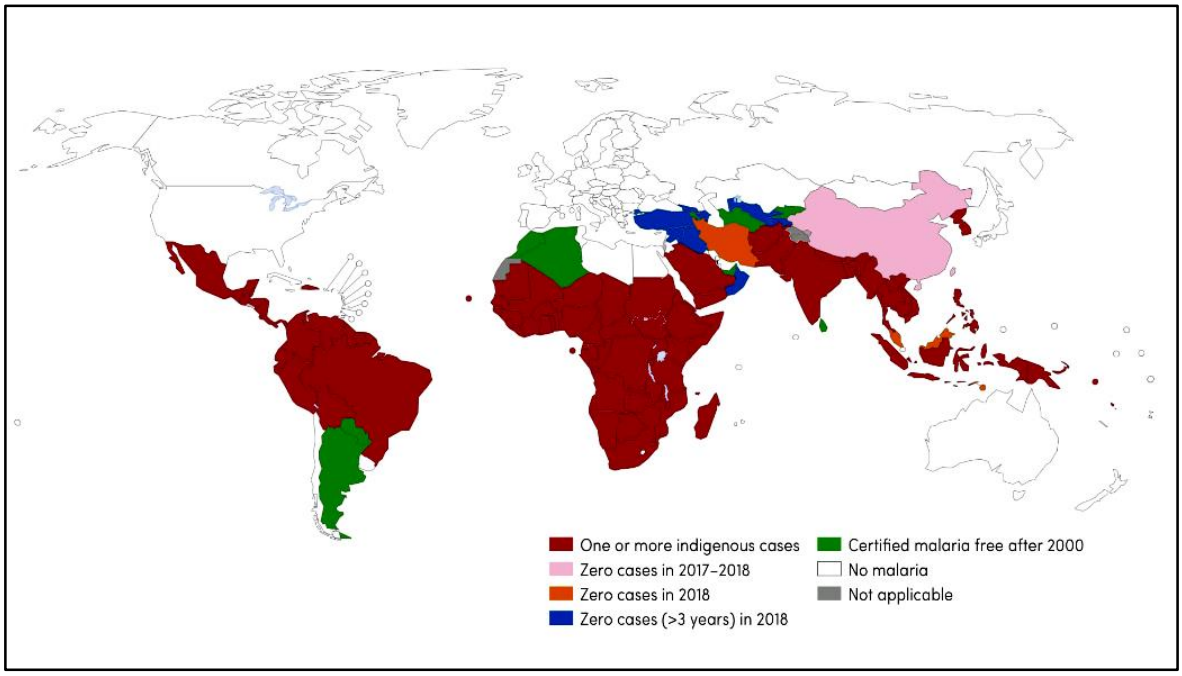

Figure 2.1 Global distribution of malaria showing countries with indigenous cases in 2000 and their status by 2018 (WHO, 2019b)

2.4 MALARIA PATHOGENESIS AND TRANSMISSION

Malaria is a mosquito-borne infection caused by the protozoan parasites of the *Plasmodium* species, with five species mainly attributed to almost all malaria infections in humans with more than 120 species of *plasmodium,* affecting birds, mammals, and reptiles (Ashley et al., 2018; Caminade et al., 2014). *Plasmodium falciparum* is the most prevalent parasite that affects humans, while infection by *P. ovale*, *P. knowlesi*, *P. malariae*, and *P. vivax* are less common and geographically restricted (Ashley et al., 2018; Howes et al., 2015; Roucher, Rogier, Sokhna, Tall, & Trape, 2014). In 2018,

P. falciparum accounted for about 99.7% of all reported malaria cases in the WHO African Region, 50% of WHO South-East Asia, 65% of WHO Western Pacific Regions, and 71% of WHO Eastern Mediterranean Region (WHO, 2019c).

Although most mortalities and severe malaria cases are accounted for by *P. falciparum, the P. vivax* effect on severe malaria morbidity is not to be underrated. The female *Anopheles* mosquitoes transmit the malaria parasites to humans, typically by a bite after dark. The *Anopheles gambiae ss*, *A. funestus,* and *A. arabiensis* are Africa's three most widespread vectors, with *P. vivax* mostly prevalent in Central and South America and South Asia (Battle et al., 2019; Wiebe et al., 2017). The malaria parasite's life cycle varies based on the type of infection in humans and female *Anopheles* mosquitoes (**Figure 2.2**). The manifestation of malaria infection, prevention, and treatment strategies depend on the parasite's life cycle stages.

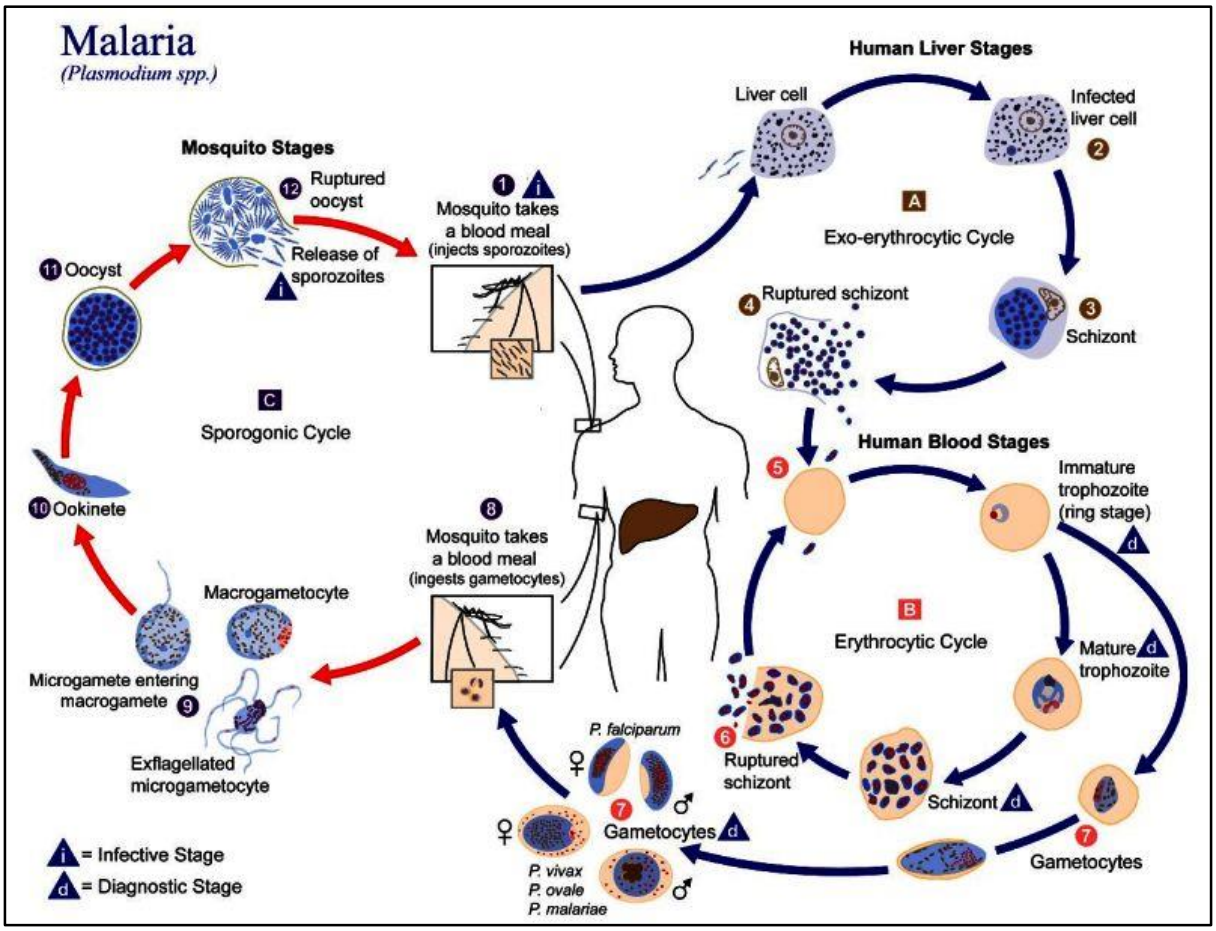

Figure 2.2 The malaria parasite's life cycle (CDC, 2010).

The transmission of malaria infection differs based on the area being seasonal, stable, unstable, and low transmission. In Nigeria, more than 90% of the total population is at risk of malaria because malaria is endemic throughout the country, with at least 50% of the population having one malaria episode each year (Olowookere, Adeleke, Abioye-Kuteyi, & Mbakwe, 2013). All malaria transmissions in Nigeria are caused by *Plasmodium falciparum* (Olowookere et al., 2013). In South Africa, malaria transmissions occur during the summertime between September and May (Biggs et al., 2017). Malaria transmission in Ghana is predominantly stable but varies slightly with wet and dry seasons. Malaria occurs throughout the year, and it is hyper-endemic in all regions of the country (Dery et al., 2010). *Plasmodium* species known to cause malaria in Ghana are *falciparum*, *malariae,* and *ovale* (Dery et al., 2010), with *falciparum* being the most dangerous and deadliest, not doubting the severity of *Plasmodium vivax* and *knowles*i to cause severe malaria (Walker, Nadjm, & Whitty, 2017). *Plasmodium falciparum* has an incubation period between 10 and 14 days (MoH, 2014).

2.5 CLINICAL MANIFESTATIONS AND DIAGNOSIS OF MALARIA

Managing malaria cases consists of suspect case identification based on the manifestation of signs or symptoms, appropriate diagnostic tests, and possible treatment initiation. Symptoms of malaria may develop after six days following an infected bite. The incubation period of *Plasmodium ovale*, *P. malariae,* and *P. vivax* infections is generally more extended (10 to 14 days). *Plasmodium ovale* and *P. vivax* may relapse or manifest after an extended period due to hepatic hypnozoites activation (Walker et al., 2017). The intensity of malaria transmission determines the distribution of clinical symptoms at different ages. The clinical manifestation of malaria infection is broad and influenced by immune status, age, pregnancy, and the parasite's genotype and species. Malaria presentations can either be uncomplicated or severe/complicated (Ashley et al., 2018).

Malaria diagnosis during pregnancy poses some challenges, including low circulating levels of parasites, placental sequestration of parasitised erythrocytes, and limited advanced diagnostic methods in malaria-endemic areas. Morbidity and mortality are reduced by early diagnosis and treatment of malaria. The density of the malaria parasite determines the accuracy of the diagnostic test. The gold standard for malaria

diagnosis remains microscopy, which has an average detection limit of 15 parasites per µL of blood by a well-equipped and experienced technician (White et al., 2014). However, the use of rapid diagnostic tests (RDTs) can detect as low as 200 parasites per µL of circulating parasite antigens such as Histidine Rich Protein 2 (HRP2) (Kyabayinze et al., 2016; WHO, 2018) in the absence of a laboratory test. It has been found that Histidine Rich Protein 2 (HRP2)-based RDT works more efficiently than plasmodium lactate dehydrogenase-based RDT especially in symptomatic pregnant women (D'Alessandro et al., 2018). In Ghana, malaria diagnosis used to be clinical, but progressively, diagnosis is being moved to parasitological confirmation as the basis to initiate treatment (MoH, 2014).

2.5.1 Uncomplicated Malaria

Fever, cough, headache, chills, and body aches, among others, are symptoms of uncomplicated malaria rendering diagnosis unreliable (Ashley et al., 2018). However, uncomplicated malaria can be defined as a patient presenting with fever (axial temperature of 37.5 degrees Celsius or rectal temperature of 38.5 degrees Celsius) on examination and a positive result either from microscopy or rapid diagnostic test (RDT) with no presentation of severe malaria (MoH, 2014).

2.5.2 Complicated/Severe Malaria

Severe malaria may present with severe anaemia, confusion, acute respiratory distress, pulmonary oedema, shock, prostration, jaundice, and repeated vomiting (Ashley et al., 2018). Severe malaria is defined by the Ministry of Health of Ghana in ''Guidelines for Case management of malaria in Ghana'' 2014 as a patient presenting with one or more signs of severe malaria and a confirmation from a parasitological investigation. Several factors can predispose a person to severe malaria, which includes genetic factors (sickle cell disease, Blood group O) and acquired factors (pregnancy and early postpartum, HIV, malnutrition) (Ashley et al., 2018).

2.6 EFFECT OF MALARIA INFECTION ON PREGNANCY AND BIRTH OUTCOME

The scourge of malaria continues to infect vulnerable pregnant women. In sub-Saharan Africa, malaria infected approximately 11 million pregnant women in 2018, and an estimated number of children born with low birth weight was 872 000 (WHO, 2019c). Malaria in pregnancy is a leading cause of global maternal morbidity and poor birth outcomes. Susceptibility to malaria infection complications is higher in pregnant

women than in non-pregnant women. In malaria-endemic regions of sub-Saharan Africa, malaria in pregnancy is estimated to contribute to 12–20% of stillbirths, with observed lower rates if prompt treatment is initiated for the mother (Moore, Simpson, Scoullar, McGready, & Fowkes, 2017). Findings from some longitudinal studies have purported that infection with malaria during the first half of pregnancy can result in premature delivery and can also result in foetal growth restriction, miscarriage and together contribute to lower birth weight new-borns (Briand et al., 2016; Landis et al., 2009; Schmiegelow et al., 2017).

Malaria infection during pregnancy increases the risk of severe maternal anaemia, including others (Bawa, Auta, & Liadi, 2014). In a review, the authors also found that maternal death, miscarriage, stillbirth, low birth weight, and risk associated with neonatal mortality were increased in pregnant women (López del Prado et al., 2014). Increasing parity has been associated with decreasing susceptibility to malaria. A quarter of maternal deaths reported in India were associated with malaria, and pregnant women were three times more susceptible to malaria than their non-pregnant counterparts (Sappenfield, Jamieson, & Kourtis, 2013). Malaria infection accounts for a significant cause of morbidity and mortality among pregnant women and children in Ghana (Ministry of Health, 2014). Sequestration of malaria parasites in the placenta of a pregnant woman where infected red blood cells stick to the organ's blood vessels is dangerous to both mother and foetus, leading to malfunctioning of the placenta (Ministry of Health, 2014).

2.7 IMPACT OF HIV INFECTION ON MALARIA DURING PREGNANCY

Malaria and HIV infection imposes a high health and financial burden on developing countries' economies, leading to increased health expenditure to reduce these diseases' impact. The distribution of malaria and HIV widely overlaps in tropical zones and mostly in sub-Saharan Africa (Ministry of Health, 2015). An increase in malaria prevalence and the severity of clinical malaria and impaired response to treatment with antimalarial are associated with HIV infection; and are dependent on immunodepression, age, and previous immunity to malaria (Flateau et al., 2011; Kwenti, 2018). During pregnancy, the risk of malaria infection increases among HIV infected pregnant women (Kuile et al., 2004). The manifestation of more severe malaria and malaria-related mortalities is associated with HIV infection and worsening

immunosuppression (Ministry of Health, 2015). HIV infected pregnant women are twice as prone to clinical malaria, irrespective of gravidity (Kwenti, 2018).

Two cross-sectional studies from Malawi initially proposed the impairment of HIV-infected pregnant women's ability to control *P. falciparum* infections. The authors reported a lower prevalence of parasitaemia at the first antenatal visit among HIV-negative women than in HIV-infected women (Steketee et al., 1996). Thus, HIV infection during pregnancy weakens a pregnant woman's ability to control placental infection, *P. falciparum* parasitaemia, and neonatal infections. Studies reviewed by González et al. (2012) further indicate that HIV infection during pregnancy increases the risk of peripheral, placental, and cord blood infections, severe anaemia, high parasitaemia density, delivery of low-birth-weight, preterm infants, febrile malaria illness, postneonatal mortality, intrauterine growth retardation, and maternal mortality due to recurrent and severe malaria infections (González, Ataíde, Naniche, Menéndez, & Mayor, 2012).

In Africa, about 10% of malaria-HIV co-infection prevalence was reported (Rattanapunya et al., 2015). Malaria has been identified as a source of HIV-related deaths in Africa and included as an AIDS-related opportunistic infection by the Centre for Disease Control and Prevention (CDC) since 2009 (Rattanapunya et al., 2015). Unstable malaria transmission areas increase the risk of malaria infection among HIV infected persons (Rattanapunya et al., 2015). Malaria severity and parasite densities are increased in patients with malaria and HIV co-infection (Ashley et al., 2018). There is a higher prevalence of malaria where pregnant women are also HIV infected and are unaffected by their number of pregnancies (United Nations Development Programme, 2015). Recently, malaria in HIV infected pregnant women has also been reported to induce systemic inflammatory response associated with a higher risk of preterm birth despite daily trimethoprim-sulfamethoxazole and antiretroviral therapy intake (McDonald et al., 2019).

2.8 MANAGEMENT OF UNCOMPLICATED AND COMPLICATED MALARIA DURING PREGNANCY

Most African countries use Artesunate-Amodiaquine (AS-AQ) and Artemether-Lumefantrine (AL) as the first-line treatments for *P. falciparum* malaria infection, with some countries adopting the use of Dihydroartemisinin-Piperaquine (DHA-PPQ) in

their treatment policies, including Ghana. The overall average efficacy rates for *P. falciparum* were 99.3%, 98.5%, and 98.0% for DHA-PPQ, AS-AQ, and AL, respectively (MoH, 2014; WHO, 2019c).

The World Health Organization recommends using Quinine with Clindamycin for seven days to treat uncomplicated malaria in the first trimester. If Quinine or Clindamycin is not available or treatment fails, Artemisinin-based Combination Therapy (ACT) or oral Artesunate with Clindamycin should be used for seven days (D'Alessandro et al., 2018; Odongo, Bisaso, Byamugisha, & Obua, 2014). Quinine should be used to treat *plasmodium falciparum* malaria only when infections are resistant to Chloroquine (D'Alessandro et al., 2018). Dihydroartemisinin-Piperaquine should be preferred to Artemether-Lumefantrine in the second trimester because it has a longer prophylactic period after treatment (D'Alessandro et al., 2018).

Treatment of uncomplicated malaria during pregnancy in Ghana is outlined below (MoH, 2014):

1. First trimester: Oral Quinine alone or Oral Quinine and Clindamycin
2. Second trimester: Artesunate-Amodiaquine or Artemether-Lumefantrine
3. Third trimester: Artesunate-Amodiaquine or Artemether-Lumefantrine

The risk of developing severe or complicated malaria is higher among pregnant women. In cases of severe malaria in pregnancy, treatment without delay with parenteral antimalarial such as Artesunate and intensive care are critical for the mother's survival (Ashley et al., 2018; Nosten, McGready, & Mutabingwa, 2007). Findings from a review that analysed clinical treatment outcomes of 10 studies on severe malaria corroborated the WHO recommendation that intravenous Artesunate, if not available, intramuscular Arthemeter be used in all pregnancy trimesters (Kovacs, Rijken, & Stergachis, 2015; Ministry of Health, 2015). Intravenous use of Quinine is less efficacious and has safety concerns in pregnant women compared with intravenous Artesunate. Quinine is known to cause recurrent hypoglycaemia; however, it is also recommended in the absence of Artesunate or Arthemeter (D'Alessandro et al., 2018; Kovacs et al., 2015). Severe or complicated malaria cases not caused by *P. falciparum are* currently managed in the same manner as severe *P falciparum* malaria (Baird, Maguire, & Price, 2012).

2.9 MALARIA PREVENTIVE STRATEGIES DURING PREGNANCY

Plasmodium infections cause adverse birth outcomes, such as preterm delivery, foetal loss, and intrauterine growth retardation. WHO recommends vector control or chemoprevention in pregnant women or specific contexts such as complex emergencies and elimination to prevent malaria in endemic Africa. The core interventions recommended by WHO to prevent mosquito bites are sleeping under an insecticide-treated net (ITN) and indoor residual spraying (IRS). ITNs and IRS can be supplemented by larval source management or other environmental modifications (Choi et al., 2019). The World Health Organisation further recommends the daily use of co-trimoxazole prophylaxis in HIV-positive pregnant women or intermittent preventive treatment in pregnancy sulphadoxine-pyrimethamine (IPTp-SP) for HIV-negative women (WHO, 2014).

The strategies employed in malaria control during pregnancy in Africa and Ghana include intermittent preventive treatment (IPTp), insecticide-treated nets (ITNs), and complete treatment course initiation with effective antimalarial during routine antenatal visits for case management. The Presidential malaria initiative seeks to upscale the coverage of the above proven preventive and therapeutic interventions toward eliminating malaria (President's Malaria Initiative Ghana, 2018).

The incidence of clinical cases of malaria and the prevalence of *P. falciparum* infection reduced by 40% and 50%, respectively, in endemic Africa between 2000 and 2015. The prevention and control of malaria have immensely proven to be effective, with an estimated 663 million clinical cases of malaria predicted to have been prevented between 2000 and 2015 in Africa (Bhatt et al., 2015). The main identified intervention controls were indoor residual spraying of insecticides (IRS) and insecticide-treated nets (ITNs), which were evaluated to have prevented 10% and 68% of clinical malaria cases, respectively. The prompt use of ACTs as control interventions also averted 22% of severe clinical cases of malaria (Bhatt et al., 2015).

2.9.1 Chemoprevention of Malaria in HIV-Negative and HIV-Positive Pregnant Women

Intermittent preventive treatment in pregnancy (IPTp) with sulphadoxine-pyrimethamine (SP) is recommended by WHO to be given to all pregnant women in moderate to high areas of malaria transmission in Africa during each antenatal clinic

(ANC) visit. Each SP administration should begin as early as possible in the second trimester (but not during the first trimester) at least one-month intervals during pregnancy (WHO, 2014). In HIV infected pregnant women, the WHO recommends the daily use of co-trimoxazole as prophylaxis to prevent malaria and other opportunistic infections. Due to the higher potential risk of adverse reactions with related sulphonamide containing drugs, IPTp-SP is contraindicated in HIV-infected pregnant women on co-trimoxazole (Gimnig et al., 2006). In Ghana, HIV infected pregnant women on sulphur containing drug treatment such as co-trimoxazole (within four weeks) are exempted from the use of SP during pregnancy (MoH, 2014).

The protective effects of IPTp to avert maternal anaemia and adverse birth outcomes, such as intrauterine growth retardation, preterm delivery, and foetal loss, are well documented. Comparing the efficacy of IPTp with sulphadoxine-pyrimethamine (IPTp-SP) against no intervention or placebo in a review of six trials found that two or more doses of IPTp during pregnancy (mostly HIV-negative) reduced the risk of antenatal parasitaemia (62%, 41–76; five trials), spontaneous abortions (39%, 1–62; three trials), moderate-to-severe anaemia (relative risk reduction 40%, 95% CI 25–53; three trials), low birth weight (19%, 1–33; five trials) and placental parasitaemia (55%, 39–67; five trials) (Radeva-Petrova, Kayentao, ter Kuile, Sinclair, & Garner, 2014).

The prevalence of placental malaria among HIV-negative women and HIV-positive women receiving IPTp-SP and daily co-trimoxazole were similar in cross-sectional studies analysed in a systematic review (Manyando, Njunju, & D'Alessandro, 2013). In another systematic review and meta-analysis, the use of co-trimoxazole in malaria prevention among HIV-positive pregnant women was non-inferior to IPTp-SP concerning placental malaria, infant mortality, and low birthweight. HIV-infected pregnant women in Africa should use co-trimoxazole rather than IPTp-SP to prevent malaria complications in infants (Suthar et al., 2015).

Despite the preventive benefits of chemo-protective such as IPTp-SP during pregnancy, the uptake of IPTp worldwide and in Ghana has not reached optimal coverage. The rate of coverage of pregnant women receiving IPTp-SP from 36 African Countries that have adopted the IPTp policy was 60%, 49%, and 31% for the first (IPTp1), second (IPTp2), and third (IPTp3) doses, respectively in 2018. However, a relative increase in IPTp3 coverage was observed for 2018 compared with the 22% coverage reported in 2017 (WHO, 2019c). A retrospective study that analysed data

from 2011 to 2015 of 17484 pregnant women on the recommended uptake of three or more doses of IPTp-SP in Kintampo of Ghana found a low IPTp-SP coverage (20.9% - 45.9%) (Oppong et al., 2019).

In a recent survey from Northern Ghana, pregnant women attending antenatal care who received more than three doses of sulphadoxine-pyrimethamine were associated with improved pregnancy outcomes such as having healthy baby weight and full-term delivery. Strengthening efforts toward improving early antenatal clinic visits could enhance SP uptake and improve pregnancy outcomes (Anto, Agongo, Asoala, Awini, & Oduro, 2019). Quakyi et al. (2019) assessed IPTp-SP coverage and the impact of increased doses from two study sites in Ghana and found that pregnant women who took more than three doses of IPTp-SP were associated with an over 0.165 kg average increase in birth weight. The authors observed that plasma SP levels at delivery were also associated with increased uptake of IPTp-SP (Quakyi et al., 2019).

In the 36 African countries that reported IPTp coverage to WHO in 2018, only 31% of pregnant women were given the recommended three or more doses of IPTp. This indicates that two-thirds did not receive the recommended preventive therapy of three or more treatments. Besides, 18% of pregnant women who attended antenatal care at least once did not receive any IPTp, a missed opportunity that could rapidly and considerably increase IPTp coverage if harnessed (WHO, 2019c).

2.9.2 Insecticide Treated Nets (ITNs)

Insecticide Treated Bed Nets (ITNs) are a proven malaria preventive strategy for reducing the malaria infection burden during pregnancy. Pregnant women who sleep under ITNs can decrease the contact between them and mosquitoes, providing an insecticidal effect and a physical barrier (WHO, 2019c). ITNs are a relatively cheaper and more effective approach for malaria prevention during pregnancy in reducing mosquito bites, thus decreasing malaria infections in endemic areas of sub-Saharan Africa.

The use of insecticide treated nets reduced malaria parasites' prevalence by 13%, episodes of uncomplicated malaria by 50%, and complicated malaria by 45% compared with the same population with no net usage in regions of stable malaria transmission (Lengeler, 2004). The appropriate use of ITNs as a malaria intervention strategy has been reported to modify stillbirth risk by reducing its rates. ITNs use

during pregnancy has also been associated with lesser placental malaria rates and low birth weights (Gamble, Ekwaru, & ter Kuile, 2006).

In a systematic review by Pryce et al. (2018) on ITN use in malaria prevention, the authors reported that the use of ITNs decreased the prevalence of *Plasmodium falciparum* malaria by 17% and the incidence of uncomplicated malaria episodes of *P. falciparum* by nearly 50% compared to no net usage. The rate of severe malaria episodes dropped by 44% in the ITN group compared to the no net group (Pryce, Richardson, & Lengeler, 2018). The use of insecticide-treated nets (ITNs) was evaluated to have prevented 68% of clinical cases of malaria between 2000 and 2015 (Bhatt et al., 2015).

However, several factors affect the use of ITNs in Ghana. These include poor knowledge and perception of ITNs and malaria, discomfort (due to heat), lack of access to ITNs, and frequent sleeping arrangement changes (Manu et al., 2017; Ricotta, Oppong, Yukich, & Briët, 2019).

2.9.3 Indoor Residual Spraying (IRS)

Indoor Residual Spraying (IRS) is recommended to further prevent malaria infection during pregnancy for a rapid malaria transmission reduction. Indoor residual spraying is a vector control intervention strategy involving insecticide application to the inside walls of housing structures that often serve as resting sites for mosquitoes, typically once or twice a year (WHO, 2019c). Indoor residual spraying forms a vital component of the Ghana malaria control strategy toward reducing Ghana's malaria burden. IRS has significantly affected entomological transmission indices and malaria prevalence (Coleman et al., 2017).

The IRS's global protection for people at risk of malaria decreased from a 5% peak in 2010 to 2% in 2018 across all WHO regions except the WHO Eastern Mediterranean region. The observed decrease in IRS coverage may be attributed to countries switching to a more expensive alternative from the pyrethroid insecticides to alleviate mosquitoes' resistance to pyrethroid base insecticides (WHO, 2019c).

During pregnancy, IRS's use in high transmission areas of Uganda observed a significant reduction in parasite prevalence and malaria incidence. The prevalence of placental parasitaemia was significantly lower at delivery in women with IRS protection

than in women with no IRS protection. The risk of adverse birth outcomes such as neonatal/foetal deaths, preterm birth, and low birth weight was higher in women with no IRS protection than in women with IRS protection (Muhindo et al., 2016). However, discontinuing IRS in historically high malaria transmission areas of Uganda was associated with a rapid increase in malaria disease (Raouf et al., 2017).

2.10 HEALTH EDUCATION AND HEALTH OUTCOME

Health is affected by an individual's situation, community environment, and political climate where they live (Raingruber, 2014). Mackintosh (1996) defines health education as providing health knowledge to individuals to make informed decisions on a particular action on health (Mackintosh, 1996; Raingruber, 2014).

Prioritising patient education is essential in nursing practice by the American Nurses Association (ANA) and the International Council of Nurses (ICN). Patients' adherence and satisfaction improved after effective patient education (Kelliher, 2013). Patient education involves providing information to patients and families concerning their health, thereby enhancing their quality of life, increasing adherence to treatment and management, increasing patient satisfaction, and shortening patient hospitalisation (Livne, Peterfreund, & Sheps, 2017). Appropriate educational strategies, either formal or informal, outlined by Kelliher (2013), are effective communication, adequate staffing, and administrative support to nurses/midwives.

A study on nurses and patient education showed that to promote adherence among patients, care must be centred on the patient's lifestyle and self-care (Kelliher, 2013). In a situation where patient education through communication is ineffective, adverse effects such as medication-related errors occur (Livne et al., 2017). The health transformation of individuals, societies and healthcare systems is through nurses' help (Raingruber, 2014). Nevertheless, a study of 25 focus groups of nurses in a medical-surgical unit showed that nurses frequently missed patient education, among the other nine aspects of care that should be rendered to patients (Kalisch, 2006). Practical health goals can be achieved if health education is effectively practised at the community level (Raingruber, 2014). Many factors have been identified as stumbling blocks impeding nurses from engaging in patient education. These include nurses' work overload, lack of communication skills, lack of educational materials, inadequate

skills and knowledge, insufficient managerial support, and unprioritised patient education than other aspects of care given precedence (Livne et al., 2017).

A qualitative study of nurses in Iran confirmed some of the factors hindering patient education, such as unprioritised patient education, unclear expectation regarding patient education from supervisors in the unit these nurses work, inappropriate communication skills, and lack of motivation (Farahani, Mohammadi, Ahmadi, and Mohammadi, 2013). Nurses' values and staff development should include patient education and teaching strategies (Livne et al., 2017). All nurses'/midwives' clinical practice needs interpersonal skills and educational competencies essential for a patient's adherence and satisfaction (Kelliher, 2013). Kelliher (2013) concluded that nurses/midwives need support through training to deliver patient education.

2.11 IMPACT AND ROLE OF HEALTH EDUCATION ON MALARIA PREVENTION AND TREATMENT

Health promotion serves as an essential tool to educate patients and communities about malaria and maintain community involvement in malaria prevention towards eliminating malaria. Patients and community members are empowered to better understand malaria and preventive strategies and cooperate to treat the disease through malaria health education programs.

At an antenatal clinic in Adis Zemen Hospital in North-western Ethiopia, few participants (1.3%) knew that medicine could prevent malaria compared to 100% of participants listing ITNs as a preventive strategy (Goshu & Yitayew, 2019b). Some pregnant women refuse to receive SP during antenatal clinic visits. They believe SP has adverse effects on pregnancy, whereas others refuse to accept SP because they do not have permission from their husbands before SP use (Ameh et al., 2016). Doku et al. (2016) reported a dropout rate concerning the use of IPTp, which was attributed to late antenatal visits, poor attitudes of health workers toward pregnant women, and inadequate knowledge of IPTp among pregnant women. A study among Ugandan women attending an urban antenatal clinic showed that almost all the pregnant women who took part in the survey had heard of SP. Still, only 57% said it prevented malaria in pregnancy, and 15.4% said it was given as malaria treatment. There were significant associations with adherence to SP and age, educational level, number of antenatal

clinic visits in previous pregnancies, and knowledge of SP when analysed independently using logistic regression (Odongo et al., 2014).

In a study in the Bugiri District of Uganda, about 50.5% stated that IPTs tablets were a malaria preventive strategy. The study also showed that 33.4% did not know the number of times SP should be taken, and 47% did not know the effects of malaria on pregnancy. In this same study, pregnant women said they knew IPTp from health staff (88.2%), friends (4.8%), and media (4.8%) (Muhumuza, Namuhani, Balugaba, Namata, & Kiracho, 2016). Muhumuza et al. (2016) further stressed the need for health education campaigns on IPTp among pregnant women to improve their knowledge and adherence.

Interactive malaria education initiative to enhance participant's uptake of malaria control intervention strategies conducted in Limpopo, South Africa, observed a correct understanding of malaria transmission and prevention approaches to increase by 21.4% and 10.5%, respectively (Cox et al., 2018). Future research needs to develop health promotion solutions and test interventions to enhance patients' and community's understanding of malaria and preventive strategies (Cox et al., 2018). In a recent randomised controlled parallel-group trial conducted in the Borno state of Nigeria, pregnant women attending antenatal care who received a 4-hour health education on malaria for four months improved significantly in knowledge (12.75%; $p < 0.001$), motivation (8.55%; $p < 0.001$), and behavioural skills (6.350%; $p < 0.001$) on malaria prevention compared to a control group who received health education on breastfeeding for the same duration (Balami et al., 2019). Owusu et al. (2018) investigated knowledge, attitude, and practices among people living with HIV towards malaria in Ghana and found that increased malaria parasitaemia was associated with inaccurate knowledge of malaria causes and preventive approaches.

A cross-sectional study on 400 pregnant women attending antenatal clinic visits in a primary health facility in Nigeria reported that 62% knew mosquito bed nets as a malaria preventive practice in pregnancy, and 64% knew that SP could prevent malaria in pregnancy (Ameh et al., 2016). The increased knowledge on insecticide-treated bed nets and SP use in pregnancy to prevent malaria was accredited to the health education given to pregnant women during antenatal clinic visits (Ameh et al., 2016). Increased awareness of malaria preventive measures during pregnancy was

observed to correlate with ANC attendance, which may be attributed to the pregnant women's health education during ANC visits (Miaffo, Some, Kouyate, Jahn, & Mueller, 2004).

A study in Nigeria on the use of the insecticide-treated net and malaria preventive education reported that in a period of three months, malaria parasitaemia reduced among study participants who were HIV-infected (Olowookere et al., 2013). Misunderstanding of improper dissemination of health education concerning malaria in pregnancy affects adherence to preventive strategies for malaria. It is evident in the study of Olowookere et al. (2013) that routine preventive education and Insecticide-Treated Nets (ITNs) use given to HIV-infected persons prevented malaria among them and thus improved their quality of life. Pregnant women with more than four antennal clinic attendance had good knowledge of malaria in pregnancy and IPTp-SP as a preventive strategy for malaria in pregnancy. More than four ANC attendance was associated positively with optimum doses of IPTp-SP uptake among pregnant women studied in Sunyani Municipality of Ghana (Ibrahim et al., 2017).

Health education attenuates misconceptions and challenges that commonly prevent pregnant women from seeking and adhering to treatment during pregnancy. These concerns may surround but are not limited to taking drugs on an empty stomach, using medication in pregnancy, and fearing possible adverse effects (Aregbeshola & Khan, 2018; Jaiteh et al., 2016; Rassi et al., 2016). Furthermore, the education of close relatives such as husbands could be a significant factor, as a study in Nigeria found that in households where both partners understand the benefits of antenatal clinic visits and IPTp were associated with higher IPTp uptake (Aregbeshola & Khan, 2018). It has been suggested by Anchang-Kimbi et al. (2014) the uptake of IPTp-SP may be hindered by the late enrolment of pregnant women at antenatal clinics and lesser clinic visits; however, health education on the health benefits of early and regular antenatal attendance may increase the coverage of IPTp (Anchang-Kimbi et al., 2014).

Health education on malaria and Long Lasting Insecticidal Treated Nets (LLINs) use in an out-patient department of a health facility in Nigeria demonstrated an effective strategy to improve malaria knowledge and LLINs usage (Afolaranmi, Hassan, Amaike, Miner, & Oyebode, 2015). In a study conducted in a health centre in Rwanda, pregnant women who received education on malaria had improved knowledge of

malaria and effectively utilised preventive methods such as sleeping under ITNs to reduce malaria incidence (Nishimwe & Kerr, 2012).

2.12 SUMMARY

This chapter has presented a literature review on relevant studies. It included the effect of malaria infection on pregnancy, the impact of HIV infection on malaria during pregnancy, sources of malaria health education and knowledge and preventive strategies used by pregnant women. The subsequent chapter discusses the research methodology.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 INTRODUCTION

The previous chapter presented the literature review discussing the epidemiology of malaria, the effect of malaria and HIV infection on pregnancy, health education and malaria preventive strategies. This chapter outlines the research design and paradigm, study area and population. The employed sampling techniques, size determination, data collection, and analysis have been elaborated. Finally, measures to enhance rigour in qualitative and quantitative research and ethical considerations have also been highlighted.

3.2 RESEARCH DESIGN AND PARADIGM

Crotty outlined that to begin a research process, a researcher may or must have a purpose, researchable question, an idea of what the research outcome will add to knowledge, ways to collect and analyse data, the reason for choosing, and employing several or particular design and method (Crotty, 1998). Crotty's four essential components of ensuring that research results have positive implications for readers were adapted for this study. These include epistemology, theoretical perspective, methodology and methods (Crotty, 1998).

3.2.1 Epistemology

Epistemology as a worldview is defined as "*the theory of knowledge embedded in the theoretical perspective and thereby in the methodology*" (Crotty, 1998). In this study, two epistemological views were described because of the mixed methods approach.

3.2.1.1 Subjectivist

Subjectivists look at the view of participants during a research study (Creswell & Creswell, 2017). This approach has been used to identify the subjective elements in malaria health education nurses/midwives provide to HIV infected pregnant women concerning malaria and pregnancy during antenatal clinic visits. Nurses'/midwives' personal experiences were the basis for knowledge.

3.2.1.2 Objectivism

Objectivism is embraced by social researchers and is related to positivism or post-positivism. In the quantitative aspect of this study, objectivism as epistemology has

been used to examine the relationship between the independent and dependent variables of the research. HIV infected pregnant women's knowledge was assessed on malaria health provided by nurses/midwives in the three selected Hospitals in the Lower Manya Krobo District.

3.2.2 Theoretical Perspective

3.2.2.1 Interpretivism

Interpretivists argue that natural science looks for a frequency to obtain quantitative, abstract, and observational laws. In contrast, the social sciences seek qualitative individual cases to include subjective views, emotions, values, and opinions that cannot be counted and observed directly (Crotty, 1998). Interpretivism necessitates the subjective meaning of a social action to be grasped by the researcher (Bryman, 2016).

Nurses/midwives were asked to talk about their experiences educating HIV infected pregnant women on malaria health during antenatal clinic visits, considering their beliefs and feelings.

3.2.2.2 Positivism

Positivism is credited to Auguste Comte. As a theoretical perspective, positivism is a foundation for all quantitative research. This theoretical perspective is based on the scientific knowledge that can be verified and compared to non-scientific knowledge based on opinions, beliefs, and feelings (Crotty, 1998). HIV infected pregnant women's knowledge was assessed on malaria health.

3.2.3 Methodology

The methodology is the design behind the data collection technique.

3.2.3.1 Mixed Methods

Mixed methods research combines quantitative and qualitative methods, techniques, and concepts in one study. The two forms of data sets can either be connected, merged, or embedded within the other. There are advantages of mixed methods identified. These include participant enrichment, instrument integrity and limitations of both approaches (quantitative and qualitative) are minimised.

A convergent parallel (convergent concurrent) mixed method adequately captured data on malaria health education provided by nurses/midwives. This method was also

used to identify malaria prevention strategies and the factors affecting effective malaria health education to HIV infected pregnant women. There was no order or sequence during data collection or its analysis. This research design required the concurrent collection of qualitative and quantitative data without using a theoretical framework initially; however, a framework to guide nurses/midwives in providing health education on malaria to HIV infected pregnant women emerged based on the health belief model and the information motivation behaviour model (elaborated in chapter five, section 5.6, page 81).

The mixed methods design was appropriate for this study because the limitations of both qualitative and quantitative approaches were reduced, and a better understanding of the phenomenon was achieved (Creswell & Creswell, 2017). Also, using the mixed methods strategy was to understand better the knowledge of HIV infected pregnant women on the use of preventive strategies to prevent malaria in pregnancy. This approach was also helpful to provide a voice for HIV infected pregnant women, a marginalised group in our society.

Furthermore, this study used this strategy to determine convergence and divergence after qualitative and quantitative data were gathered and analysed separately. Both quantitative and qualitative data collection took place simultaneously (Creswell & Creswell, 2017), allowing the researcher to save limited resources such as time and finances.

3.2.4 Methods

Methods are data collection techniques aimed at obtaining answers to research questions. The methods for the qualitative and quantitative approaches for this study were interviews and questionnaires, respectively. These techniques are further elaborated on in section 3.7.

3.3 STUDY AREA

The study was conducted in three hospitals purposively selected in the Lower Manya Krobo District in the Eastern Region of Ghana. These selected hospitals serve a population of 89,246 and over in the District. Two hospitals are public, and the other is a Christian health hospital.

The researcher selected these hospitals because the hospitals offer antenatal clinic services. It is also located in the District with the highest prevalence (5.64%) of HIV infection and has reported malaria cases (Ghana AIDS Commission, 2017).

3.4 STUDY POPULATION

Since this study was a mixed methods research, two populations were used. The target populations for this study were all nurses/midwives working in the antenatal unit, and all HIV infected pregnant women attending antenatal clinics in Lower Manya Krobo District. The accessible population was the available population the researcher had access to (Gray, Grove, & Sutherland, 2017).

3.5 SAMPLING TECHNIQUE

Sampling is when a particular population group is selected (Gray et al., 2017). A partially controlled setting was used for this study since data were collected in a health facility. This setting was appropriate for interviewing nurses/midwives and administering questionnaires to HIV infected pregnant women. All research participants and respondents were recruited using a positive, informative and non-persuasive approach explaining the content of the study and the duration of the data collection. Each research participant/respondent was allowed to participate willingly without coercion.

3.5.1 Hospital

According to Alvi (2016), probability sampling is when a researcher randomly selects from a population, and the population tends to be chosen again. A non-probability sampling relies on the researcher's subjective judgement (Alvi, 2016). Based on the knowledge of the study's objective, purposive sampling was used to select all three hospitals in Lower Manya Krobo District. The Lower Manya Krobo District population, where the hospitals are situated, has a population severely affected by HIV/AIDS and suffers malaria epidemics.

3.5.2 Qualitative Data Collection from Nurses/Midwives

Purposive sampling was used to select participants for the interview. It allowed nurses/midwives at the antenatal clinics to describe the meaning of providing malaria health education to HIV infected pregnant women and produce rich data. Also, the limited number of staff ranging between either one and/or two at post influenced the choice of the sampling method used. Other non-probability methods, such as

convenience and network sampling, could have been used for the study. However, it would not have been appropriate for this study since a specific population group was needed.

The sample size obtained was interviewed until additional sampling gave no new information or when informational redundancy occurred, i.e. when data saturation was reached (Fusch & Ness, 2015). To confirm data saturation, one participant was interviewed in addition to the sample obtained (Fusch & Ness, 2015). Interview participants (nurses/midwives) were not provided with any reward for their participation. The researcher deemed it appropriate to be ethical and not coerce research participants into participating in the study. The nurses/midwives were recruited between December 2019 and December 2020. This took a while because of their busy schedule and the rise of COVID-19 pandemic in the Republic of Ghana.

3.5.2.1 Inclusion Criteria

The selection criterion was based on the scope of the study. Inclusion criteria for the qualitative aspects of this study were nurses/midwives who were permanently employed in the selected facility at the antenatal clinic and nurses/midwives at the antenatal unit who signed the informed consent. All nurses/midwives who consented to participate in the study were included irrespective of the number of years of employment/experience at the maternal care services or their experience in managing malaria.

3.5.2.2 Exclusion Criteria

Those excluded from this study were not in the scope of the research. They included:

1. Staff at the antenatal clinic who were not nurses/midwives.
2. Nurses/midwives at the antenatal clinic who did not consent.
3. Nurses/midwives who were not permanently employed, such as students and interns.
4. Nurses/midwives who were not working in the antenatal units.

3.5.3 Quantitative Data Collection from HIV Infected Pregnant Women

It was described in detail by Gray et al. (2017) the various sampling techniques, probability and non-probability methods. Non-probability purposive sampling was used

to identify respondents who were a representation of the study phenomenon. Unlike the general population of pregnant women, the subjects (HIV infected pregnant women) were limited for conducting the study. Therefore, a purposive sampling sought to select HIV infected pregnant women from various backgrounds, ages, marital statuses, and educational levels. This sampling technique was sure to increase representativeness. An effective strategy to recruit HIV infected pregnant women using a language they could understand best was achieved by explaining the purpose of the study where necessary.

All HIV infected pregnant women who met the selection criteria were first approached by the attending nurse/midwife during their visit, aware of the ongoing study. This posed no threat since confidentiality remained in the circles of the attending nurse/midwife, the researcher, and the research respondent. The nurse/midwife then introduced the researcher and referred the prospective respondent to the researcher, who detailed the study's outline. The purpose and nature of the research, what is involved in the study, potential risk, benefits, cost and compensation, confidentiality, voluntary participation/withdrawal, the outcome of the study, feedback to-respondents, sharing of respondents' information/data, storing of data collection materials, the provision of informed consent (Appendix I) and whom to contact for further clarification and questioning were explained to the participant. The research respondents (HIPW) could ask questions about the information provided. The consent form was given to respondents who were willing to participate in the study to sign. The researcher kept a copy while a copy was given to the study respondent.

Quantitative study respondents were provided with a health education brochure/poster on malaria for their valuable time during data collection. The National Malaria Control Programme office in Accra, Ghana, provided the educational brochure/poster after a letter of request (Appendix VI) was sent upon obtaining ethical clearance (UZREC and GHSREC).

3.5.3.1 Inclusion Criteria

The inclusion criteria for the quantitative aspect of this study were pregnant women attending antenatal clinic visits who were HIV infected and signed consent forms. This was because the scope of this study was about HIV infected pregnant women. This group of participants had started antenatal visits or reported for the first time at the

clinic. Furthermore, there were no limits or restrictions in terms of the number of previous pregnancies, period/gestation of pregnancy, and previous malaria-related treatment received among the HIV infected pregnant women included in the study who consented.

3.5.3.2 Exclusion Criteria

Exclusion criteria were those outside the scope of the study. These include:

1. Non-pregnant women.
2. Non-HIV infected pregnant women.
3. HIV infected pregnant women who did not sign a consent form.
4. HIV infected pregnant women who do not attend antenatal clinic visits in the selected hospitals.

3.6 SAMPLE SIZE DETERMINATION

To draw a meaningful conclusion that reflects the population of Lower Manya Krobo District (LMKD), it was essential to consider the sample size, that is, to draw inference about the population under study (Taherdoost, 2017).

For a sample size to be adequately determined, factors such as level of precision, also known as sampling error or an acceptable margin of error, level of confidence and degree of variability must be considered (Taherdoost, 2017). The sample size for this study was determined, bearing the financial resources of the researcher in mind, who the respondents were, and the population of the study area (Lower Manya Krobo District). Sample size can be determined using software available online or statistical formulae (Taherdoost, 2017).

3.6.1 Qualitative Study (Nurses/Midwives)

A sample frame consisted of all nurses/midwives at the antenatal clinics under all three hospitals in Lower Manya Krobo District using the eligibility criteria after being granted ethical clearances. In qualitative research, the sample size is usually not determined. Data is collected until saturation occurs. Hence a sample size calculation was not done for this population. A total number of three participants participated, one from each facility.

3.6.2 Quantitative Study (HIV Infected Pregnant Women)

A sample frame was acquired by searching for published articles and reports on HIV prevalence among pregnant women attending antenatal clinics in Lower Manya Krobo District. This was to estimate the sample size, which could represent the entire population.

It was found that the Eastern Region of Ghana recorded an HIV prevalence of 2.7% in 2015. The age group documenting the highest prevalence was between 35-39 years (3.4%) and the lowest within 15-19 years (0.7%) in both males and females (Ghana Health Service/ Ministry of Health, 2016). The Lower Manya Krobo District recorded a 5.64% prevalence rate at the District level, the highest in the Country (Ghana AIDS Commission, 2017). The prevalence of HIV among pregnant women in the Lower Manya Krobo District was 8.9% in 2007 (NACP, 2008) cited by (Laar, Ampofo, Tuakli, & Quakyi, 2009). A recent study conducted at three study sites (Upper Manya Krobo District, Kwahu West District and Yilo Krobo District) in the Eastern Region found the prevalence of HIV among 1 109 pregnant women to be 8% (Yoon et al., 2012). The Upper Manya Krobo District and Yilo Krobo District share boundaries with Lower Manya Krobo District on the north and southwest, respectively.

In this study, the chosen sampling error was 5%. The confidence level was set at 95%, meaning that of 100 samples, 95 of the sample provided an accurate estimate (Taherdoost, 2017). On this note, Cochran's sample size formula (equation 1) was used to estimate the sample size of HIV infected pregnant women. The projected sample size for the HIV infected pregnant women was 120, with an estimated sample size of 113 using Cochran's formula. The estimated sample size was based on the HIV prevalence of 8% (0.08) among pregnant women attending antenatal clinics with the District. However, the data collection ended with a total number of 110 respondents.

Cochran's formula

$$n = \frac{Z^2\, p(1-p)}{e^2}$$ **Equation 1**

Where:

Z = The value of ***1.96*** at a confidence level of 95%.

e = The acceptable error margin of ***0.05*** (5%).

P(1-P) = estimate of variance, where *P* is ***0.08*** (8%), the prevalence of HIV among pregnant women in the chosen population.

3.7 STUDY VARIABLES

In this study, two variables were used. They are independent and dependent variables. They are explained below.

3.7.1 Independent Variables

Independent variables included in this study phase (and related to HIV infected pregnant women) are listed as follows:

1. age and date of birth
2. marital status
3. employment status
4. educational level
5. number of pregnancies

These variables have an impact on health knowledge, hence, explored. Research respondents were asked to state their age in a space provided on the questionnaire. Respondents were further asked to select their marital status, thus if they were single, married, living with a partner (Co-habiting) or divorced. On their employment status, respondents could select either employed (Government/Private), self-employed, unemployed or student. In addition, the respondent's educational status was assessed; no educational background, primary (P1-6), high school (JHS-SHS) or tertiary (College/University). Finally, the number of times they had been pregnant could influence their health knowledge. Respondents were allowed to select their number of pregnancies (primiparous or multiparous).

3.7.2 Dependent Variables

The dependent variables (causes, prevention, education, complication) assessed the respondent's knowledge of malaria.

3.8 DATA COLLECTION TECHNIQUES

Data collection techniques aim at achieving answers to research questions. The researcher collected qualitative data from nurses/midwives using an interview guide and quantitative data from pregnant women simultaneously using a survey questionnaire.

The data collection for both groups (participants and respondents) was performed during regular clinic visits in a natural setting to minimize manipulation of the participants/respondents or the environment, which could influence the results.

The three antenatal clinics work from Monday to Friday and are open from 7:00 am to 4:00 pm but do not work on public and national holidays. The data collection began in December 2019 and ended successfully in December 2020. **Figure 3.1** shows a schematic workflow of how data collection was performed.

3.8.1 Interview (Qualitative Data Collection from Nurses/midwives)

Qualitative data collection focuses on flexibility in the research process and keeping participants meaning in view (Creswell & Creswell, 2017). An interview occurs when researchers collect data from research participants through verbal conversations in person or by telephone (Gray et al., 2017). Semi-structured interviews were conducted by the researcher for the qualitative element of this study. The interviews occurred in a private, quiet room at the antenatal clinic, having face-to-face interaction with each participant. Rapport was established by the researcher, introducing herself and asking the participants (nurses/midwives) to introduce themselves without providing their full names. This ensured a favourable and comfortable environment for the researcher and the interview participant. The rationale for conducting the interview, including the nature of the study, the aim of the study, potential risks and benefits, voluntary participation or withdrawal and what the data collected will be used for, were explained to the participating nurse/midwife. After that, informed consent was provided and signed by the participants who consented to participate in the study, which paved the way for the researcher to conduct the interview.

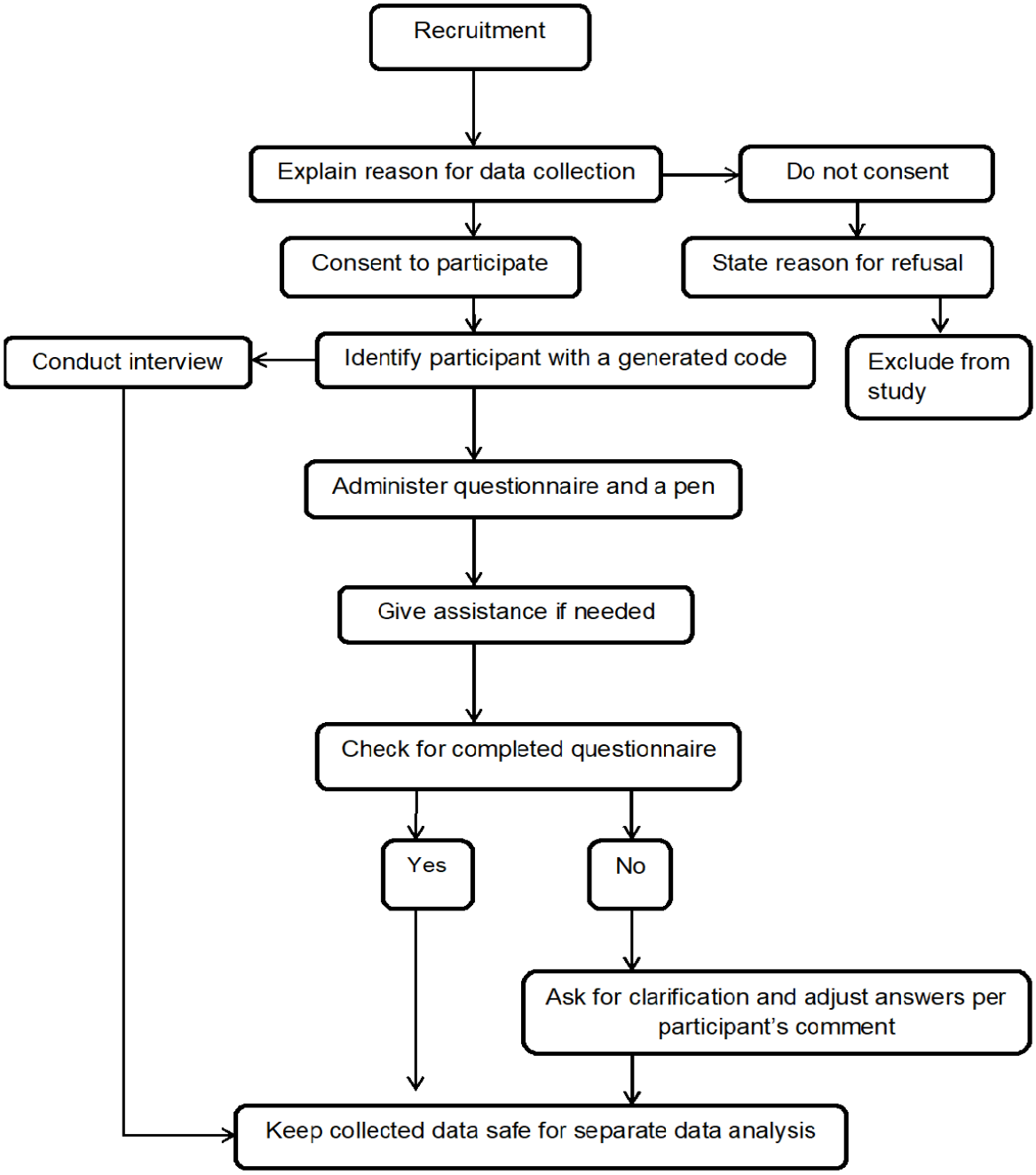

Figure 3.1 Flowchart for the data collection procedure (Figure by the Researcher).

An approved written interview guide (Appendix III) using semi-structured interview questions/probes was used to conduct the interviews with the nurses/midwives. The semi-structured interview consisted of open-ended questions, which allowed for in-depth and spontaneous responses to be collected. According to (Alshenqeeti, 2014), semi-structured interviews allow researchers to probe further with other questions not

written in the interview guide. As outlined by (Arsel 2017), a semi-structured questionnaire does not always strictly follow a prescribed order. Words or questions were changed to suit participants when necessary, and probe questions differed from participant to participant. This made the interview process easier to follow, well-controlled and directed towards achieving the study's goal (Arsel, 2017).

The interviews were audio-recorded with a digital recording device. Creswell suggests making notes (memos) of salient points and not relying only on audio recording. Initial questions began by asking participants about their general knowledge of the subject. The question asked was, ‘what can you tell me about malaria?’. The nurses’/midwives' interview enriched the research data with additional information such as the initiation of malaria education, the content of the malaria education and challenges they face in providing education on malaria.

Interview skills before the study were developed by conducting interviews with the supervisor and colleagues to gain experience before data collection from study participants. During interview sessions, attention was given to participants not to disrupt them when they were talking, either by fidgeting and/or laughing instead of nodding (Gray et al., 2017).

Exploring questions were asked to seek further information on a point participants raised (Seidman, 2019). Codes (Hosp-PO-Nurse, Hosp-AL-Nurse and Hosp-AS-Nurse) were assigned to research participants, and no names were mentioned during the interview.

A disadvantage of conducting an interview is the time involved in collecting and analysing the data. Also, a researcher may ask probing questions seeking an appropriate response, which may introduce bias (Bolderston, 2012).

3.8.2 Questionnaire (Quantitative Data Collection from HIV Infected Pregnant Women)

A questionnaire is a vital instrument to get information from respondents. The researcher developed the questionnaire for use in this study (Appendix II). All respondents who reported to the antenatal clinic for their routine visits and met the inclusion criteria took part in the study through invitation by the nurse/midwife. The researcher explained the purpose of the study to the respondents, and an information

sheet was also provided for them to read. After this, a consent form was provided for the respondents to sign or thumbprint to participate in the study.

The questionnaire was adapted and modified by the researcher from the Ghana Malaria Indicator Survey 2019 (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). Further adjustments were made to the questionnaire and pre-tested for ease of comprehension before being administered by the researcher to the study respondents. According to Jones, Baxter, & Khanduja (2013), priority should be placed on the sequence of how questions appear on the questionnaire, important questions first, and demographic details last. This study presented demographic data first to introduce the respondents to the main questions. The questionnaire consisted of two parts or sections. The first part of the questionnaire included questions about the socio-demographic data; age, marital status, employment status, educational level, and the number of pregnancies. The second section of the questionnaire assesses the study respondent's malaria knowledge, malaria preventive approaches, source of malaria education, and when nurses/midwives provided education on malaria during pregnancy. All categories of the population in the research, such as age, and level of education, were included to ensure internal validity.

The researcher then provided questionnaires to the respondents in a private room to complete after receiving care from the attending nurse/midwife and waiting for their laboratory results or supplements. The distribution of the questionnaires during the waiting ensured that the pregnant women answered the questionnaire at their convenience. This technique was convenient compared to administering the questionnaires after assessing all services at the antenatal clinic, as respondents may be tired and hungry, which may then cause a low response rate and reluctance to answer questions. To comply with confidentiality and data protection, the same code was assigned to the questionnaire and the consent form for each respondent.

Assessing the relationship among variables and the effectiveness of malaria health education among HIV infected pregnant women would be difficult to achieve by asking open-ended questions. This is because the questionnaire may amount to several pages of questions that may be boring to respondents, increasing response error and questionnaire fatigue. Therefore, about 90% of the questions were closed-ended. Respondents answered questions by a tick (√) which was easier for respondents.

3.8.2.1 Advantages of Administering a Questionnaire

DeFranzo (2016) outlined that the advantages of administering questionnaires include simplicity of administration, inexpensive, administered anywhere and everywhere, such as by telephone, and data can be collected from large sample sizes, while analysis can be performed using statistical software to improve validity and reliability.

3.8.2.2 Disadvantages of Administering a Questionnaire

A disadvantage of using a questionnaire is that respondents are often reluctant to respond to the questions posed. To increase the response rate for this study, the researcher explained the purpose of the study in clear and more straightforward terms. The attending nurse/midwife assisted by reading and translating the questionnaire in either Krobo or Ga-Adangbe (a local language mainly spoken in the study area) to the few who had difficulty reading and understanding English. Another disadvantage is that respondents may have thought that answering the questions would invade their privacy. Respondents were assured of confidentiality by keeping their identities anonymous. Data collected were kept on a computer with a password, and the University's policy on the number of years the researcher could keep collected information adhered to. The collected data will be kept for a maximum of five years, after which paper versions will be shredded and electronic copies permanently deleted from saved devices.

3.8.3 Precautionary measures during face-to-face data collection amid the COVID-19 pandemic.

This section provides the considerations and measures taken during the in-person data collection amid the COVID-19 pandemic at the selected hospitals. Following the national COVID-19 preventive protocols, the selected hospitals ensured that all persons visiting the ANC washed their hands with soap under running water, sanitized their hands, checked their temperature and wore face masks before entering the clinic (Ministry of Finance, 2020; Ministry of Health, 2020).

The researcher;

i. Informed and explained to the respondent(s) of the COVID-19 preventive measures based on the existing guidelines by the Ministry of Health in a clear manner prior to the collection of data.

ii. Avoided physical contact such as handshakes and hugging in greeting questionnaire respondents or interviewees.
iii. Maintained at least a one-meter distance during the interviews with the nurses/midwives.
iv. Ensured that a face mask was worn during the interviews or administering the questionnaires.
v. Sanitized hands after administering a questionnaire to a respondent or conducting an interview.

3.9 PILOT STUDY

A pilot study was conducted with five respondents to validate the survey instrument in the quantitative study. These five respondents were pregnant and attending antenatal clinics and consented to participate in the study. This was necessary to obtain clarity, ensure validity and reliability, and determine the average time needed by a respondent to complete the questionnaire. A few changes were made, such as rearranging some of the questions and rephrasing ambiguous questions to enhance comprehension.

The subjects for the pilot study were subsequently excluded from the study.

3.10 TOOLS FOR DATA ANALYSIS

In this study, both qualitative and quantitative data were analysed separately, and the results were combined or merged to give a complete picture of the phenomenon. Because of convergent parallel (convergent concurrent) mixed methods, no precedence was given to either the qualitative or quantitative method because of convergent parallel (convergent concurrent) mixed methods.

3.10.1 NVivo for Qualitative Data Analysis

The qualitative data were analysed descriptively through content analysis (qualitative) of the transcribed audio-recorded interviews.

Qualitative research data are non-numerical written words, audiotapes, or photographs (Creswell 2014) obtained from observation, interviews, or focus groups. There are two types of content analysis: conceptual analysis, which counts the frequency of themes in transcribed data (quantitative content analysis) and relational analysis (qualitative content analysis), which explores the relationships between concepts/themes (Bengtsson, 2016; Mayring, 2014).

A relational/qualitative content analysis classifies text data through several processes such as open coding, categorization and defining categories into a hierarchical structure where applicable (Bengtsson, 2016; Mayring, 2014). In this study, qualitative data obtained from the semi-structured interviews were analysed by qualitative (relational) content analysis using NVivo 12 software for coding and categorization.

3.10.2 SPSS for Quantitative Data Analysis

The quantitative data collected were coded in numbers and entered with a unique value into Microsoft Excel and analysed with Statistical Package for the Social Sciences (SPSS, IBM version 27).

The quantitative data were analysed descriptively and inferentially. Descriptive statistics were used to describe demographic variables using measures of central tendency, distribution and variance to avoid omitting relevant information in the data (Gray et al., 2017). Descriptive statistics were displayed in different forms, such as tables, graphs, and statistical summaries.

Inferential parametric statistics conclude and infer the population from the sample chosen for the study. During the analysis, a Chi-square test was used to compare the relationship between variables and the Pearson correlation coefficient was used to explore the strength of the associations between variables.

For parametric statistics, the distribution of data should be normally distributed (Grove & Cipher, 2017). The normal distribution of the study was determined using SPSS, IBM version 27. The variables analysed were measured on an interval or ratio scale. Inferential statistics can either describe or identify the differences and associations between variables.

For non-parametric statistics, data distribution should not necessarily be normally distributed. Non-parametric statistics can also describe and identify differences or associations between variables.

3.11 PLAGIARISM AND ACADEMIC INTEGRITY

Breach of academic integrity results in Plagiarism. The University of Zululand's research ethics and plagiarism policies were implemented and followed. The supervisor reviewed the whole dissertation and later by 'Turnitin' for plagiarism.

3.12 AFTERMATH OF RESEARCH STUDIES

The knowledge generated from this research study will be disseminated through conferences and workshops. Manuscript(s) is/are being prepared to be published in a peer-reviewed journal accredited by the University.

3.13 STRATEGIES TO ENSURE AND ENHANCE RIGOR

An error can originate from several sources such as participants/respondents, researchers, institutions, events and/or the environment (Gray et al., 2017). Some of these errors or problems can be controlled and minimized, while others are inevitable. In this section, the quality of the qualitative and quantitative data is separately discussed.

3.13.1 Measures to ensure trustworthiness in qualitative data

In the qualitative phase of this study, techniques such as credibility, transferability, dependability and conformability were used to ensure trustworthiness.

3.13.1.1 Credibility

In qualitative studies, credibility is essential to ensure thoroughness. Several techniques were used to ensure credibility (O'Leary, 2017).

3.13.1.1.1 Saturation

Research participants were interviewed until additional sampling gave no new information or when informational redundancy occurred, thus, when data saturation was achieved.

3.13.1.1.2 Prolonged Engagement

Sufficient time was invested (approximately between nine to fifteen minutes) during an interview session with participants to understand their experiences of providing malaria health education and establishing rapport (O'Leary, 2017). The researcher visited the research setting multiple times before initiating interviews with participants. This was to identify any challenges that might affect the interview process. The participants were reassured that the information provided would be kept confidential. They were told that information about their names and place of work would not be asked during the interview session; however, initials of their names, for example, may be used.

3.13.1.1.3 Triangulation

In this study, two different methods, individual interviews of nurses/midwives at the antenatal clinics and a questionnaire administered to HIV infected pregnant women at the antenatal clinics were used as a data collection strategy to ensure triangulation (Shenton, 2004). The knowledge of HIV infected pregnant women on malaria health education was verified with the experiences of nurses/midwives who provided malaria health education.

3.13.1.1.4 Honesty

Research participants and respondents in this study had the right to refuse to participate or withdraw after accepting to participate without penalty. This was to ensure that participants and respondents were not coerced to provide information for the study (Shenton, 2004).

Research participants were also reassured that the information provided had no wrong answers, and the given answers attracted no punishment or penalty (Shenton, 2004).

3.13.1.1.5 Peer Debriefing

The proposal presentation at the nursing department, the Faculty of Agriculture and Science, and symposiums offered colleagues and other academic researchers opportunities to provide their feedback on the study. This study was systematically scrutinized by the supervisor, ethical review committees of the University of Zululand, Ghana Health Service (GHS), and the selected hospitals' respective administrations. These also ensured credibility.

3.13.1.1.6 Member Checking

The interview findings (transcribed, analysed and final report of data collected) were checked for originality from interview participants to ensure credibility.

3.13.1.2 Transferability

Transferability occurs when a population or phenomenon under study can represent a wide setting or other population (O'Leary, 2017). The study's final report included research details, such as the type of study, research setting, sample and sampling techniques, duration of data collection, data collection methods, and analysis. This ensures that other local and international researchers could use the same protocol or phenomenon for a more expansive setting or other population.

3.13.1.3 Dependability

Dependability ensures that the research study is well documented and elaborated to allow other researchers to reproduce similar research. To achieve reliability, the following points were included in the study.

I. The research design and how it was implemented (Shenton, 2004).

II. The details of data collection and analysis (Shenton, 2004).

3.13.1.4 Confirmability

Confirmability allows other researchers and readers to confirm conclusions by ensuring triangulation, providing researchers' assumptions at the onset of the study, recognizing the advantages and disadvantages of the research methods used, and constructing an audit trail (Shenton, 2004).

An audit trail was kept by providing an accurate and detailed codebook or memo. A code list with a brief definition of each code was made. Each time a sentence was coded, it was checked against the code definition to ensure the appropriate and adequate code description. Again, the transcribed data that were analysed were validated by the nurses/midwives who took part in the data collection to reduce bias by the researcher.

3.13.2 Measures to Ensure Reliability and Validity in Quantitative Data

Reliability and validity are used mostly in quantitative studies to describe how accurate a study is. They are further elaborated on below.

3.13.2.1 Reliability

This context is about how far; a research study can produce the same result on several occasions using the same procedure by different or the same researchers (Noble & Smith, 2015). The methods, methodology, sampling technique, pilot study, and ethical consideration were consistently outlined in various sections to ensure reliability.

3.13.2.2 Validity

Validity measures how accurate a concept is in a research study (Noble & Smith, 2015). To ensure validity in this study, the appropriate methods of data collection and sampling techniques were used.

3.14 ETHICAL CONSIDERATION

In nursing, clinical practice is guided by ethics, and these ethical guidelines apply to nursing research (Gray et al., 2017). Ethics in historical research has influenced the intervention of ethical guidelines globally. In developing countries, research increases the risk of mistreating research participants due to decreased accessibility to research funds and illiteracy, among other reasons that should not be the case (Emanuel, Wendler, Killen, and Grady, 2004).

The University of Zululand Review Ethics Committee approved the research proposal with certificate number **UZREC 171110-030 PGM 2019/46** (Appendix IV). It was also approved by the Ghana Health Service Ethics Review Committee with the number **GHS-ERC 036/10/19** (Appendix V). Further authorizations were obtained from the three Hospitals. The nursing officers in charge of the hospitals introduced the researcher to the staff of the ANC clinic. Several ethical considerations are also discussed, as adapted from Emanuel et al., 2004.

3.14. 1 Community Participation

The study involved the Lower Manya Krobo District, nurses/midwives and pregnant women at the selected Hospitals in the District. Permission was acquired from the Ghana Health Service (GHS) Ethics Review Committee and then sent to the various administrations of the Hospital to engage the community. A partnership was made with selected Hospitals in the District for planning and conducting the study. Nurses/midwives and HIV infected pregnant women's cultural diversity was equally respected.

3.14.2 Social Value

The health and well-being of HIV infected pregnant women and children under five will be improved after the importance of malaria health education is communicated and emphasized in the study. The Lower Manya Krobo District benefited from the research as findings from the study contributed to strategies to reduce and/or eliminate local malaria transmission. This study also contributed to Local, Regional and National priority to eradicate malaria in Ghana and the world.

3.14.3 Scientific Validity

Both qualitative and quantitative data were collected separately in a private room using individual face-to-face interviews with nurses/midwives and a developed questionnaire

on HIV infected pregnant women at the antenatal clinics to ensure privacy. A special form of right to privacy was used to protect both nurses/midwives and HIV infected pregnant women, where elements such as name and identification numbers were removed. Data collected were stored on a computer and a flash drive with a password to keep data confidential and easily retrievable for analysis. The method of analysis for the study was appropriate and thorough. Information derived from the study will be kept confidential for five years following data collection, as stipulated by the University of Zululand.

3.14.4 Risk-Benefit Ratio

This study had no predictable risk since the data collected generated knowledge to enhance nursing/midwifery practice on education given HIV infected pregnant women on malaria during antenatal clinic visits and future pregnant women. The participants were not exposed to any risk since the research was non-invasive.

Furthermore, to reduce harm, the following were followed; informed consent was obtained; respondents' identity was not revealed, but initials were captured instead on the consent forms.

It was also explained to respondents clearly, what the research was about (educational purpose) and even showed them the questionnaire.

The respondents were not kept for a long time during data collection. They were also allowed to withdraw from participating in the study when they felt so. The respondents were again protected from social harm by conducting the survey privately.

The advantages and disadvantages of participating in the study were assessed, but the researcher aimed to avoid harm. A mere inconvenience such as economic risk was prevented by respecting the time allocated for data collection.

The nurses/midwives in the antenatal units were encouraged to reinforce malaria health education, and educational materials were provided to all pregnant women irrespective of their health status, educational background, or ethnic group, thereby improving the entire community's health.

3.14.5 Independent Ethics Review

To conduct this study without any form of ethical misconduct, the ethics policy of both the University of Zululand (UNIZULU) and Ghana Health Service (GHS) Ethics Review

Committees were followed. Permissions from the selected Hospitals in Lower Manya Krobo District were obtained, and the Hospital's ethics protocols and the ethics guidelines outlined by (Emanuel et al., 2004) were followed.

3.14.6 Informed Consent

Informed consent is used when a researcher seeks a research participant's agreement to participate in a study without coercion and deception after the content of the study has been explained sufficiently (Gray et al., 2017).

The research participants were provided with a statement describing the content of the study (information sheet) when data were collected and that the investigation is part of an academic requirement. An explanation of a participant's withdrawal or willingness to participate was included in the consent form. Consent information was explained in the most common language the pregnant women spoke. These included Krobo, Ga and Ga-Adangbe. The nurses/midwives did not encounter translation problems since they were trained in an 'official language', English, and were literate. Information on the consent form was written and simplified to meet all reading levels. All participants signed the consent form and received a copy. The researcher will keep the original signed consent form in a safe drawer under lock and key for five years, as required by the ethics review committee of the University of Zululand.

3.14.7 Respect for Recruited Participants and Respondents

All the research participants and respondents (nurses/midwives and HIV infected pregnant women) were treated justly and respectfully. Research participants and respondents had the opportunity to consent or not participate after the purpose of the study was explained. Participants had the right to quit after voluntarily agreeing to participate in the study without penalty. During the individual interview of the nurses/midwives, names were not mentioned during recording and participants were told they had the right to withhold information.

Participants were assured that information gathered during the study from their records and any form of identification remained confidential during the dissertation writing, reports, presentation and publication of findings. Interview participants were informed that direct quotes from the interview would be included in professional publications and presentations. The Hospitals understudy will be provided with a copy of the final dissertation report.

3.14.8 Selection of Participants

Purposive sampling was used to select the hospitals in Lower Manya Krobo District. This method was appropriate for this study because the population in the study area where the Hospitals are situated has a population severely affected by HIV/AIDS and suffers from malaria epidemics.

Purposive sampling was also used to select nurses/midwives at the antenatal clinics in selected hospitals. Purposive sampling was appropriate because it allowed for the inclusion of eligible participants.

Non-probability purposive sampling was used to select HIV infected pregnant women who attended the antenatal clinic. This technique was chosen to ensure representativeness which included subjects of different ages and educational levels.

3.15 DELIMITATION OF THE STUDY

Outlined below are several delimitations and scopes identified in this study.

3.15.1 Research Setting

The target population chosen for this study was nurses/midwives and HIV infected pregnant at the antenatal clinic because it is within the scope of the study. This study is also limited to the Lower Manya Krobo District because it is a malaria-endemic area and has the highest prevalence of HIV infection in Ghana.

3.15.2 Resources

Due to resource constraints such as finance and limited time to complete the degree, studies cannot be performed in other health facilities in the Lower Manya Krobo District or other Regions in Ghana with malaria endemics.

3.15.3 Analysis

Divergences from analysed qualitative and quantitative data were not followed up because of limited finance and the time duration of the study. Recommendations for further research were suggested to that effect.

3.16 RISK ANALYSIS

A forecast limitation to the study was the reluctance of participation by nurses/midwives and HIV infected pregnant women even after the purpose of the research had been explained. For the nurses/midwives, it may be due to workload or

understaffing of the unit under study. English, Krobo and Ga-Adangbe languages were used for the patients' data collection.

3.17 SUMMARY

This chapter presented the research process. The researcher posited the use of a Positivist's and Interpretivist's philosophy. A qualitative and quantitative approach (mixed methods) answered the research questions. Data was collected using an interview and questionnaire technique and then analysed using Nvivo and SPSS. It was also explained in detail the sampling technique and how the sample size for this study was determined. Strategies ensured to enhance rigour were described in detail. The ethical consideration guiding this study was also elaborated, not leaving out the scope and limitation of the study.

In chapter 4, the results of both qualitative and quantitative data and their interpretations are presented.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

The previous chapter outlined the details of the research methodology used in this study. A convergent parallel mixed methods design in which both quantitative and qualitative data were concurrently collected and analysed in this study. A developed semi-structured interview guide was used to collect qualitative data from nurses/midwives. A developed questionnaire was also used to collect quantitative data from HIV infected pregnant women attending the antenatal clinics.

This chapter presents and describes the qualitative and quantitative results of Malaria Health Education (MHE) provided to HIV Infected Pregnant Women (HIPW) attending antenatal clinics.

The researcher went beyond just the presentation or description of results (Fusch & Ness, 2015). This is called inference. The researcher employed an interpretive mind-set to draw conclusions that allowed high-quality research. Equal priority (QUAL+QUAN) was given to both qualitative and quantitative findings. Both forms of data were analysed separately but concurrently. The presentation of results begins with qualitative data analysis followed by quantitative data analysis. The merging or triangulation of the qualitative and quantitative results provides an avenue for comparison.

This chapter was put together by following systematic steps to answer the research questions below. They are;

I. What malaria health education and preventive strategies do nurses/midwives provide to HIV infected pregnant women during antenatal visits?
II. What are the sources of malaria health education and preventive strategies employed by HIV pregnant women?
III. What factors affect effective malaria health education to HIV infected pregnant women?
IV. What framework for malaria health education for pregnant women diagnosed with HIV could emerge?

4.2 FINDINGS OF QUALITATIVE DATA ANALYSIS

4.2.1 Background of Research Participants

This section presents the qualitative findings generated from face-to-face interviews with three nurses/midwives. They were purposively selected from each of the selected health facilities in the Lower Manya Krobo District. The interviews were conducted using a semi-structured interview guide developed by the researcher after going through the literature. The supervisor edited and proofread the interview guide prior to data collection. The interview guide gathered data about malaria health education provided to HIV infected pregnant women by nurses/midwives during antenatal clinic visits.

4.2.2 Results of Step-by-Step Qualitative Content Analysis

The qualitative analysis provides answers to the following questions:

i. What malaria health education and preventive strategies do nurses/midwives provide to HIV infected pregnant women during antenatal visits?

ii. What factors affect effective malaria health education to HIV infected pregnant women?

Interview participants were asked about the cause of malaria, prevention strategies provided, and factors affecting effective education on malaria. The names of the research participants were undisclosed.

Data analysis in a qualitative study is a reflective process where a researcher goes back and forth after analysing the data. A qualitative/relational content analysis was used as the analytical method for this study's qualitative aspect. To sustain confidentiality, acronyms have been used for the interviewed nurses/midwives. The interview ranged in length from nine minutes to fifteen minutes.

The first step in the qualitative data analysis was transcribing the individual interviews on a computer in Microsoft Word 2016. Transcriptions were done manually by the researcher. The audio-recorded interviews were transcribed verbatim, but not all utterances were added. The transcribed data were imported into Nvivo 12 software for analysis. The approach outlined by Erlingsson and Brysiewicz (2017) was adapted to analyse the data. The transcribed data were read several times and divided into

meaning units, and the meaning units were then labelled to form codes. The codes were then categorised. The codes were further compared for relationships and dissimilarities.

4.2.3 Emergent themes from analysis of the qualitative data

A theme is when two or more categories are grouped, whereas a category is when related codes are grouped (Erlingsson & Brysiewicz, 2017). Six main themes and three subthemes were derived from this study analysis and are presented in **Table 4.1**. The words of the research participants are shown in italics to give a rich account of the analysis.

Table 4.1 Overarching theme, themes and sub-themes of malaria health education provided to HIV infected pregnant women during ANC visits by the nurse/midwife at the three Hospitals.

Main themes	Themes	Sub-themes
Malaria health education and preventative strategies provided by nurses/midwives	Malaria health education provided by nurses/midwives	1. Initiation of malaria 2. Content of the malaria education
	Preventative strategies provided by nurses/midwives	1. Malaria preventative strategies in general 2. Institutional support 3. Malaria preventative strategies in pregnancy
Factors affecting malaria health education to HIV infected pregnant women	Challenges nurses/ midwives encounter	1. Noncompliance 2. Staff shortage 3. Long waiting time

4.2.3.1 Initiation of Malaria Education

In the interviews, the nurses/midwives stated that the initiation of malaria education to the HIV infected pregnant women largely depended on when they visited the ANC. Two of the nurses/midwives reported initiating malaria education when pregnant women register at the ANC:

"We start as soon as we see the pregnant women at the antenatal clinic (ANC). So right from the start of the ANC [visit], we start talking [to them] about malaria and other things." [Hosp-AL-Nurse/Midwife]

"At registration, once they come to register, we give them education on malaria." [Hosp-AS-Nurse/Midwife]

On the other hand, a nurse/midwife at another ANC further highlighted that the ANC facility does have schedules for health education and promotion, which includes a monthly education on malaria for pregnant women:

"We give it in general; we do not have any specific time that maybe we gather the HIV infected mothers [to educate] them. We have a schedule for health education. Malaria is every month, so, every month, we give health education on malaria. So it depends on the time the pregnant woman comes, sometimes they wait till three months [or] four months, most of them second trimester before they even come here for antenatal cards, so, as and when you [the pregnant women] come that is when you [the pregnant women] get the information." [Hosp-PO-Nurse/Midwife]

4.2.3.2 Content of the Malaria Education

The nurses/midwives were further asked about the content of the malaria education they provided to the HIV infected pregnant women. The nurses/midwives reported that the malaria education content included what malaria is, the cause of malaria, the effect of malaria on their pregnancy, their susceptibility to malaria during pregnancy, the severity of malaria during pregnancy, and available preventive strategies.

A nurse/midwife said:

"We talk about malaria; the cause (we tell them that malaria is caused by a mosquito), the prevention. [The] prevention [of malaria] is our key education." [Hosp-PO-Nurse/Midwife]

Also, the following was added by the other nurses/midwives:

> *"We tell them what malaria is, the effect malaria would have on their pregnancies if they are infected, and also how to prevent it."* [Hosp-AS-Nurse/Midwife]
>
> *"We tell them that malaria is caused by an infected mosquito. Mostly they bite at night."* [Hosp-AL-Nurse/Midwife]
>
> "*We let them know that since their immune system is low, they can easily become sick, especially with malaria, unlike other pregnant women. So we let them know that if they do not sleep in their insecticide-treated nets, [and], they do not take their Sulphadoxine Pyrimethamine regularly, it is likely they will contract the malaria infection."* [Hosp-AL-Nurse/Midwife]

Thus, an HIV infected pregnant woman's susceptibility to malaria infection and the severity of the disease during pregnancy are vital components of the content of the malaria health education delivered by the nurses/midwives at the antenatal units.

4.2.3.3 Malaria Preventive Strategies

The nurses/midwives reported preventive strategies they provide to HIV infected pregnant women to prevent malaria during pregnancy to generally comprise protective methods to prevent mosquito bites and antimalarial drugs (IPT-SP) use. In the interview data, maintaining clean surroundings to avoid mosquito breeding, sleeping under insecticide-treated bed nets (ITNs), spraying their rooms with insecticide sprays and taking antimalarial drugs (IPT-SP) were the main preventive strategies the nurses/midwives mentioned to provide to the HIV infected pregnant women for malaria prevention during pregnancy.

> *"What we do is, we have the Sulphadoxine Pyrimethamine (SP) that we start giving to them after 16 weeks, then, from the start of the ANC too, we give them the insecticide-treated net. Then we tell [the pregnant women] how to keep the surroundings clean so that they do not harbour mosquitoes around their surroundings to give them malaria."* [Hosp-AL-Nurse/Midwife] *"So, especially in the night, if they [the pregnant women] want to sit outside, that means they*

would have to protect themselves, so they do not get bitten by the infected mosquito for them to get malaria." [Hosp-AL-Nurse/Midwife]

"For the prevention, we first of all talk about how to prevent malaria using the insecticide-treated net, and then talk about cleaning the environment, clearing the stagnant waters, clearing the bushes and all that, overcrowded and then we talk about the IPT that we give them here and then mosquito spray, they can spray their rooms [with insecticide spray] too." [Hosp-PO-Nurse/Midwife]

"So after the education, we go-ahead to give them the mosquito nets (insecticide-treated nets) to sleep under … so that they do not get bitten by the mosquito in the first place, to be infected with malaria ... in the course of the pregnancy. After 16 weeks, we also give them the Sulphadoxine Pyrimethamine as prophylaxis to prevent them from also getting malaria… that one is DOT (Directly Observed Therapy). We also educate them on personal hygiene, keeping their environment clean and all that. Weeding bushy areas to prevent the breeding of mosquitoes in their areas." [Hosp-AS- Nurse/Midwife]

4.2.3.4 Institutional Support

The nurses/midwives mentioned receiving varied support from the hospital, the district health directorate and the Ghana health service. These include the hospital ensuring the availability of RDT kits for malaria tests, mosquito nets for free distribution, and sulphadoxine-pyrimethamine at the ANC unit.

"The hospital always makes sure that we have the test kits [RDT test kit for testing malaria] and always make sure we have the Sulphadoxine Pyrimethamine and the mosquito nets." [Hosp-AL-Nurse/Midwife]

"For [the] Ghana Health Service, they are doing well. They make sure that the hospital is provided with ART, the antiretroviral treatment for HIV positive mothers. So we always have them." [Hosp-AL-Nurse/Midwife]

"The district [health directorate] is supportive. They provide us with insecticide-treated nets and then also with the SP. And they are all for free, so we do not sell to the clients. It is free; we just give it to them." [Hosp-AS-Nurse/Midwife]

Additionally, the ANC unit receives educational materials on malaria for posting around the ANC and continued staff training, especially on a new malaria treatment protocol.

> *"They support us with educative materials; we have [posted] around that we use in educating the 'women' when they come to the clinic. And then, once [in] a while too, they train when there is a new protocol, in the treatment of malaria, a refresher course is done and then majority if not all nurses and midwives, the majority are trained."* [Hosp-AS-Nurse/Midwife].

4.2.3.5 Malaria in Pregnancy

Despite the nurses'/midwives' education on malaria preventive measures, some pregnant women presented malaria symptoms during ANC visits, which confirmed malaria positive when tested. However, the nurses/midwives highlighted that these malaria cases were few.

> *"Yes. Some, not majority, but a few of them present with symptoms of malaria. You test, and it will be positive, and they are treated."* [Hosp-AS-Nurse/Midwife]

> *"Few we have recorded, a few. Given the mosquito nets, they still come with malaria."* [Hosp-PO-Nurse/Midwife]

4.2.3.6 Challenges Nurses/Midwives face in Malaria Education

Further analysis of the interview data revealed some challenges the nurses/midwives encounter in providing malaria education. The nurses/midwives described the primary challenges/barriers to their efficient delivery of health education on malaria to HIV infected pregnant women during ANC visits were long waiting time at the ANC (time constraints), limited staff or staff shortages at the ANC, and non-compliance of the pregnant women.

4.2.3.6.1 Non-compliance/Attitude of Pregnant Women

The nurses/midwives mentioned that compliance with using malaria preventive strategies to prevent malaria during pregnancy was a problem.

"Compliance has been the problem … the ones they take home like the net, they come, you ask them, do you sleep under it, and they give you excuses. But though some sleep under it." [Hosp-AS-Nurse/Midwife]

"Given the mosquito nets, they still come with malaria, but they claim they have been sleeping inside, but they have been staying out for long. So we give them the option of either they wear long sleeves or use the mosquito repellent, but we are not at home with them, so they do what they do." [Hosp-PO-Nurse/Midwife]

They [the pregnant women] do not like sleeping in the mosquito net, [and] do not like taking the IPTp-SP, so I think the health authorities made it DOT, you [the pregnant women] have to stay here and take it in front of us [nurses/midwives]." [Hosp-PO-Nurse/Midwife]

Another nurse/midwife also highlighted that some pregnant women complained of heat when they slept in the ITNs, while others gave different excuses for not sleeping in their bed nets.

"… you [the nurse/midwife] provide the mosquito nets, but they [the pregnant women] do not sleep under it. They always tell you they feel hot when they sleep under it. So that has been the major challenge." [Hosp-AS-Nurse/Midwife]

4.2.3.6.2 Staff Shortage at the ANC

The ANC delays can be attributed to work overload due to the staff shortages [one permanent nurse/midwife at each ANC used in this study]. A nurse/midwife at the ANC described the situation as follows:

"We do not have more staff at the ANC. So, one person is doing all these [rapid testing, entering their records into books, enrolling them on medication], and other clients are waiting… and here is the case you have to still educate them on malaria issues. It becomes a problem." [Hosp-AL-Nurse/Midwife]

The staff shortages further affect the nurses'/midwives' ability to deliver effective malaria health education to pregnant women during ANC visits. A nurse/midwife recommended:

"If we can give them [pregnant women] quality maternal health education, we have to increase staff. So that at least we are two or three, if one person is taking care of another person who is HIV-positive which may take time, the other one will be taking care of the other client so that it will not be like we are wasting time on one particular client." [Hosp-AL-Nurse/Midwife]

Thus, the ANC's permanent employed nurses/midwives are expected to divide their time between their workload and provide health education on malaria to HIV infected pregnant women attending the ANC.

4.2.6.3 Long waiting time at the ANC

Some ANC nurses/midwives mentioned the pregnant women's long waiting times during ANC visits as significant challenges.

"… So, one person [the nurse/midwife], you [the nurse/midwife] sit with one person [HIV pregnant woman] for not less than 30 minutes. So, for the other clients [other pregnant women], waiting for their turn to be taken care of at times becomes an issue." [Hosp-AL-Nurse/Midwife]

"*The long waiting time is "a challenge because of less staff at the ANC."* [Hosp-AL- Nurse/Midwife]

Thus, the long waiting time can be a substantial challenge, especially for pregnant women who reside far from the hospital facilities and may also have other children under their care.

4.3 FINDINGS OF QUANTITATIVE DATA ANALYSIS

4.3.1 Background of Research Respondents

This section outlines this study's quantitative results obtained from a developed questionnaire. A sample size of one hundred and ten (110) of the projected one hundred and twenty (120) HIV infected pregnant women responded to the questionnaire. The self-developed questionnaire was used to complete the questions that addressed respondents' demographic data: including age, marital status, employment status, educational level, and the number of pregnancies. The second part of the questionnaire assessed the pregnant women's knowledge of malaria by

asking how malaria is contracted, how malaria is prevented, where they receive information on malaria, malaria diagnosis in the past and current pregnancies, and any reported malaria complications.

The quantitative data were descriptively and inferentially analysed. These steps included data preparation and description, which involved data entry. The collected data were inspected for flaws. This made it easier during the first stage of data preparation.

The collected data were arranged in order and were checked for accuracy and usefulness. Symbolic abbreviations were used to classify the collected data. The collected data were analysed with version 27 of the Statistical Package for Social Sciences (SPSS). Descriptive statistics were used to summarise the data. Pearson's chi-square/Fisher exact tests were performed to determine associations, while Pearson's correlation was further used to assess the strength of the association.

4.3.2 Socio-demographic Characteristics of Study Respondents

Table 4.2 presents the study respondents' socio-demographic profiles according to their age, marital status, employment status, level of education, and the number of pregnancies.

All the study respondents (n=110) provided information concerning their age. The respondents' mean age was 29 (SD=5.62), with a minimum age of 15 years and a maximum age of 45. Most of the respondents (60.9%, n=67) were between 26 and 35 years. The respondents also provided information on their marital status. The majority of the respondents were married (45.5%, n=50), followed by 37.3% (n=41) living with a partner (co-habiting), 16.4% (n=18) being single while 0.9% the respondents being divorced/separated.

On the employment status of the respondents, 65.5% (n=72) indicated to be self-employed, 22.7% (n=25) were unemployed, 9.1% (n=10) were employed while 2.7% (n=3) indicated to be students. In terms of the level of education of the respondents, 53.6% (n=59) had attained high school education, 30.0% (n=33) had attained primary education, and 9.1% (n=10) had attained tertiary education, whereas 7.3% (n=8) reported having no formal education. When it comes to the number of pregnancies, most of the respondents have had two and three pregnancies representing 30.9%

(n=34) and 29.1% (n=32), respectively, followed by 22.7% (n=25) who have had one pregnancy. 17.5% (n=19), on the other hand, have had four or more pregnancies.

Table 4.2 Socio-demographic characteristics of the study respondents (N = 110).

Characteristics	Frequency (N)	Percentage (%)	Range	Mean±SD
Age group in years			15-45	29±5.6
15-25	29	26.4		
26-35	67	60.9		
36-45	14	12.7		
Marital status				
Single	18	16.4		
Married	50	45.5		
Living with a partner	41	37.3		
Divorced/Separated	1	0.9		
Employment status				
Employed	10	9.1		
Self-employed	72	65.5		
Unemployed	25	22.7		
Student	3	2.7		
Educational level				
No formal education	8	7.3		
Primary	33	30.0		
High school (JHS/SHS)	59	53.6		
Tertiary education	10	9.1		
Number of pregnancies				
1	25	22.7		
2	34	30.9		
3	32	29.1		
4+	19	17.3		

4.3.3 Malaria Knowledge and Sources of Malaria Health Education

The data from the questionnaires indicated that a high proportion of the respondents showed a good level of knowledge about the cause of malaria and when malaria causing mosquitoes bite (**Table 4.3**). Nearly all the pregnant women (99.09%, n=109) in this study correctly attributed mosquito bites as the cause of malaria; however, some held other notions that dirt (2.7%, n=3), oil (0.9%, n=1), and not having enough rest (0.9%, n=1) were other causes of malaria. Most of the respondents (90.0%, n=99) said that malaria causing mosquitoes bite at night. An additional test was performed to find

significant differences between knowledge of the cause of malaria and the socio-demographic characteristics. The Chi-square/Fischer's exact test showed no significant association between mosquito bite knowledge as the cause of malaria and all the socio-demographic characteristics ($p > 0.05$) (**Table 4.4**).

Table 4.3 HIV infected pregnant woman's knowledge of malaria and sources of malaria health education.

Variables	Frequency (N)	Percentage (%)
Knowledge of the Cause of Malaria		
Do not know	1	0.9
Mosquito bite	109	99.1
Cold weather	0	0
Sexual intercourse	0	0
Others		
Dirt	3	2.7
Oil	1	0.9
Not having enough rest	1	0.9
Time malaria causing mosquitoes bite		
I do not know	6	5.5
During the day	5	4.5
In the night	99	90.0
Initiation of malaria education by Nurses/Midwives		
Within three months of pregnancy	57	51.8
Four-six months of pregnancy	41	37.3
After seven months of pregnancy	1	0.90
Do not remember	11	10.0
Number of times nurses/midwives provided malaria education		
Never	2	1.8
Once	8	7.3
Two times	8	7.3
Three or more times	92	83.6
Source of Malaria Education		
Television	44	40.0
Newspaper	2	1.8
Nurses or Midwives	103	93.6
Others		
Relatives (Home & father)	2	1.8
School	3	2.7
Health education/talk	2	1.8
Information centre	1	0.9

Table 4.4 The relationship between malaria knowledge and socio-demographic characteristics of respondents.

		Cause of malaria		**When do mosquitoes bite**			
		Chi-square association		Chi-square association		Pearson's correlation	
Variables	***N***	**X^2**	***p*-value**	**X^2**	***p*-value**	***r***	***p-value***
Age	110	14.8	0.9	60.4	0.107	-	-
Marital status	110	5.1	0.1	26.9	0.000*	0.1	0.116
Employment status	110	3.4	0.3	20.2	0.002*	-0.3	0.000*
Educational level	110	2.3	0.5	7.3	0.289		
Number of pregnancies	110	4.8	0.1	6.5	0.368		
asterisk (*) denotes statistically significant *p*-values (p<0.05)							

Furthermore, the pregnant women's knowledge of when malaria causing mosquitoes bite was significantly associated with their marital status (X^2 = 5.1, p < 0.001) and employment status (X^2 = 3.4, p = 0.002). The Pearson's correlation indicates that a moderate inverse correlation exists between the pregnant women's knowledge of when malaria causing mosquitoes to bite and employment status (r = -0.3, p < .001) (**Table 4.4**).

More than half (51%, n=57) of the pregnant women responded to receiving education on malaria within three months of pregnancy by a nurse/midwife. This was followed by 37.3% (n=41) who reported receiving education on malaria by a nurse/midwife in their fourth-six months of pregnancy (**Table 4.3**). In contrast, one pregnant woman reported receiving her education on malaria after seven months of pregnancy. However, 10% (11) could not remember when a nurse/midwife provided education on malaria during pregnancy. Pearson chi-square test indicate that the initiation of malaria education by the nurses/midwives at the ANC was significantly (p < .05) associated with their Age (p = 0.004), marital status (p = .04), and employment (p = .02) (***Table 4.5***).

Table 4.5 Association and strength of association between socio-demographic characteristics versus initiation of malaria education by Nurses/Midwives at the ANC.

		Chi-square association		Pearson's correlation	
Variables	***N***	**X^2**	***p*-value**	***r***	***p*-value**
Age	110	108.35	0.004*	-.086	.37
Marital status	110	17.49	0.04*	.024	.81
Employment status	110	19.69	0.02*	-.008	.93
Educational level	110	11.92	0.22	-	-
Number of pregnancies	110	9.54	0.39	-	-
asterisk (*) denotes statistically significant *p*-values (p<0.05)					

On the source of malaria education, nurses/midwives (93.6%, n=103) and television (40%, n=44) constituted the primary malaria education source. Two of the respondents mentioned the newspaper as a source for receiving malaria education. Other sources such as Relatives (1.8%, n=2), school (2.7%, n=3), Health education/talk (1.8%, n=2) and an information centre (0.9%, n=1) were also reported by the respondents (**Table 4.3**).

Among the pregnant women who reported to have received education on malaria by a nurse/midwife at the ANC, the majority (83.6%, n=92) said they had received malaria education on three or more occasions (**Table 4.3**). Pearson chi-square test further revealed that the number of times an HIV infected pregnant woman received education on malaria by a nurse/midwife at the ANC is significantly ($p < .05$) associated with their marital status ($p = .001$), Employment ($p = .001$) and the number of pregnancies ($p = .01$) (**Table 4.6**). Pearson's correlation coefficients estimated the strength of these associations. Findings indicate a weak positive linear relationship between the number of times a nurse/midwife provided education on malaria and marital status ($r = 0.2$, $p = 0.12$), number of pregnancies ($r = 0.1$, $p = 0.07$) and knowledge of the cause of malaria ($r= 0.1$, $p = 0.282$). However, a weak negative linear relationship was found between the number of times a nurse/midwife provided education on malaria and employment ($r = -0.2$, $p = 0.01$) (**Table 4.6**).

Table 4.6 Association and strength of association between the number of times a nurse/midwife provided health education on malaria versus socio-demographic characteristics and knowledge of the cause of malaria.

		Chi-square association		Pearson's correlation	
Variables	***N***	**X^2**	***p*-value**	***r***	***p*-value**
Age	110	54.3	0.094	-	-
Marital status	110	27.5	0.001*	0.240	0.12
Employment	110	27.8	0.001*	-0.24	0.01*
Educational level	110	13.4	0.14	-	-
Number of pregnancies	110	21.4	0.011*	0.176	0.07
Knowledge of cause of malaria	110	12.8	0.005*	0.104	0.28
asterisk (*) denotes statistically significant *p*-values ($p<0.05$)					

4.3.4 Malaria Preventive Strategies and Malaria in Pregnancy

Regarding malaria preventive practices (**Table 4.7**), the majority (87.3%, n=96) of the pregnant women reported sleeping regularly under insecticide-treated bed nets as the common malaria prevention approach during their pregnancy. The spraying of rooms with insecticide spray or burning mosquito coils at night as a malaria preventive strategy was also stated by 45.5% (n=50) of the pregnant women. Also, cleaning the environment to prevent mosquitoes from breeding and applying mosquito repellents on the body were reported by 40% (n=44) and 12.7% (n=14), respectively. However, only four (3.6%) pregnant women mentioned taking antimalarial medicine for malaria prevention.

Furthermore, 10% (n=11) of the pregnant women reported having been diagnosed with malaria in their previous pregnancy, whereas 6.4% (n=7) said they had been diagnosed with malaria in their current pregnancy. Maternal anaemia (12.7%, n=13), Low birth weight (2.7%, n=3) and Preterm delivery (0.9%, n=1) were some of the malaria complications reported to have been experienced by the pregnant women before (**Table 4.7**).

Table 4.7 Malaria preventive strategies, malaria reported cases and malaria complications during pregnancy.

Variable	Frequency (*n*)	Percentage (%)
Malaria preventive strategies		
Clean the environment	44	40
Spray the room with an insecticide spray or use mosquito coils	50	45.5
Take antimalarial medicine	4	3.6
Sleep under a mosquito bed net (ITNs)	96	87.3
Use a mosquito repellent on the body	14	12.7
I do not know	1	0.9
Other		
Wearing long sleeves at night	1	0.9
Use of fan (standing/ceiling fan)	1	0.9
Malaria diagnosis in a past pregnancy		
Yes	11	10
No	99	90
Malaria diagnosis in the current pregnancy		
Yes	7	6.4
No	103	93.6
Malaria Complications		
Maternal anaemia	14	12.7
Low birth weight	3	2.7
Death of baby	0	0
Preterm delivery	1	0.9

4.4 INTEGRATION OF THE QUALITATIVE AND QUANTITATIVE RESULTS

Integration is a deliberate approach in which a researcher combines qualitative and quantitative data in a single study (Creswell, 2014). Applying a convergent parallel mixed methods design in this study allowed the concurrent collection of quantitative and qualitative data, the separate analysis of the two data sources, and the integration/comparison of both results through merging (Moseholm & Fetters, 2017). The third phase of analysis in a convergent parallel mixed methods design integrates qualitative and quantitative data.

The narrative weaving approach of merging quantitative and qualitative results was adopted in this study. The merging of the results through thematic weaving connected each data set, weaving back and forth around similar concepts or themes from the analysed quantitative and qualitative data (Bazeley, 2017; Curry & Nunez-Smith,

2015; Moseholm & Fetters, 2017). The convergent parallel mixed methods study showed a rounded understanding of how the qualitative components provided information about malaria health education nurses/midwives provided to HIV infected pregnant women during ANC visits. The emerged themes from the study were the initiation of malaria education, the content of the malaria education, malaria preventive strategies and the challenges nurses/midwives faced in educating pregnant women on malaria.

4.4.1 Initiation of malaria education

In the interviews, the nurses/midwives stated that the initiation of malaria education to the HIV infected pregnant women largely depended on when they visited the ANC. When the pregnant women were asked when a nurse/midwife provided education on malaria during pregnancy, 51.8% of the respondents reported having received malaria health education from a nurse/midwife within the first three months of pregnancy. Also, 37.3% (n=41) of pregnant women reported receiving malaria education within 4 to 6 months of pregnancy.

4.4.2 Content of the Malaria Education

The qualitative result revealed that the content of the malaria education the nurses/midwives provided to the HIV infected pregnant women centred on the cause of malaria, the effect of malaria on their pregnancy, their susceptibility to and the severity of malaria in their pregnancy, and the available preventive strategies. The quantitative results showed that 99.1% and 90.0% of the respondents had correct knowledge of the cause of malaria and when malaria causing mosquitoes usually bite, respectively. This demonstrates that the education by the nurses/midwives on the cause of malaria to the pregnant women at the ANC has been able to increase awareness and knowledge of malaria.

4.4.3 Malaria Preventive Strategies

The qualitative results showed that sleeping under Insecticide-Treated Bed Nets (ITNs), maintaining clean surroundings to avoid mosquito breeding, spraying their rooms with insecticide sprays, use of mosquito repellent on the body and taking antimalarial drugs (IPTp-SP) under Direct Observation Therapy (DOT) were the

primary malaria preventive methods the nurses/midwives mentioned to provide during education on malaria to the HIV infected pregnant women for malaria prevention during pregnancy. The nurses/midwives emphasised that the ITNs are provided for free to pregnant women during ANC visits. According to the quantitative results, ITNs were mainly used by 87.3% (n=96) of the pregnant women (Figure 4.1). Although the nurses/midwives mentioned that IPTp-SP tablets (antimalarial drug) were provided to pregnant women attending the ANC under direct observation therapy (DOT) from 16 weeks of pregnancy, the quantitative data suggest that the pregnant women may not know that the SP tablets given to them under DOT are antimalarial drugs, since only 3.6% of the pregnant women responded to the use of antimalarial medicines during pregnancy. Also, the pregnant women made use of insecticide spray/coil (45.5%), maintained a clean environment (40%), and used mosquito repellent (12.7%) (**Figure 4.1**). Thus, convergence was observed for the malaria preventive methods, except for antimalarial medicine, where partial data divergence was observed.

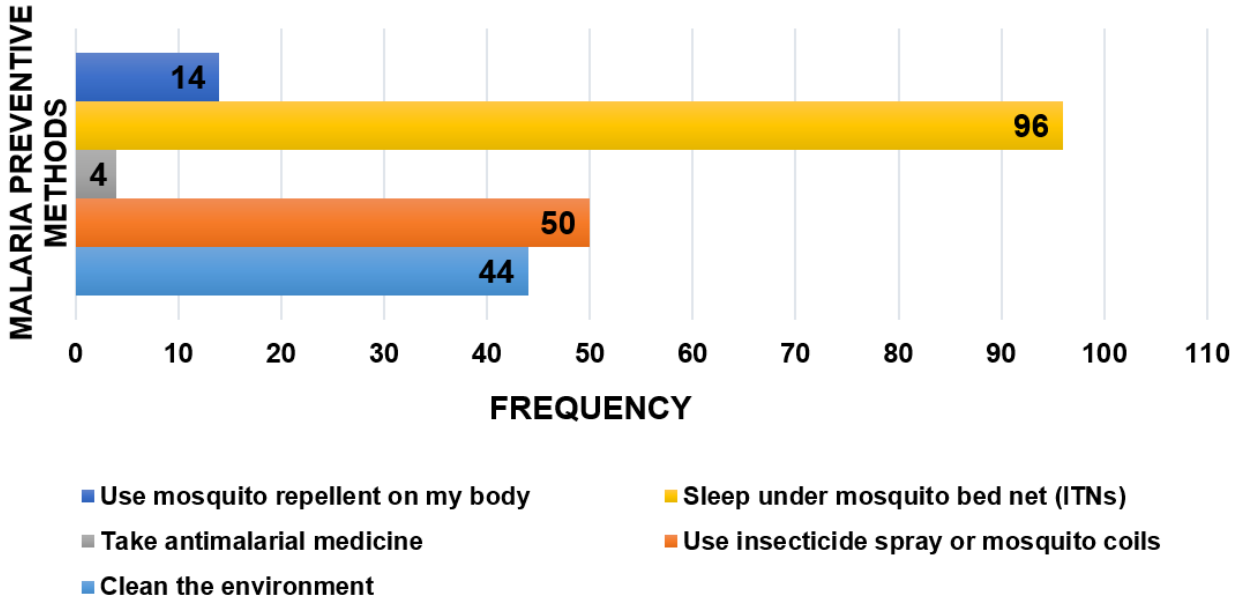

Figure 4.1 The primary malaria preventive strategies utilized by HIV infected pregnant women to prevent malaria in pregnancy.

4.4.4 Malaria in Pregnancy

When asked about malaria in pregnancy, the nurses/midwives indicated that a few pregnant women presented confirmed malaria cases. The quantitative results showed that 10% (n=11) and 6.4% (n=7) of pregnant women reported confirmed malaria in

their previous and current pregnancies, respectively. The quantitative result converges with the nurses'/midwives' assertion that few pregnant women had malaria during pregnancy.

4.4.5 Challenges of Nurses/Midwives in Educating Pregnant Women on Malaria

There was no quantitative parallel for challenges nurses/midwives faced in educating pregnant women on malaria.

4.5 SUMMARY

This chapter presented findings from both quantitative and qualitative data analyses. Background of both research participants and respondents were given. The themes that emerged from the qualitative data were elaborated on and presented in words, while quantitative findings were also shown in frequencies and figures. The latter part of the chapter illustrated the integration of both qualitative and quantitative results. The next chapter presents the discussion of the study.

CHAPTER FIVE
DISCUSSION

5.1 INTRODUCTION

The previous chapter presented, analysed, and interpreted the data. This chapter discusses the findings obtained from the qualitative and quantitative analysis and how the quantitative and qualitative results related to each. Data were collected from 110 HIV infected pregnant women and three nurses/midwives at the antenatal clinic of three hospitals in the Lower Manya Krobo District of Ghana simultaneously. This study's objectives were to investigate malaria health education nurses/midwives provide to HIV infected pregnant women during antenatal clinic visits; the sources of malaria health education and preventive strategies employed by HIV pregnant women; and the challenges nurses/midwives face in providing education on malaria to HIV infected pregnant women.

In the discussion below, the following have been deliberated: malaria knowledge and source of malaria education, malaria health education nurses/midwives provide to HIV infected pregnant women, malaria preventive strategies, malaria in pregnancy and its complication, and finally, factors affecting effective malaria health education at the antenatal clinic.

5.2 MALARIA KNOWLEDGE AND SOURCE OF MALARIA EDUCATION

In this study, 99.1% and 90.0% of the HIV infected pregnant women knew the cause of malaria and when malaria causing mosquitoes bite, respectively. However, none of the socio-demographic characteristics in this study was statistically significant with an HIV infected pregnant woman's knowledge of malaria's cause ($P > 0.05$). The result obtained from this study is comparable to studies conducted by Obol and colleagues (2011), Caroline, Doris, & Tuah (2016) and Goshu & Yitayew (2019).

Among pregnant women visiting the antenatal clinic at a General Hospital in Accra-Ghana, 97% of the pregnant women identified mosquito bites as the cause of malaria (Caroline, Doris, & Tuah, 2016). Similarly, all (100%) of the pregnant women attending ANC in North-western Ethiopia stated that a mosquito's bite transmits malaria (Goshu & Yitayew, 2019a). Also, 91% of the pregnant women in the Gulu District of Uganda knew that malaria was caused by mosquitoes (Obol, David Lagoro, & Christopher Garimoi, 2011).

However, this study's finding is higher than those reported by Habimana, Gikunju & Magu (2020) and Oladimeji, Tsoka-Gwegweni, Ojewole & Yunga (2019). In assessing malaria knowledge among pregnant women in Rwanda's southern province, 77.6% of the pregnant women had the correct knowledge that the female anopheles transmits malaria (Habimana, Gikunju, & Magu, 2020). Also, the pregnant women's knowledge of malaria's cause and when malaria causing mosquitoes feed were 85.29% and 63.3% among pregnant women attending the maternity clinic in Ibadan, South-West Nigeria (Oladimeji, Tsoka-Gwegweni, Ojewole, & Yunga, 2019).

Furthermore, in this study, the HIV infected pregnant women's primary sources of malaria health education were nurses/midwives (93.6%) and television (40.0%). The newspaper (1.8%), relatives (1.8%), school (2.7%), and health talk/education (1.8%) were among other minor sources of education on malaria. Thus, nurses/midwives ranked as the highest source of malaria health education, followed by television. Among the pregnant women who reported to have received education on malaria by a nurse/midwife at the ANC, the majority (83.6%, n=92) said they had received malaria education on three or more occasions. Pearson chi-square test further revealed that the number of times an HIV infected pregnant woman received education on malaria by a nurse/midwife at the ANC was significantly associated with their marital status, employment and the number of pregnancies.

The 2019 Ghana malaria indicator survey found television (77%) and health workers (22%) to be the first and third most common sources through which women receive malaria messages (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). Omaka-Amari and Obande-Ogbuinya (2016) found television (64.4%) and the antenatal clinic (59.7%) to be the second and third education sources on malaria among pregnant women attending 12 hospitals in the Ebonyi State of Nigeria.

5.3 MALARIA HEALTH EDUCATION NURSES/MIDWIVES PROVIDE TO HIV INFECTED PREGNANT WOMEN

Health education during pregnancy is critical for improving mother and infant outcomes (Herval, Oliveira, Gomes, & Vargas, 2019). HIV infected pregnant women need to know all issues affecting their health, including malaria in pregnancy; hence regular scheduled ANC visits are considered a good platform for providing health education on malaria. The malaria health education the nurses/midwives mentioned to have

delivered to the HIV infected pregnant women in the current study included: the causes of malaria, how malaria is transmitted, manifestation if one is infected, the effect malaria infection has on pregnancy and how malaria can be prevented.

The nurses/midwives further indicated motivating the pregnant women to adopt the available malaria preventive methods by highlighting their benefits while minimising their perceived barriers to adopting these approaches.

A malaria educational intervention study supports this study's findings; the malaria health education given to pregnant women at an antenatal clinic includes what causes malaria, the mode of transmission, the signs and symptoms; its complications during pregnancy; and how to prevent it. The pregnant women were further motivated to adopt malaria preventive measures, and the possible barriers to adopting these preventive approaches were also addressed (Balami et al., 2019, 2021).

Malaria health education provided by nurses in Rwanda to pregnant women improved their knowledge of malaria and empowered them to make effective decisions to decrease malaria prevalence in pregnancy (Nishimwe & Kerr, 2012). Health education on malaria by health professionals (nurses/midwives) during ANC visits represents an effective educational approach to increase malaria knowledge and enhance behavioural change toward utilising malaria preventive and treatment methods (Afolaranmi et al., 2015; Balami et al., 2019, 2021; Kumar et al., 2020).

When the pregnant women were asked when in pregnancy nurses/midwives provided education on malaria, the majority (51.8%) stated receiving education on malaria within three months of pregnancy, whereas 37.3% said between the fourth and six months of pregnancy. This study's findings suggest early exposure of pregnant women to malaria information from the nurses/midwives at the ANC.

Therefore, malaria health education policies need to be strengthened as an integral component of antenatal care. The nurses/midwives providing malaria health education to the HIV infected pregnant women at the ANC need to encourage other family members and husbands' involvement.

5.4 MALARIA PREVENTIVE STRATEGIES

Pregnant women's knowledge of malaria's cause, susceptibility to malaria, and the severity of malaria during their pregnancy are essential for taking the necessary preventive actions against malaria and seeking treatment if infected with malaria. The nurses/midwives in this study indicated that maintaining clean surroundings to avoid mosquito breeding, sleeping under Insecticide Treated Nets (ITNs), spraying their rooms with insecticide sprays/burning mosquito coil and taking antimalarial drugs (IPTp-SP) were the primary malaria preventive strategies they provided to the HIV infected pregnant women during an antenatal clinic visit for malaria prevention during their pregnancy.

To prevent malaria complications in pregnancy, pregnant women need to sleep every night under ITN, as stated in the 2014-2020 strategic Plan for Malaria Control in Ghana (MOH, 2014). In Ghana, Long Lasting Insecticidal Nets (LLINs) are routinely distributed for free to pregnant women during their first antenatal care (ANC) visit. The distribution and use of LLINs are central interventions for preventing malaria infection in Ghana. During antenatal clinic visits, the interviewed nurses/midwives confirmed freely distributing mosquito nets to pregnant women.

The majority of the HIV infected pregnant women (87.3%) reported sleeping under insecticide treated nets at night as a malaria preventive method. This study's obtained result is higher than the results of studies conducted by Dun-Dery and colleagues (2020), Nishimwe and Kerr (2012), Mbong et al. (2020) and Habimana and colleagues (2020). In assessing malaria health education's effectiveness for pregnant women by nurses at selected health centres in Rwanda, Nishimwe & Kerr found that 80.0% of the pregnant women indicated sleeping under mosquito nets to prevent malaria (Nishimwe & Kerr, 2012).

Dun-Dery et al. also found the regular use of ITNs among pregnant women attending ANC in 37 primary care clinics in Ghana to be 75%. However, 89% of pregnant women reported owning a mosquito net (Dun-Dery, Beiersmann, Kuunibe, & Müller, 2020). In Rwanda's Southern province of the Huye district, Habimana et al. found that 84.1% of pregnant women use LLINs for malaria prevention (Habimana et al., 2020). Mbong, Edem, and Hussain (2020) found mosquito net usage as a malaria preventive method

among pregnant women in the suburban community in the Akwa Ibom State of Nigeria to be 84.6%.

Despite the high utilisation of the ITNs, the interviewed nurses/midwives mentioned that some pregnant women complained that "*they feel hot when they sleep under*" the ITNs as a crucial reason for not using the provided mosquito nets. This study's qualitative results corroborate another study conducted in Ghana's middle belt. Some pregnant women felt the mosquito nets entrap heat during warm weather, making it uncomfortable to sleep under the net. A pregnant woman said, "*There is always heat in the ITNs, so during pregnancy, it becomes uncomfortable to sleep in*" (Manu et al., 2017).

The Ghana Malaria Indicator Survey 2019 also shows that 25% of the respondents stated that it was too hot sleeping under the ITNs as a barrier to not using the ITNs (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). The use of bed nets has been shown to reduce airflow (Von Seidlein et al., 2012), and the discomfort of feeling hot under ITNs is likely unbearable in the hottest and most humid season of the year (Aberese-Ako, Magnussen, Ampofo, & Tagbor, 2019; Bhalla, Cleenewerck, Okorafor Kalu, & Abubakar Gulma, 2019; Koenker & Yukich, 2017; Manu et al., 2017). A pregnant woman in a study said that "*sleeping inside the net is hot, and we cannot sleep comfortably at night because of heat we, sweat inside the net … When rain falls, the weather will become cool, then sleeping under the net becomes sweet*" (Bhalla et al., 2019). The main problem for not using the LLINs, according to 52.2% of the respondents in a study conducted in Northwest Region Cameroon, were heat and suffocation (Ntonifor & Veyufambom, 2016).

The nurses'/midwives' assertion on providing education and reassurance on the use of ITNs to protect themselves and their unborn child from malaria and the free distribution of ITNs at the ANC may explain the high usage of mosquito nets among pregnant women in the current study. Malaria preventive education effectively increases the use of LLIN among pregnant women to prevent malaria in pregnancy (Kumar et al., 2020; Sonibare, Bello, Olowookere, Shabi, & Makinde, 2020).

Findings also indicated that 45.5% and 40.0% of the pregnant women in the current study used insecticide mosquito spray/coil and cleaned their environment to prevent malaria, respectively. The use of insecticide mosquito spray/coil in the present study

was similar to the 41.9% use of insecticide spray and coils to prevent malaria in pregnancy found by Okafor, Ezekude, Oluwole, and Onigbogi (2019).

Fondjo, Addai-Mensah, Annani-Akollor, Quarshie, Boateng, Assafuah, and Owiredu (2020) found that 74.5% of the pregnant women in their study used mosquito repellent as a malaria preventive measure, which is higher than the 12.7% reported by the pregnant women in this current study. However, mosquito repellent use in this study was higher than the reported 8.6% usage among pregnant women in Rwanda (Nishimwe and Kerr, 2012).

In Ghana, intermittent preventive treatment of malaria in pregnancy with Sulphadoxine-pyrimethamine (IPTp-SP) is a complete therapeutic course of antimalarial medicine administered to pregnant women at regular ANC visits to prevent malaria (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). Currently, IPTp-SP administration has been integrated into ANC services, where three tablets of IPTp-SP are given to pregnant women from the 16th week of pregnancy or after quickening, once every month until delivery under Directly Observed Therapy (DOT) free of charge to the pregnant women (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020).

In this study, the interviewed nurses/midwives mentioned giving IPTp-SP to HIV infected pregnant women under DOT at the ANC after 16 weeks of pregnancy. However, only 3.6% of the pregnant women stated to use antimalarial medicines for malaria prevention during pregnancy. A possible explanation is that the pregnant women may not know or be aware that the three white tablets (SP) the nurses/midwives give to them to take at the ANC in front of the nurses/midwives (DOT) is an antimalarial medicine. This phenomenon may possibly be attributed to nurses/midwives giving SP tablets to pregnant women during ANC visits without explaining the tablets' purpose.

This current study's observation is no different from what was found by Arnaldo, Cambe, Magaço, Chicumbe, Rovira-Vallbona, Rosanas-Urgell, et al. (2019) in Southern Mozambique. The authors found that while most (56.5%) of the interviewed pregnant women did not know of IPTp-SP for malaria prevention, 76.1% of them mentioned they had been given three white tablets they had taken in front of the nurse during ANC visits at least once. A pregnant woman said, *"I did not know the reason I*

was given these tablets. They only told me to take three tablets [referring to SP]*"*. Besides, the nurses/midwives at the ANC acknowledged giving SP tablets to pregnant women during ANC visits without explaining to them the purpose of the tablets. A practice the nurses attributed to patient overload, thus compelling them to perform quick consultations to manage the pressure. A nurse/midwife said, "*we are overworked, with much to do…. And when the women come for a prenatal consultation, I often just give the tablets for malaria prevention, sometimes even without explaining carefully the details.*" (Arnaldo et al., 2019).

Pregnant women not given IPTp-SP (35%) and not being aware (42%) were the most common reasons pregnant women in the 2019 Ghana Malaria Indicator Health Survey (GMIS) cited for not taking more than one or two times IPTp-SP (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). In the Eastern Region of Ghana, where the current study was conducted, the percentage of pregnant women who received one or more, two or more and three or more doses of IPTp-SP were 82.2%, 68.4%, and 42.2%, respectively at the antenatal clinics (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020). However, when the knowledge of the women was assessed on what they can do to prevent themselves from getting malaria, only 2.2% of the women in the Eastern Region (N = 640) mentioned taking preventive medications compared to the 75% who said sleeping under a mosquito net (Ghana Statistical Service (GSS), Ghana Health Service (GHS), 2020).

Similarly, at an antenatal clinic in Adis Zemen Hospital in North-western Ethiopia, few participants (1.3%) knew that medicine could prevent malaria compared to 100% of participants listing ITNs as a preventive strategy (Goshu & Yitayew, 2019b). These findings suggest that the distribution of intermittent preventive therapy, Sulphadoxine-pyrimethamine (IPTp-SP), without fully explaining what it is or its use to pregnant women, might be a common practice at antenatal clinics. However, further studies will be needed to substantiate this preliminary observation.

5.5 MALARIA IN PREGNANCY AND MALARIA COMPLICATIONS

In this study, 6.4% and 10.0% of the HIV infected pregnant women attending antenatal clinics reported having been diagnosed with malaria in their current and previous pregnancies, respectively. Reported malaria in the current pregnancy of the respondent in this was lower than those found in studies by Dako-Gyeke and Kofie

(2015), Anabire et al. (2019), and Fondjo et al. (2020) but higher than a study by Oluwagbemiga et al. (2020). Among pregnant women living within two slum areas of Accra, Ghana, 57.4% and 42.6% of the participants reported malaria in their current pregnancy (Dako-Gyeke & Kofie, 2015). The prevalence of malaria infections among pregnant women visiting six different health facilities in the Northern Region of Ghana tested by Rapid Diagnostic Tests (RDTs) and Polymerase Chain Reaction (PCR) was 14.1% and 13.4% (Anabire et al., 2019). Also, Fondjo et al. (2020) found that 8.9% of the pregnant women attending the antenatal clinic at three selected hospitals in Ghana with malaria during their pregnancy. However, Oluwagbemiga et al. (2018) found malaria prevalence among pregnant women attending an antenatal clinic in Lagos, Nigeria, to be 2%.

5.6 FACTORS AFFECTING EFFECTIVE MALARIA HEALTH EDUCATION AT THE ANTENATAL CLINIC

The main challenges for efficient delivery of malaria health education to HIV infected pregnant women mentioned by the interviewed nurses/midwives at the ANC were time constraints/long-waiting time, work overload due to limited/shortages of staff, and non-compliance of the pregnant women in the use of malaria preventive approaches.

Staff shortages and long waiting time/time constraints at the ANC were significant challenges affecting effective malaria health education to HIV infected pregnant women visiting the ANC in the current study. Nurses/Midwives are considered the backbone of the health care system, and the shortage of nurses/midwives in the selected facilities of this study is not a localised phenomenon.

Many factors have been identified as stumbling blocks impeding nurses' involvement or engagement in patient education. These include nurses' work overload, lack of communication skills, lack of educational materials, inadequate skills and knowledge, insufficient managerial support, and unprioritized patient education compared to other aspects of care that are given precedence (Livne et al., 2017).

The effectiveness of focused antenatal care, which seeks to afford much time for direct contact with pregnant women by nurses/midwives in delivering education on pregnancy-related issues, is hindered by long waiting time, workload, and inadequate nurses/midwives at the ANC (Baffour-awuah, Mwini-nyaledzigbor, & Richter, 2015). The insufficient number of nurses/midwives providing antenatal services makes

pregnant women wait for long hours. Some turned away due to limited staff to see all or some facilities imposing daily quotas (Jinga, Mongwenyana, Moolla, Malete, & Onoya, 2019). Long waiting times at the ANC have also been identified as a critical reason for pregnant women's late initiation of antenatal care (Warri & George, 2020). Long waiting times at the ANC have been identified as a potential barrier to IPTp-SP uptake and the use of ANC services (Arnaldo et al., 2019).

The challenges of limited staff and long waiting times at the ANC may be closely related. When effective health care is affected by the staff shortage, it lengthens waiting time since human resources are mainly required to disseminate malaria health education. Addressing staff shortages at the ANC may also address long waiting times during antenatal clinic visits since pregnant women may not need to wait for hours to take their turn.

Another mentioned challenge is non-compliance to the use of malaria preventive approaches. Some pregnant women do not sleep in the freely distributed net, citing discomfort due to heat as a barrier and other varied excuses for not using them. Some pregnant women may also avoid taking the IPTp-SP. These non-complying behaviours of the pregnant women may demotivate the nurses/midwives in their provision of malaria education (Farahani et al., 2013).

Despite the challenges mentioned above, the nurses/midwives received varied support from the hospital, the district health directorate, and Ghana Health Service. The nurses/midwives assert that the hospital ensured the availability of malaria RDT kits for malaria tests, mosquito nets for free distribution, and sulphadoxine-pyrimethamine at the ANC unit. One of the interviewed participants also mentioned that their ANC unit receives educational materials on malaria for posting at the ANC and continued staff training, especially on a new malaria treatment protocol.

5.7 EMERGING FRAMEWORK FOR MALARIA HEALTH EDUCATION

Malaria knowledge, prevention and control can be explained to HIV infected pregnant women visiting antenatal clinics using health behaviour theories. Health behaviour theories provide theoretical frameworks for creating malaria health messages and educational materials (Glanz, Rimer, & Viswanath, 2008). The integration of these models in designing malaria education messages and materials may assist

nurses/midwives in providing structured and effective malaria health education to HIV infected pregnant women at the ANC.

The Rational Model (RM), also known as the Knowledge, Attitudes, And Practices (KAP) model, strives to prevent negative and encourage positive health behaviour choices. This model is based on the premise that increasing a person's knowledge will prompt a change in attitudes/beliefs and change health behaviour. The weakness of the RM/KAP model is that although knowledge is necessary, but typically not a sufficient factor in changing collective or individual behaviour. Research findings in malaria, family planning and HIV/AIDS have shown that knowledge is not the only determinant of behavioural change. An individual's perception of susceptibility and severity, self-efficacy, response efficacy, attitudes and norms of disease increases the likelihood of behaviour change (Boulay, Lynch, & Koenker, 2014; Cundill et al., 2015; Kilian et al., 2016; Koenker et al., 2015; Russell et al., 2015; Strachan et al., 2016).

The theory of behaviour change outlined in the Health Belief Model (HBM) (Becker, 1974; Glanz et al., 2008) can be applied as a framework in guiding malaria health education to HIV infected pregnant women during ANC visits. The HBM is one of the most extensively used health behaviour theories, consisting of six primary constructs that predict health behaviour. These constructs are perceived susceptibility, perceived severity, perceived benefits to action, perceived barriers to action, self-efficacy, and cues to action. Outlined below are how these constructs can be leveraged to deliver malaria health education to HIV infected pregnant women toward preventing and controlling malaria during pregnancy.

5.7.1 Perceived Susceptibility:

This is an HIV infected pregnant woman's belief about her chances of getting malaria during pregnancy. The HIV infected pregnant woman's perception of her risk susceptibility to malaria infection may significantly affect her willingness to take preventive actions against malaria infection during her pregnancy.

5.7.1.1 Potential intervention approach:

The nurse/midwife providing malaria health education needs to define HIV infected pregnant women's susceptibility/risk of malaria infection and complications during pregnancy by helping them develop an accurate perception of their malaria risk. Thus,

the nurse/midwife needs to tailor the malaria knowledge/information based on their characteristic behaviour.

5.7.2 Perceived Severity:

This is an HIV infected pregnant woman's belief about malaria's seriousness and consequences in her pregnancy. HIV infected pregnant women may not respond to malaria preventive actions (e.g., taking IPTp-SP, using ITNs etc.) if they do not view malaria during pregnancy as a severe disease. Pregnant women need to perceive the potential seriousness of malaria in pregnancy (MIP) in terms of pain (e.g., miscarriage, stillbirth etc.), discomfort (e.g., severe anaemia, low birth weight etc.), economic difficulties (e.g., repeated malaria infection might lead to loss of time from work etc.) and maternal death.

5.7.2.1 Potential intervention approach:

The nurse/midwife providing malaria education should specify the consequences of MIP, the recommended preventive actions and available treatments should they be infected with malaria during pregnancy.

5.7.3 Perceived benefits:

This is a pregnant woman's belief about the effectiveness of taking malaria preventive action to reduce the risk of susceptibility or seriousness of MIP. The HIV infected pregnant woman must be made to believe that the recommended malaria preventive strategies (e.g., taking IPTp-SP, use ITNs etc.) and available malaria treatments during pregnancy will benefit them and their unborn child.

5.7.3.1 Potential intervention approach:

The nurse/midwife providing malaria health education must explain how, where, and when to take the appropriate malaria preventive actions and seek treatment when diagnosed with malaria and the potential benefits or outcomes.

5.7.4 Perceived barriers:

This is the pregnant women's belief about the difficulties (material and psychological cost) in practising the recommended preventive strategies.

5.7.4.1 Potential intervention approach:

The nurse/midwife at the ANC needs to offer reassurance and assistance and correct any misinformation an HIV infected pregnant woman may have about malaria in pregnancy and the available preventive methods.

5.7.5 Cue to action:

These factors influence a pregnant woman's readiness to perform malaria preventive measures.

5.7.5.1 Potential intervention approach:

The nurse/midwife can provide "how-to" or "when to" information to promote awareness and use reminder systems. These triggers may be in the form of reminder notes or text messages from the nurse/midwife on the timelines for coming to the ANC for IPTp-SP, posters/flyers on benefits of ITNs etc., to be posted around the house.

5.7.6 Self-efficacy:

This is the confidence in one's (pregnant woman's) ability to take the necessary actions to prevent malaria infection.

5.7.6.1 Potential intervention approach:

The nurse/midwife providing the education on malaria should guide the pregnant women in performing malaria preventive actions. These can be done by using progressive goal setting, demonstrating the desired behaviour, and verbal reinforcement.

The information-motivation-behavioural skills (IMB) model consists of three internal constructs that illustrate the factors influencing health behaviour change. The IMB model was first developed to explain HIV preventive behaviours among students (Fisher & Fisher, 1992; Fisher, Fisher, Williams, & Malloy, 1994). Combining the three constructs of information, motivation, and behavioural skills can change behaviour. The information construct comprises the required knowledge about a specific health behaviour; the motivation construct consists of beliefs, perceptions, attitudes, emotional responses, and social support. Finally, the behaviour skills construct is the objective ability or self-efficacy required to change health behaviour changes.

The IMB model assumes that malaria preventive behaviour during pregnancy is a function of a pregnant woman's information about malaria prevention, motivation to engage in malaria prevention, and behavioural skills for performing the specific acts involved in malaria prevention. Thus, an HIV infected pregnant woman will implement malaria preventive practices if she has accurate information, is motivated, and has the required skills (**Figure 5.1**).

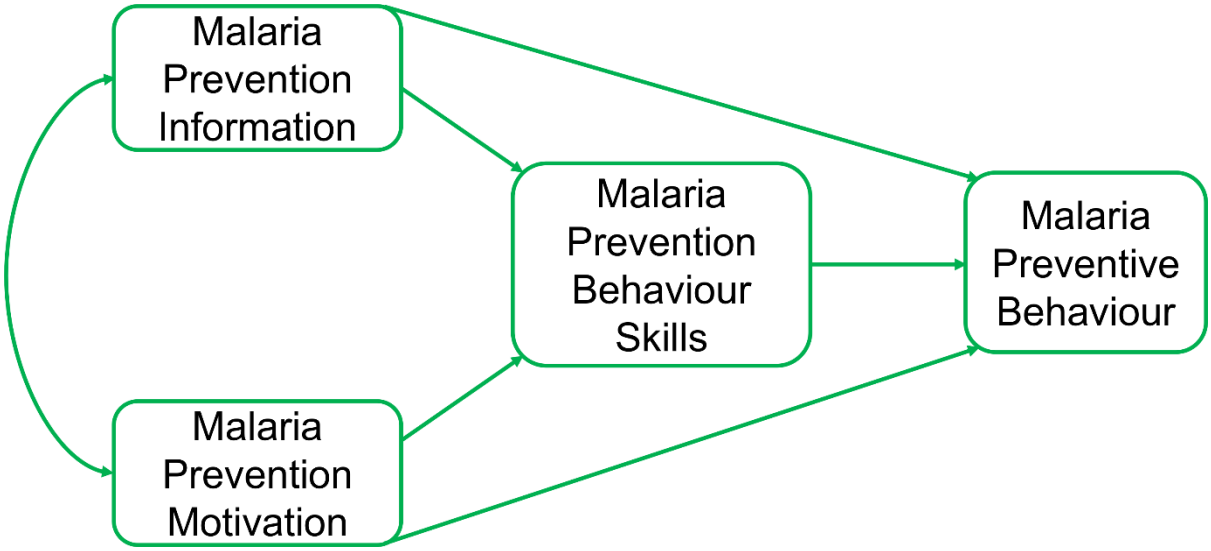

Figure 5. 1 The information-motivation-behaviour (IMB) model as a framework for malaria preventive behaviour (Figure by Researcher).

Balami and colleagues developed, implemented, and assessed malaria health educational intervention's effect using the information-motivation-behaviour model among pregnant women attending the antenatal clinics in a hospital in Nigeria. The authors found a 6.350% ($p < 0.001$), 12.75% ($p < 0.001$), and 8.55% ($p < 0.001$) increase in behavioural skills, total knowledge, and motivation, respectively, among the intervention group on ITN usage and IPTp uptake compared to the control group who received health education on breastfeeding (Balami et al., 2019).

To guide malaria health education to HIV infected pregnant women attending antenatal clinics, the health belief model and the information motivation behaviour model have been integrated to develop a malaria health educational intervention (MHEI) framework (**Figure 5.2**). The MHEI framework for Malaria health education to HIV pregnant women demonstrates the importance of increasing knowledge and awareness about malaria, increasing her belief/perception about her susceptibility to

and severity of malaria; increasing her perceived benefits of malaria preventive practices, minimizing her perceived barriers to adopting malaria preventive approaches while providing cues to action, and motivation to increase her self-efficacy in implementing the desired health behaviour change.

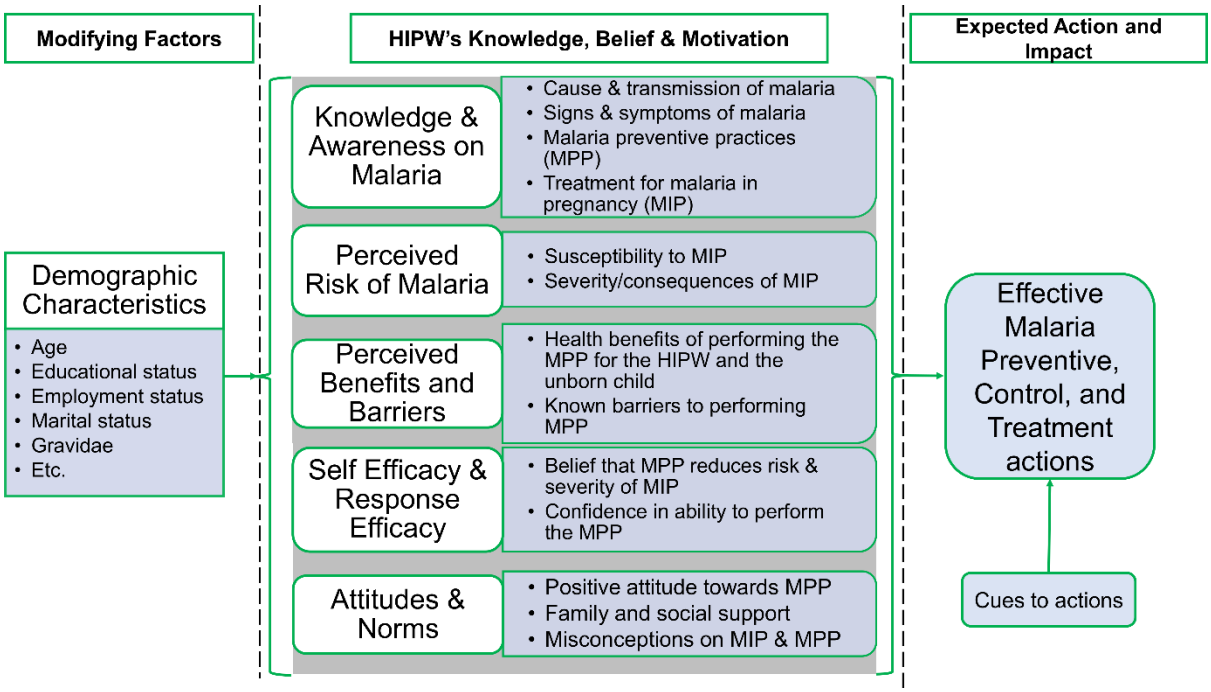

Figure 5.2 Proposed malaria health educational intervention (MHEI) framework to guide nurses/midwives in providing health education on malaria to HIV infected pregnant women at the ANC (Figure by the Researcher).

When HIV infected pregnant women receive sufficient knowledge and awareness about malaria; see themselves as susceptible to malaria during pregnancy; believe that malaria in pregnancy poses potentially severe consequences for them and their unborn child; believe that the available malaria preventive strategies (IPTp-SP, ITNs, Insecticide spray/repellent use, etc.) and treatments would be beneficial in either alleviating their susceptibility to malaria or reducing its severity; and believe that the benefits of adopting the proven preventive measures outweigh their perceived barriers (discomfort in ITN usage, long waiting time at ANC for IPTp-SP, etc.), they will be more likely to perform the needed actions to alleviate their risks for malaria (RBM, 2018).

5.8 SUMMARY

The discussion above showed that almost all HIV infected pregnant women knew what causes malaria. The nurses/midwives also scored the highest in providing education on malaria. The nurses/midwives also indicated several strategies they give to HIV infected pregnant women during their clinic visits, with most HIV infected pregnant women reporting the use of malaria preventive methods.

Several factors were mentioned to affect malaria health education at the antenatal clinic. This included inadequate staff and non-adherence to education provided on preventive strategies for malaria. In addition, the health belief model and the information-motivation-behaviour model were integrated to propose a framework to guide nurses/midwives in promoting malaria health education among susceptible populations such as HIV infected pregnant women. The next chapter (chapter six) gave recommendations and future research perspectives, and the study concluded.

CHAPTER 6

CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH PERSPECTIVE

6.1 INTRODUCTION

This study began by introducing the reader to the study by stating the problem statement, research questions, aim, and objectives. The significance of the study was outlined. The study further continued by providing a detailed discussion of the literature review. The next chapter presented the results and displayed them in both text and diagram. The findings of the study were compared to other studies. Furthermore, applying the Health Behaviour Theory and Information-Motivation-Behaviour model was elaborated and integrated to propose the Malaria Health Educational Intervention (MHEI) framework.

This current chapter concludes the study and makes recommendations to the Ministry of Health (Ghana), the Ghana Health Service, the Nursing and Midwifery Training Institutions, and nurses and midwives at antenatal clinics. The chapter further states the study's limitations and finally concludes the research with a statement.

6.2 OVERVIEW OF THE STUDY AND CONCLUSION

This study described the malaria health education provided to vulnerable HIV infected pregnant women to prevent malaria in pregnancy. A convergent parallel mixed methods design allowed themes from the qualitative analysis to help understand and explain findings obtained from the quantitative analysis.

The malaria health education the nurses/midwives in the current study provided to HIV infected pregnant women during ANC visits included: the meaning of malaria, how malaria is acquired, how vulnerable they are to be infected with malaria during pregnancy, the devastating effect malaria has on pregnancy, and actions pregnant women can embark upon to prevent the malaria infection. The majority of the HIV infected pregnant women in this study displayed high knowledge of the cause of malaria and when malaria-causing mosquitoes do bite. Misconceptions of the cause of malaria were observed to be minimal.

The study respondents' primary education sources on malaria were nurses/midwives and television. The malaria preventive strategies the nurses/midwives provide to HIV

infected pregnant women include maintaining clean surroundings to avoid mosquito breeding, sleeping under insecticide-treated bed nets (ITNs), spraying their rooms with insecticide sprays, and taking antimalarial drugs (IPT-SP). Most of the HIV infected pregnant women use insecticide-treated nets, followed by insecticide spray/coils and avoiding mosquito bleeding by maintaining a clean environment as the primary malaria preventive methods.

The identified challenges for effective malaria health education delivery included staff shortages, long waiting times at the ANC and noncompliance by the pregnant women in implementing malaria preventive methods. The staff shortage increases the workload of the nurses/midwives at the ANC, which may lead to nurses/midwives at the ANC giving IPTp-SP to pregnant women without always explaining the purpose of the tablets. Thus, the general lack of staff at the ANC has implications for effective malaria education for pregnant women during antenatal visits. This is because an insufficient number of staff implies less attention to the individual needs of HIV infected pregnant women, including one-to-one/tailored malaria health education. The staff shortages and long waiting times are related; hence, addressing staff shortages at the ANC may also address long waiting times during antenatal clinic visits.

The use of malaria preventive education effectively increases malaria knowledge and malaria preventive approaches among pregnant women (Balami et al., 2019; Kumar et al., 2020). Therefore, there is a need to strengthen the malaria health education policy as an integral component of the antenatal care service to enhance effective utilisation. Such health educational interventions have a positive potential to be implemented nationwide by incorporating them into regular antenatal health sessions provided by nurses/midwives at antenatal clinics. Malaria health education messages or materials should not only seek to increase knowledge on malaria but also incorporate target behaviours and behavioural factors such as perceived susceptibility and severity, self-efficacy, response efficacy, norms, and attitudes.

6.3 RECOMMENDATIONS

This section provides valuable recommendations for health policy, nursing management, and future research in providing malaria health education to HIV infected pregnant women during antenatal clinic visits.

6.3.1 Ministry of Health and the Ghana Health Services

i. The nurses/midwives believe staff shortages are a high priority; hence, adequate deployment of nurses/midwives at the antenatal clinics is needed to offset the increased workload and long waiting time at the ANC to ensure effective delivery of malaria health education.
ii. Strategically designed malaria educational interventions can play an essential role in increasing malaria knowledge and scaling up malaria prevention among pregnant women. Hence, malaria health education needs to be fully integrated into the broad spectrum of malaria interventions with adequate time and resources.
iii. The Ghana Health Service and the Ministry of Health should provide support and enhance the health communication skills of nurses/midwives at antenatal clinics through continuous training, orientation, and supportive supervision.
iv. Malaria health educational messages or promotional materials should be designed to incorporate knowledge, motivation, target behaviours and behavioural factors: such as perceived susceptibility and severity, self-efficacy, response efficacy, norms, and attitudes.
v. Provide continued in-service training to nurses/midwives working at the ANC to update them on new IPTp-SP protocols and guidelines.
vi. The National Malaria Control Program of the Ghana Health Service should develop short malaria in pregnancy educational films/videos to play at the ANC for pregnant women while waiting for their turn during routine antenatal visits. The NMCP of the GHS can also implement the use of short message services (SMS) applications such as the MomConnect (Seebregts, Barron, Tanna, Benjamin, and Fogwill, 2016; Grobbelaar and Uriona-Maldonado, 2019) on a national scale to provide HIV infected pregnant women with short messages on malaria and IPTp-SP.

6.3.2 Nursing and Midwifery Training Institutions

i. Health education and promotion should be strengthened in nursing and midwifery training institutions to equip nurses and midwives with health behavioural communication skills to deliver effective malaria education at health facilities.

6.3.3 Nurses/midwives providing malaria education at the ANC

i. The nurses/midwives need to adopt varied instructional strategies by using short educational films, flip charts, handouts, short message service (SMS), and teaching techniques such as interactive counselling and discussion can be employed as intervention strategies.
ii. The nurses/midwives need to use multiple channels (e.g., mass media, interpersonal communication [verbal – oral and written, nonverbal – gestures, mimics], etc.) in disseminating malaria health information to HIV infected pregnant women.
iii. The nurses/midwives providing malaria education should encourage pregnant women to regularly use ITNs while addressing known barriers and misconceptions about ITNs. ITNs are a relatively cheaper and more effective method in reducing mosquito bites to prevent malaria during pregnancy.
iv. The nurses/midwives providing education on malaria to pregnant women should stress the importance of caring for ITNs and provide them with the information and skills on how to care for their ITNs to ensure the nets last longer for malaria prevention (Gabrielle C. Hunter, 2016; Helinski et al., 2015; Koenker et al., 2015)

6.4 IMPLICATIONS FOR FUTURE RESEARCH

The following research areas are recommended for future research

i. It is recommended that future researchers replicate the current study at malaria and HIV endemic regions of Ghana and other African Countries to validate findings across a broader geographic spectrum.
ii. Research needs to be conducted to assess IPTp-SP uptake and coverage of optimal doses among HIV infected pregnant women in the Lower Manya Krobo District.

6.5 LIMITATIONS OF THE STUDY

Limitations of a research study represent areas for improvement and future suggestions. In the Interpretivism paradigm, knowledge is subjective, relative to particular circumstances, and reality representation is based on individuals' interpretation (Levers, 2013). Hence, using the Interpretivist's methodology, the researcher acknowledges that the study results relate to the study participants'

experience and meaning as interpreted from the researcher's view. Therefore, the generalization of this interpretive study is limited to the studied geographical location.

The current study respondents are limited to HIV infected pregnant women who attend antenatal clinics.

The study respondents' reported malaria cases during pregnancy were self-reported and were not verified by RDT testing or microscopy analysis.

6.6 CONCLUDING REMARKS

This study suggests the appropriate integration of malaria health education in routine antenatal clinic visits. It is an excellent strategy to impact malaria knowledge, target behavioural factors, deliver malaria-specific interventions to prevent malaria in pregnancy and reduce the burden of malaria morbidity and mortality among HIV infected vulnerable pregnant women. Furthermore, there is a need for the National Malaria Control Program (NMCP) of the Ghana Health Service to monitor and evaluate the current state of malaria health education disseminated by nurses/midwives at the ANCs across the country.

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APPENDICES

APPENDIX I: CONSENT FORM

Researcher's name

Patricia Agyarewaa Appiah-Kubi

Project title

THE PROVISION OF MALARIA HEALTH EDUCATION BY NURSES/MIDWIVES TO HIV INFECTED PREGNANT WOMEN DURING ANTENATAL CLINIC VISITS AT LOWER MANYA KROBO DISTRICT OF GHANA

Introduction

You are being asked to participate in this research study. Your participation is voluntary. You were selected because you are pregnant, and malaria can affect your baby. Please ask any questions you do not understand the consent form before agreeing to participate. Your participation will involve answering a questionnaire.

Purpose

The purpose of this study is to find ways to stop malaria from making pregnant women sick in your community. Malaria can make you lose your baby. We want you to tell us what you know about malaria and what nurses tell you about malaria. This study is an academic work and parts of the research would be published.

Procedures

If you agree to participate in this study, you will be asked to fill out the questionnaire in the nurse's/midwife's room at the antenatal clinic for a duration of 15 minutes or be interviewed with a digital audio recording device. You will be asked questions about malaria. No one else will be there, except the researcher, nurse/midwife and yourself. The researcher will provide questionnaires after signing the form. You are free to ask for assistance to fill out the questionnaires or you may answer it yourself. You may skip any questions you do not wish to answer and move on with the next. But your input will be greatly appreciated to answer the purpose of this study. A special code will identify you to keep your information confidential and anonymous.

Potential Risks: There is no predictable risk involved in this study since research conducted is non-invasive. However, a mere inconvenience such as economic risk will be prevented by respecting the time allocated for data collection.

Possible Benefits: There may be no direct benefit to you. Nevertheless, your involvement may help find solutions to how malaria can be reduced in your communities.

Costs: The study will not incur any cost to you as you will be recruited and complete a questionnaire during your routine antenatal clinic visits or working hours in the hospital.

Confidentiality: Your name and identity will remain anonymous (thus, coded). The information you provide will not be shared with anyone outside of the research team. The results of the study will be examined as a dissertation, published in a journal, and presented at conferences.

Compensation: There is not cash compensation; however, a health education brochure on malaria may be provided to you after taking part in this study.

Voluntary participation/withdrawal: You have the right to withdraw from this study without any explanation, or any penalty or loss of benefits such as treatment of care rendered by nurses/midwives at the antenatal clinic.

Number of participants

An estimated number of HIV infected pregnant women (150) and sufficient number of nurses/midwives will be recruited for this study.

Feedback to participant: I will recap the information you have provided to allow corrections. Also, findings from the study will be shared with the participating hospitals to be assessed by participant.

Contact for questions

You can ask any questions now or later. Other questions about the research may be directed to **Patricia Agyarewaa Appiah-Kubi** (yaagyarewaa16@gmail.com) on **+233541816828.** You may also contact my supervisor Prof. Jane Kerr (kerrj@unizulu.ac.za) on +27836269423. This proposal has been reviewed and approved by University of Zululand Review Ethics Committee (UZREC) and the Ghana

Health Service Ethics Review Committee (GHS-ERC), which protects the research participant from any harm. Kindly contact the **GHS-ERC** on **+233-0302681109** or **UZREC** on **+2735 902 6887**.

Consent signature

Participant

This document has been read by myself or read to me. I have had the opportunity to be informed about the purpose of the study, procedures, possible risks and benefits. An opportunity has been given to me to ask questions before I sign and to ask questions any time during the study. I have been informed of no penalty and loss of benefits if I refuse to participate. I consent willingly to participate in this research.

……. …….

Signature of participant Date

Researcher

I have accurately explained the details of the research as outlined in the consent document. To the best of my knowledge participant clearly understood. I confirm that the opportunity was given to the participant to ask questions and the appropriate answer given to my knowledge. I also confirm that participation was voluntary.

…….. …….

Signature of researcher Date

Interpreter

I have accurately assisted the researcher to explain the information in this document in…….. I am satisfied that the participant understands all aspects of the research and the content of this document to make an informed consent to participate or not.

……. ……..

Signature of interpreter Date

APPENDIX II: QUESTIONNAIRE

This questionnaire is designed to find out “The Provision of Malaria Health Education by Nurses/Midwives to HIV Infected Pregnant Women During Antenatal Clinic Visits at Lower Manya Krobo District of Ghana.”

This questionnaire is divided into two parts. Please read the instructions for each section before answering the questions.

1. **Demographic data**.

This section asks about your demographic data. Please indicate your answer to each question:

A. Age: ……

B. Marital Status:

Single

Married

Living with a partner (*Co-habiting*)

Divorced

Other……

C. Employment Status:

Employed (*Government/Private*)

Self-employed

Unemployed

Student

D. Educational level:

None

Primary (P*1-6*)

High school (*JHS-SHS*)

Tertiary (*college/University*)

E. Number of pregnancies

1

2

3

4 and above

2. Assessing of malaria knowledge

This part is asking about your source and knowledge on malaria.

F. How does one get malaria?

Do not know

Mosquito bite

Witchcraft

Cold weather

Sexual intercourse

Other……

G. What time does malaria-causing mosquitoes bite?

Do not know

During the day

In the night

Select more than one for I and J

H. How do you prevent malaria?

Do not know

Clean the environment

Spray the room with an insecticide spray

Take medicine

Sleep in a mosquito bed net

Use a mosquito repellent on my body

Other……

I. Where did you hear about malaria?

Television

Newspaper

Nurses/midwives

Other……...

J. How many times have nurses/midwives told you about malaria?

Never

Once

2 times

3 times or more

K. When in the course of pregnancy do nurse/midwives tell you about malaria?

Within 3 months of pregnancy

4 – 6 months of pregnancy

After 7 months of pregnancy

Do not remember

L. Have you had complications due to lack of malaria education during pregnancy?

Yes ☐ No ☐

If yes, what was the complication?

.....

.....

THANK YOU

APPENDIX III: INTERVIEW GUIDE

Instruction:

Nurses/midwives should consent to participate in the interview with information that the interview will be audio-recorded and transcribed during thesis writing. Information sheet about the study as well as informed consent should be signed preceding the interview

Interviewee:

Nurses/midwives working at the antenatal unit who are willing to be interviewed can participate in the study.

Introduction:

The researcher introduces herself and establishes rapport, and reintroduces the study process.

I. What can you tell me about malaria?

Probe: where do you think HIV infected pregnant women get malaria education from?

II. What malaria health education do you give to pregnant women? Probe: What are your experiences telling pregnant women about malaria?

III. What malaria health education do you give to HIV infected pregnant women to prevent malaria infection?

Probe: what do you think are the challenges nurses/midwives encounter when educating HIV infected pregnant women during antenatal clinic visits?

IV. When do you provide malaria health education to HIV infected pregnant women attending antenatal clinic?

Probe: What is your experience telling HIV infected pregnant women about malaria?

V. What makes malaria in HIV infected women a threat?

Probe: What are your general reasons for educating HIV pregnant women on malaria?

VI. Do you provide HIV infected pregnant women with preventive strategies during antenatal clinic visits?

Probe: what are some of the preventive measures?

VII. What support does the unit have from Ghana Health Service (GHS) to provide malaria health education?

Probe: what do you think can be done to improve the malaria health education of HIV infected pregnant women attending antenatal clinic in your facility?

THANK YOU

APPENDIX IV: UNIVERSITY OF ZULULAND ETHICAL CLEARANCE CERTIFICATE

UNIVERSITY OF ZULULAND
RESEARCH ETHICS COMMITTEE
(Reg No: UZREC 171110-030)

RESEARCH & INNOVATION
Website: http://www.unizulu.ac.za
Private Bag X1001
KwaDlangezwa 3886
Tel: 035 902 6731
Fax: 035 902 6222
Email: DlelanaM@unizulu.ac.za

ETHICAL CLEARANCE CERTIFICATE

Certificate Number	**UZREC 171110-030 PGM 2019/46**						
Project Title	**MALARIA HEALTH EDUCATION PROVIDED TO HIV INFECTED PREGNANT WOMAN IN SELECTED HOSPITALS IN LOWER MANYA KROBO DISTRICT, EASTERN REGION OF GHANA**						
Principal Researcher/ Investigator	Patricia A. Appiah-Kubi						
Supervisor and Co-supervisor	Dr Kerr						
Department	Nursing						
Faculty	Science and Agriculture						
Type of Risk	Med Risk – Data collection from people						
Nature of Project	Honours/4th Year		Master's	x	Doctoral		Departmental

The University of Zululand's Research Ethics Committee (UZREC) hereby gives ethical approval in respect of the undertakings contained in the above-mentioned project. The Researcher may therefore commence with data collection as from the date of this Certificate, using the certificate number indicated above.

Special conditions:

(1) This certificate is valid for 1 year from the date of issue.
(2) Principal researcher must provide an annual report to the UZREC in the prescribed format [due date-01 October 2020]
(3) Principal researcher must submit a report at the end of project in respect of ethical compliance.
(4) The UZREC must be informed immediately of any material change in the conditions or undertakings mentioned in the documents that were presented to the meeting.

The UZREC wishes the researcher well in conducting research.

CHAIRPERSON
UNIVERSITY OF ZULULAND RESEARCH ETHICS COMMITTEE (UZREC)
REG NO: UZREC 171110-30
02 -10- 2019
RESEARCH & INNOVATION OFFICE

Professor Gideon De Wet
Chairperson: University Research Ethics Committee
Deputy Vice-Chancellor: Research & Innovation
02 October 2019

APPENDIX V: GHANA HEALTH ETHICS REVIEW COMMITTEE CLEARANCE CERTIFICATE

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
GPS Address: GA-050-3303
Tel: +233-302-681109
Fax + 233-302-685424
Mob + 233- 050-3539896
Email: ethics.research@ghsmail.com

MyRef. GHS/RDD/ERC/Admin/App
Your Ref. No. 191599

24th October, 2019

Patricia Agyarewaa Appiah-Kubi
P. O. Box 13219
Arena, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 036/10/19**
Project Title	Malaria health education provided to HIV infected pregnant women during antenatal clinic visits in selected Hospitals in Lower Manya Krobo District, Eastern Region of Ghana
Approval Date	24th October, 2019
Expiry Date	23rd October, 2020
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

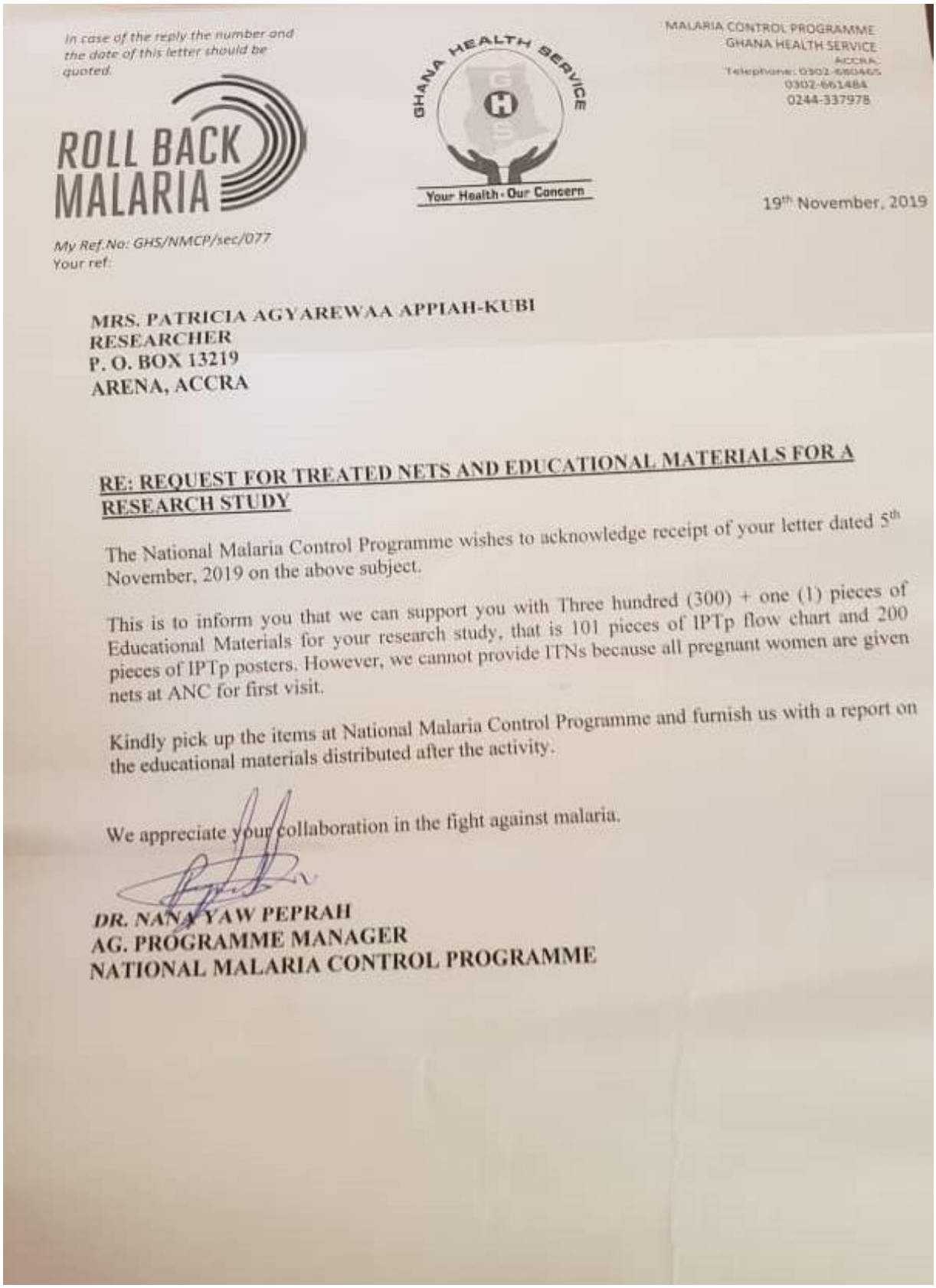
The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. Cynthia Bannerman
(GHS-ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

APPENDIX VI: APPROVAL OF REQUEST LETTER TO THE NATIONAL MALARIA CONTROL PROGRAMME OF THE GHANA HEALTH SERVICE FOR MALARIA EDUCATIONAL MATERIALS



In case of the reply the number and the date of this letter should be quoted.

ROLL BACK MALARIA

GHANA HEALTH SERVICE
Your Health - Our Concern

MALARIA CONTROL PROGRAMME
GHANA HEALTH SERVICE
ACCRA.
Telephone: 0302-680465
0302-661484
0244-337978

19th November, 2019

My Ref.No: GHS/NMCP/sec/077
Your ref:

MRS. PATRICIA AGYAREWAA APPIAH-KUBI
RESEARCHER
P. O. BOX 13219
ARENA, ACCRA

RE: REQUEST FOR TREATED NETS AND EDUCATIONAL MATERIALS FOR A RESEARCH STUDY

The National Malaria Control Programme wishes to acknowledge receipt of your letter dated 5th November, 2019 on the above subject.

This is to inform you that we can support you with Three hundred (300) + one (1) pieces of Educational Materials for your research study, that is 101 pieces of IPTp flow chart and 200 pieces of IPTp posters. However, we cannot provide ITNs because all pregnant women are given nets at ANC for first visit.

Kindly pick up the items at National Malaria Control Programme and furnish us with a report on the educational materials distributed after the activity.

We appreciate your collaboration in the fight against malaria.

DR. NANA YAW PEPRAH
AG. PROGRAMME MANAGER
NATIONAL MALARIA CONTROL PROGRAMME

APPENDIX VII: PERMISSION LETTER TO HOSPITAL A

Hansen Road SDA School
P.O.Box 13219
Arena, Accra

21/11/19

To whom it may concern
Akuse Government Hospital

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Nursing at the University of Zululand. My supervisor is Dr Jane Kerr. The proposed topic of my research is **Malaria health education provided to HIV infected pregnant women during antenatal clinic visits of selected hospitals in Lower Manya Krobo District, Eastern Region of Ghana**.

The objectives of this study are:

I. To determine malaria health education and preventive strategies nurses/midwives provide to HIV infected pregnant women during antenatal visits.

II. To identify the source of malaria health education and preventive strategies employed by HIV infected pregnant women

III. To identify the factors that affect the effectiveness of malaria health education to HIV infected pregnant women.

I am hereby seeking your consent to conduct this study. To assist you in reaching a decision, I have attached to this letter:

(a) A copy of an ethical clearance certificate issued by the University and Ghana Health Service

(b) A copy of the research instruments which I intend using in my research.

Should you require any further information, please do not hesitate to contact my supervisor or me. Our contact details are as follows:

Dr Jane Kerr (+27836269423) email: kerrj@unizulu.ac.za
Patricia Agyarewaa Appiah-Kubi (+233541816828) email: yaagyarewaa16@gmail.com

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

……

Patricia Agyarewaa Appiah-Kubi

APPENDIX VIII: PERMISSION LETTER TO HOSPITAL B

Hansen Road SDA School
P.O.Box 13219
Arena, Accra

21/11/19

To whom it may concern
St. Martins De Porres Hospital

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Nursing at the University of Zululand. My supervisor is Dr Jane Kerr. The proposed topic of my research is **Malaria health education provided to HIV infected pregnant women during antenatal clinic visits of selected hospitals in Lower Manya Krobo District, Eastern Region of Ghana**.

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Dr Jane Kerr (+27836269423) email: kerrj@unizulu.ac.za
Patricia Agyarewaa Appiah-Kubi (+233541816828) email: yaagyarewaa16@gmail.com

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

……

Patricia Agyarewaa Appiah-Kubi

APPENDIX IX: PERMISSION LETTER TO HOSPITAL C

Hansen Road SDA School
P.O.Box 13219
Arena, Accra

21/11/19

To whom it may concern
Atua Government Hospital

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Nursing at the University of Zululand. My supervisor is Dr Jane Kerr. The proposed topic of my research is **Malaria health education provided to HIV infected pregnant women during antenatal clinic visits of selected hospitals in Lower Manya Krobo District, Eastern Region of Ghana**.

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I. To determine malaria health education and preventive strategies nurses/midwives provide to HIV infected pregnant women during antenatal visits.

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Dr Jane Kerr (+27836269423) email: kerrj@unizulu.ac.za
Patricia Agyarewaa Appiah-Kubi (+233541816828) email: yaagyarewaa16@gmail.com

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

……

Patricia Agyarewaa Appiah-Kubi