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UNIVERSITY OF THE WITWATERSRAND, FACULTY OF HEALTH SCIENCES

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(IMPLEMENTATION SCIENCE)

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TITLE:

ACCEPTABILITY OF MALARIA RAPID DIAGNOSTIC TEST AMONG HEALTH WORKERS IN KINTAMPO NORTH MUNICIPALITY, GHANA

MICHAEL ANABA

STUDENT NUMBER: 1314614

SUPERVISORS:

DR. LATIFAT IBISOMI

(UNIVERSITY OF WITWATERSRAND, SCHOOL OF PUBLIC HELTH)

PROF. SETH OWUSU –AGYEI

(UNIVERSITY OF HEALTH & ALLIED SCIENCES, HO- GHANA)

NOVEMBER 2017

DECLARATION

I, Michael Kurubire Anaba declare that this thesis is my own, unaided work. It is being submitted for the Degree of MSc Epidemiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



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(Signature of Candidate)

15 day of November, 2017 in Johannesburg

ABSTRACT

Background: Research suggests that treatment of malaria is not evidenced based resulting in malaria parasites becoming resistant to antimalarial drugs. WHO recommends a malaria rapid diagnostic test (mRDT) for implementing the policy of test-based management of malaria to avoid inaccurate diagnosis and misuse of antimalarial drugs. Ghana adopted the "Test-Before-Treat" guideline to facilitate the diagnosis for malaria with mRDT. However, Health Workers (HWs) still treat half of febrile patients with negative malaria results with antimalarial drugs suggesting limited or lack of acceptability of the intervention. This study sought to measure the level of mRDT acceptability and examine its associated determinants among HWs in the Kintampo North Municipality (KNM) of Ghana.

Methods: This study employed a cross-sectional study design from February to April, 2017. Data on mRDT acceptability, its determinants and user characteristics were collected from 110 HWs in KNM involved in malaria management. The survey tool was based on two frameworks – the Technology Acceptance Model (TAM) and Normalization Process Theory (NPT). The latter proposed coherence, collective action, cognitive participation and reflexive monitoring as determinants for the implementation of the health intervention. A composite acceptability score was computed from a 21-item questionnaire for each respondent. Composite scores were also computed for the key determinants as well as median and inter-quartile ranges. The respondents were divided into three equal groups (tertiles) for ordered logistic regression to examine the relationship between acceptability and its determinants.

Results: The median acceptability score was 84 with interquartile range of 68-103. About 34% of HWs were in the low acceptability tertile, while 37% and 29% were in the moderate and high acceptability tertiles respectively. In the unadjusted model, determinants relating to each of the constructs of the adapted conceptual framework were identified, with a the clarity

over the scope and boundaries of mRDT (coherence); variable investment in mRDT (cognitive participation); availability of resources, skills and training to deliver mRDT (collective action), improved reflection and feedback on the HW role in mRDT implementation and its impact (reflexive monitoring), rural HWs and HWs with three and above years' experience positively influenced acceptability of mRDT. In the adjusted model, improved coherence, cognitive participation, working in rural facilities, community health officers and HWs with three and above years of experience were associated with high acceptability of mRDT. Whilst improved reflexive monitoring negatively influenced acceptability of mRDT.

Conclusion: To successfully implement mRDT for test based management of malaria, HWs need to be equipped, resourced individually as well as the social or organizational context within which they work. In addition, programme implementers and policy makers must consider the roles of HWs and the how mRDT fit with their existing skill-sets. Furthermore, supervision and technical support of HWs is essential to facilitate transition to test based management with mRDT.

DEDICATION

To God Almighty for His amazing grace and my mother, the Late Christiana Asigre. Mr. Dennis Naaba my father, Matilda Anaba my sister and Eric Anaba my brother for their support during the hard time.

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LIST OF ABBREVIATIONS

ACT: Artemisinin-Based Combination Therapy

AOR: Adjusted Odds Ratio

CHO: Community Health Officer

CHPS: Community-Based Health Planning and Services

CHV: Community Health Volunteer

FIND: Foundation for Innovative New Diagnostics

HIV: Human Immuno-deficiency Virus

HREC: Human Research Ethic Committee

HW: Health Worker

HWE: Health Worker Experience

KNM: Kintampo North Municipality

IQR: Interquartile Range

IMCI: Integrated Management of Childhood Illness

MRDT: Malaria Rapid Diagnostic Test

NHIA: National Health Insurance Authority

NHIS: National Health Insurance Scheme

NMCP: National Malaria Control Programme

NPT: Normalization Process Theory

TAM: Technology Acceptance Model

USAID: United States Agency for International Development

UAOR: Unadjusted Odds Ratio

WHO: World Health Organization

DEFINITION OF TERMS

Acceptability: It refers to how mRDT is in congruence with values, beliefs or practices of the Health Worker (HW).

Health Workers: This refers to physician assistants, nurses, midwives, laboratory technologists and community health officers involved in diagnosis and management of malaria.

Private Health Facility: This refers to a non-governmental facility professionally licensed and regulated to provide of health services**.**

Public Health Facility: This refers to a governmental facility professionally licensed and regulated to provide of health services.

Malaria Rapid Diagnostic Test: It is a health technology that detects malaria parasites with little amount of blood. Blood for the test is commonly obtained from a finger-prick and results are available within 15-30 minutes.

Coherence: It is the sense-making work or activities implemented to support HWs individually and collectively when they are faced with the problem of operationalizing mRDT.

Cognitive Participation: It is the relational work that enables HWs to build and sustain a community of practice around mRDT.

Collective Action: This refers to the operational work or activities implemented to enact mRDT, whether this represents a new technology or complex healthcare intervention**.**

Reflexive Monitoring: It is the appraisal work to assess and understand how the use of mRDT affects HWs and those around them.

Ease of use: It refers to the degree to which a HWs believe that using mRDT would be free of effort.

Perceived Usefulness: The degree to which a HW believes that using an mRDT would enhance his or her job performance.

Intention to Use: It refers to a HW's perceived likelihood of using mRDT.

Community-Based Health Planning Sites: It refers to an approved structure consisting of a service delivery point and accommodation complex to support the delivery of a basic package of essential health services towards attaining Universal Health Coverage and managed by usually two to three CHOs and CHVs.

Community Health Officer: A trained and oriented community HW in a CHPS.

Community Health Volunteers: These are non-salaried community members who are identified and trained in supporting CHOs in a community.

CHAPTER ONE: INTRODUCTION

This chapter provides a background on the global burden of malaria and the situation in Ghana. It discusses why acceptability as an implementation outcome is critical in the successful implementation of mRDTs. It also defines key concepts around acceptability of mRDTs and identifies a gap in the existing literature on the acceptability of malaria rapid diagnoses tests among HWs. Finally, it presents the conceptual framework used for the study.

1.1 BACKGROUND

Forty percent of the global population is at risk of malaria and the majority of this percentage resides in developing countries(1). The disease is found throughout the tropical and subtropical regions of the globe and causes more than 300 million acute illnesses and at least one million deaths annually(1). According to the World Health Organization (WHO) report in 2016, there were 212 million new cases of malaria in 2015. The African continent accounted for 90% of the recorded number of malaria cases(2). In 2015, there was an estimated 429,000 malaria deaths worldwide(2). Ninety two percent of malaria related mortality is from the African continent (2).

The WHO recommends parasitological confirmation for all suspected malaria cases before antimalarial drug is administered(2). Malaria Rapid Diagnostic Tests (mRDTs) have the potential to greatly improve the quality of management of malaria infections, especially in remote areas with limited access to good quality microscopy services (2). Also evidence from other endemic sub-Saharan African settings suggests between 10 and 80% of malaria-negative patients are prescribed antimalarial drugs(6). This indicates variable and often poor providers' compliance with the test-before treat guideline. The approach however leads to the over-diagnosis of malaria and the overuse of antimalarials, with attendant development of strains of the parasites that are resistant to previously-used antimalarials(7).

According to the Ghana Health Service health facility data, malaria is the number one cause of morbidity and mortality in children under five years of age, accounting for 33% of hospital deaths, 38% of all outpatient illnesses and 36% of all admissions in the country(8). Malaria transmission in Ghana is endemic and mostly uninterrupted, with peaks in the rainy seasons. The entire population of over 24 million is at risk of infection year round (7). Over three million cases were reported in 2013, accounting for 38% of all outpatient illnesses and 36% of hospital admissions. . Early, accurate diagnosis and treatment with a recommended antimalarial drug combination is a key component of malaria control efforts(2).

Recently, other malaria control programs outcomes in Ghana have improved, however progress towards providing correct diagnosis to all suspected malaria cases and prompt and effective treatment to 100% of confirmed malaria cases in accordance to treatment guidelines by 2020 has been slow (9). Though the country has implemented the "Test-Before-Treat" guideline for malaria with mRDT to facilitate diagnosis. However, Health Workers (HWs) still treat half of febrile patients with antimalarial drugs despite negative malaria results suggesting limited or a lack of acceptance of the intervention(10). Several implementation factors such as healthcare delivery constraints, provider perceptions, social dynamics of care delivery and limited provider engagement in policy processes can inhibit the quality of implementation of health interventions(7).

1.2 PROBLEM STATEMENT

Ghana National Malaria Control Programme (NMCP) provided mRDTs and trained HWs on their usage in order to ensure access to malaria testing of all suspected cases at both public and private health facilities(11). Behaviour Change Communication activities were also

implemented to scale up acceptability and improve service delivery among HWs (12). Despite the strength of the evidence in mRDT and huge investment by donors and the Government of Ghana, half of febrile patients still receive malaria treatment with negative malaria rapid diagnostic tests (10). This suggests limited or a lack of acceptability of the intervention. Since the lack of acceptability is considered a major impediment to successful implementation(13), this study investigated factors affecting acceptability of mRDT among HWs in Kintampo North Municipality (KNM), Ghana.

1.3 JUSTIFICATION

Understanding the acceptability of mRDT among HWs provided a picture of how rapid diagnostic test (RDT)-based management of malaria is understood and practiced which is essential for the successful implementation of a universal rule of 'test and treat'(14). It also highlighted the context specific determinants affecting acceptability of mRDT amongst HWs in KNM. Furthermore, improving access to prompt malaria testing has fared sub-optimally compared to other malaria control interventions, therefore strengthening diagnosis and treatment in all settings would help to reduce malaria morbidity and mortality(2). This study contributes to the existing literature on factors affecting acceptability of mRDT. It provides a foundation for designing and implementing quality improvement strategies to improve the acceptability of mRDT amongst HWs. This research also provides an opportunity to reduce the emergence of drug resistance by reserving antimalarial drugs for those who have the disease.

Acceptability is dynamic and one of the key outcomes affecting implementation(15). mRDT acceptability among HWs needs to be promoted to have an impact on malarial diagnosis and treatment(2). In order to achieve and maintain confidence in mRDT-based diagnoses, a good quality assurance system must be in place(2). This study advanced this agenda by adapting the Technology Acceptance Model which proposes three constructs essential for measuring

health technology acceptance(16) as there is limited use of implementation science frameworks to evaluate implementation of mRDT and similar evidenced based interventions in general despite the field becoming increasingly popular among policy makers, stakeholders and practitioners in low- and middle-income settings. The study further highlighted organizational and individual factors and a range of other factors that need to be considered when implementing a health technology like mRDT.

This study identified factors that facilitated and hindered implementation of mRDT; it identified gaps in the literature and highlighted directions for future research on the implementation of similar health interventions.

1.4 RESEARCH QUESTION, AIM AND OBJECTIVES

1.4.1 RESEARCH QUESTION

What are the determinants of mRDT acceptability among HWs in Kintampo North Municipality, Ghana?

1.4.2 AIM

To identify determinants of mRDT acceptability among HWs in Kintampo North Municipality, Ghana.

1.4.3 SPECIFIC OBJECTIVES

To measure the level of acceptability of mRDT among HWs in Kintampo North Municipality, Ghana.

To describe determinants of mRDT acceptability among HWs in Kintampo North Municipality, Ghana.

To examine the relationship between the determinants and acceptability of mRDT among HWs in Kintampo North Municipality, Ghana.

1.5 LITERATURE REVIEW

In this section, the determinants of acceptability of mRDT amongst HWs is discussed. Furthermore, the conceptual framework which this research was based on is presented. The determinants of mRDT acceptability among HWs discussed here are grouped under the constructs of the Normalization Process Theory (NPT) adapted as the conceptual framework for this study. This framework is a conceptual tool intended to assist in understanding the factors that affect implementation processes of health interventions. The constructs include coherence, cognitive participation, collective action and reflexive monitoring(17). Other factors identified in the literature were classified under these four constructs. The framework was adapted to include respondents' characteristics that might influence the acceptability of mRDT amongst HWs. The Technology Acceptance Model (TAM) was adapted to measure the acceptability of mRDT. According to this model the measure of acceptability of health technology is guided by three key constructs; ease of use of the technology, perceived usefulness and intention to use the health technology(18). This model posits that if a health technology is easy to use, perceived to be useful and end-users express an intention to use, it is acceptable (18).

1.5.1 IMPLEMENTATION OUTCOMES

Implementation Research is the scientific study of the challenges affecting implementation of evidenced based interventions. Implementation researches have argued that effective implementation leads to improved programme outcomes(19). Therefore, to evaluate the quality of implementation, one must assess implementation outcomes(15). Implementation outcomes are the effects of deliberate and purposive actions to implement new treatments, practices and services(15). In addition, they serve as parameters of implementation success and very important intermediate outcomes to programme outcomes(15).

Proctor et al, described eight implementation outcomes: acceptability, feasibility, penetration, adoption, cost, fidelity, appropriateness and sustainability(15). This study will focus on acceptability, in relation to the implementation of malaria rapid diagnostic tests. Acceptability is considered as the perception among end users that a given health intervention, service or innovation is in congruence with the their beliefs, values and practices (15). It could be assessed from the perspective of the provider as well as the consumer, and at different stages of implementation (early, during or later in implementation) (15).

1.5.2 IMPLEMENTATION OF MALARIA RAPID DIAGNOSTIC TEST

In 2013, Ghana adopted the WHO's recommendation and developed guidelines for the implementation of mRDT diagnosis approach by updating the 2009 malaria case management guidelines(20). HWs at various levels of the health system received training on the mRDT diagnosis approach of the new malaria case management. The mRDT is for the clinical diagnosis of all suspected cases of malaria in health centers that lack laboratory facilities. This new approach helps to reduce the emergence and spread of drug resistance by reserving antimalarial drugs for those who actually have the disease(21).

However, reports have shown that in Ghana, the probability of fever that could be attributed to malaria was as high as 67%(14). It has also been reported that in Ghana 73% of children were presumptively diagnosed and treated for malaria(22). Furthermore, half of febrile patients with negative mRDT results still receive antimalarial drugs suggesting limited or lack of acceptability of the intervention(10). As such, the implementation of mRDT can be said to be sub-optimal and still lagging behind with regards to the National Malaria Control Programme(NMCP) target to provide correct diagnosis to all suspected malaria cases and prompt and effective treatment to 100% of confirmed malaria cases in accordance to treatment guidelines by 2020 (9).

1.5.3 ACCEPTABILITY OF MRDT AMONG HWS

1.5.3.1 Ease of use

This construct looks at the capability of the HW to perform the test, interpret the results and comply with the treatment guidelines. It assesses HWs feelings of whether the test is conducted conveniently. A study reported that HWs, especially the elderly, reported that it was difficult to see the test marks and the control lines in poor light and that they did not know what to prescribe for negative results, hence their reluctance to diagnose patients using the mRDT(23). Another study found that the pipette of mRDT proved difficult for use by some HWs because they lacked the skill to accurately pipette 5 µl of blood(23). Common errors and challenges such as incorrect drops of buffer, forgetting to clean the patient's finger with an alcohol swab before conducting the test, reading the test results at incorrect time due clinic workload were reported in another study (23).

1.5.3.2 Intention to use

This construct looks at HWs readiness to carry out a blood test every time it is necessary, then comply with national treatment guidelines per the test results. In Uganda HWs indicated that mRDT posed a threat to their capacity to make individual clinical judgments, which undermined their credibility with their patients because they were compelled to offer treatment per the guideline and not their experience and contextual problems(24). A study in East Africa reported that HW perception about mRDT is that it placed additional pressure on them due to huge clinic workload and the community's demand for the new diagnostic tool affected their capability and readiness to perform the test(25). Another study indicated that patients fear pain from needle pricks and this discouraged HWs from conducting the test (26).

In addition, a study found that people who strongly believed that using health technology would help them (performance expectancy) and that effort expectancy of the tool, were more

inclined to use it in the future. On the other hand, people who did not believe in the possible advantages of health technology or believed that it would be difficult to use were less inclined to use an innovation. Another report observed that older people require special attention to improve their readiness to use new innovations because older people had either never used the health technology or believed that the technology is difficult to use(27) .Venkatesh et al. stated that social influence only plays a role in a mandatory context and that people become increasingly dependent on intervention, they will also become more open to the influence of others(27).

1.5.3.3 Perceived usefulness

This refers to HWS perception that mRDT is important for their work and that the intervention is capable of confirming the presence or absence of malaria. A study found that laboratory technologists raised concerns that mRDTs are not able to quantify malaria parasites and that very low density parasitemia could remain undetected by mRDTs(28). However, another study found that HWs were satisfied with mRDT and were enthusiastic to use the technology on a daily basis because they felt that it was a relevant tool for fever case management(29). HWs perceived mRDTs provide a sense of professionalism in healthcare and patients regarded the intervention as a symbol of improved quality care by HWs and this promoted its acceptability(26). Other HWs' perceived mRDT as delaying time to commence treatment, whilst others had doubts on the results, especially negative results, and this affected their confidence and willingness to perform the test (24).

Variations in health technology acceptance rates amongst clinicians have been reported to range between 29% and 50% in previous studies(30,31). Findings from a Ugandan study indicated that 40% of HWs indicated that they will not object administering antimalarial drugs to patients testing negative and that they have doubts about mRDTs (24). A survey of

Swedish mental health professionals that examined acceptance of health care technology found that behavioral intentions to use health technology in the clinical context was low among health professionals with 88% of participants indicating a low-to-moderate acceptance of the health technology(32).

Table 1 Summary of Literature that explain each domains of Acceptability

TAM Domain	**Sub-themes**
Ease of Use	Perceived threats mRDT poses to HWs and patients safety and comfort . Ability to comply with the test result and guidelines Common errors and challenges associated with the technology
Perceive Usefulness	Sense of professionalism that mRDT offer Confidence in the health technology Relevance of the tool in the diagnosis of malaria
Intention to Use	Self-efficacy Social influence, Performance expectancy

1.5.4 DETERMINANTS OF ACCEPTABILITY OF MRDT

1.5.4.1 Coherence

Coherence: It involves the process of sense-making and understanding what individuals and organizations have to go through in order to facilitate or inhibit the implementation of a new intervention. It also assesses whether the users of the intervention see it as differing from existing practice or have a shared view of its importance, understand how it will affect them as individuals or embrace its potential benefits(33).

In relation to mRDT, HWs acceptability of mRDT is predicted by the level of understanding of how this intervention differs from existing practices of the presumptive treatment of suspected cases of malaria. It is therefore critical that HWs have a shared view on the aims, objectives and expected benefits of the intervention(34). This construct emphasizes the need for HWs to have a clear understanding of their specific tasks and responsibilities in the implementation of the intervention as well as the necessity to understand its value and benefits (33). However, it has been found that work or preparatory activities such as policy building or dissemination of information on policy guidelines to end users in order to make sense of new health interventions have received very little attention(33).

HWs in South Africa reported that a limited clarity on the nature and scope of a health intervention jeopardized the successful implementation of an intervention(35). The study further found that the unsuccessful implementation of diagnostic tools was due to no clear distinctions of HW roles and responsibilities(35). The lack of preparatory activities such as policy building or dissemination of information on treatment guidelines were reported as reasons for HWs misconception of the essence and benefits of mRDTs in the diagnosis of suspected malaria cases(36,37). Lack of a proper understanding of the value of mRDT was also cited as a challenge to acceptability among HWs in Myanmar (38). Gallacher et al also found that improving understanding in an intervention by enhancing access to information improves the HWs value and acceptability of the health technology (39).

1.5.4.2 Cognitive participation

Cognitive participation evaluates the activities implemented to engage HWs and encourage them to “buy into” the new intervention(33). It looks at the process that people and organizations have to go through in order to lure intended users of the intervention to embrace a new practice. These processes are energized by investments of commitment made by

participants. This factor emphasizes the HWs need to "buy into" the idea of the mRDT in order for its implementation to be successful.

It is pertinent to sustain the involvement of HWs through various strategies such as providing incentives during the implementation process in order to sustain their participation(40). Incentives were found to encourage participation amongst HWs in integrating new innovation into routine practice(33). A similar study indicated that changing practices may be difficult to implement in facilities where HWs are over-stretched with work and where there is low HW motivation(41,42).

Contextual health system factors in Ghana such as increased patient inflow at hospitals made it difficult for clinicians to ask every patient to go for parasitological test with mRDT(43). In the same study, HWs interviewed were of the opinion that implementation of a National Health Insurance Scheme (NHIS) contributed to inappropriate diagnosis of malaria by some HWs for financial gains. This is because the major form of payment from the NHIS to health facilities is for the prescribed treatment(43).

HWs in Myanmar reported that their motivation for using mRDT depended on provider empowerment and improved provider-patient relationships(38). A study found that activities such as recruiting "local champions" facilitated the participation of HWs in the implementation process of a health intervention(33). Project managers are reported to have influence in the implementation of a test intervention as they provided the needed training, resources or general support during implementation(41). Another study affirmed the finding that facility managers were critical to the successful implementation of a health technology as they were responsible for key performance outcomes at health facilities where implementation is ongoing(35).

HWs reported not having appropriate resources to perform mRDT (such as the infrastructure needed to dispose of needles after conducting the test) that hindered its usage(44).

Surveys in Tanzania, Mozambique and the Democratic Republic of Congo revealed that between 50% and 62% of health facilities did not have rapid diagnostic tests in stock and even when the tests were available, HWs reverted to presumptive diagnosis due to the high clinic workload and staff shortages(45). In another study, guideline reference material including pictorial job aids for mRDT were not available at facilities to support mRDT use amongst HWs (46). The report also indicated that where job aids were available, they were not in high visibility areas and were not accompanied by the necessary communication to ensure their effective usage(47).

1.5.4.3 Collective action

This factor explains the work performed in operationalizing a new intervention. It deals with the activities implemented to enable users of an intervention enact the new practice. These processes are energized by investments of effort made by participants. It also evaluates how the intervention affects roles and responsibilities or training needs of users(48). It further involves the organizational support that HWs receive during the implementation process of the mRDT and shows whether they have confidence in the mRDT. A study in South Africa on the implementation of new diagnostic innovation revealed that the challenge in achieving collective action amongst HWs was due to long periods spent on using the health technology and this affected their acceptability of the innovation(35).

The literature has shown that several determinants of acceptability of health technologies include organizational factors such as the way new technology integrates with the existing

technology, workflow and management support(33). Another study indicated that supervision should be ensured as an operational activity since it is capable of promoting HWs competence and acceptance of an intervention(23). A study found that acceptability of a technological health instrument is influenced by positive communication and a well-designed training programme(49). Findings from the study proved that training members of organizations is essential in implementing and sustaining the intervention(49). The report further recommended that training should begin soon after intervention implementation and that stakeholders should review the manuals later in the process of implementation to ensure that challenges are addressed(49).

In Ghana, a lack of trainers trained in IMCI (Integrated Management of Childhood Illness) at district levels, trained to support HWs has been found to jeopardize successful implementation of the test based management of malaria(50). Hiennemann et al argued that adequate training before implementation of complex health technologies improves intervention acceptability among users(32). Other work reported that HWs identified training needs and high attrition rates and space constraints within clinics as day-to-day challenges for the implementation of new health technology(41). It was further highlighted that an effective clinical decision support system minimizes the effort required by clinicians to accept and use the health care technology(51).

1.5.4.4 Reflective monitoring

This the informal and formal evaluation of a new practice once it is implemented. This is done in order to scertain its pros and cons and which develops users' understanding of the impact of the intervention. These processes are facilitated by investments of effort made by participants. Evaluation could either allay concerns or confirm the need for amendments to an intervention being implemented(33). Acceptability of an intervention among HWs is reported

to be influenced by the availability of regular feedback mechanisms to help clarify roles and boundaries during the implementation process(52). Hooker and colleagues found that limited feedback on the implementation of an intervention affected perceptions on the change practice at the later stages of implementation(53).

Another study revealed that the lack of opportunity for HWs to reflect on an innovation and relay concerns to be addressed on a health screening intervention slowed down full implementation(17,54). Maintaining regular formal monitoring of a new clinical practice and ensuring HWs' confidence and security in using interventions are essential in the implementation process(52).

1.5.4.5 HW Background Characteristics

Menachemi and Brooks, found that acceptance of health care technology was higher among male HWs hence this suggests gender differences in the acceptance of health care technology(55). In contrast to these findings, in a review by Ward et al(56), gender and age did not have a significant effect on the participants' acceptance towards health-related technology. A study carried out by Duyck et al. found no significant differences in health technology acceptance scores among different category professionals in an organization(57). In another study on HWs acceptability of a health care technology, it was reported that the group with a specialty degree had higher mean acceptance scores(58). Other studies reported that acceptability of health care technology can vary in different settings Ward et al. (56) and Kukafka et al.(59).

Liu et al found that the acceptability of a health technology is influenced by the medical context(60). HWs surveyed in rural Uganda regarded mRDTs as appropriate for basic health facilities in remote settings without laboratory infrastructure, whilst HWs in urban and larger

health centers with laboratories preferred the use of microscopy(47). The study also reported that both public and private health facilities prioritized clinical judgment over a malaria test result based on malaria prevalence in the setting, risks and consequences of delayed treatment (47). In hospitals in the urban areas, clinicians were reported to be unable to fully implement all the test based management of malaria requirements because of the many patients they had to attend to(43).

Norman & Skinner confirmed that knowledge and experience of HWs were positively related with health technology acceptance(56). On the other hand, other studies could not confirm a distinct influence of age or professional experience as direct predictors of acceptance of health technology(32,60). A Ghanaian study highlighted the point that facility heads, staff leaders and laboratory personnel demonstrated more clarity of the underlying rationale for mRDT than other professional categories like female nurses(47). Other individual factors such as educational levels, work experience, age, gender and training have been highlighted to influence acceptability of mRDT(61,62).

1.6 GAPS IDENTIFIED IN THE LITERATURE

A review of the literature indicates a growing body of knowledge on the implementation of mRDT with regards to factors influencing its implementation. However, there is limited use of implementation science principles and frameworks despite the field becoming increasingly popular among policy makers, stakeholders and practitioners in low- and middle-income settings(63). It also revealed a lack of consensus on how to measure acceptability as an implementation outcome(71).There were limited studies especially in developing countries that evaluated the implementation of mRDT using implementation science frameworks. Little is known on the implementation of mRDT in Ghana and the acceptability of mRDT among HWs has been barely assessed in this context.

1.7 CONCEPTUAL FRAMEWORK

As stated earlier, the TAM and NPT were adapted for this study (23,64,65). Therefore, to measure acceptability of mRDT, all three constructs; ease of use, perceived usefulness and intention to use were utilized. The adaptations were made by rewording to suit mRDT health technology. The four Normalization Process Theory (NPT) constructs (Coherence, Cognitive Participation, Collective Action, and Reflexive Monitoring) that affect the implementation of health interventions especially health technologies were adapted(65). The adaptation involved rewording to suit the topic of study and adding respondents to ascertain their influence in acceptability of mRDT among HWs in KNM. The conceptual model for this study is shown in Figure 1.

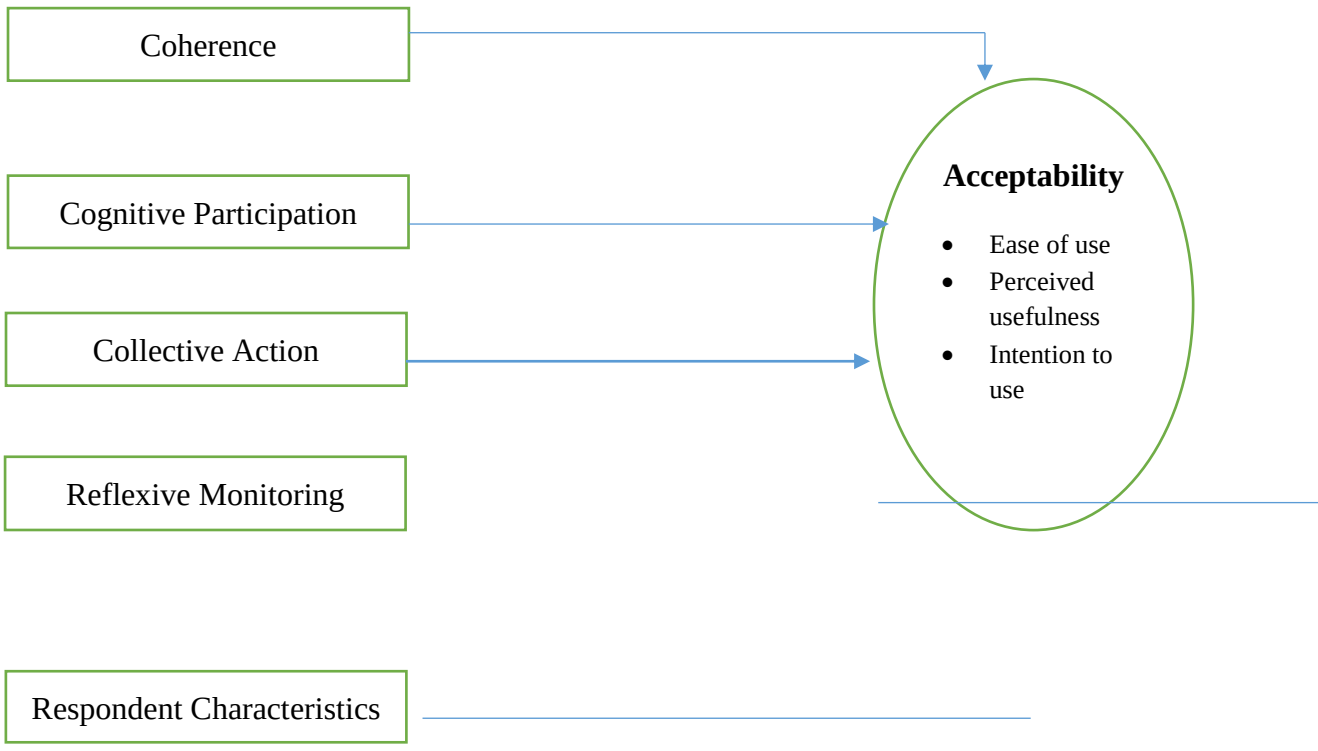


Figure 1 Adapted Conceptual Model on Determinants of Acceptability of Malaria Rapid Diagnostic Test Among Health Workers adapted from NPT(17), TAM(16)

CHAPTER TWO: METHODOLOGY

This chapter presents the research design used, the study site, the target population for the study, data collection tools and procedures, data management, study variables and analysis plan.

2.1 STUDY DESIGN

This study employed a cross sectional study design that provided a snapshot of the acceptability of mRDT amongst HWs in KNM. The goal of a cross-sectional study is to examine factors that are associated with a particular characteristic of interest(66). Therefore, this design was chosen to examine the possible cause and effect relationship between acceptability of mRDT and its determinants.

2.2 STUDY SITE

The study was conducted in 19 of the 20 health facilities in the KNM (Figure 2). The facilities include 1 public hospital and 3 private clinics, 4 health centers and 11 Community-based Health Planning and Services (CHPS) centres. The public hospital provides support to sub-districts and communities for referrals, emergencies and training. The health centers and private clinics provide basic curative care, disease prevention and maternity services. The CHPS compounds engage in outreach programmes and provide basic curative care including treating minor ailments. Kintampo North Municipality is situated within the middle belt of Ghana on latitude 8˚45N and 7˚45N and longitudes 1˚20W and 2˚1W(67).

The municipality occupies an area of 4,892.6 Km^2 with a population of 95,480, and population density of 19.5 /km^2(68). This municipality was selected because of the high levels of malaria transmissions. There are approximately 269 infective bites per individual in a year in this area(69). Furthermore, malaria is the major cause of under-five out-patient attendance

in all health facilities in the municipality(70). The health facilities are embedded in the respective sub-districts shown on the map (Figure 2).

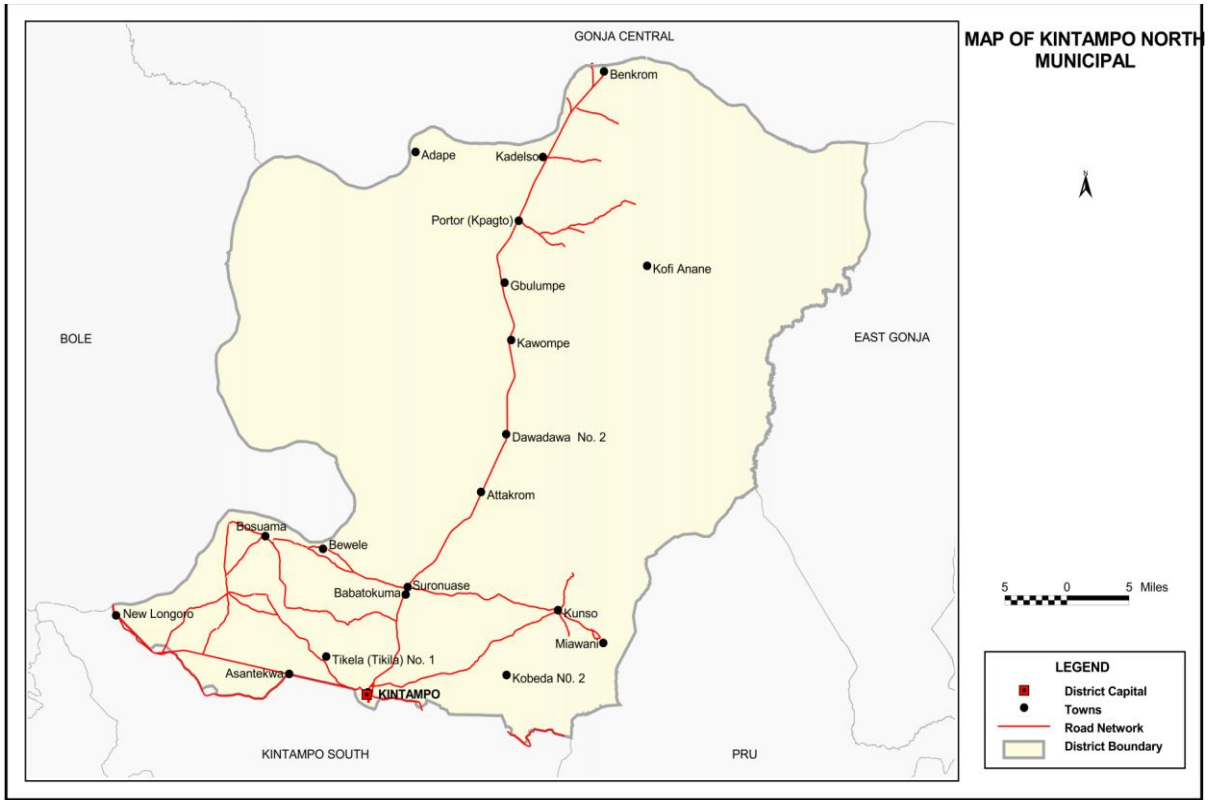


Figure 2: Relief Map of Health Facilities in Kintampo North Municipality. Source: Ghana Statistical Service.

2.3 STUDY PARTICIPANTS

The study participants were HWs- physician assistants, nurses, midwives, laboratory technologists, nurse Assistants and community health officers from public and private primary health facilities within Kintampo North Municipality (KNM). These range of HWs were interviewed because most care in the primary health settings in Ghana are performed by non-physicians as physicians are few throughout the system.

All HWs involved in the management and care malaria cases in the district were included in the study. About 125 HWs were reported to be involved in malaria case management at the time of study. Since the total study population size for the HWs in the study area was small,

the survey was conducted with all HWs available at the time of the study. A total of 110 HWs from 19 out of 20 facilities provided informed consent and participated in the survey. To estimate the required sample size of patient HWs, STATA 14 was used at a 95% confidence interval; assuming a 50% prevalence of acceptability and 80% power. Upon these sample size and power calculations, a minimum of 95 HWs or more were required.

2.4 INCLUSION CRITERIA

All HWs from the selected health facilities were involved in the management of malaria and conducted mRDTs.

2.5 EXCLUSION CRITERIA

HWs involved in the management of malaria who were on leave or unavailable at the time of interviews were excluded.

2.6 DATA COLLECTION

A paper-based questionnaire was designed and used as the survey instrument. The questionnaire consisted of three parts. The first section gathered information about the respondent's basic characteristics. The second section collected information on domains of acceptability of mRDT and the third elicited the determinants affecting acceptability of mRDT amongst HWs. The questionnaire was structured with Likert scale responses ranging from strongly agree to strongly disagree. The questionnaire was designed in line with Normalization Process Theory, whilst the content was guided by the FIND mRDT implementation manual and other factors identified in literature (65,71,72). Data was collected by field workers together with the principal investigator. The field workers were trained to ensure quality assurance in the data collection process. Data was collected from 16 February 2017 to 24 March 2017. The tool used for data collection was a structured, interviewer administered questionnaire. All interviews were administered in English. The questionnaire is provided in Appendix 3.

2.6.1 VALIDITY OF THE INSTRUMENT

Validity is the accuracy and meaningfulness of inferences, which are based on the research results. The NPT and TAM questionnaire have been psychometrically tested for reliability in other studies(17,58,73). In this study the Cronbach's alphas for each of the constructs were above 0.70(Table 1) hence factor analysis was not pursued. The alphas are: coherence (12 items and alpha of 0.74), cognitive participation (5 items and alpha 0.75), collective action (13 items alpha 0.83), reflexive monitoring (7 items with alpha of 0.77) and acceptability(21 items alpha 0.83).

Face validity of this tool was done by requesting clinicians who have used mRDT and managed malaria cases to evaluate the questionnaire for clarity and adequacy. The tool was also revised with input from a supervisor on clarity, fluency and adequacy. The tool was then pretested in a health facility in the Ashanti Akim North District, which is a different setting but shares similar dynamics with the study site to determine the feasibility and appropriateness of the tool.

Table 2 Cronabch's alphas for Acceptability of mRDT and its Determinants

Variable	Cronbach' s α	Items
Coherence	0.76	12
Collective action	0.83	5
Cognitive participation	0.75	13
Reflective monitoring	0.77	7
Acceptability	0.86	21

2.7 DATA MANAGEMENT

Data coding, entry verification and cleaning were conducted by four research assistants using Microsoft Excel and the data completeness and consistency was checked. Participants were followed-up for responses where there were missing values or information. Codes were assigned to variables for analysis. Data was then exported into Stata version 14.1 for analysis.

2.8 STUDY VARIABLES

2.8.1 Outcome Variable

Acceptability of mRDT was the outcome variable. Scores obtained from responses to a 21-item questionnaire were based on a 5 point Likert scale for each respondent. This was summed up to develop a composite score called an acceptability score.

2.8.2 Explanatory Variables

Coherence, collective action, cognitive participation and reflexive monitoring were computed by summing points obtained from responses to each of the corresponding items. Other variables were: age, sex, category of health worker, highest qualification, and geographical location of HW and years of experience. All the variables are shown in Table 2 below.

Table 3 Study variables

Outcome Variable	**Type of variable**	**Values in Analysis**
Acceptability	Continuous	25-103
Explanatory Variable		
Coherence	Continuous	25- 57
Cognitive participation	Continuous	10- 25
Collective action	Continuous	19 - 65
Reflexive monitoring	Continuous	13 - 43
Age	Continuous	20-51
Sex	Categorical	1 - "Female" 2- "Male"
Category of Health Worker	Categorical	1 "Nurse" 2 Other(Community health officer, Laboratory Technologist, Physician Assistant, CHV)
Highest qualification	Categorical	1 - "Degree" (HW with a minimum of four-year training to provide health care services. 2- "Diploma" refers to HWs trained for a maximum 3years to render basic health care services 3 - "Certificate"(HW with minimal training health care with a maximum of 2 years
Geographical location of Health Worker	Categorical	1 - "Urban" 2 - "Rural"
Years of experience	Categorical	1 - "Less than 3years" 2 - "3years and above"

2.9 DATA ANALYSIS PLAN

2.9.1 To measure the level of acceptability of mRDT among HWs in facilities in Kintampo North Municipality

Twenty-one items were used to measure acceptability of mRDT. The study used the Cronbach alpha to measure the internal consistency of results across the 21 items. The Cronbach alpha was 0.86 indicating strong reliability and indicating that the items could be summed up for use in analysis. The composite score for each respondent was computed (Appendix 1). The overall composite score of acceptability of mRDT for the study population was then calculated together with the mean and standard deviation as well as the median and interquartile range. The overall composite score of acceptability of mRDT was then categorized into Tertiles (3 groups). Computations of overall acceptability and tertiles are displayed in box plots.

2.9.2 To describe determinants affecting mRDT acceptability amongst HWs in health facilities in Kintampo North Municipality

The four key determinants: coherence, cognitive participation, collective action and reflexive monitoring all had acceptable Cronbach alphas above 0.70. Median and mean scores were then computed for each determinant. Median scores of all key determinants for each tertile of acceptability were also computed and reported.

Respondent characteristics (age of respondent, category of HW, years of experience, sex, highest qualification and geographic location of HW) under each Tertile of acceptability were described using frequency and percentages.

2.9.3 To examine the relationship between the determinants and acceptability of mRDT amongst HWs in health facilities in the Kintampo North Municipality.

An ordinal logistic regression analysis was used to examine the association between the determinants and the acceptability of mRDT. The technique was adopted because the outcome variable was in ordinal format. Adjusted and unadjusted odd ratios were reported at a 95% confidence interval and Pseudo R^2 of the model was reported. The assumption of proportional odds for the model was examined using the Brant test and the assumption of proportional odds was upheld.

2.10 ETHICAL CONSIDERATIONS

Ethical approval was sought from the Wits Human Research Ethic Committee (HREC) and Institutional Ethics Committee (IEC) of Kintampo Health Research Center in Ghana. Wits HREC (Medical) gave unconditional approval on 13 January 2017 with clearance certificate no: M161196 (Appendix 6). The full ethical approval from the IEC of Kintampo Health Research Center in Ghana was dated 30 January, 2017 with certificate no: KHRCIEC 2017-1(Appendix 5). Permission was also sought from the Municipal Health Directorate and management of the health facilities included in the study (Appendix 7). Informed consent (Appendix 3) was obtained from the study participants and confidentiality was assured before the interviews were conducted.

Study participants were fully informed about the purpose and benefits of participating in the study (Appendix 5). Participants who agreed to be part of the study were required to sign the consent form as an indication of their willingness to participate and returned the consent form to the field data collector. All the information obtained from this study was kept confidential and used for the purpose indicated for the study. The information is securely stored in locked

cabinet without the names of the participants. There was no risk involved in participating in this study. Participants were informed that participation in the study was voluntary and they could withdraw from the study at any time without attracting any penalty. Participants were not coerced into taking part in the study and they were informed that there would not be any direct benefit or compensation for participation. No identifying variable like names was collected in order to maintain the anonymity of respondents.

2.11 DISSEMINATION

Initial findings of the study were presented to researchers, postgraduate students and the staff of the Kintampo Health Research Center during a scientific review meeting. A virtual presentation was also made at the scientific meeting on Collaborations in Global Implementation Science Teaching at University of North Carolina. The compiled research report will be submitted to the library of the University of Witwatersrand, Johannesburg for the public. Findings from this study will also be communicated to HWs, researchers, programme implementers and other stakeholders through workshops, seminars and conference presentations. This report will also be prepared for journal publication.

CHAPTER THREE: RESULTS

3.0 INTRODUCTION

This chapter presents the main results on the level of acceptability of mRDT, description of determinants affecting acceptability of mRDT and the relationship between the identified determinants and acceptability of mRDT amongst HWs in KNM. Firstly, the respondent characteristics were described, followed by the development of an acceptability composite for the acceptability of mRDT. Lastly there is a description of determinants affecting acceptability of mRDT among HWs in KNM. Finally, the relationship between the identified determinants and acceptability of mRDT among HWs' in KNM will be examined.

3.1 RESPONDENT CHARACTERISTICS

Data were gathered from HWs involved in the management of malaria and the use of mRDT in health facilities in KNM. The profiles of the respondents are shown in Table 3. A total of 110 HWs from 1 Public Hospital, 3 Private Clinics, 4 Health Centers and 11 Community Based Health Service Sites were interviewed. There were 57.3% males and 42.7 % females. The mean age of respondents was 29.6 years with a standard deviation of 5.8. With regards to category of HW, it was found that the majority of respondents were nurses (37.3%), and 62.7% were other categories of HWs comprising of community health officer, laboratory technologists, physician assistants and community health volunteer.

HWs with less than 3 years experience were 47.3% and those with 3 years and over experience were 52.7%. For highest qualification those with a degree made up 13.6% of the sample, certificate holders made up the majority of 63.6%, followed by diploma holders (22.7%). The majority of the HWs worked in rural health facilities (66.4%) and those working

in urban health facilities made up 33.6% of the sample. Table 2 summarizes the respondent characteristics.

Table 4: Descriptive Statistics of Respondents

Variable	Mean(SD)	Frequency (N=110)	%
Category of Health Worker			
Nurses		41	37.3
Other HW category (CHO, Laboratory Technologist, CHV)		69	62.7
Highest Qualification			
Degree		15	13.6
Diploma		25	22.7
Certificate		70	63.6
Years of Experience (years)			
<3years		52	47.3
3+		58	52.7
Age of HW(years)	29.6(5.8)		
Sex			
Female		47	42.7
Male		63	57.3
Geographic Location of HW			
Urban		37	33.6
Rural		73	66.4

3.2 MEASURING LEVEL OF ACCEPTABILITYOF mRDT AMONGST HWs

3.2.1 Acceptability of mRDT among HWs

The Cronbach's alpha for the 21 items was 0.86 which indicated that the acceptability scale was reliable. A composite acceptability score was computed for each respondent by summing up the 21 item scale. A histogram of the acceptability scores is presented in Figure 3. The histogram shows that distribution of the scores is skewed to the left. The median score will thus be used for interpretation. Further the skewed distribution suggests that it cannot be

operationalized as a linear variable. Thus, the scores were ranked and divided into three equal groups (Tertiles) as shown in Table 4; (1st Tertile =low acceptability, 2nd Tertile = moderate acceptability and 3rd Tertile = high acceptability). The median acceptability score was 84 for all HWs and 75, 85 and 96 for Tertiles 1, 2 and 3, respectively. Figures 4 and 5 display the Box plots of overall acceptability score and per Tertiles respectively.

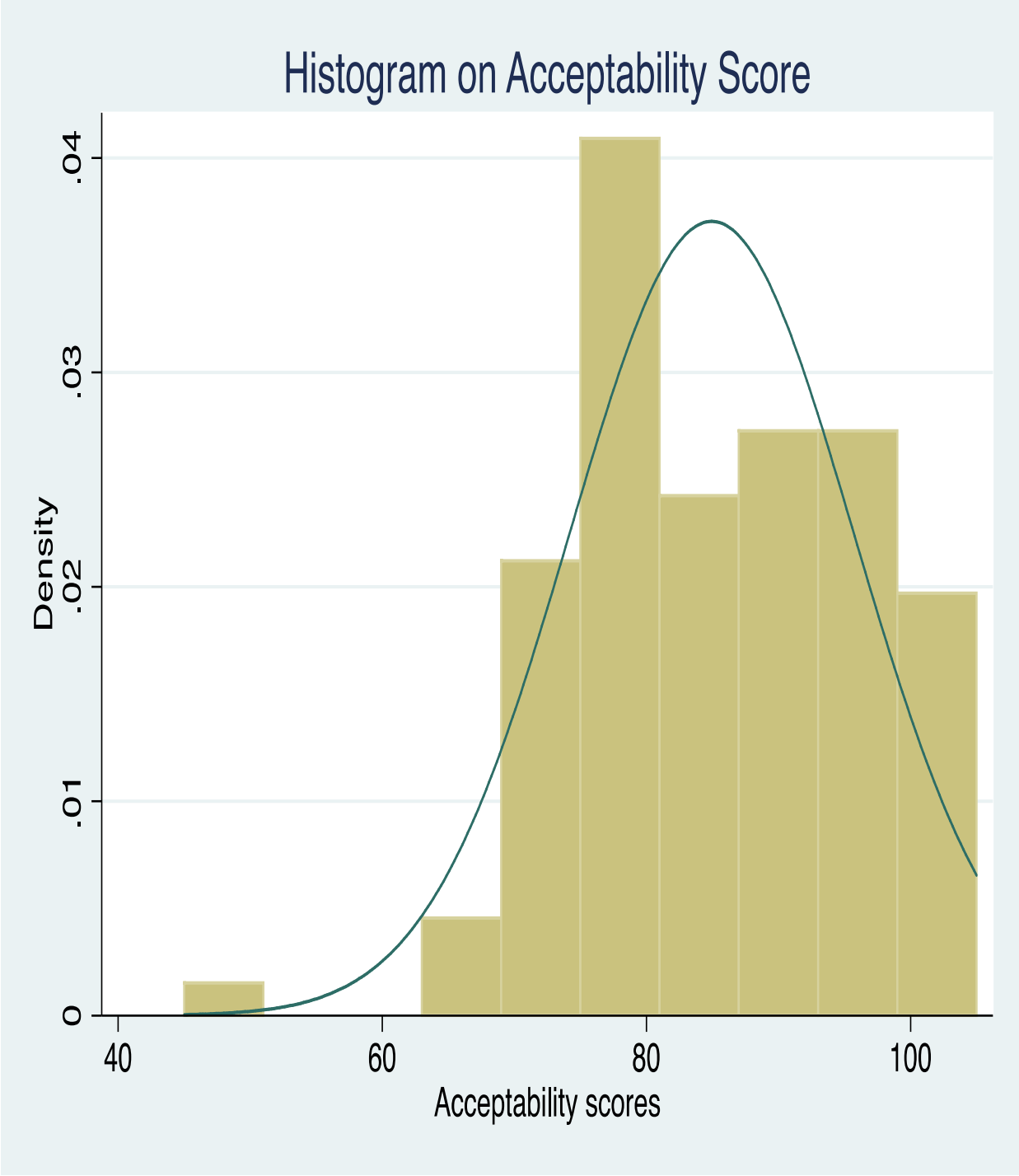


Figure 3 Histogram on Overall Acceptability Score

Table 5 Acceptability scores per Tertiles

Variable	N	%	Acceptability Score	Median	Interquartile Range
Overall Acceptability	110	100	45 -105	84	68-103
Tertile 1	37	33.6	45 -79	75	68 -79
Tertile 2	41	37.3	80 - 91	85	80-91
Tertile 3	32	29.1	92 -105	96	94-103

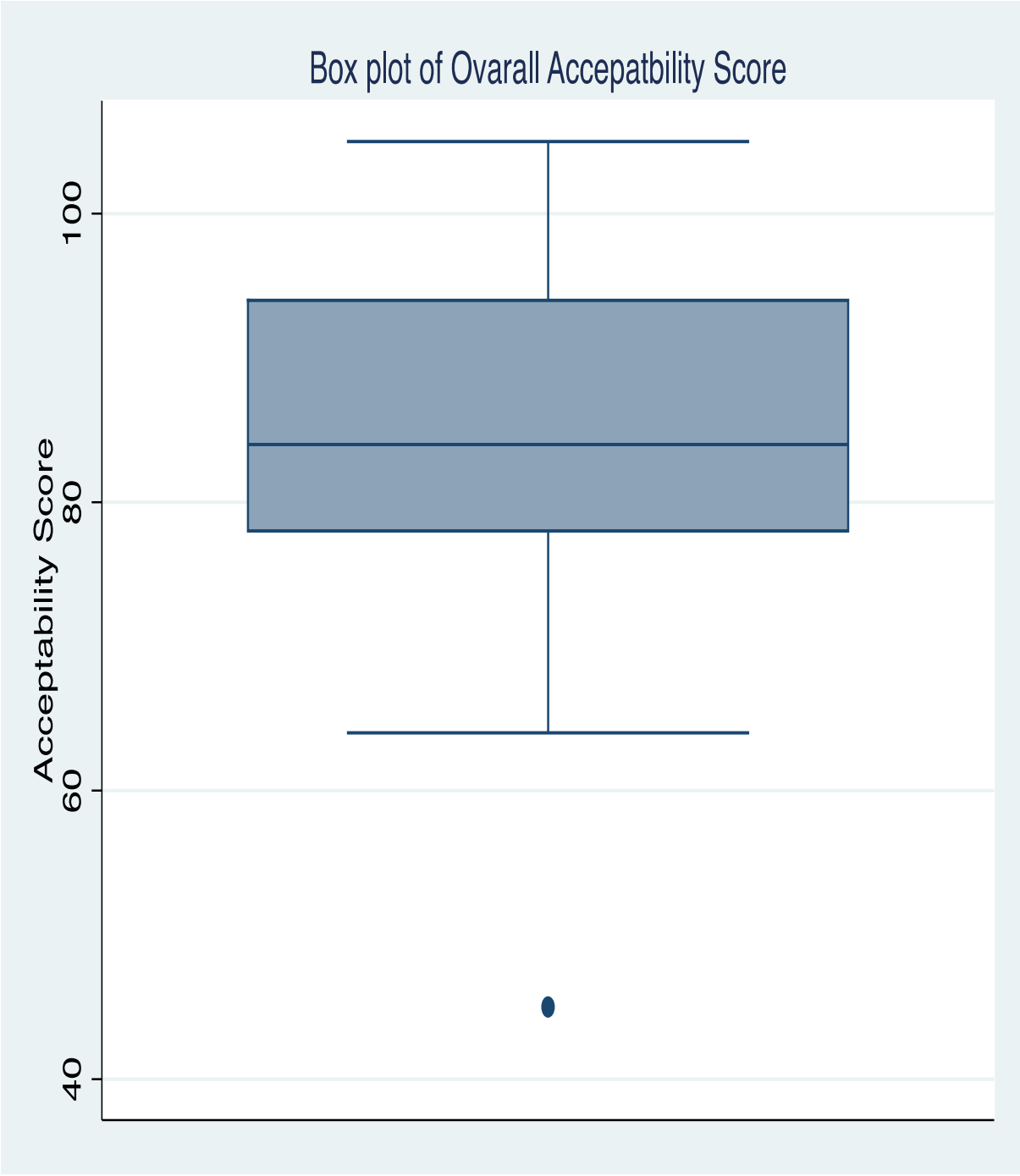


Figure 4 Box plot of Overall Acceptability Score among all HWs

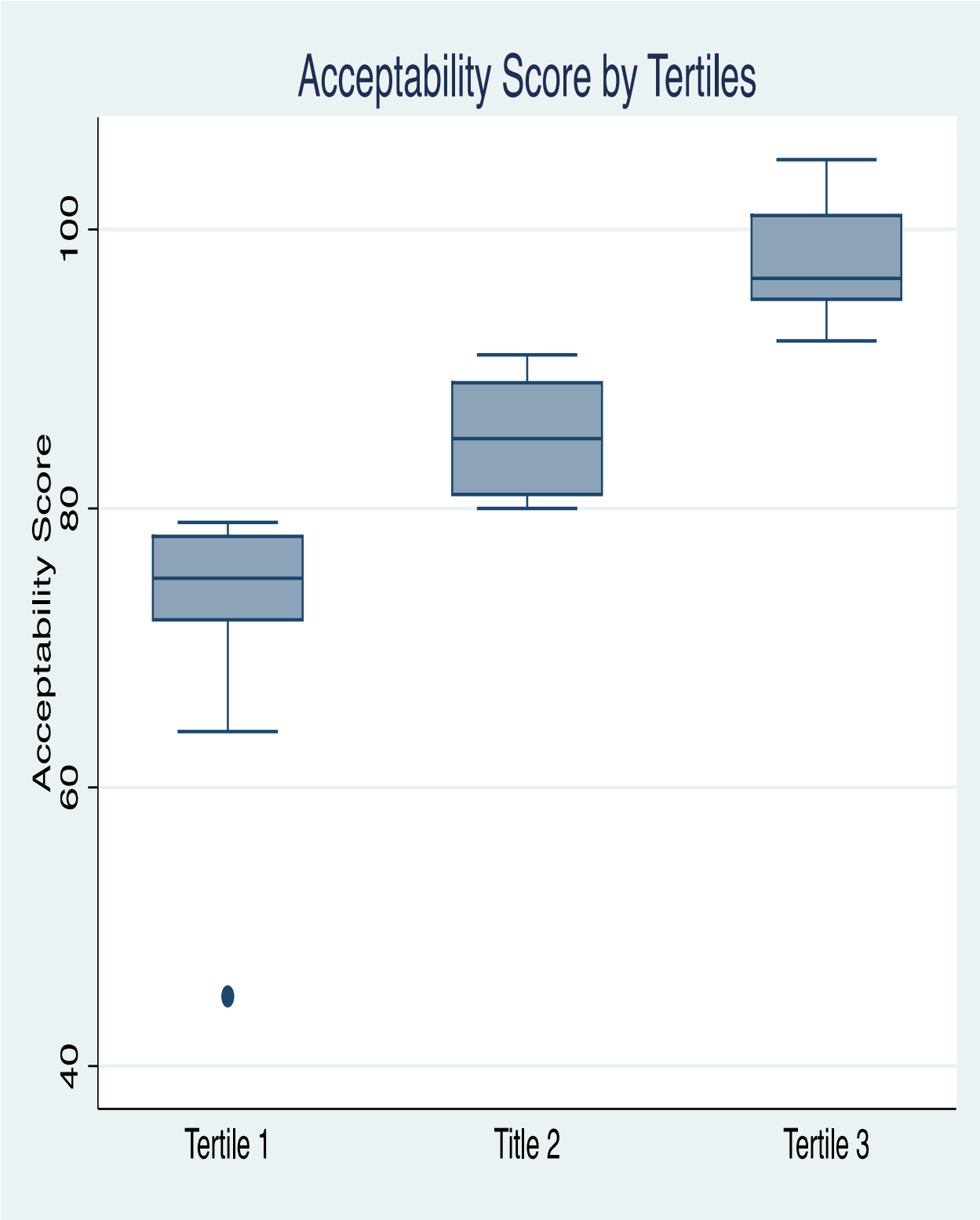


Figure 5 Box Plot of Acceptability Score by Tertile

3.3 Describing Determinants of Acceptability of mRDT among HWs

The items were summed up for each determinant. The scores ranged from 25 – 57 for coherence, 10 - 25 for cognitive participation, 19 -65 for collective action and 13 - 43 for reflexive monitoring as shown in Table 5. Distribution of the scores of the major determinants were skewed, thus the medians were used for interpretation.

Table 6. Determinants of Acceptability and Scores

Variable	Score
Coherence	25- 57
Collective action	10 - 25
Cognitive participation	19 -65
Reflective monitoring	13 - 43

The median scores and interquartile range of the key determinants according to tertiles of acceptability are presented in the Table 6. The overall median coherence score among HWs was 42 with an interquartile range of 30-55. HWs in the 1st Tertile obtained median coherence scores of 37 and interquartile ranges of 30-48. Those in the 2nd Tertile obtained a median score of 43 and interquartile ranges of 40-47. Median coherence scores among HWs in the 3rd Tertile was 52 with interquartile ranges of 39-55. In the 1st Tertile of coherence, median acceptability was 78 and interquartile ranges was 72-92 whilst the 2nd Tertile 81(72-95). However, HWs in the 3rd Tertile had median acceptability of 95 with interquartile ranges of 79-102.

The median cognitive participation score was 20 and the interquartile range was 11-25. HWs in the 1st Tertile had a median participation score of 18 with an interquartile range of 11-25. Median cognitive participation scores and interquartile ranges of HWs in the 2nd and 3rd Tertiles were 20 (20-21) and 24 (23-25) respectively. Cognitive participation score by Tertiles

showed that HWs in the 1st, 2nd and 3rd Tertiles had median acceptability scores and interquartile ranges of 78(71-91), 81(72-97) and 95(84-102) respectively.

For collective action, the median score was 46 and the interquartile range was 27-61. The median score was 37 with an interquartile range of 27-40 for HWs in the 1st Tertile. While the median collective action score for HWs in the 2nd Tertile was 46 with interquartile ranges of 42-49. Those in the 3rd Tertile obtained a median collective action score of 54 with interquartile ranges of 39-61. Collection action score by Tertiles showed that HWs in the 1st, 2nd and 3rd tertiles had median acceptability scores and interquartile ranges of 79(68-92), 85(72-100) and 92(78-102) respectively.

For reflexive monitoring, the median score among all HWs was 32 and the interquartile range was 19-42. Median reflexive monitoring scores and interquartile ranges of HWs in the 1st and 2nd Tertiles was 24(19-29) and 32(31-34) respectively. The median reflexive monitoring score for HWs in the 3rd tertile was 37 with interquartile ranges of 21-37. In the 1st and 2nd Tertiles of reflexive monitoring scores, the median acceptability was 80 and interquartile ranges were 72-100 and 81(72-100) respectively. However, HWs in the 3rd Tertile had median acceptability of 94 with interquartile ranges of 78-102.

The median age of HW was 28 and interquartile range was 28(23-42). HWs within the 1st Tertile had a median age of 24 years with interquartile ranges of 23-26, 24(23-26) and 37(32-42) for the 2nd and 3rd Tertiles respectively. In the 1st, 2nd and 3rd Tertiles of age, median and interquartile range of acceptability was 85(72-100), then 81(72-100) and 87(72-101) for the second and 3rd Tertiles respectively.

Table 7: Descriptive Statistics of Key Determinants Affecting Acceptability of mRDT

Variables	Number of Participants	Mean(SD)	Range of Score	Median (IQR)	Median Acceptability (IQR)
Coherence	110	42(7.8)	25-57	42(30-55)	
Tertile 1	38	35(3.8)	25-39	37(30-39)	78(72-92)
Tertile 2	39	42(2.4)	40-47	42(40-47)	81(72-95)
Tertile 3	33	51(2.7)	48-57	52(48-55)	95(79-102)
Cognitive Participation		19(3.5)	10-25	20(11-25)	
Tertile 1	38	16.(2.6)	10-19	17(11-19)	78(71-91)
Tertile 2	41	20(0.4)	20-21	20(20-21)	81(72-97)
Tertile 3	31	23(0.8)	22-25	24(23-25)	95(84-102)
Collective Action		45.(8.9)	19-65	46(27-61)	
Tertile 1	37	35(4.9)	19-40	37(27-40)	79 (68-92)
Tertile 2	37	45(2.3)	41-49	46(42-49)	85(72- 100)
Tertile 3	36	54(4.3)	50-65	54(50-61)	92(78-102)
Reflexive Monitoring		30(6.1)	13-43	32(19-42)	
Tertile 1	39	24(3.5)	13-29	24(19-29)	80 (72- 100)
Tertile 2	37	32(38)	30-34	32(31-34)	81 72 -100)
Tertile 3	34	38(2.3)	35-43	37(36-42)	94(78-102)
Age		29(5.8)	20-51	28(23-42)	
Tertile1	39	24(1.5)	21-37	24(23-26)	85(72-100)
Tertile 2	37	28(1.9)	20-51	28(27-30)	81(72-100)
Terile 3	34	36(4.4)	22-45	37(32-42)	87(72-101)

IQR= Interquartile Range, Min/Max= Minimum and Maximum Score

3.3. 2 Other Determinants of Acceptability of mRDT

Amongst HWs with a degree, the median acceptability score was 81 and the interquartile range was 74-92 while those with a diploma had a median of 81 with interquartile ranges of 72-96 and those with certificates had a median acceptability score of 85 and an interquartile range of 72-102.

Median acceptability and inter-quartile range scores for urban HWs and rural HWs was 79, interquartile range (75-87) and 89 with interquartile range (72-102) respectively.

The median acceptability score for females was 86 with interquartile ranges of 72-102 and 83 with interquartile ranges of 72-101 for males.

Median acceptability and inter-quartile range scores for HWs with more than three years of experience and those with less than three years' experience was 78(71-100) and 87(74-102) respectively as shown in Table 7.

Table 8: Descriptive Statistics of other Determinants by the Overall mRDT Acceptability Score

Variables	Number of participants	Range of Score	Median (IQR)
Overall Acceptability	110	45-105	84(68-103)
Category of Health Worker			
Nurses	41	64-103	81(72-100)
Other (Physician Assistant, Laboratory Technologist and CHO,)	69	71-105	86(71-102)
Highest Qualification			
Degree	15	64-103	81(74-92)
Diploma	25	68-103	81(72-96)
Certificate	70	45-105	85(72-102)
Years of Experience (years)			
<3years	52	45-105	78(71-100)
3+	58	64-105	87(74-102)
Sex			
Female	47	64-105	86(71-102)
Male	63	45-105	83(72-101)
Geographic Location of HW			
Urban	37	64-103	79(75-87)
Rural	73	45-105	89(72-102)

IQR = Inter Quartile Range, Min/Max= Minimum and Maximum Score

3.4 THE RELATIONSHIP BETWEEN THE DETERMINANTS AND ACCEPTABILITY OF mRDT AMONGST HWs.

3.4.1 Unadjusted Model

In the unadjusted model, coherence, cognitive participation, collective action and reflexive monitoring showed a statistically significant association with acceptability of mRDT at 95% and p-value <0.05(Table 7).

Coherence: For each unit increase in the coherence score, the odds of high acceptability was 1.21 times greater than moderate-to-low acceptability (OR=1.21, 95%CI=1.06-1.29).

Cognitive Participation: For each unit increase in the cognitive participation score, the odds of high acceptability was 1.52 times greater than the moderate-to-low acceptability (OR=1.52, 95%CI=1.31-1.76).

Collective Action: For each unit increase in the collective action score, the odds of high acceptability was 1.11 times greater than moderate-to-low acceptability (OR=1.11, 95%CI=1.06-1.16).

Reflexive Action: The results suggested that for each unit increase in the reflexive monitoring score, the odds of high acceptability was 1.08 times greater than the moderate-to-low acceptability (OR=1.08, 95%CI=1.02-1.15).

Rural HWs: For rural HWs, the odds of high acceptability versus the moderate-to-low acceptability was 3.71 times higher than for urban HWs. (OR=3.71, 95% CI=1.72-7.96).

Three years and above experience: For three years and above experience, the odds of high acceptability versus moderate -to-low acceptability was 3.84 times higher than for HW with less than 3 years experience (OR=3.84, 95%CI=1.83-8.05).

3.4.2 Adjusted model

All variables were fitted in this model. This adjusted model showed six determinants that were significant at 95% and a p value <0.05. The Pseudo R^2 was 0.36 which suggests that 36% of the variance of acceptability of mRDT is explained by the model (Table 8). There was no multicolinearity after a fitting correlation matrix with the explanatory variables.

Coherence: For every unit increase in the coherence score, the odds of high acceptability were 1.23 times greater than the moderate-to-low acceptability (OR=1.23, 95%CI=1.11-1.37).

Cognitive participation: For every unit increase in cognitive participation score, the odds of high acceptability was 1.35 greater than the moderate-to-low-acceptability (OR=1.35, 95%CI=1.10-1.66).

Reflexive monitoring: For every unit increase in the reflexive monitoring score, the odds of high acceptability were 0.88 times less than the moderate-to-low acceptability (OR=0.88, 95%CI=0.79-0.97).

Rural HWs: For rural HWs, the odds of high acceptability versus moderate-to-low acceptability was 6.99 times higher than for urban HWs (OR=66.99, 95%CI=1.82-26.84)

HWs with three years experience and above: For HWs with three years of experience and above, the odds of high acceptability versus moderate-to-low acceptability was 5.53 greater than three years and less (OR= 5.53, 95%CI=1.98-15.42).

Other HW categories: For other categories of HWs (physician assistants, CHO, CHV and laboratory technologists), the odds of high acceptability versus moderate-to-low acceptability was 2.60 times higher than for nurses (OR=2.62, 95%CI=0.99-6.0)

Table 9: Unadjusted and Adjusted Odds Ratios of the Determinants Associated with Acceptability of mRDT

Determinant	Unadjusted High vs. Moderate & Low UAOR(95%CI)	Adjusted High vs. Moderate & Low AOR (95% CI)
Coherence	1.21(1.06-1.29) *	1.23(1.11-1.37)*
Cognitive Participation	1.52(1.31-1.76) *	1.35(1.10-1.66)*
Collective Action	1.11(1.06-1.16)*	0.96(0.87-1.05)
Reflexive Monitoring	1.08(1.02-1.15)*	0.88(0.79-0.97)*
Age of Health Worker	1.03(0.97-1.09)	0.95(0.87 -1.04)
Experience of Health Worker		
Below 3 years 3years above	1.00(Reference) 3.84(1.83-8.05) *	1.00(Reference) 5.53(1.98-15..42)*
Sex		
Female Male	1.00(Reference) 0.64(0.32-1.28)	1.00(Reference) 1.04(0.38-2.84)
Geographical location of Health Worker		
Urban Rural	1.00(Reference) 3.71(1.72-7.96)*	1.00(Reference) 6.99(1.82-26.84)*
Highest Qualification		
Degree Diploma Certificate	1.00(Reference) 0.94(0.27-3.12) 1.42(0.50-4.03)	1.00(Reference) 1.48(0.33-6.64) 0.79(0.14-4.33)
Category of Health Worker		
Nurse Other (Physician Assistants, Community Health Officers, Laboratory Technologists)	1.00 (Reference) 1.86(0.84-4.11)	1.00(Reference) 2.62(0.99-6.0) *

Note *p < 0.05, UAOR = Unadjusted Odds Ratio, AOR= Adjusted Odds Ratio

CHAPTER FOUR: DISCUSSION

This chapter provides an understanding of the level of acceptability and the identifies determinants influencing acceptability of mRDT amongst HWs. The section also highlights the limitations of the study.

4.1 LIMITATIONS OF THE STUDY

The data comprised of self-reported responses, which are susceptible to measurement error. Social desirability is another possible limitation as there is a chance that a HW would provide responses that are favorable or pleasing to the interviewer. The study also used interviewer administered questionnaires which could pose opportunities for interviewers to subtly influence the subject into giving answers skewed towards their own opinions, prejudices and values. However, interviewers were trained on the data collection tool to improve their understanding as a quality control measure.

This study was targeted at all HWs involved in the management of malaria and conducting of mRDT in KNM. The responses of doctors could not be gathered because none were available at the time of the study. Though the lack of their responses from doctors could have affected the findings, KNM is a rural setting and most care in the area is provided by non-physicians and with only two physicians in the municipality. Finally, due to the cross-sectional nature of the study, it was not possible to attribute causal relationships between the responses and independent variables considered. Despite these, the results do contribute to efforts that seek to improve the implementation of health interventions in resource limited settings.

4.2 DISCUSSION

4.2.1 Level of mRDT acceptability

Despite the evidence of effectiveness of mRDT, this study confirms that majority of HWs were in the moderate of 2nd tertile of acceptability. Ease of use and perceived usefulness is higher among HWs than intention to us. Further work is needed to facilitate misconceptions about inferior efficacy, implementation, or quality of mRDT and increase mRDT education with tailored provisions and inclusion of HWs in the development of future diagnostic tools. A study reported that if confidence in intervention is low then the intervention may not be delivered as expected, which would impact its overall effectiveness(74).

Studies, conducted, proved that a short education about types, effectiveness, or benefits of health interventions can enhance acceptance among health workers(75). Recently, Donovan and colleagues demonstrated that a short text-and video-based presentation about health technology improved HWs knowledge and attitudes (perceived advantages) towards the technology but not intention to future use in comparison to a control group(76). There is evidence of findings from a study conducted in Uganda that reported that 54% of HWs were reluctant to diagnose patients with mRDT(24).

This study also found that the median acceptability of mRDT among rural HWs was higher than that of urban HWs. This was probably because rural facilities in KNM did not have laboratories hence relied on the mRDT technology heavily for malaria diagnosis. This is consistent with findings from HWs' surveyed in rural Uganda who regarded mRDTs as appropriate for basic health facilities in remote settings without laboratory infrastructure(47). Moreover, in KNM most rural facilities did not have laboratories and therefore relied on the mRDT technology. Other studies have also reported variations in acceptability of health technology acceptance rates among clinicians within different clinical settings(30,31). The

results support findings in Ghana that urban hospitals were found to be unable to fully implement all the test based management measures of malaria with mRDT because of high clinic workloads(43).

4.2.2 Determinants of mRDT acceptability among HWs in KNM

This study brought to light several determinants that affected acceptability of mRDT among HWs in KNM. This was advanced by adapting a conceptual framework which went beyond the factors in the original NPT but also included HW characteristics that could affect the acceptability of mRDT among HWs in KNM.

4.2.2.1 Coherence

This is the extent to which an intervention is coherent or understandable to end-users. An intervention or health technology that is not congruent with the operational needs and clinical practices of users is likely not to be accepted(33). For an intervention to be accepted, programme implementers must ensure that end users must see the intervention as an opportunity to enhance the standard of care or practice(17). This could be achieved by convincing HWs of the importance and benefits of change in practice(33),thus the justification of a shift in practice from presumptive treatment to test-based management with mRDT. The present study found that HWs were unable to integrate the test-based management of malaria in the existing health care system because they lacked insights on policy changes, regulation and guidelines that come with mRDT implementation. This situation can be improved through organizing meetings

together over organizational boundaries and discussing the challenges for a collective view of the process involved in embedding the intervention (43).

Similarly, lack of training on new policy guidelines affected implementation on new treatment in in Ethiopia(13). The training involves conducting a basic needs assessment

which includes health workers' skills and the organisation of care prior to mRDT introduction can help to identify the target audiences, the proper it is important to understand who, in practice, will be using mRDTs. Similarly, technical assistance is considered to be important once implementation begins(77). Some health workers will only require technical skills in performing the mRDT, managing stores or record keeping and others will require significant training on fever case management.

Malaria rapid diagnostic tests presented a shift from the presumptive diagnosis of malaria to a parasitological diagnosis of all suspected cases of malaria. It therefore required shared expectations and understandings on the value of the intervention and the HWs' role in embedding it in clinical practice. Thus the construct-coherence posits that a mRDT is more likely to be accepted if the intervention maintains or enhances existing norms and social relations of the HWs(17). The current study confirms this position, as HWs with higher median coherence scores were found in the high acceptability tertile. This was not surprising since coherence was one of the significant determinants affecting acceptability of mRDT amongst HWs in KNM.

This result is in line with the report that a lack of understanding of the value and benefit of mRDT and the wider test based policy, coupled with inconsistencies in treatment guidelines were contributory factors for HWs' misconceptions of the value of mRDT in fever case management(78). The findings were also consistent with the review that work directed at making health interventions understandable to HWs when given attention yields a better quality of implementation(33).

Other research demonstrated that improving HWs' understanding by enhancing access to information and improving awareness of the goals and benefits of an intervention promotes

implementation success(39). The current study also supports the findings of recent study that evaluated discharge planning implementation in healthcare setting using normalization process theory found that it was difficult for HWs to know the border between the community regulations and the healthcare regulations, and how they could activities promote implementation. The study therefore recommends a collective view on the process through meeting together to discuss organizational boundaries and how clear doubts and challenges in implementing the new practice(73).

4.2.2.2 Cognitive participation

This construct investigates the extent to which an intervention can be integrated with existing knowledge, practices and skill sets of HWs. The construct argues that acceptability is more likely if an intervention maintains or improves confidence within existing professional networks(79). HW confidence in an intervention therefore requires agreement on the credibility and utility of the intervention(35). This study observed that commitment colleagues and credibility of mRDT amongst HWs was low. This suggests that there was little leadership involvement amongst HW teams in promoting or engaging with the intervention. The inability of HWs to respond to challenges arising from embedding mRDT into real clinical environments was evident as time constraints were a recurrent problem for the parasitological diagnosis of all suspected cases with mRDT. The introduction of test based management of malaria with mRDT presented a change from previous norms, when HWs provided malaria treatment presumptively(14,50). This change required a reconsideration of roles of HWs and a fit of mRDT with existing skill-sets(35).

In the current study, HWs with lower median cognitive participation scores were in the lower median acceptability score range compared to those with higher median cognitive participation scores. The data showed that cognitive participation positively influenced

acceptability of mRDT among HWs. This is in accordance with the view that strategies such as engagement and better collaboration provides better understanding of when, what, how and with whom information should be exchanged. Newly recruited HWs should also be supported by management to boost their confidence on the intervention. Providing emotional support, and mechanisms to promote local problem solving and extending principles of ownership by involving all in the process of implementation (12). Recruiting "local champions" or leaders to resolve confusion and disagreements among HWs on the credibility of an intervention and the provision of incentive promotes acceptability(28,34,48).

The current study supports the finding HWs who were confident in their role were better able to handle others' expectations and had a better understanding of when, what, how and with whom information should be exchange with during the implementation of intervention. The study underscored the role of experience in successful implementation as confidence in came with experience among the HWS. On the other hand whilst newly qualified HWs lacked knowledge about the intervention which led to poor information exchange which led to implementation challenges(73). The failure to recognize roles and accept responsibilities for certain tasks during implementation among the health care teams result in implementation failures as reported in an evaluation study(73). Greenhalgh et al described staff that are engaged in and motivated toward new practices as change facilitators that promote implementation among colleagues(80). We can therefore interpret that the establishment of specific mRDT coordinators might be a solution for the implementation of mRDT.

4.2.2.3 Collective action

This construct involves the work performed by individuals or organizations in operationalizing a new technology in practice. It emphasizes the contextual integration of new interventions, particularly the extent to which they are managed and resourced. The provision

of adequate support, particularly the resources required for the implementation of health interventions has an impact on implementation outcomes. This has been acknowledged in several studies that evaluated the implementation of health innovations (29,35).

In the current study the HWs with low median scores for collective action were found in the low category of acceptability whilst those with higher median collective action scores were in the high acceptability category (Tertile 3). A similar study indicated that performing, reading and interpreting mRDT in the context of busy clinics was a challenge for HWs and hence affected the mRDT programme(29). Clinic workload for the clinicians and stock-outs ancillary items like cotton, waste bins and gloves in health facilities have been rnoted to affect mRDT implementation, which is consistent with the current study(78). Implementation of an intervention is inhibited due to individual skills, beliefs and knowledge and this was reported in a study using the normalization process theory to evaluate implementation of health care guideline(74). Lack of knowledge impeded the implementation process due to perceived difference in information exchanged amongst the health care teams compromising of different HW categories(74). This observation supports the finding in this study.

4.2.2.4 Reflexive monitoring

This factor deals with evaluation of the impact of an intervention and how it influences implementation processes(79). Evaluation can either allay concerns or confirm the need for amendments to a health intervention being implemented (35,39). Thus to successfully implement a health intervention, users of the innovation need to review their experiences of implementation and if necessary adapt the intervention to suit the local context(81).

However, in this study as reflexive monitoring increased, the probability of acceptability of mRDT decreased, thus factor was negatively associated with the acceptability of mRDT. This

finding is inconsistent with the report that adequate time and supportive supervision to appraise the implementation of health intervention improves implementation effectiveness (82). Chew- Graham et al also found that acceptability of a new clinical intervention depends on maintaining regular formal monitoring of the new clinical practice to ensure the work remains on the agenda(52). Hooker et al also reported that HWs not getting useful feedback on outcomes impeded implementation of health interventions(53).

In a study by Hofflander et al. (83), time was discovered to be an important aspect that affected the outcome of the implementation process in healthcare. They found that individuals needed time to prepare, to reflect and to understand the new practice and its advantages, and the ways it in which it was implemented. They needed time to test the new practice in everyday work and time to reflect on how it might interplay with existing routines, work tasks and regulations.

4.2.2.5 Respondent characteristics

4.2.2.5.1 Age

HWs within the 3rd age Tertile had higher mean acceptability as compared to those in the 2nd and 1st age Tertiles. However, the study did not find any relationship between acceptability and the age of HWs. A review by Ward et al. revealed that age did not have a significant relationship on the participants' acceptance of health-related technology(56).

4.2.2.5.3 Sex

The current study found higher median acceptance scores among female HWs compared to their male counterparts. However, the study found no significant relationship between the two variables. The lack of a significant relationship between sex and acceptability of MRDT was

supported in a review by Ward et al., that indicated that the participant sex had no significant relationship on the participants' acceptance of health-related technology(56).

4.2.2.5.3 Geographical location of HW

The finding from this study reported the significant relationship between acceptability of mRDT and the geographical location of the health worker. HWs in urban health facilities were less likely to have high acceptability of mRDT compared to HWs in rural facilities. This result was consistent with reports that HWs surveyed in rural Uganda regard mRDTs as appropriate for basic health facilities in remote settings without laboratory infrastructure, whilst HWs in urban and larger health centers with laboratories preferred the use of microscopy(47). This is in congruence with findings that acceptability of health care technology amongst HWs can vary from one clinical setting to another(56).

Similar observations were made by Liu et al., these showed that the acceptability of a health technology amongst HWs is influenced by the medical context(60). Findings in Ghana reveal that Urban area hospitals were unable to fully implement all the test based management of malaria processes because of the many patients they had to attend to(43).

4.2.2.8 Years of experience

There was a relationship between years of experience of HW and acceptability of mRDT. The study found that for HWs with more than three years of experience were more likely to have a high acceptability of mRDT compared to those with less than three years of experience. These findings are consistent with Norman & Skinner's findings, they found that the higher the level of experience of HW, the more likely they are to have a higher health technology acceptance score(84). Other studies have reported that HWs with longer years of experience with a health technology were more likely to accept the technology(61,62).

4.2.2. 8 Highest qualification and Category of HW

This data did not reveal significant relationships between highest qualifications and acceptability of mRDT. However, the study found that nurses had lower acceptability compared to other HW category (CHO, CHV, physician assistants, and laboratory technologists). The results indicated that other categories of HWs were more likely to have high mRDT acceptability than nurses. A study reported that facility heads, staff leaders and laboratory personnel demonstrated more clarity of the underlying rationale for the mRDT than other professional categories like nurses(47). On the other hand, Duyck et al. found no significant difference in health technology acceptance scores among different categories of professionals in an organization(57). In other studies on HWs acceptability of a health care technology; clinicians with a specialty degree had a higher mean acceptance score(58).

CHAPTER FIVE: CONCLUSION & RECOMMENDATION

5.0 INTRODUCTION

This chapter presents the conclusion and recommendation from the study. The conclusion and recommendations are presented in order with the study objectives.

5.1 CONCLUSION

In conclusion, majority of the participants were in the moderate or 2nd Tertile of acceptability among and acceptability varied across urban HWs and rural HWs. HWs are important stakeholders in acceptance and implementation of mRDT. Despite growing evidence of effectiveness of mRDT, the study shows that majority HWs in KNM still moderate acceptability. Intention to- use seems lower compared to ease of use and perceived usefulness. Further studies are needed in order to compare the acceptance levels within different facilities and category of HWs and the impact of these domains on acceptability.

Multiple implementation factors including: the lack clarity over the scope and boundaries of mRDT (coherence); variable investment in mRDT (cognitive participation); limited resources, skills and training to deliver mRDT (collective action), limited reflection and feedback on the HW role in mRDT implementation and its impact (reflexive monitoring) affected acceptability. Coherence was a strong predictor of mRDT acceptability thus uncertainties of the value and benefit of test based management with mRDT and its ability to integrate the intervention into routine clinical practice was evident. This study therefore highlighted the importance of providing adequate information, disseminating and communicating policy

changes to HWs in order to shift from presumptive treatment under the Integrated Management of Childhood Illness (IMCI) policy to test based management with mRDTs.

The findings revealed a positive significant relationship between cognitive participation and acceptability of mRDT thus HWs participation and engagement during implementation is vital for rapid diagnostic test (RDT) based management of malaria to be successfully implemented. The study however revealed negative relationships between reflexive monitoring (regular feedback on the impact on mRDT) and HW acceptability.

The data also found relationships between HW characteristics such as years of experience and geographic location and acceptability of mRDT. This finding suggests NPT and TAM are useful theoretical frameworks for understanding the determinants and contributions of user characteristics to mRDT acceptability. This lays a foundation for quality improvement efforts towards improving mRDT acceptability among HWs. The data also provided an opportunity for further adaptation of the conceptual framework in future studies that may seek to evaluate the implementation of similar health interventions.

5.2 RECOMMENDATIONS

Ensuring HWs totally accept mRDT as a tool for implementing the test based management of malaria policy, depends on their understanding of the value and benefit of mRDT and this requires dissemination of goals and objectives of the "Test and Treat" policy. Making resources available such as job aids and policy guidelines will help integrate the intervention into the existing health care system. This should also be backed up by supportive visits and supervision to ascertain challenges that HWs face when integrating and sustaining the intervention. Policy makers should consider providing on job training HWs on mRDT to improve competencies and produce consistent use of the technology and reliable outcomes to

meet the needs of the ever increasing number of malaria patients visiting the health facilities.

Also, it important to provide adequate incentives to sustain and encourage the use of mRDT amongst HWs. The recruitment of local "champions" will foster participation in embedding mRDT in the real world. From this study it can be concluded that respondent characteristics could be important additions to the NPT model for understanding implementation of health interventions. Future research could expand on what has been learnt in this study by investigating the background characteristics of HWs and how these may influence the acceptability of similar interventions.

There is a need for mixed method research to be carried out on the acceptability of mRDT to provide a more balanced understanding of contextual factors amongst HWs. This will generate a strong body of evidence to influence policy and decision making. Lastly, further research is required to investigate the relationship between mRDT acceptability and actual use of mRDT among HWs in clinical practice. This is because acceptability is a proximal indicator of mRDT use and could be used to model implementation success of the intervention(15).

5.3 IMPLICATIONS OF THE STUDY

This study has many implications for policy makers, mRDT programme managers and HWs in the KNM of Ghana. The data of the study shows further research is required to understand the contextual challenges affecting successful implementation of mRDT beyond the study setting. This study also showed that programme implementers, policy makers and HWs all have a major role to play in in successful implementation of mRDT to achieve intended health outcomes. Policy makers, clinicians and programme implementers should therefore

collaborate with researchers to conduct further studies on how to identify implementation challenges.

The study also highlights the important role that HWs play in the implementation process of mRDT. While HWs receive policy or treatment guidelines from the policy makers, they should be involved in the implementation process, from development to revision of guidelines for test based management of malaria since they are the end users of the intervention. This could be achieved by supportive visits and supervisions to ascertain the contextual challenges that HWs are facing in integrating and sustaining the intervention into the existing health system

The NPT offers a generalizable framework for analysis, which can explain and shape the implementation process of evidenced based interventions and improve integration of new practices or supportive tools.

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APPENDIX 1

Respondent ID	Intention to Use Score	Perceived Usefulness Score	Ease of Score	Overall Acceptability Score
1	18	24	26	68
2	25	30	35	90
3	13	24	35	72
4	13	24	35	72
5	21	18	40	79
6	18	20	36	74
7	24	30	47	101
8	24	26	41	91
9	18	22	32	72
10	20	24	36	80
11	20	24	32	76
12	19	24	37	80
13	16	24	37	77
14	20	23	35	78
15	21	18	41	80
16	19	20	39	78
16	6	16	23	45
17	15	25	32	72
18	18	24	41	83
19	16	13	35	64
20	20	22	38	80
21	25	26	46	97
22	18	20	36	74
23	19	18	27	64
24	19	28	44	91
25	19	25	34	78
26	20	24	34	78
27	18	24	37	79
28	25	26	44	95
29	20	16	39	75
30	20	26	35	81
31	23	28	40	91
32	20	30	39	89
33	20	27	40	87
34	22	18	32	72
35	25	23	44	92
36	25	25	30	80
37	18	15	41	74
38	19	24	42	85
39	21	29	41	91

40	19	22	38	79
41	19	24	42	85
42	14	16	41	71
43	19	17	35	71
44	19	24	38	81
45	25	29	46	100
46	21	28	39	88
47	14	24	37	75
48	23	23	49	95
49	24	30	47	101
50	24	29	47	100
51	24	25	42	91
52	25	30	50	105
53	22	30	43	95
56	20	24	37	81
57	21	28	47	96
58	23	28	39	90
59	17	22	33	72
60	20	21	35	76
61	24	30	43	97
62	20	30	39	89
63	21	23	31	75
64	19	18	39	76
65	25	26	47	98
66	20	16	36	72
67	20	27	39	86
68	16	24	41	81
97	23	25	38	86
70	21	22	37	80
71	23	23	41	87
72	19	24	40	83
73	19	23	36	78
74	25	28	48	101
75	20	24	39	83
76	24	30	48	102
77	24	29	49	102
78	20	19	39	78
79	24	17	44	85
80	19	20	39	78
81	21	25	44	90
82	20	29	47	96
83	22	24	38	84
84	23	27	45	95
85	24	23	47	94
86	18	24	28	70

87	20	28	48	96
88	25	25	41	91
89	21	25	41	87
90	21	25	33	79
91	17	24	40	81
92	20	22	39	81
93	24	30	49	103
94	18	19	35	72
95	23	26	47	96
96	22	29	45	96
97	24	30	49	103
97	24	30	46	100
98	25	29	40	94
99	22	28	44	94
100	22	25	37	84
101	20	22	38	80
102	22	27	47	96
103	20	24	35	79
104	21	30	44	95
105	22	30	35	87
106	25	30	50	105
107	20	21	39	80
108	21	24	44	89
109	23	26	44	93
110	21	30	49	100
Total score	2270	2690	4384	9344

APPENDIX 2

INFORMATION LETTER

Study Title: Acceptability of mRDT among health workers in private facilities in Kintampo North Municipality.

Good Day,

My name is Michael Anaba Kurubire and I am a masters student at University of Witwatersrand, in the School of Public Health. I wish to conduct research to understand factors affecting health workers' acceptability of rapid diagnostic test of malaria in private facilities in Kintampo North Municipality.

The reason why I am conducting this study is that less than half suspected cases of malaria in the country are confirmed by parasitological diagnosis which has led to misuse of antimalarial drugs. Findings from this study will reveal the factors affecting acceptability of mRDT among health workers which will provide feedback to effect change in practice for efficient use of anti-malarial drugs.

An interviewer administered questionnaire with three sections will be used. The first section will collect demographic data, whereas the second and third sections will examine acceptability of mRDT and factors affecting mRDT among health care workers. The entire survey will take at least thirty minutes.

I invite you to participate in the study. You will be asked to sign an informed consent. Participation is voluntary and you may choose not to participate or to withdraw from the study at any time, without any penalties.

Anonymity and confidentiality will be ensured and your identification will not be disclosed or reported in the study. You will derive no direct benefit as an individual from participating in

the study, but the results of the study will provide valuable information to improve implementation of new health technologies in the future and improve the diagnosis of malaria. There is no risk involve in the study.

The Human Research and Ethics Committee and Postgraduate Committee of the University of the Witwatersrand as well as the Ghana Health Service Ethics Review Committee have approved the study.

Thank you for taking time to read this information letter. Should you require any further information regarding the study, please contact the principal investigator through the following email; **mikeanaba@gmail.com or 1314614@students.wits.ac.za or Tel +233 24277**

APPENDIX 3

CONSENT FORM

I hereby confirm that I have been satisfactorily informed by the study staff (……) about the nature of his study entitled "**Acceptability of malaria rapid diagnostic test among Health Workers in Kintampo North Municipality**".

I have received, read and understood the written information sheet regarding the study. I am also aware that the results of the study, including personal details and my responses about the topic will be anonymously processed into a study report.

I have been explained to that all information will remain confidential and there will be no penalty or loss of benefits resulting from my responses or participation.

I may, at any stage, without prejudice, withdraw consent and participation in the study and there will be no penalty or loss of benefits to my withdrawal.

I have had sufficient opportunity to ask questions and, of my own free will, I am prepared to participate in the study.

Name of Participant ...……..…… Signature…….…….

Place……. …….. Date……

Name of Investigator…….....…. Signature…….

Place…….……. Date……

APPENDIX 4

University of the Witwatersrand Malaria Rapid Diagnostic Test Questionnaire mRDT 17th February 2017	FORM NO

SECTION A (PARTICIPANT CHARACTERISTICS) (*Please circle the box as appropriate*)

1. Sex of Respondent……....	1. Male	2. Female			SEX
2. Age of respondent……	1. 18-29 yrs.	2. 30-39 yrs.	3. 40-49 yrs	4. 50+	AGE
3. Category of health workers…	1. Doctor	2. Nurse	3. Physician assistant	4. Nurse assistant	4. Community health officer	CHW
	5. Laboratory Technician		6. Community Volunteer	7. If other specified ……		CHWO
4. How long have you managed malaria cases……...	1. 2yrs and below	2. 3-5yrs	3. 6-10yrs	4. Above 10yrs		MMC
5. Highest qualification..	1. Degree	2. Diploma	3. Post graduate	4. Certificate	5. None	HQ
6. Level of health facility……..	1. Hospital	2. Health Center	3. CHPS	4. Maternity Homes	5. Others ……..	THF
7. Type of operation……	Private	Government				TOP
8. When was the last time of you received training in malaria rapid diagnostic test ...	1. within the last 6months	2.Between 6month to 12months	3. Between 12months to 24months	4. Over 24months		TRDT

SECTION B (ACCEPTABILITY)

Please circle the statement with the following scales *1- Strongly disagree 2- Disagree 3- Neither agree nor disagree 4-Agree 5-Strongly agree*

QNo	Question EASE OF USE	*Indicator*:	*1*	*2*	*3*	*4*	*5*	
1	Overall, performing malaria rapid diagnostic test is easy		1	2	3	4	5	EOU1
2	Collecting blood sample from patients' finger for malaria rapid diagnostic test is easy		1	2	3	4	5	EOU2

3	Adding the correct amount of sample onto the absorbent pad of malaria rapid diagnostic test kit is easy	1	2	3	4	5	EOU3
4	Using the micro-pipette of the malaria rapid diagnostic test kit for collecting blood sample is easy	1	2	3	4	5	EOU4
5	Adding the correct amount of buffer solution to the specimen well of malaria rapid diagnostic test kit is easy	1	2	3	4	5	EOU5
6	Accurately timing the malaria rapid diagnostic test before reading and recording the result is easy	1	2	3	4	5	EOU6
7	Correctly reading and interpreting the malaria rapid diagnostic test result is easy	1	2	3	4	5	EOU7
8	Interpreting weak positive test results of malaria diagnostic test is easy	1	2	3	4	5	EOU8
9	My interaction with malaria rapid diagnostic test is clear and understandable	1	2	3	4	5	EOU9
10	Rapid diagnostic test kits use raises issues of blood safety and waste disposal	1	2	3	4	5	EOU10
QNo	PERCEIVED USEFULNESS	1	2	3	4	5	
1	Using malaria rapid test kit enables you to diagnose malaria accurately	1	2	3	4	5	PUF1
2	Using malaria rapid diagnostic kit improves your job performance	1	2	3	4	5	PUF2
3	Using malaria rapid diagnostic test kits enhances your efficiency on the job.	1	2	3	4	5	PUF3

4	Using malaria rapid diagnostic kit enables you to provide better evidence for malaria treatment	1	2	3	4	5	PUF4
5	Using malaria diagnostic test kit is useful in your job	1	2	3	4	5	PUF5
6	Using the malaria diagnostic test kit enables you to accomplish diagnostic investigation more quickly	1	2	3	4	5	PUF6
7	Using malaria rapid diagnostic test kit increases your output of malaria diagnosis and treatment	1	2	3	4	5	PUF7
QNo	INTENTION TO USE/Acceptability	1	2	3	4	5	
1	I am able to conduct malaria rapid diagnostic test based on the product instructions	1	2	3	4	5	ITU1
2	I am able to wait for the specified reading time for malaria rapid diagnostic test	1	2	3	4	5	ITU2
3	I am able to integrate malaria rapid test in the routine diagnosis and management of malaria	1	2	3	4	5	ITU3
4	I am able to comply with the treatment guidelines for malaria based on the results malaria rapid diagnostic test	1	2	3	4	5	ITU4
5	I will continue to use malaria rapid diagnostic test kits irrespective of the cost involved.	1	2	3	4	5	ITU5
6	I am able to accommodate all complexities that comes with using malaria rapid diagnostic test kits.	1	2	3	4	5	ITU5

SECTION C FACTORS AFFECTING ACCEPTABILITY OF MALARIA RDT

Please circle the statement with the following scales *1-strongly disagree, 2-disagree 3-Neither disagree nor agree 4-agree and 3- strongly agree*

Q No	*Coherence*	1	2	3	4	5	
1	Malaria rapid diagnostic tests differs from usual ways of presumptive diagnosis of malaria	1	2	3	4	5	CCH1
2	There are posters and communication materials that clearly indicate the aims and actions of the malaria rapid diagnostic test programme at my place of work.	1	2	3	4	5	CCH2
3	Staff in this facility have a shared understanding of the purpose of malaria rapid diagnostic tests	1	2	3	4	5	CCH3
4	I understand how malaria rapid diagnostic tests affects the nature of my own work	1	2	3	4	5	CCH4
5	The potential value of malaria rapid diagnostic tests can be seen by everyone in the facility	1	2	3	4	5	CCH5
6	I am properly informed the role of rapid diagnostic tests in ruling out malaria and the need for proper management of Non-Malarial Febrile Illness (NMFI)	1	2	3	4	5	CCH6
7	In this facility quality control results of malaria rapid diagnostic test is available to demonstrate its accuracy when used to monitor its performance in the field	1	2	3	4	5	COH7
8	There is a training schedule in place on malaria rapid diagnostic test for health workers in this facility	1	2	3	4	5	COH8
9	The training I received in malaria rapid diagnostic test is in line with national relevant policy and guidelines for malaria treatment	1	2	3	4	5	COH9
10	The National Malaria Control Program rapid diagnostic test job aids are consistent with the RDT manufacturer's instructions	1	2	3	4	5	COH10
11	The training I received in malaria rapid diagnostic test took into account the plasmodium species and the type of rapid diagnostic test available in my facility	1	2	3	4	5	COH11

12	Training manuals describe how RDT results will be recorded in patient registers and what RDT-specific information should be collected in the register?	1	2	3	4	5	COH12

QNo	*Collective Action*	1	2	3	4	5	
1	There are key people who drive malaria rapid diagnostic tests forward and get others involved in the process in this facility	1	2	3	4	5	COA1
2	Conducting malaria rapid diagnostic test is a legitimate part of your role	1	2	3	4	5	COA2
3	In this facility we work together in new ways of using malaria rapid diagnostic test.	1	2	3	4	5	COA3
4	The use of malaria rapid diagnostic test is supported by all in this facility.	1	2	3	4	5	COA4
5	The central medical stores in this facility is able to provide supply of ancillary logistical needs alongside RDTs (e.g. gloves, sharps waste boxes, timers, microscopy reagents etc	1	2	3	4	5	COA5
6	There are performance monitoring processes in place for malaria rapid diagnostic tests in this facility, e.g temperature stability condition	1	2	3	4	5	COA6
7	There is a supervisory plan in place in this facility to monitor the use of malaria rapid diagnostic test kits	1	2	3	4	5	COA7
8	Colleagues here are involved and responsible for maintaining quality of malaria rapid diagnostic test	1	2	3	4	5	COA8
9	There is close collaboration with Integrated management of childhood illnesses (IMCI) strategists to make use of their experience in improving the skills of health workers in malaria diagnosis	1	2	3	4	5	COA9
10	There is collaboration with the other programs in non malarial febrile illness management and district Ministry of Health leaders	1	2	3	4	5	COA10

11	Management adequately supports the use of malaria rapid diagnostic test in the facility	1	2	3	4	5	COA11
12	Job aids, user guides, and manuals are prepared and supplied, along with malaria rapid diagnostic test kits in this facility	1	2	3	4	5	COA12
13	There is sustained supply of malaria rapid diagnostic test and ancillary products (gloves, sharps container, cotton) to support RDT use	1	2	3	4	5	COA13
QNo	*Cognitive Participation*	1	2	3	4	5	
1	Malaria rapid diagnostic test is easily integrated into your existing work	1	2	3	4	5	COP1
2	I have confidence in my colleagues ability to use rapid diagnostic test kit for malaria diagnosis	1	2	3	4	5	COP2
3	Work is assigned to those with skills appropriate to perform malaria rapid diagnostic test	1	2	3	4	5	COP3
4	I am satisfied with my colleagues level of knowledge about when to use a rapid diagnostic test and what management should be undertaken based on those results.	1	2	3	4	5	COP4
5	The guidelines for rapid diagnostic test storage are clear and used by all staff in this facility	1	2	3	4	5	COP5
QNo	*Reflective Monitoring*	1	2	3	4	5	
1	The staff here agree that malaria rapid diagnostic test is worthwhile	1	2	3	4	5	REM1
2	The procedure and process involved in the performance of malaria rapid diagnostic test can be modified to promote effective usage	1	2	3	4	5	REM2

3	There is clear reporting channel for me to report increased levels of invalid tests, damaged packaging, or any unexpected results or concern over tests not functioning correctly.	1	2	3	4	5	REM3
4	There are guidelines for management of discrepant results which take into account the parasite density of the infections in this facility	1	2	3	4	5	REM4
5	All rapid diagnostic test results are reported in the Health Management Information System or temporarily in a parallel malaria surveillance system in this facility	1	2	3	4	5	REM5
6	There are procedures in place for obtaining feedback in any problem encountered with the use of malaria rapid diagnostic test	1	2	3	4	5	REM6
7	Performance monitoring processes are in place for malaria rapid diagnostic test and are used	1	2	3	4	5	REM7
8	There is evaluation of health worker performance in malaria rapid diagnostic test preparation, and confirmation that manufacturers 'instructions were followed	1	2	3	4	5	REM8
9	There is regular assessment of storage and transport conditions of rapid diagnostic test in this facility	1	2	3	4	5	REM9
QNo	*Health Worker Experience*	1	2	3	4	5	
1	Malaria rapid diagnostic test has increased your sense of professionalism	1	2	3	4	5	HWE1
2	Malaria rapid diagnostic test has improved your individual confidence in malaria management	1	2	3	4	5	HWE2
3	Malaria rapid diagnostic test has improved patients trust in the treatment given to them	1	2	3	4	5	HWE3
4	Malaria rapid diagnostic test has enabled you to better engage patients in clinical decision making	1	2	3	4	5	HWE4

APPENDIX 5

Kintampo Health Research Centre (KHRC) Institutional Ethics Committee (IEC)
P.O Box 200
Kintampo, B/A
Ghana, West Africa

Tel: +233(3520)92037 (Ext 117)
E-mail: fred.kanyoke@kintampo-hrc.org

FULL ETHICAL APPROVAL CERTIFICATE

Michael Anaba
University of Witwatersrand
School of Public Health
Parktown – Johannesburg
South Africa.

Date: 30th January, 2017

Study ID: KHRCIEC/2017-1

Title of study: Acceptability of Malaria Rapid Diagnostic Test among Health workers in health facilities in Kintampo North Municipality.

Principal Investigator: Michael Anaba

Supervisor(s): Dr. Latifat Ibisomi, Dr. Seth Owusu-Agyei

Type of Review: Full Board Review

Approval Date: 30th January, 2017

Expiration Date: 30th June, 2017

1. The Kintampo Health Research Centre Institutional Ethics Committee (IEC) is constituted and operates in conformance with requirements of 45 CFR 46, 21 CFR 50, 21 CFR 56 and section 3 of the International Council on Harmonization Guidelines, as well as all applicable regulatory, legal, and other ethical requirements governing human subject research in Ghana. The OHRP Federal Wide Assurance number for the committee is 00011103; the IRB registration number is 0004854.

2. The above study in title was reviewed by the IEC on 17th January, 2017 and given conditional approval.

3. The Committee after carefully going through your revised study protocol has granted you full ethical approval for implementation of the study.

4. The following documents were reviewed and approved;
   4.1 Acceptability of Malaria Rapid Diagnostic Test among Health workers in health facilities in Kintampo North Municipality. Dated 05/01/2017
   4.2 Information sheet and consent form
   4.3 Data collection tools
   4.4 Study Budget
   4.5 Curriculum Vitae of PI

Study File number: 2017-1

THE CHAIRMAN, KINTAMPO HEALTH RESEARCH CENTRE INSTITUTIONAL ETHICS COMMITTEE

APPENDIX 6

R14/49 Mr Anaba Kurubre Michael

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M161196

NAME: (Principal Investigator)	Mr Anaba Kurubre Michael
DEPARTMENT:	Epidemiology and Biostatistics School of Public Health Private Health Facilities in Kintampo North Manicipality of Ghana
PROJECT TITLE:	Acceptability of Malaria Rapid Diagnostic Test among Health Workers in Private Facilities in KintampoNorth Municipality, Ghana
DATE CONSIDERED:	25/11/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Latifar Ibisomi
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	13/01/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in November and will therefore be due in the month of November each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 7

MUNICIPAL HEALTH DIRECTORATE
GHANA HEALTH SERVICES
P. O. BOX 2
KINTAMPO B/A
Tele/Fax :03520 -26019
27 January , 2017

OUR CORE VALUES
1. PEOPLE-CENTRED
2. PROFESSIONALISM
3. TEAM WORK
4. INNOVATION

5 DISCIPLINE
6. INTEGRITY

My Ref No. MHD/KN/ P
Your Ref No.

Dear Micheal,

Re: Permission to Conduct Study-Anaba Michael Kurubire

We have received your letter that requests us to grant you permission to conduct a study in the health facilities in the municipality.

In reference to your letter dated 20th January, 2017 you have been granted permission to use the health facilities for your MSc project with the title "**Acceptability of Malaria Rapid Diagnostic Test among Health Workers in Health Facilities in Kintampo North Municipality".**

Thank you.

Yours Sincerely

Ms Alice Afuah Vorleto
Municipal Director of Health Services