SCHOOL OF PUBLIC HEALTH, COLLEGE OF HEALTH SCIENCES, UNIVERSITY OF GHANA

USE OF RAPID DIAGNOSTIC TEST FOR DETECTING MALARIA INFECTION: HEALTH WORKERS' PERCEPTIONS AND ADHERENCE TO TEST RESULTS AT HEALTH FACILITIES IN THE AGONA EAST DISTRICT OF THE CENTRAL REGION

BY

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DECLARATION

I, Selina Ansah-Koi, declare that except for the other people's investigations which have been duly acknowledged, this work is the result of my own original research undertaken under supervision, and that this dissertation, neither in whole nor in part has not been presented elsewhere for another degree.

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DEDICATION

To HIM who has brought me this far.

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ABSTRACT

In 2010, World Health Organization came up with the policy of diagnostically testing for malaria among all age groups before treatment and Ghana has adopted this policy as part of the case management of Malaria. Presumptive diagnosis of malaria results in the abuse of anti-malaria drugs which may lead to the emergence of resistant strains of the parasite, wastage of anti-malarials and misdiagnosis of malaria. Areas without microscopy, especially the peripheral areas are to use the rapid diagnostic test to diagnose malaria before treating. Studies have shown that under ideal conditions, results of RDT are comparable to that of microscopy.

In spite of adopting this policy, studies show that clinicians do not adhere to results and continue to prescribe anti-malarials to those who test negative. This study sought to identify the proportion of malaria cases that was diagnosed presumptively compared to those that were tested at CHPS compounds and health centres in the Agona East district. It also aimed at identifying the perceptions and experiences with regards to testing before treatment using RDT among health workers in the District.

The study involved a combination of quantitative and qualitative methods. Quantitative methods were used to assess adherence to negative test results and type of diagnosis used in six health facilities within the period of July to September 2015. This was achieved by analysing routine data on reports from three Community-based Health Planning and Service compounds and three health centres in the Agona East District. For the qualitative aspect, in-depth interviews were done with a purposive sample of 14 health personnel who treat and prescribe medication across health facilities within the district to explore their perceptions on the use of RDTs and identify any implementation challenges.

Frequency tables were used to show proportions that got diagnosed with malaria, those that were presumptively diagnosed as well as treatment given to those who tested negative.

Qualitative data was analysed thematically under three broad themes namely perception about rapid diagnostic test, adherence to negative test results and implementation challenges.

Of the six health facilities in the Agona East District, 3.87% (14/362) were presumptively diagnosed with malaria whiles 96.10% (348/362) were diagnosed with malaria using RDT.

For those tested using the Rapid Diagnostic Test, 15.25% tested negative and 84.75% tested positive. Out of those who tested negative, anti-malarials were given to 20.75% and 79.25% received no anti-malarials. Health centres were much more likely to treat for malaria in cases where the results are negative compared to CHPS compounds.

Health workers perceived the kit as easy to use and also as helping to make work easier. They used the kit mainly because the policy required them to do so. They however lacked confidence in negative test results, especially in cases where the person shows suspected signs and symptoms of malaria. However, this did not always influence their prescription practices. Shortages of RDT was the main reason why prescribers were presumptively diagnosing for malaria.

There is a high testing rate in the district compared to the national testing rate. Health centres compared to CHPS compounds are likely to treat for malaria in cases where the results are negative. Health workers lack confidence in negative results and are likely to treat for malaria, refer the patient or just treat the underlying conditions if one tests negative. The major implementation challenge with regards to the RDT has to do with shortages.

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ACT	Artemisinin-based Combination Therapy
CHN	Community Health Nurse
CHO	Community Health Officer
CHPS	Community-based Health Planning and Services
EN	Enrolled Nurse
IDI	In depth interviews
MRDT	Malaria Raid Diagnostic Test
MP	Malaria Parasites
OPD	Out Patient Department
RDT	Rapid Diagnostic Test
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

A parasite called plasmodium causes malaria, which is transmitted by the bite of an infected anopheles mosquito. Once inside the body, they multiply in the liver causing an infection in the red blood cells (Olasehinde, Ajayi, Taiwo, Adekeye, & Adeyeba, 2010). Ten to fifteen days after the bite from an infected anopheles, one may show signs such as headaches, vomiting and fever (Opare et al., 2014).

Despite the numerous interventions, malaria accounts for about a million deaths and over 400 million cases yearly, 90% of these deaths occur in Sub-Saharan Africa (Bilal et al., 2015). In 2012, an estimated 482,000 under 5-year-olds died from malaria in Ghana and also accounted for 38% of all outpatient illnesses, 35% of all admission and 34% of deaths in children under 5 years (Fenny, Asante, Enemark, & Hansen, 2015).

Malaria is usually diagnosed based on microscopy and this is seen as the gold standard (Diakite et al., 2012). World Health Organzation (WHO) has endorsed malaria diagnostic test as an addition to microscopy in detecting malaria parasites at lower levels of health care (Asiimwe et al., 2012). Diagnosis based on symptoms and treatment of uncomplicated malaria is still common in many parts of Africa although there are problems with this strategy (Ansah, Epokor, Whitty, Yeung, & Hansen, 2013). Recent research in malaria endemic countries including Ghana shows that drug shops most often rely on presumptive diagnosis and are willing to sell cheap and less effective drugs (Fenny, Hansen, Enemark, & Asante, 2014).

The introduction of the test, treat, and track initiative launched by WHO shows that malaria should be managed based on evidence. Relying only on symptoms lead to overtreatment of patients without malaria (Eibach et al., 2013). As at 2012, 41 out of 44 malaria endemic countries under WHO Africa Region had adopted the policy of diagnosing malaria by testing before treatment irrespective of age group (Bastiaens, Bousema, & Leslie, 2014).

Rapid diagnostic test use antibodies to detect the presence of malaria antigen (Visser, Daily, Hotte, & Dolkart, 2015). To conduct a rapid diagnostic test, a tester obtains a drop of blood by pricking a finger, this is then placed in a plastic device, results are ready between 15-20 minutes (Cohen et al., 2015). Rapid diagnostic test is recommended for diagnosing malaria in lower level peripheral facilities such as CHPS compounds; facilities such as district hospitals and higher are usually equipped with a laboratory and are therefore supposed to use microscopy for testing (Fenny et al., 2014). In Ghana management of malaria is often based on presumptive diagnosis. One reason being that health centres at the sub-district level and lower usually lack laboratory facilities except where they are large and upgrading to a higher health facility (Frank Baiden et al., 2012). Overdiagnosis of malaria has been reported not only at health provider facilities, but hospitals as well (Chandler, Whitty, & Ansah, 2010).

Rapid diagnostic test (RDT) can serve as an alternative to both clinical and microscopy based diagnoses since they are easier to perform and require minimal training. That aside, it has high accuracy under both controlled and field conditions. Various researches in Africa have shown that the rapid diagnostic test have a significant advantage over microscopy (Hansen et al., 2015). Malaria Rapid Diagnostic Test provide accurate diagnosis, requires no electricity or specialised

laboratory training and can be used in low-resource areas (Rauf, Anto, Koffuor, Buabeng, & Abdul-kabir, 2014)

Researches on patient and provider perception of the RDT have identified a range of factors affecting the use of RDT. Some include tester not believing in the report, lack of trust in the one administering the test, fear of undisclosed HIV testing and confidence in self-diagnosing malaria (Cohen et al., 2015)

There are several economic studies which assume that prescribers adhere to the results of test, however, multiple observational studies have shown that prescribers still give anti-malarial drugs although there is a negative result (Ansah et al., 2013). Three years after the malaria rapid diagnostic test policy in Ghana, a cluster randomised survey conducted in community health care facilities, showed non-adherence to the policy and that malaria diagnosis was still presumptive (Rauf et al., 2014)

A recent study shows that clinicians are reluctant to prevent treating for malaria in cases where the test results are negative. Adherence to the test result by clinicians is key to assessing whether the rapid diagnostic test is useful for managing malaria and cutting down cost (Bisoffi, Gobbi, Angheben, & Ende, 2009). A study in Burkina Faso showed that as much as 85% of people who tested negative to RDT were still treated for malaria in spite of the education that when result are negative malaria treatment must be excluded (Chandler et al., 2010). Poor adherence to malaria treatment guideline in Africa may be as a result of insufficient training, minimal supervision, socio-cultural aspects and no trust in the testing system (Salomão, Sacarlal, Chilundo, & Gudo, 2015)

This research will therefore seek to find out perceptions of health workers in the Agona East Municipal district on Rapid Diagnostic Test, factors influencing adherence or non-adherence to test results as well as challenges faced in implementing the WHO guideline of testing before treating for malaria. A health worker in this context includes community health nurses, community health officers, enrolled nurses, general nurses, midwives and physician assistants.

1.2 Problem Statement

Research in Ghana shows that 32.5% of all outpatients cases are as a result of malaria (Amponsah, Vosper, & Marfo, 2015). According to the 2014 Ghana Demographic and Health Survey, Malaria prevalence among children between the ages of 6-59 months is 27% based on microscopy testing. Based on this testing, those who live in rural areas are likely to have a higher prevalence, as well as those in the Northern, Western and Central Regions of Ghana (Ghana Demographic and Health Survey, 2014).

Presumptively diagnosing malaria has resulted in three main issues. These are the abuse of anti-malaria drugs which may lead to the emergence of resistant strains of the parasite, wastage of resources and, misdiagnosis of malaria (Frank Baiden et al., 2012). Clinical symptoms of uncomplicated malaria are vague and similar to several other diseases, therefore diagnosing based solely on symptoms lead to overdiagnosis of malaria (Ansah et al., 2013).

A very common response to fever episodes in Sub-Saharan Africa is to purchase medication from a drug store or pharmacy without seeking a professional medical advice (Cohen et al., 2015). People will prefer to seek treatment in the retail sector to avoid long waiting times, frequent stock out of medication and travelling long distances to health facilities (Cohen et al., 2015)

There has been an increase in Rapid Diagnostic Test procurement worldwide. As at 2008, it was 45 million units and increased drastically to 205 million units in 2012. Surprisingly supply of the kit is even below demand (Bastiaens et al., 2014). Also, over 200 million commercial malaria test kits are available on the market. In 2013, 48 different countries had purchased a total of 319 million Rapid Diagnostic test. Out of this number, 160 million was subsidised and distributed under the national malaria control program (Miller & Sikes, 2015).

The majority of published studies show that when rapid diagnostic tests were introduced in settings that rely on presumptive diagnoses of malaria, there were drastic decreases in the over prescription of anti-malarials (Bastiaens et al., 2014). Ideally, access to reliable and easy to use test must lead to a change from presumptively diagnosing malaria before treatment to diagnostic testing before treatment (Bastiaens et al., 2014). Presumptively diagnosing malaria as well as overusing Artemisinin-based anti-malarial is a waste of resources and can lead to the emergence of resistant parasite strains (Cohen et al., 2015).

RDT's are usually cheaper than a full course of ACT, therefore introducing RDT will not only reduce the cost of malaria treatment but also improve malaria management (Bisoffi et al., 2009). While most studies show that the introduction of RDT's lead to a reduction in anti-malarial treatment, several others also show that anti-malarials are still given to patients in spite of negative test results (Johansson et al., 2015).

A lot of countries are using Artemisinin-based Combination Therapy (ACT) as the first line medication, this is relatively expensive and can lead to unsustainability with regards to massive overtreatment with anti-malarials (Ansah et al., 2013). It has been realised that the views of health service providers influence their prescription practices (Mubi et al., 2013).

This study will therefore explore health workers' perceptions about RDT and their experiences with regards to using it.

1.3 Justification

Aside the Northern and Western regions of Ghana, Central region has the highest incident of malaria cases. In the Agona East District, the health centres and the CHPS compound all use RDTS, only one health facility in the entire district uses microscopy in addition to RDT. Presumptively diagnosing and treating malaria has many implications. One being patients may be treated for malaria whiles they may be suffering from another illness which has similar symptoms with malaria. This may result in misdiagnosed malaria with serious implications on health and possible loss of life.

The use of the RDT can help with the easy diagnosis of malaria especially in areas without laboratory services. This is a district where only 43.5% of the population has electricity as their main source of lighting, therefore, RDT is the most appropriate means of diagnosing for malaria. This makes it a suitable place for studies on RDT since the entire government health facilities has only one health center using microscopy. All the others are dependent of RDT. Not much study has been done on Rapid Diagnostic test in this district.

The human factor in use of RDT is very crucial for improved outcomes. It is therefore important to explore the perceptions and experiences of health service providers who use RDT in malaria diagnosis. This study will therefore address these challenges through the following objectives:

1.4 General Objective

The general objective of this study is to assess the use of RDT and explore perceptions of service providers in implementing the policy of testing before treatment of malaria using the rapid diagnostic test.

1.5 Specific Objectives

1. To compare those who were presumptively diagnosed with malaria to those diagnostically tested.
2. To compare the proportion of patients who tested negative to RDT and did not receive anti-malarials to those who tested negative and received anti-malarials.
3. To assess health workers experiences and perceptions of Malaria Rapid Diagnostic Test.
4. To identify reasons accounting for adherence or non-adherence to results of Rapid Diagnostic Test
5. To ascertain factors affecting the implementation of the use of Malaria Rapid Diagnostic Test by health workers.

1.6 Research Questions

How many people got tested with RDT between the periods of July 2015 to September 2015?

Of those who tested negative, what percentage was prescribed with anti-malarials?

What are the perceptions health workers have about the Malaria Rapid Diagnostic Test?

What factors influence adherence to RDTs?

Are there any challenges with the use of RDTs?

1.7 Conceptual Framework

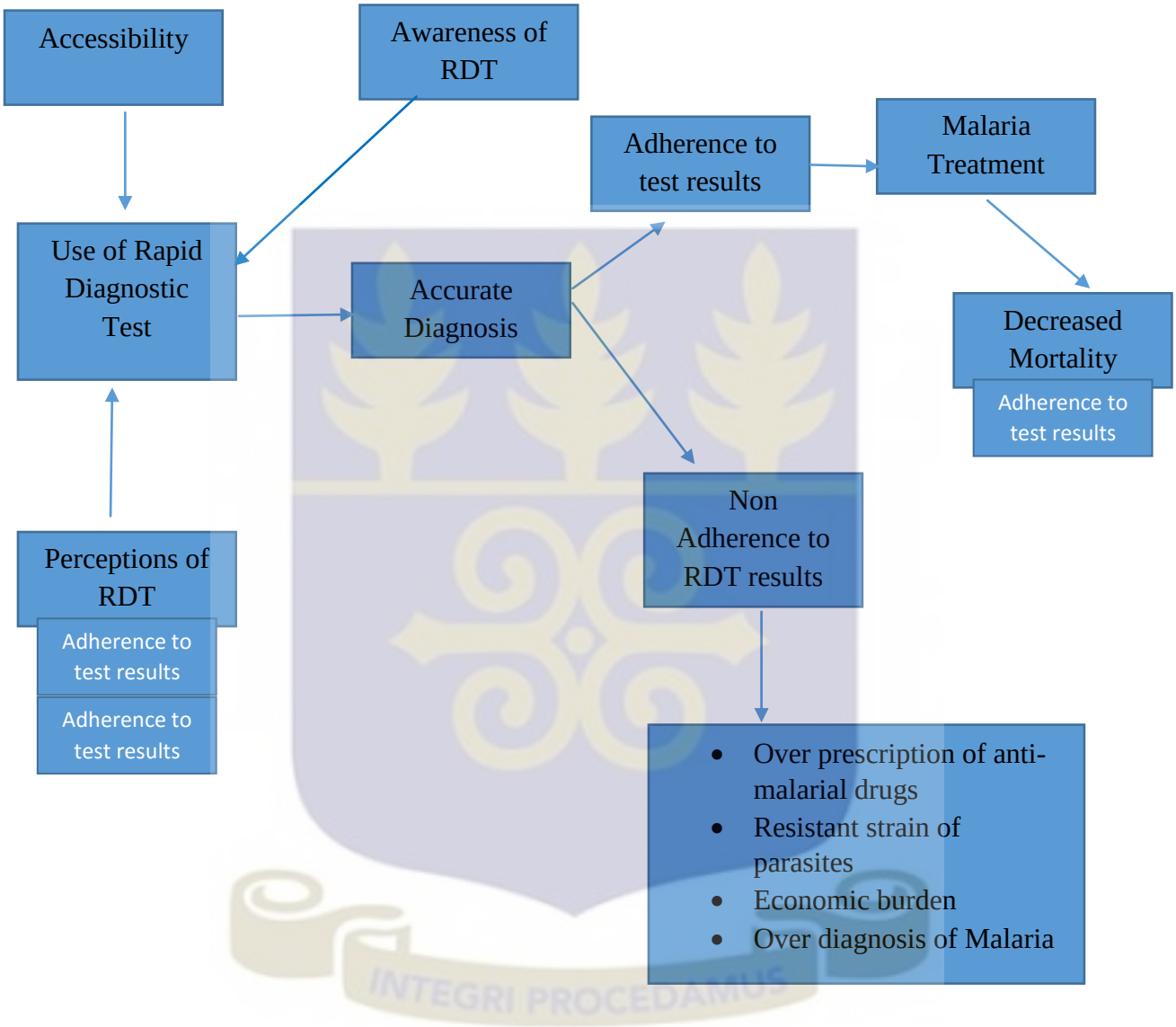


Figure 1: Conceptual Framework on Malaria Rapid Diagnostic Test and Decreased Mortality

The conceptual framework (figure 1) shows the role rapid diagnostic test plays in decreasing mortality. Use of RDT is dependent on perceptions one may have about the accuracy of the kit in diagnosing malaria, awareness of its existence and how readily available the testing kit is.

Results obtained after using RDT can lead to adherence or non-adherence especially in cases where the results are negative and health workers are of the view that the person has malaria and therefore prescribes anti-malarial.

Perceptions by health workers and patients have an influence on prescription practices among health workers. Situations have been cited where health providers have felt pressured by patients to prescribe anti-malarial drugs to them when they have tested negative for malaria (Mubi et al., 2013). Presumptive diagnosis of malaria results in the abuse of anti-malaria drugs which may lead to the emergence of resistant strains of the parasite, wastage of resources and, misdiagnosis of malaria (Frank Baiden et al., 2012).

Treating all fevers as malaria can mask some fatal conditions (Fenny et al., 2014) therefore results must be adhered to. Malaria once treated results in a decrease in mortality. In instances where the results are negative, another test must be done to discover what illness the person is suffering from. This will also decrease mortality.

Missed cases of malaria can result in preventable morbidity and mortality, it is therefore crucial that steps at reducing overdiagnosis of malaria do not increase missed cases (Chandler et al., 2010)

CHAPTER TWO

LITERATURE REVIEW

2.1 Malaria situation and measures to lessen the malaria burden

Globally the number of malaria cases in 2012 was 207 million with 627,000 deaths and 90% of these deaths occurred in Sub-Saharan Africa (Abreha et al., 2014). In Africa, these ten countries; Democratic Republic of Congo, Burkina Faso, Niger, Mozambique, Cameroon, Cote D'Ivoire, Ghana, Uganda, Nigeria and Tanzania have been identified by the WHO for accounting for 60% of malaria deaths in the African continent (Berg, 2014). The whole of Ghana is seen as hyperendemic for malaria and everybody in the country is at risk of getting infected with malaria (Fenny et al., 2014). Statistics in Ghana shows that 32.5% of all outpatients cases and 48.8% of children under five who are admitted in hospitals are as a result of malaria (Amponsah, Vosper, & Marfo, 2015). The most severe forms of malaria are caused by the *Plasmodium falciparum* and *Plasmodium vivax* (Olasehinde et al., 2010). In Ghana, *Plasmodium falciparum* is the major parasite causing morbidity and mortality in about 80-90% of cases especially in children under the age of five and pregnant women, this is followed by *Plasmodium Malariae* causing 10-20% then *Plasmodium Ovale* causing about 1%. *Plasmodium vivax* has not been identified in any part of Ghana (Malaria & Programme, 2013).

The Abuja declaration of 2006s target was to ensure universal access to the right interventions for everyone at risk of malaria. Based on this, malaria control in Ghana aimed at reducing morbidity and mortality by 75% in 2015 (Fenny et al., 2014). Early detection of malaria and early treatment are among the main approaches to preventing and control malaria (Abreha et al., 2014). Early diagnosis and appropriate treatment within a day of onset of symptoms especially

among young children and pregnant women are crucial in preventing malaria complications that can result in deaths (Boadu et al., 2016). Malaria morbidity and mortality can be reduced by effectively managing malaria cases in both the private and public health facilities (Ama P Fenny et al., 2014). The objective of reducing malaria mortality has brought about an introduction of various interventions to fight it. These include the use of insecticide-treated bed nets, the introduction of Artemisinin-based Combination Therapy (ACT) and use of the rapid diagnostic test. All of these interventions have in one way or another contributed to the reduction of malaria cases in some settings (Stresman et al., 2012). The number of recorded malaria OPD cases in Ghana was 11.4million in 2013 and there was a decline to 8.4 Million in 2014. Thus a decline of about 23.6% (Ghana Health Service 2014 Annual Report, 2015).

For many years, policymakers amongst which included the World Health Organization promoted the idea of presumptively diagnosing for malaria and treating all suspected cases with chloroquine because it was cheap and accepted by many (Ochodo, Garner, & Sinclair, 2016). Low-income countries for many years, diagnosed malaria based on symptoms because they did not have laboratory facilities, that aside anti-malarials were cheap. The symptoms of malaria are usually similar to that of many common illnesses as a result of viral and bacterial infections (Berg et al., 2012). In Ghana diagnosing malaria solely based on symptoms without testing occur very often and this exposes patients to low standards of malaria detection and treatment (Fenny et al., 2014). Clinical diagnosis of malaria although may not always be accurate, it is still the basis for therapeutic care in malaria endemic areas where there may be no access to laboratory services or where results are not regarded. This has implications such as missed cases of severe malaria, drug wastage and can result in an increase in resistance (Eibach et al., 2013).

In order to deal with the issue of testing and provision of anti-malarials based on results as well as increase case reporting, the Global Malaria Program of the World Health Organization in April 2012 launched T:3 initiative which focuses on Test, Treat and Track (Bastiaens et al., 2014). World Health Organization (WHO) in 2010 revised their guidelines for the treatment of malaria, based on the new guidelines, all cases of suspected malaria must be diagnostically tested and treated based on results (Johansson et al., 2015). In Africa, Zambia was the first country to adopt the WHO guidelines on malaria management, they revised their policy for treating malaria, in order for anti-malarials to get to those who really needed it, they introduced the Malaria Rapid Diagnostic Test (Rauf et al., 2014). In 2013, less than 33% of suspected malaria cases were diagnostically tested for confirmation (Boadu et al., 2016). Ghana is one of the countries that have adopted this policy. According to the Guideline for Case Management of Malaria in Ghana, 2014, diagnostic testing by either using microscopy or Rapid Diagnostic Test should be used to test for malaria for all age groups. Presumptive diagnosis can be done only in cases where there is no microscopy facility or RDT.

In 2009, the Ministry of Health Ghana adopted the policy of test before treatment in line with the WHO directives in order to restrict overdiagnosis and misdiagnosis of malaria as well as ensure antimalarial drugs are given to those who need it (Rauf et al., 2014). An increase in the adoption of diagnostically testing is important and can result in appropriate management of fever cases which may not necessarily be as a result of malaria and also ensure treatment is given to only those who need anti-malarials (Ezeoke et al., 2012). More than 80% of malaria treatment is done without diagnostically testing in endemic countries in Africa, which usually have poor access to diagnosis (Bastiaens et al., 2014). An important aspect of managing and controlling malaria is laboratory diagnosis. However, inaccurate microscopy and a presumptive diagnosis of

malaria occur often in a majority of malaria endemic countries (Derua et al., 2011). According to the Ghana Urban Malaria Study (2013), all over Ghana, there is an increase in under five out patient's attendance during the rainy season. Clinicians all over the country presumptively diagnose malaria irrespective of the season, however, there is roughly a fixed percentage of children presumptively diagnosed with malaria in each area. This percentage varies from place to place but is usually constant. This does not give a true picture of the malaria burden in Ghana. According to the Multiple Indicator Cluster survey for Ghana (2011), at least one out of three children with fever were presumptively diagnosed with malaria without being tested (Multiple Indicator Cluster Survey with an Enhanced Malaria Module and Biomarker, 2011). Between 2005 to 2007 testing for suspected malaria cases in Ghana was 18% and this was stagnant, however, there was a sharp increase to 35% in 2012 (Ghana Malaria Programme Review National Malaria, 2013). As at 2011, 42.9% of the OPD cases were tested before treatment of malaria, there was a tremendous increase to 74.3% in 2014 (Ghana Health Service 2014 Annual Report, 2015).

Brief About RDT

RDT is a biological test that can quickly detect the presence of antigens for malaria parasites within a period of ten to fifteen minutes, this is done by pricking the finger and obtaining drops of blood which are then put on a test strip (Zongo, Farquet, & Ridde, 2016). Much skill is not needed to use RDT and using it is not difficult, it can correctly diagnose malaria at facilities within the lower level of the health care system where microscopy is unavailable (Kyabayinze et al., 2012). Currently, rapid diagnostic tests are regarded as a point of care test because it is usually used in remote areas at the community level (Pan, 2015). RDT for malaria is being proposed as a way to ensure that anti-malarial gets to those who really need it (Chandler et al.,

2010). MRDT was developed in the 1990's however their usage in health facilities was limited as a result of the absence of an international standard to compare brands, this shortcoming has been rectified by WHO/FIND/CDC supported programme which has tested and ranked the various commercially available RDTs based on their performance (Baiden, Malm, Hodgson, Chandramohan, & Webster, 2014). Usage of RDTs in field conditions not only helps with detecting malaria among people with fever but also helps to provide prompt treatment for cases that turn out to be positive (Pan, 2015). There are mainly two types of RDT kit being used. The first known as the HRP-2 is used to identify histidine-rich protein produced by the *P falciparum* whiles the other identifies the lactate dehydrogenase enzymes produced by all species of Plasmodium that causes malaria (Odaga et al., 2014).

Facilities for diagnosing malaria infection using microscopy are usually found in hospitals and private clinics while in peripheral health facilities Rapid Diagnostic Test are used (Osei-kwakye et al., 2013). Ghana's protocol for the management of malaria recommends that lower level peripheral facilities like CHPS compounds use RDT to test for malaria whiles higher level health facilities like health centres and hospital use microscopy (Fenny et al., 2014). Two problems usually exist in local health care settings, one being the unavailability of parasite based testing, therefore, making treatment based on symptoms which aren't sensitive and specific, the other has to do with health workers not sticking to test results in instances where testing for malaria is available (Bastiaens et al., 2014).

Adherence to RDT results

According to the guidelines for case management of Malaria in Ghana 2014, health care facilities at which malaria can be diagnosed and managed has been grouped into four levels: Community

level, which comprises of households, licensed chemical sellers, community-based agents, and volunteers;- Primary health care involves CHPS compounds, health centres, private clinics and pharmacies;- Secondary level is made up of district hospitals and Tertiary level includes regional and teaching hospitals. The concept of CHPS compound is an innovative programme launched by the Ghana Health Service in 1999 to enable communities with at least 6000 residents who lack health services have access to community health nurses. Before its establishment, more than 70% of Ghanaians lived in communities that were eight Kilometres away from a health provider. That aside road networks to some of these facilities were so bad. Since its inception, there has been a rapid increase of functional CHPS zones from 300 to 1863 as at 2012 (PRESIDENT'S MALARIA INITIATIVE Ghana Malaria Operational Plan FY 2015, 2015).

Based on a standard protocol in the initial stages of malaria assessment, a patient with uncomplicated malaria may have a fever or a recent history of fever, chills, shivering and headaches. Other symptoms include bitterness in the mouth, loss of appetite, vomiting, irritability and body pains (Fenny et al., 2014). Testing for malaria before treatment can lead to a decrease in waste, less amount of money on anti-malarials and improve treatment (Mukanga et al., 2012). There is a 50% to 100% savings in cost when treatment is consistent with the result of the test (Bastiaens et al., 2014). In cases where the malaria RDT test results are negative, patients must not be treated with anti-malarial but rather investigations must be done to find out what is causing the illness (Guideline for Case Management of Malaria in Ghana, 2014). A study showed that clinicians are reluctant to prevent treating for malaria in cases where the malaria test results are negative. Adherence to results is key to assessing whether RDT is useful in the management of malaria in cutting down cost (Bisoffi et al., 2009).

Studies done in Tanzania and Zambia revealed a reduction in ACT prescriptions among community health workers after using Rapid diagnostic Test (Mukanga et al., 2012). A study on local health care workers in Uganda showed that as much as 92% of clinicians were of the view that a positive RDT test was enough evidence of the presence of malaria infection, however, 49% believed that a negative test result was adequate evidence to rule out the presence of malaria (Miller & Sikes, 2015). Another study on RDT use by health workers in Zambia showed that two out of three children were prescribed with anti-malarials in spite of a negative RDT result (Manyando, Njunju, Chileshe, Siziya, & Shiff, 2014). Another study conducted in health facilities in Malawi also showed that 58% of patients with negative RDT results were still treated for malaria (Chinkhumba et al., 2010). Prior to Ghana's adoption of the test before treatment policy, 45% of those who tested negative were still prescribed with anti-malarials (Boadu et al., 2016). Research shows cases where those who test negative and are still treated for malaria in other endemic countries in Sub-Saharan Africa range between 10-80% (Boadu et al., 2016). In Ghana, a study in rural facilities revealed 45.5% patients who tested negative received anti-malarials (Chandler et al., 2010).

There are also instances of adherence to malaria RDT results. A study in rural Tanzania showed a very high level of adherence with 83.2% of those who tested positive with RDT receiving ACT while only 7.2% of those who tested negative to the RDT received ACT (Masanja et al., 2012). Potential approaches to improve case management of malaria and reduce unnecessary prescription of anti-malarial include training health workers and making available simple diagnostic tools (Kyabayinze et al., 2012). In areas where RDTs have been introduced after intensive training focusing on treatment guidelines, suggesting other forms of treatment for those who tested negative, frequent supportive supervision and in some situations incentives to take

part in the training has resulted in adherence to test results (Chandler et al., 2010). A study in Cameroon showed that clinicians who received enhanced training on designing and implementation practices in complicated malaria management strongly agreed that it was not right to prescribe antimalarial to patients who tested negative to RDT (Febir et al., 2015). In instances where RDTs were introduced with support or as part of a training package under the Ministry of Health, RDT negative patients prescribed with anti-malarial ranged between 35-55% (Chandler et al., 2010).

Measures to introduce RDT vary and include in-service training and supervision of health workers as well as dissemination of written protocols and the introduction of the RDT test itself. These additional measures are crucial to ensuring adherence to diagnosis and treatment procedures and right usage of the test kits in the right settings (Odaga et al., 2014). A quantitative research conducted in public health facilities in a rural district in Ghana showed that in areas that already use microscopy for detecting malaria, the introduction of RDT had no impact on prescribing anti-malarials based on results of the test. However, in areas that were presumptively diagnosing malaria, the introduction of RDT resulted in a decrease in anti-malarial over prescription, however, 50% of those who tested negative to RDT were still prescribed anti-malarials (Chandler et al., 2010).

Non-adherence to results can lead to the development of drug resistance and worsens the situation by creating a continuous cycle of ill health, which affects household income and leads to wastage of the county's resources as well as resources given by donors (Boadu et al., 2016).Studies show clinicians are reluctant to adhere to results of malaria diagnostic test. Adherence to results is a key factor in determining whether RDT can reduce cost as well as

improve malaria management. Therefore if results are not going to be adhered to, testing is a waste of time and resources (Bisoffi et al., 2009).

Perceptions about RDT

A number of studies on the evaluation of the diagnostic performance of malaria RDTs have shown that it is sensitive and specific with high predictive values (Rauf et al., 2014). Studies have shown that the perceptions health service providers have plays a crucial role in influencing their prescribing practices (Mubi et al., 2013). A research in Nigeria on the availability and usage of RDT in both private and public health facilities revealed its limited usage, reasons accounting for this included lack of trust in RDT, supply issues and preference for other diagnostic tests (Ezeoke et al., 2012).

One factor that influences people's acceptance of a healthcare intervention is the perceptions about the innovation (Ezeoke et al., 2012). Malaria is labelled as a socially acceptable disease and this can lead to an inclination of diagnosing cases as malaria rather than an alternate disease (Chandler et al., 2008). In areas where cases of fever has historically been presumptively treated as malaria, a Rapid Diagnostic Test that gives a negative result can result in doubt most especially if community members do not trust modern medicine or if they do not have confidence in the new testing format that has been introduced (Miller & Sikes, 2015). Studies focusing on the perception of patients, caregivers and clinicians with regards to malaria diagnosis has shown two majors pictures; one, patient will want to be tested for malaria before being prescribed medication and two, results obtained after test may not have much impact on the prescription practices of clinicians (Derua et al., 2011).

RDT Implementation Challenges

Majority of suspected cases of malaria are treated by the private sector, however, studies in a few countries have shown that these facilities are not yet using microscopy or RDT, more than 50% of patients use the services of unlicensed shops and peddlers (Bastiaens et al., 2014).

It is important to be aware of the possibility of an increase in positive cases of malaria with the RDT, this becomes an issue especially with the use of the histidine-rich protein-2 based test which is used to detect the *plasmodium falciparum* continues to test negative weeks after the parasite has been cleared (Masanja et al., 2012). Underdiagnosis of malaria can lead to a delay in treatment and this can progress to severe cases which can result in death (Derua et al., 2011).

Factors such as storage, transport , manufacturing standards and end user use of the kit can affect the quality of rapid diagnostic test (Moonasar et al., 2009). The quality of diagnostics and drugs is dependent on how they are stored. High temperature and humidity can affect RDT hence the need to ensure manufacturer's specifications are adhered to throughout the supply chain (Bastiaens et al., 2014). Testing on a range of RDT available on the market by WHO showed a constant finding of malaria at tropical temperatures, however, there is not enough information on how storage conditions affect RDT stability (Bastiaens et al., 2014). A research conducted showed that a major challenge for community health workers is the refusal of health centres to resupply them with RDT. This was usually as a result of the health centre not being aware of the agreement with regards to stock supply or they lacking stock (Ruizendaal et al., 2014).

The National Health Insurance Scheme (NHIS) was established under the National Insurance Act 2003, Act 650. Its aim is to increase access to health care as well as ensure that citizens have access to basic health care services most especially those with low-income levels and the

vulnerable. This is a major health financing development and since it was introduced in 2005 has resulted in an increase in the use of health service (Fenny et al., 2014). NHIS led to an increase in the number of patients visiting both inpatient and outpatient departments of health facilities, resulting in an increase in the number of patients workload and making it impossible for care providers to adhere strictly to the guidelines for malaria treatment (Febir et al., 2015). A high patient load in facilities hinders the implementation of new policies. In Tanzanian, health workers attributed not using RDT's to high patient load and a shortage of staff (Bastiaens et al., 2014). A study in Tanzania showed that health workers were of the view that the introduction of RDT led to an increase in workload and there was the need for more staff to conduct testing for malaria (Bastiaens et al., 2014)

CHAPTER THREE

METHODS

3.1 Study Area

Agona East is one of the twenty-one districts in the Central Region of Ghana. It is situated at the eastern corner of the Central Region within latitudes 50º30 and 50º50'N and within longitude 0º35' and 0º55' West. It has Agona Nsaba as the capital. The total land area is 667 square kilometres. The district is bordered to the Northeast by West Akim, to the South by the Agona West Municipality, to the East by the Efutu-Senya District, to the Northwest by Asikuma-Odoben-Brakwa, and to the North and West by Birim South and Ajumako-Enyan-Assian District (The Composite Budget Agona East District Assembly for the 2015 fiscal year, 2015).

According to the Population and Housing Census 2012, the area has a population of 85,920 inhabitants. The population is made up of 52.2% females and 48.8% males. More than half (56.7%) of the residents live in rural areas whereas 43.3% live in urban localities.

Farming is the predominant economic activity in the area, employing over 70% of the labour work force in the district; other socio-economic activities include artisan work and trading. With the exception of roads from Mankrong through Akwakwaa to Asamankese and from Mankrong Junction through Swedru to Agona Nsaba which are tarred roads, all the others are feeder roads (The Composite Budget Agona East District Assembly for the 2015 fiscal year, 2015).

According to the District Analytical Report of the Agona East District, 43.5% of the population has electricity as their main source of energy mainly used for light, 39.8% kerosene lamp, 14.8%

use flashlight or torches and 1.8% use other sources which include candles, generators, solar energy and so on.

The Agona East District has five government health centres and one Christian Health Association of Ghana health centre and three private maternity homes. The area is divided into five sub-districts. These are Kwanyako, Nsaba/Duakwa, Asafo, Mankrong and Mensakrom. Each of these sub districts has a health center as well as CHPS compounds. There are a total of 25 health facilities in the district serving the entire population. Of this figure, there are 3 private maternity homes, 11 CHPS compounds, 5 government health centres, and one clinic which falls under the Christian Health Association of Ghana. With the exception of the facility at Kwanyako which uses microscopy and RDT for malaria detection, all the others use only RDT for detecting malaria.

Table 1: Health Human Resource Situation in the Agona East District

STAFF CATEGORY	NO. OF STAFF NEEDED	NO. OF STAFF AVAILABLE	OVER/UNDER STAFFING
Dist. Director of Health Service	1	1	Normal
Medical Doctors	5	0	Understaffing
Medical Assistant	5	3	Understaffing
Midwife	15	11	Understaffing
Nursing Staff (Gen)	100	83	Normal
Public Health Nurse	1	0	Understaffing

Credit (The Composite Budget "AGONA EAST DISTRICT for the 2015 FISCAL YEAR," 2015)

Table 1 shows that there is understaffing of health personnel with the exception of General Nursing Staff and District Director of Health Service.

3.2 Study Design

This is a cross sectional study using mixed methods for data collection as outlined below:

3.3 Qualitative Method

Purposive sampling was used to select health workers such as physician assistants, enrolled nurses, community health officers and community health workers. Inclusion criteria for the in-depth interview within the health centres were health personnel who could diagnose malaria, test for malaria and recommend malaria treatment within government health centres that use only RDT. This comprised physician assistant, enrolled nurses and midwives.

Inclusion criteria for in depth interviews in the CHPS compounds were people who could diagnose, test and treat malaria within the CHPS compounds. This comprised of enrolled nurses and community health nurses. In-depth interviews were conducted with people who met the inclusion criteria to represent perspectives of a range of cadres at different levels of the health system. Purposive sampling was used to select different cadres of health personnel within the various health facilities in the district. The interview of health personnel was stopped when it got to a point where no new information was obtained. Themes explored during the interview included adherence, supply of RDT kit, challenges regarding use of rapid diagnostic test, perceptions of the new policy on testing before treatment of malaria, and success regarding use of Rapid Diagnostic Test. Two district health directorate staff were also interviewed to find out about supply issues with regards to RDTs.

List of government health facilities were obtained from the District Health Directorate of the Agona East District. To ensure a fair representation, participants for the in-depth interview were purposively selected from each of the five health facilities under the five districts.

In all, fourteen in-depth interviews were conducted with a physician assistant, enrolled nurses, midwifes and community health nurses and two district health directorate staff were interviewed.

3.4 Quantitative Method

This included review of secondary data at six randomly selected health facilities. Three of these facilities were health centres and the other three were CHPS compounds. The inclusion criteria were government health facilities that used RDT and had no microscopes.

Sample Size calculation

The sample size for the quantitative research was calculated using Cochran's formula where

$n = Z^2pq/e^2$ (Israel, 2013).

Based on the above formula,

n is sample size

Z is confidence level of 95% (standard value of 1.96)

e is margin of error of 5% (standard value of 0.05)

p is 30% (0.30). This is the estimated number of malaria outpatient cases nationally. Malaria accounts for about 30% of all outpatient cases in Ghana as at 2014 (Ghana Health Service 2014 Annual Report, 2015).

q is 1-p which is 1-0.30=0.7

Below is the solution for calculating the sample size using Cochran's formula

$n=1.96^2(0.30*0.7)/0.05^2$

n=3.8416*0.21/0.0025

n=322.7 or 323

Therefore the minimum sample size was 323.

A total of 116 was obtained from 3 CHPS compounds and a total of 246 was obtained from 3 health centres making a grand total of 362.

3.5 Sampling Procedure for Health Centres

There are a total of six health centres in the district. Out of this, two facilities were excluded. One was excluded because it was a private facility and was under the Christian Health Association Ghana, the other which was a government establishment was also excluded because they used microscopy as well as RDT in detecting malaria and the study was focusing on facilities that use only RDT in testing for malaria.

Three out of the remaining four government health centres were therefore randomly selected. Systematic Sampling was used to get the data for each of the health facility visited.

Formula for Systematic Sampling is k=N/n

Where k is the sampling interval, N is the population size and n is the sample size.

The Consulting Room Register was assessed for each health center and counted the total number of provisional malaria cases for the periods of July to September, 2015 in order to get the sampling frame. The total number of provisionally diagnosed malaria cases obtained from the register was divided by the expected sample size for each facility. The required sample size for each facility was 86. The figure obtained after the division served as the interval for the selection of cases.

Since every positive malaria case is treated, focus was not on that. However, in cases where the results were negative, a request for the patients folder was made to find out the kind of medication prescribed, the symptoms and temperature.

Some facilities had an RDT register in which they recorded the results of those tested. However, for each of the health facility visited, the consulting room register had a portion showing whether the person was tested or not and the results.

The total number obtained for the three health centres was 246.

3.6 Sampling Procedure for CHPS compounds

There are eleven CHPS compounds and three were randomly sampled. The names of the CHPS compounds were written on separate sheets of papers and folded. All the folded papers were shuffled and three were randomly selected. The consulting room register was assessed to record the total number of patients who were provisionally diagnosed with malaria within the period of July to September, 2015. Since the CHPS compounds receive fewer patients compared to the health centres, total number of malaria cases for the three month period was recorded. After obtaining the provisional number, checks were done to determine those that were tested before

treatment and those that were presumptively diagnosed and treated. There was no need to call for the folder of the patients who tested negative since the consulting room register already had a record of that as well as the symptoms presented and medication given.

The total malaria cases for facility A was 23, facility B was 33 and Facility C was 60. This gave a grand total of 116.

3.7 Quality Control and Rigor

Trustworthiness in qualitative research is a way of ensuring ethical considerations and getting findings as close as possible to research findings. Triangulation of sites, audit trail and peer debriefing were strategies used for ensuring trustworthiness in this research. Triangulation of sites allowed me to collect data from different sites – government health centres, CHPs compounds and also from different geographical locations. Even though all these sites treated malaria, the settings and locations differ. Audit trial involved use of detailed field notes, memos and documentation of steps taken before arriving at decisions. Peer debriefing involved utilization of supervision and ongoing discussions with academic advisors that helped to present objective view of the research. To ensure reliability of the quantitative data, research assistants received training on how to collect the data. Data collection was done under the supervision of the principal investigator with four research assistants. Two of the research assistants focused on the quantitative aspect and two on the qualitative aspect. At the end of the day, data collected was cross checked for accuracy.

3. 8 Data Processing and Analysis

3.8.1 Quantitative Data

Data collected were entered into a Microsoft excel sheet and coded. To ensure accuracy of the data, it was independently cross-checked by the research assistant and the principal investigator. Data was imported into Stata Version 13.1 for analysis. The proportion of patients who were presumptively diagnosed and those who were tested were expressed as percentages and displayed using tables. The proportion of patients who tested negative and received anti-malarial and those who tested negative but did not receive anti-malarial was also displayed as percentages using tables.

3.8.2 Qualitative Data

Interviews were audio recorded and transcribed into a Microsoft Office word sheet. Transcribed data were manually sorted and grouped based on the themes such as perceptions of RDT, challenges in the use of RDT and adherence to test results.

3.9 Ethical Considerations

Ethical clearance for the study was obtained from the Ethical Review Committee of Ghana Health Service. Privacy and confidentiality was maintained throughout the study. Records abstracted from the consulting room register were kept anonymous to hide identities of persons involved. No identifying information such as the name of the patient was captured from the records. Permission was sought from the District Health Directorate of the Nsaba Health Directorate to assess the health records of the selected health facilities in the district. An informed consent was sought from health personnel who were interviewed and confidentiality

was assured regarding the information collected. Privacy was ensured during the interview. During the consenting process, participants were made aware that the information they provide will contribute to the improvement of malaria case diagnosis in the district. Participants were also made aware that the interview session will be audio taped, and they were free to withdraw from the study at any point if they felt uncomfortable and that there were no known risks associated with the study.

Contact information of the principal investigator and the administrator of the ethical review committee were made available to participants to seek further clarification if need be.

CHAPTER FOUR

RESULTS

4.1 Quantitative Results

Proportion that was presumptively diagnosed with malaria compared to proportion tested

For the three health centres, 2.44% (6/246) were presumptively diagnosed and treated for malaria whiles a larger proportion of 97.56% (240/246) were tested for malaria with the RDT within a three month period (Table 2).

Table 2: Type of Diagnosis for Health Centres

Type of Diagnosis	Frequency	Percentage
Presumptive	6	2.44
Tested with RDT	240	97.56
Total	246	100

Between July to September 2015, 6.90% (8/116) were presumptively diagnosed and treated for malaria in the CHPS compound whiles 93.10% (108/116) were tested for malaria using RDT. This can be seen in table 3.

Table 3: Type of Diagnosis for CHPS compounds

Type of Diagnosis	Frequency	Percentage
Presumptive	8	6.90
Tested with RDT	108	93.10
Total	116	100

Combining all the six health facilities, 3.87% (14/362) were diagnosed with malaria clinically whiles 96.13% (348/362) were diagnosed with malaria using RDT (Table 4).

Table 4: Type of Diagnosis for all facilities

Type of Diagnosis	Frequency	Percentage
Presumptive	14	3.87
Tested with RDT	348	96.13
Total	362	100

For children under the age of 5, 1 out of 124 was presumptively diagnosed whiles 1 out of 226 were diagnosed using RDT (Table 5).

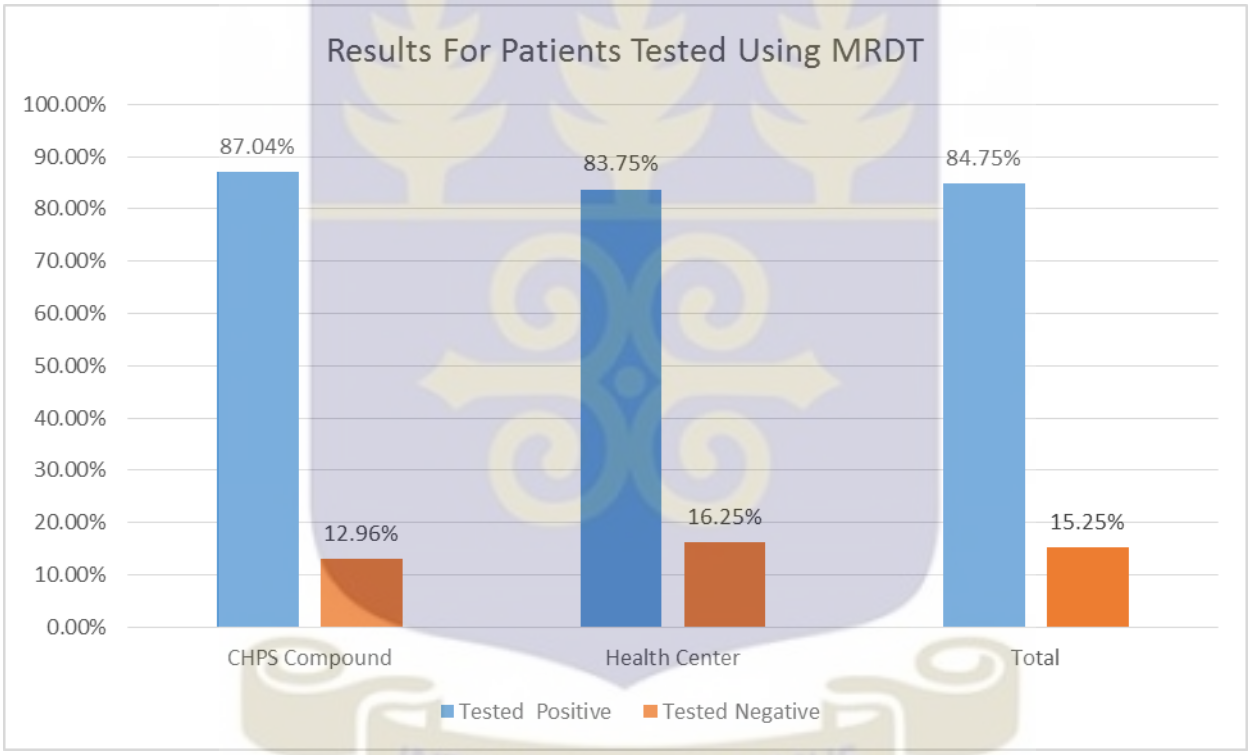
Table 5: Type of diagnosis based on age

AGE	TYPE OF DIAGNOSIS		
	PRESUMPTIVE	**TESTED**	**TOTAL**
UNDER 5	1	123	124
ABOVE 5	1	225	226

4.2 Results for those tested with RDT

From Figure 2, 84.75% (300/354) of patients who were tested with MRDT in all the six health facilities tested positive whiles 15.25% (54/354) tested negative. For the CHPS compounds, 87.04% (94/108) tested positive and 12.96% (14/108) tested negative whereas for the health centres, 83.75% (201/240) tested positive and 16.25% (39/240) tested negative.

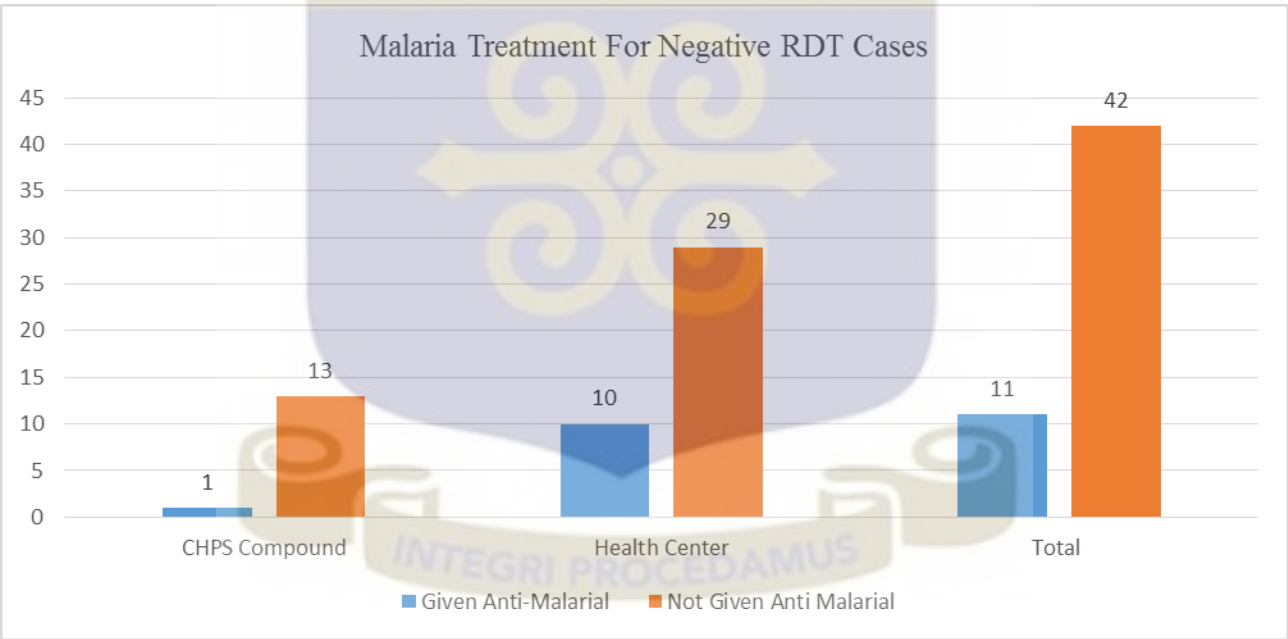
Figure 2: Results of Patients Tested Using Malaria Rapid Diagnostic Test



From figure 3, for the three CHPS compounds, 7.14% (1/14) received anti-malaria treatment although they had a negative test result and 92.86% (13/14) patients who tested negative received no anti-malarial treatment. In the case of the three health centres, 25.64% (10/39) were treated for malaria although the test result was negative and 74.36% (29/39) of patients who tested negative were not treated for malaria.

For the total CHPS Compounds and Health Centres, Anti-Malarials were given to 20.75% (11/53) patients who tested negative to the RDT result, while 79.25% (42/53) patients who tested negative were not treated for malaria.

Figure 3: Treatment given to patients who tested negative to RDT



4. 3 Qualitative Results

4.3.1 Background of IDI Participants

Table 6: Demographic Details of IDI Participants

Variable	Frequency (N=14)	Percentage
Type of facility participants works with		
Health Center	9	35.71
CHPS Compound	5	64.29
Sex		
Female	9	64.29
Male	5	35.71
Cadre of health workers		
Community Health Nurse	1	7.14
Community Health Officer	1	7.14
Enrolled Nurse	5	35.71
Physician Assistant	1	7.14
Principal Midwifery Officer	1	7.14
Senior Midwifery Officer	1	7.14
Senior Staff Nurse	1	7.14
Staff Community Health Nurse	1	7.14
Staff Nurse	2	14.29
Duration Working At Current Position		
1 year	2	14.29
2 years	3	21.43
3 years	2	14.29
4 years	4	28.57
6 months	2	14.29
7 years	1	7.14
Whether trained in the use of RDT		
No	3	21.43
Yes	11	78.57

Participants for the in-depth interview were purposively selected from nine different health facilities in the district. Participants were selected from all the five sub-districts. For some facilities, more than one person was interviewed in order to get views from different cadres of

health personnel. CHPS compound participants were 35.71% and 64.29% were selected from Health Centres. Males were 35.71% whiles 64.29% were females.

With regards to cadres of health workers interviewed 14.29% of the participants interviewed were staff nurses and 35.71% enrolled nurses. The other positions were made up of Community Health Nurse, Community Health Officer, Physician Assistant, Principal Midwifery Officer, Senior Midwifery Officer, Senior Staff Nurse and Staff Community Health Nurse had a 7.14% each.

Although all the staff can test and treat for malaria, not all had received training in the use of RDT. Those who had received training in the use of RDT were 78.57% whiles 21.43% had received no training but learnt on the job.

4.4. Themes influencing health workers experiences and perceptions of MRDT

Analysis of health workers' in-depth interview transcripts identified a number of perceptions regarding the Rapid Diagnostic Test. These were grouped into four thematic areas: perception: logic of testing, perception: RDT, perception: RDT kit, and perception: early detection of the malaria parasite. Details are provided below.

Perception (logic of testing)

The logic guiding RDT use differed from one health professional to another. The first factor which was identified had to do with compliance with the national policy on testing before treatment. Most of the CHPS compound staff stressed on that fact. The following quotes illustrate that.

> *…it is a guideline we are following, the policy says test before treating so, so far as the client has come and shown the symptoms you have to test* [CHN, CHPS compound].

> *The policy is saying you should test and treat. So far as the test has shown to be negative, you will not treat for malaria but other conditions and we have tried and it is getting us good results* [CHO, CHPS compound].

However generally, it was mainly the symptoms presented by the patients that guided the use of RDT, some of which included fever, headache, chills and vomiting and diarrhoea, especially among children under five years. The most frequent symptom identified was fever. One community nurse stated:

> *If the sign shows to be malaria then we test malaria with the RDT before we can treat. There are some cases like someone comes with a wound and doesn't show any sign of malaria so we don't test* [Enrolled nurse, HC].

Nevertheless, there was a tendency to use RDTs routinely once they were available. This can be seen from the quote below

> *Actually, where we are, we know our cases are more or less malaria, we are in a malaria prone zone...sometimes when they come in with a wound, we try to do the RDT and sometimes it comes out positive. So any case that comes we try to do the RDT not only when you are complaining of malaria symptoms* [CHO, CHPS compound].

The health workers in all the facilities admitted the introduction of the malaria RDT had made their work so much easy. Once the person shows signs of malaria they test and treat accordingly. There is no need to probe to find other causes once it is positive. Below are quotations to show that.

> *It has been helping us a lot because we don't have a medical assistant or doctor around so it help us with the diagnosis* [Enrolled Nurse, HC].

> *RDT is very very good because it makes the work very easy for you, when the person comes and you suspect malaria when you check when it's positive you just treat the person and you are free, you don't have to probe and probe and probe whether it's malaria or not* [CHN, CHPS compound].

> *It's helping us pinpoint the malaria cases and its help us give the right treatment to the patient* [Enrolled Nurse, HC].

> *...it has helped us as a whole as a health service to realise that the number of malaria cases we were diagnosing at first was not actually all malaria and so now the rate at which the disease is occurring is coming down a bit* [Physician Assistant, HC].

Aside making their work easier it has also helped increase their confidence in treating malaria. It has also made them look like professionals in the sight of the patients this was admitted by a community health officer. In the remote areas, people usually use the services of quack doctors and by using the RDT to test before treatment it gives the perception that they are professionals who know what they are about as compared to the quack doctors.

> *It has also helped show we are professionals. Sometimes I go for home visits, those quack doctors don't test before treating so when they see am testing, they say no, this is the right thing am doing* [CHO, CHPS Compound].

In addition to the above, some admitted it challenges them to read more to know other alternate diagnoses as well as help give a true picture of the malaria burden. Below is a quote by a physician assistant,

> *It helps us to think broader, I wouldn't have to sit in my consulting room and the nurses and all the staff wouldn't have to go malaria, malaria, malaria. Now they like to learn about the other conditions, those ones, the silent ones like pneumonia were also killing especially the kids but we were not seeing them because we were always going for malaria* [Physician Assistant, HC].

Perceptions: about RDT

Health personnel identified human factors that may influence negative test results. Factors such as drawing inadequate blood, not waiting long enough to read result and the amount of buffer used. A Physician assistant summed it up by saying:

> *I wouldn't say a challenge with the kit, I would say probably with the people who do it, with the volume of blood they have to take, the volume of the buffer they have to add. Those ones affect it that much. And then sometimes too how people read is also another challenge. The line might be somehow faint so if they can't see, they just write negative there. I think those are the major challenges I've found* [Physician assistant, HC].

His view was supported by another Midwife at a health centre who said the following,

> *There are times we are in a hurry so that initially we thought it is negative but afterwards when the result is left for a while, about twenty minutes we see that it becomes positive. It is the timing.*

Although on the whole the RDT was seen as beneficial, one enrolled nurse was of the view that aside being beneficial it can also affect the perception people have about the facility. This usually occurs if they are to refer every negative test case. Below is what she said:

> *It doesn't make our work that effective, because when they come you have to refer, when they come you have to refer and with this, you will see, they will lose confidence in us* [Enrolled nurse, HC].

Perception About RDT kit

With regards to the perception about the RDT kit currently being used, some staff recommended the need for an additional container with a buffer since there were instances that the added buffer received had dried up.

In addition to the above, the gloves inside the testing kit were very light. Another had to do with the pin used for pricking the finger. Requested the pin should be such that it would not be visible so it can easily be used on children. Below is a quote from an enrolled nurse to buttress her point.

> *There used to be this needle that you don't see but you prick after you prick you see there is a needle prick but you don't see the needle. I would have preferred those needles to the needle that comes with the RDT for the kids. Sometimes they give you a tough time* [Enrolled nurse, HC].

Also, there was a preference for all the kit to be packaged such that once you pick a kit, it contains everything you need for just one test rather than separating them.

> *I don't like this brand, the first brand was ok, they packaged everything, but with this one, you have to look for your pipette and other stuff* [Enrolled nurse, HC].

Perception: early detection of malaria parasite

Most of the participants were of the view that there were instances that the RDT will not be able to detect the malaria parasite. Cited a number of instances where the RDT had come out negative but after retesting after some days in turns out negative.

In some cases too, the result will be negative and after going in for microscopy it turns out positive.

> *…me myself I have experienced that before. I used the RDT twice but it was negative but when I went to the lab and they did the microscopy it was plus plus* [CHO, CHPS compound].
>
> *This RDT detects only the falciparum but we have other types of malaria so perhaps the person is showing the other types* [Staff community health nurse, CHPS compound].
>
> *We have been having the notion that at times it doesn't pick the malaria MPs so I don't know if that is true, there are times when a person presents symptoms of malaria and you test and it is negative so I tell you at times this kit doesn't pick so go to the lab, I don't know if it is the right thing but that is what we do* [Enrolled nurse, HC].
>
> *We were made to know that at early stages sometimes you can check and the sample that you pick, it will not contain the parasite so it will read negative so at that stage you don't treat or give anti malarial* [CHO, CHPS compound].

Another reason cited by participants was that sometimes patients take in anti-malaria drugs before coming to the facility and this affects the results of the test.

> *Some people will be taking drugs before coming…so once you test it will be negative* [CHN, CHPS compound].

4.5 Reasons accounting for adherence or non-adherence to RDT results

Two broad themes were identified from the various transcriptions with regards to factors accounting for adherence or non-adherence to RDT results. These are confidence in RDT results and constraint: what to do

Confidence in RDT results

All the staff interviewed had confidence in a positive test result and treated for malaria when the test turned out to be positive. However, there were mixed responses with regards to the accuracy of a negative test result especially in cases where the person shows signs and symptoms of malaria.

Below are quotations to show their level of confidence in test results:

> *When you come with the complains of malaria, and I test for malaria and it is positive that is when I have confidence but at times they show signs and you test and it is negative, and if you go to the laboratory you test and it is positive* [Enrolled nurse, HC].

> *...sometimes we don't believe (the results) that is why we refer the person* [Principal midwifery officer, HC].

> *...Ok 50-50 because there are times where you do RDT, it negative but the moment you treat malaria the person is ok* [Enrolled Nurse, HC].

Constraint: what to do

In instances where patients test negative, they were divergent views with regards to what must be done. Most admitted they gave patients some analgesic and medication for other underlying conditions, in such cases patients were asked to go home and come after some days if the condition gets worse. They cited instances where patients had come back and retesting showed they had malaria. Below are quotes on what is done generally.

> *When someone comes and is complaining of vomiting we check and see if it is RDT positive, if it is positive we treat if not then we have to treat only vomiting* [Enrolled nurse, HC].

> *...so you tell the client that you know this early stage it couldn't pick the parasite so it will read negative so you manage the signs and symptoms so that she goes and later when she feels other complication or when she's having more symptoms she should come for retesting* [CHN, CHPS compound].

> *…when you come with the complains of malaria, and I test for malaria and it is positive that is when I have confidence but at times they show signs and you test and it is negative, and if you go to the laboratory and you test it is positive* [Enrolled nurse, HC].

The workers from the health centres generally said they will refer the person to another facility for microscopy in cases where the results are negative but the person shows signs and symptoms of malaria.

One cited an instance where the patient didn't come after some days. Met the person later in the community and the person was really sick. Re-testing showed it was positive. Although for the CHPs compound they may not trust the results of negative RDTs they would rather prefer to wait to get a positive result before they treat. It was only one person who said he will treat only if he has consulted a health staff higher than him and the one has given him the go ahead to treat. Below is what was said:

> *If it is negative, I will have to call the medical assistant so she will give me the guidelines whether I should treat or I should do other diagnosis or ask further questions* [CHO, CHPS compound].

For the health centres, patients were likely to be treated for malaria in cases where the results are negative but the person shows clear signs and symptoms of malaria or when upon further probing, no underlying condition is found. One clinician made this point:

> *The client will come maybe fever very high and then will be presenting with chills and sometimes with night sweat, headache and then probably some of them will even be having some kind of psychosis and then you do the RDT and then RDT is negative and then as a clinician you try asking so many questions to rule out any other diseases conditions and you find out that you are not getting any positive to treat and so you just have to go ahead and treat* [Physician Assistant, HC].

Participants from the CHPS compound all agreed that negative results should not be treated. They were of the view that patients who test negative should be treated for other under underlying conditions and made to go home and return if it gets worse for retesting.

4.6 Factors affecting the implementation of the use of RDT by health workers

Implementation challenges: supply issues and shortages

The problem of implementation appears to have nothing to do with usage of the malaria RDT as a working tool in health facilities since most health workers perceived it to be very beneficial to health centres and were using it.

The main implementation challenge had to do with shortages with the RDT kit and adhering to negative test result. The later has already been discussed in the previous section. With the exception of three facilities all the other staff admitted they had experienced shortages within the past two years. Below are some quotes:

> *Yes there are those cases where you don't have the RDTs, you go to the district and sub district and you are not getting any, so the policy says that when you exhaust all these means then you can fall on the signs and symptoms, then you treat malaria* [CHN, CHPS compound].

> *I think is this year, about one getting to two months there was no RDT in the system so it means for that short period you would see that malaria cases are going to rise because whenever the client comes in and you are not sure you want to be on the safer side so probably you would want to add some antimalarial to it* [Physician Assistant, HC].

The District Health Directorate supplies the RDT kit to the various facilities. For the CHPS compounds they can also get supply of the kit from their sub district. In instances of shortages, they can get some from their sub district or the nearest compound. Personnel cited an instance were a faulty kit was supplied but that batch was recalled when a problem was identified and since then it has not happened again.

CHAPTER FIVE

DISCUSSION

5.1 Type of diagnosis

There are generally two main methods used to diagnose malaria. Symptomatic is the most common and usually used at places where there were no laboratory facilities or trained personnel to take blood samples and test for malaria. The other is testing of which there are different types. Testing is a preferred choice because it gives a true picture of the malaria situation and ensures anti-malarial gets to those who really need it.

The health facilities accessed in Agona East District, as much as 96.13% of the cases were tested with RDT before treatment for malaria. This figure is much higher than the national testing rate where the percentage of OPD cases that got tested before receiving treatment for malaria was 74.3% as at 2014 (Ghana Health Service 2014 Annual Report, 2015). It is also higher than that of the Africa sub-region which has a testing rate of 64% as cited by Ochodo, Garner & Sinclair (2016).

The general agreement among health workers about the usefulness of the RDT as a working tool shows an endorsement of testing before treatment. According to Hansen et al, (2015) studies done in Asia and Africa have shown that the advantages of using RDT outweigh that of presumptive diagnosis and RDT when used under field conditions perform just as light microscopy or even better.

5.2 Treatment for negative results

From the study, 20.75% of patients who tested negative were still treated for malaria. This figure is lower compared to a study by Manyando et al, (2010) on health workers in Zambia where two out of three children were prescribed anti-malarial in spite of a negative test result. It also contradicts a study by Chandler et al, (2010) in rural facilities in Ghana, which revealed that 45.5% of patients who tested negative were treated for malaria. A reason for this disparity may be as a result of the time these studies were conducted. Both studies were conducted at a time when the policy of testing before treatment had just been accepted in many countries. According to Mubi et al, (2013) a decrease in anti-malaria prescription in instances where the patient tests negative may be an indication of acceptance of RDT as a working tool as well as a sign of adequate training in its usage.

5.3 Perceptions and experience about RDT

Health workers were of the view that the testing kit had not only made their work easy but has also increased their confidence in the diagnosis of malaria. Asiimwe et al, (2013) did a study on health workers perception on health facilities in Uganda and showed that RDT served as an empowerment tool for health workers and helped them make diagnosis which they felt was reliable as compared to using their judgment.

Health workers in this study identified human factors such as not drawing adequate blood, amount of buffer added, hurriedly reading results and self-medication as factors affecting RDT results. This was confirmed by Uzochukwu et al, (2013) in a study of Health workers behavior in Southeastern Nigeria where they found that inadequate blood volume and timing in relation to reading the result reduced sensitivity of the test.

Health workers were of the view that there are instances where the RDT was not able to detect the parasites. A study by Mcmorrow et al, (2011) attest to this assertion, that the HRP2 test based RDT kit are very sensitive to *p. falciparum* parasite loads above 100-200/µL parasites and currently does not detect parasites below this density.

According to Miller and Sikes (2015), 22% of patient have acute fever although their parasite density is below 200/µL which is the standard parasite density an RDT should be able to detect before an endorsement can be given by WHO.

5.4 Reasons for adherence and non-adherence

Health workers confirmed they had confidence in positive RDT results and were therefore likely to treat if it turns out positive. There was non-adherence to negative test results. The main reasons accounting for this were, lack of confidence in results and the RDT not being able to detect the parasite during the early stages. Health workers therefore treated for malaria in some negative cases, or referred the person for microscopy when in doubt or treated the symptoms patients' presents. This finding is similar to one done by Febir et al, (2015) where health workers lacked trust in negative results and therefore treated with ACT. According to Mubi et al, (2013) the right training and equipping health personnel with the capacity to diagnose other conditions play a crucial role in adherence to test results.

5.5 Implementation Challenges-supply/stock outs

A number of participants cited instances where the buffer they received had dried up, this can have implications on the results obtained. According to Bastiaens et al, (2014) the way RDTs are stored can affect their performance, factors such as humidity and high temperature can damage

the RDT. There is therefore the need for measures to be in place to ensure manufacturer instructions are followed throughout the supply chain.

Some of the challenges identified in the use of RDT were that it causes long queues. However, the health centres did not really face such challenge. One facility had developed a system whereby once a person comes and shows signs of malaria, the person is first tested before coming to see the nurse so that by the time it is his turn, the results would have been ready.

A number of studies have identified shortages of RDT as factors affecting implementation of the test before treatment Policy. A study in Mozambique by Hasselback et al, (2014) showed that, on the average, the health centres studied experienced 50% stock out of RDT within the eight month period of the study. The district Health Directorate has no storage facilities so they distribute the RDT upon receiving it. Some health facilities had never experienced shortage however some had experienced it in the past year.

The CHPS compound usually gets their RDTS from their sub-districts. When faced with shortages they sometimes borrow some from the nearest health facilities. There is the need for sustained supply of RDT to prevent presumptive diagnoses and treatment.

Limitations

For some facilities, information for children under five years of age with malaria were only recorded in the children's weighing book which is kept by the parent making it impossible to identify the kind of treatment given. In such instances where there was no record for treating the child, there was a replacement with the next case.

The study was also conducted at a time when community health nurses were on national strike. However this did not affect the study since some community health nurses were interviewed.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Testing rates in the district was much higher compared to the National testing rate as at 2014. Also, the proportion of patients who tested negative but received treatment for malaria was on the low side with health centres much more likely to treat as compared to CHPS compounds.

On the whole, health workers viewed the RDT as a very useful tool which has made work easier however some lacked confidence in negative results although generally there was confidence in positive results. In cases where the results are negative, they are likely to treat for malaria, refer for microscopy, or treat the underlying conditions.

The major implementation challenge identified was shortages of RDT kit however this was not the case in some of the health facilities.

6.2 Recommendations

Based on this study, recommendations are focused at three different levels; National, District and health facility and community.

National level

1. Efforts must be made to ensure availability and sustenance of diagnostics and logistics required for testing for malaria to enhance effective and targeted case management.
2. RDT kits used should be such that results will be a true verification of patient's condition. Efforts must be made to ensure RDTs used are of good quality and manufacturer's instructions are followed, this will help give accurate test results.

3. Some of the CHPS compounds visited are located in very remote areas and people walk long distances to visit these facilities. Asking patients who test negative to go and come back can be detrimental to their health. CHOs and CHNs must receive frequent training on additional diagnosis for negative cases.

The above recommendations can be implemented by the Ghana Health Service and the Malaria Control Program.

District level

Some health staff had never received training on the use of RDT. There is a need for training and refresher training on the use of RDT for health workers, especially those who diagnose and treat malaria. The directorate can organise training and retraining sessions as and when appropriate.

Health Facility and Community level

Community health outreach programs organized by the directorate must also be targeted at education on RDTs so community members can accept negative results, be honest about treatment they have already had when they report to the health facilities as well as go for referrals if need be.

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APPENDICES

Appendix One: Interview Guide Form

UNIVERSITY OF GHANA, LEGON

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF SOCIAL AND BEHAVOURIAL SCIENCE

INTERVIEW GUIDE FOR HEALTH WORKERS

Use of Rapid Diagnostic Tests for detecting malaria infection and service providers' perceptions and adherence to test results at health facilities in the Agona East District of the Central Region

1. Sex:
2. Highest Training Qualification:
3. Current Position:
4. How long have occupied this position:
5. Have you ever received training on RDT?
6. If yes, when was that?
7. How long was the training?
8. Do you prescribe medication?
9. Which brand of kit is usually used for diagnosing malaria?

Perception

10. Is the rapid diagnostic kit easy to use?
11. Do you have confidence in RDT results?
12. What is your view about the policy of testing before treatment of malaria

Adherence

13. Have there been situations where you have prescribed antimalarial to patients who tested negative to RDT? If yes can you talk about it?

14. Do patients sometimes ask you to prescribe antimalarial even though the results of RDT are negative?

15. Are you willing to test a person for malaria and provide anti-malarial based on the results.

16. What are some of the challenges preventing you from testing before treatment?

17. What do you usually do if the results are negative but the person shows clear symptoms of malaria?

Implementation Challenges

18. What are some of the challenges faced when using the rapid diagnostic test?

19. What steps must your facility take to have RDT kits and how difficult or easy are these steps?

20. Have you experienced any RDT supply issues like shortages within the past six months?

Appendix Two: Information Sheet

UNIVERSITY OF GHANA, LEGON

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF SOCIAL AND BEHAVOURIAL SCIENCE

Topic: Use of Rapid Diagnostic Tests in detecting malaria infections and health worker' perceptions and adherence to test results at health facilities in the Agona East District of the Central Region

INFORMATION SHEET

I am Selina Ansah-Koi a Master of Public Health Student of the University of Ghana, Legon. I am doing a research on adherence to rapid diagnostic test results and implementation challenges with regards to use of rapid Diagnostic test in health facilities within the Agona East district of Central Region of Ghana.

I will like to get your view on this area. This session will be digitally recorded and kept for a period of two years after which all information will be deleted.

If you need any clarification or further information please let me know. This interview should not take more than an hour and half of your time.

Appendix Three: Consent Form

CONSENT FORM

Researcher: Selina Ansah-Koi

Contact: maakobe@gmail.com

Telephone: 0267160797

Please Initial Box

Interview will be audio recorded and transcribed at the same time	☐
I confirm that I have read and understood the information sheet above and I have had the opportunity to ask questions	☐
I understand that my participation is voluntary and I am free to withdraw at any time	☐
I agree to take part in the above study	☐
I agree to the use of anonymized quotes in the publication	☐

…….	…….	…….
Name of Participant	Date	Signature
…….	…….	…….
Name of Researcher	Date	Signature