**“If you see a tortoise sitting on a fence post, it certainly did not get up there by itself.”**

**African Proverb**

# University of Alberta

Using Malaria Rapid Diagnostic Tests in Ghana: Understanding Healthcare Providers' Compliance with Policy Guidelines for Malaria Diagnosis in Peripheral Facilities

by

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**DEDICATION**

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**ABSTRACT**

Financing and implementation of malaria control measures expanded vastly over the past decade, leading to substantial reductions in global malaria morbidity and mortality. Yet malaria still threatens health and socio-economic development among the poorest populations particularly in sub-Saharan Africa, where limited health systems capacity hampers effective control. Early diagnosis and effective treatment are essential to reduce the disease burden. Expert microscopy - the gold standard for malaria diagnosis - is unsustainable in remote settings with limited laboratory infrastructure. Rapid Diagnostic Tests (RDTs) enable parasite-based diagnosis in these settings and are widely deployed across sub-Saharan African countries including Ghana. However, presumptive treatment based on the presence of fever persists across the region, leading to rampant over-diagnosis of malaria and consequent over-consumption of antimalarials. Inappropriate antimalarial use contributes to emerging drug resistance, threatens the feasibility of expanding treatment access among affected populations, and undermines the effectiveness of malaria control measures.

The World Health Organization recommends diagnostic confirmation of suspected malaria cases prior to antimalarial treatment. Ghana adopted this guideline in 2009 and employed RDT use to support guideline implementation. However, RDT use is beset with operational challenges including poor compliance among healthcare providers with the test-before-treat guideline. Poor compliance has been reported in Ghana and is widespread across sub-Saharan Africa. Although guideline compliance is central to the successful implementation of test-based malaria management in these settings, its underlying factors are barely understood.

In this thesis, I investigated healthcare providers' compliance with the test-before-treat guideline for malaria in Ghana. I present this research in three consecutive and complementary papers. Chapter 1 comprises a review of the literature on barriers and facilitators regarding RDT use for malaria diagnosis across sub-Saharan Africa. In Chapter 2, I illustrate the significance of the qualitative approach I employed to investigate guideline compliance for confirmatory malaria testing in Ghana. In Chapter 3, I identify and explain the determinants of guideline compliance from the healthcare providers' perspective. Uncomplicated malaria in Ghana is managed within the jurisdiction of primary healthcare. The findings of

this research therefore pertain to improving guideline compliance for malaria management within primary healthcare settings in Ghana.

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## INTRODUCTION

Over 200 million clinical cases of malaria occurred in 2010, resulting in worldwide deaths estimated between 665,000 and 1.2 million [1, 2]. About 90% of global malaria cases occur in sub-Saharan Africa each year [3, 4]. The disease is caused by *Plasmodium spp.*, a blood parasite transmitted through the bite of Anophelene mosquitoes [5]. Falciparum malaria is the deadliest form of infection and the most common in Ghana and most of sub-Saharan Africa [6-8]. Children less than five years of age and pregnant women in endemic areas are highly vulnerable to complications and even death from severe malaria. The World Health Organization (WHO) strongly recommends effective treatment within the first 24-48 hours of infection, without which malaria can progress rapidly in severity and lead to death [9] . Microscopic detection of parasites in blood samples is considered the gold standard for malaria diagnosis [10, 11]. However, this service is difficult to sustain in remote areas with poor infrastructure [12-15]. Consequently, symptomatic diagnosis based on a history of fever, was promoted for decades to enable prompt, life-saving treatment in under-resourced endemic areas lacking the requisite infrastructure for quality–assured microscopy[1] [4, 5, 14, 16, 17]. Presumptive treatment practices were reinforced by the availability of inexpensive antimalarials such as chloroquine that have since succumbed to parasitic resistance [9, 14, 18].

Significant expansion in financing and implementation of malaria control measures within the past decade led to a decline in malaria-attributable fevers in both high and low-to-moderate transmission settings [1, 19, 20]. Artemisinin-based combination therapies (ACTs) have since replaced former first-line treatments for uncomplicated malaria to counter widespread parasitic resistance in high transmission settings [21-23]. ACTs are more effective but also more expensive than many of the antimalarials no longer recommended for treatment. Inappropriate ACT consumption is therefore economically and clinically undesirable and contributes towards emerging drug resistance [14, 18, 24].

[1] Footnotes:

Quality-assured microscopy constitutes microscopy services conducted in a setting that includes monitoring and maintenance of high accuracy, reliability, and efficiency of all (laboratory) services. This includes attention to all factors affecting lab performance, including test performance, internal and external quality control, equipment and reagent quality, workload, workplace conditions, support and training of laboratory staff. **Source:** WHO, Malaria Microscopy, Quality Assurance Manual, Volume 1

Moreover, the thin pipeline for developing new antimalarials legitimates concern about emerging parasitic resistance [25-27].

In 2009, the WHO issued recommendations for confirmatory testing prior to treating suspected malaria patients of all ages in endemic settings. The objective of this guideline is to reduce inappropriate antimalarial consumption in order to limit the spread of drug resistance in endemic regions [23]. Proponents of this guideline cite evidence of declining malaria transmission including in high transmission areas as sufficient grounds for promoting a universal test-before-treat approach for malaria in all endemic settings [28, 29]. Moreover, rapid diagnostic tests (RDTs) capable of detecting malaria parasite antigens in a finger-prick sample of blood are widely available for use in resource-constrained environments. RDTs do not require laboratory infrastructure and enable parasite-based diagnosis in facilities where microscopy is unavailable [10, 11, 30-33]. Nonetheless, other opinions support a more incremental approach to confirmatory malaria diagnosis. This perspective draws attention to constrained health system capacity, diversity and complexity of barriers, including the poorly understood issue of healthcare providers' compliance with the confirmatory testing guideline, as deterrents to a universal test-before-treat recommendation for malaria in resource-poor settings [12, 29, 34, 35].

Ghana adopted a test-based approach to malaria management in 2010. Current national guidelines require confirmatory testing prior to treating suspected malaria patients aged five years and older [36, 37]. RDTs are widely deployed to enable rapid and reliable diagnosis at peripheral facilities. Yet presumptive treatment practices remain common in Ghana and across sub-Saharan Africa. Moreover, where RDTs are used, healthcare providers frequently treat patients inconsistently with test results [29, 38-42]. This lack of consistency between test results and case management decisions indicates poor healthcare providers' compliance with the confirmatory testing guideline for malaria [29, 43]. Poor compliance leads to routine over-diagnosis of malaria and mis-management of non-malarial fevers, worsened health outcomes, and a loss of essential household, national, and donor resources [44-46]. Over-diagnosis of malaria further limits accurate reporting, which is necessary to accurately assess intervention impact and progress with malaria control and thereby to prevent donor fatigue. Sustaining global momentum is critical to expand coverage of proven interventions to the poorest populations with the greatest need [14, 47, 48].

The significance of RDT use to effective and sustainable malarial control is increasing [5, 16, 49-51]. However, the potential for RDTs to enable accurate malaria diagnosis for effective and targeted antimalarial treatment hinges on healthcare providers' compliance with case management guidelines [29, 34, 43]. Yet there is limited knowledge about the underlying determinants of poor guideline compliance and about effective strategies to address this challenge [52, 53].

In this thesis, I investigated healthcare providers' compliance with guidelines for rapid malaria testing at peripheral facilities in Ghana. The work comprises three consecutive and complementary papers.

In Chapter 1, I examine the state of the evidence surrounding routine RDT use for malaria diagnosis in sub-Saharan Africa. RDTs are the *modus operandi* for implementing parasite-based malaria diagnosis in poor-resource settings [5, 12, 54]. Identifying barriers and facilitators regarding RDT implementation is central to understanding healthcare providers compliance with guidelines promoting RDT adoption.

Building on knowledge gleaned through the literature review in Chapter 1, I document in Chapter 2 the design, conduct and relevance of the focused ethnographical (qualitative) approach for investigating guideline compliance among primary healthcare providers in Ghana. The study was conducted in the Atwima-Nwabiagya district of the Ashanti Region in Ghana. In this paper, I explain the suitability of the research methodology for addressing the stated objectives. I further outline the measures taken to ensure rigor and quality in the research design, conduct and outcome. The significance of establishing coherence between the philosophical, theoretical, and methodological foundations of this study is illustrated. Qualitative methodologies are suitable for addressing research objectives that aim to explain patterns of behavior, socio-cultural perspectives or experiences related to health and illness, or health services utilization [55, 56]. Clinical encounters involve several variables that do not reliably conform to the predictability of quantitative research [57]. Consequently, there is increasing recognition of the importance of qualitative approaches for generating knowledge to inform policy and practice related to healthcare delivery. Focused ethnographies (FEs) involve a traditional ethnographical research approach bounded within the specific context of particular sub-groups within society [58-60]. The World Health Organization adopted this approach to study cultural perspectives surrounding infectious

diseases in developing countries in order to inform disease management recommendations and strategies [61-63]. Methods inherent to the approach have also been used to advise guideline uptake for managing malaria and to prevent reintroduction in areas of the Western Pacific where the disease has been successfully eliminated [64, 65].

A summary of the research process outlined in Chapter 2, the findings and the significance of this research are documented in Chapter 3. I present a detailed account of primary healthcare providers' perspectives on guideline compliance for malaria diagnosis in Ghana and outline the conceptual model for investigating guideline compliance among the providers. I explain guideline compliance as a composite interaction at the point of care, influenced by a host of factors, among which the essential structural components relate to policy, practice and technology for diagnosing malaria. The legitimacy of the conceptual model and the findings I present in Chapter 3 are verifiable based on existing literature, as documented in the comprehensive review documented in Chapter 1. Evidence from the primary research conducted highlights the significant interplay between RDT use and guideline implementation from the healthcare provider's perspective. Using ethnographic data analysis procedures, I address the main research objective of understanding guideline compliance by identifying the major determinants of poor guideline compliance among primary healthcare providers in a Ghanaian setting. I further describe how these determinants influence compliance. The reliability of the findings is demonstrated through the expository data collection and analysis procedures presented in Chapters 2 and 3. The identification of the essential determinants and how these influence guideline compliance as presented in Chapter 3, represent a significant contribution towards bridging the knowledge gap about guideline compliance for rapid malaria diagnosis in an endemic setting.

The findings of this thesis have implications for a diverse body of stakeholders in malaria control. These include healthcare practitioners, policy and program officials, technology developers, and funding institutions concerned with expanding universal diagnostic coverage for malaria in low-resource environments.

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# CHAPTER ONE

BARRIERS AND FACILITATORS TO ROUTINE USE OF RAPID DIAGNOSTIC TESTS IN CASE MANAGEMENT OF MALARIA: A REVIEW OF THE LITERATURE ON SUB-SAHARAN AFRICA.

## Introduction

Accurate diagnosis of malaria is essential to promote targeted antimalarial use in endemic settings where fevers are commonly attributed to malaria (Perkins and Bell, 2008). The World Health Organization (WHO) currently recommends confirmatory testing by microscopy or where unavailable by rapid diagnostic tests prior to treating suspected malaria cases (World Health Organization, 2010). Based on this recommendation, case management guidelines for malaria in Ghana now specify parasitological confirmation of suspected cases aged five years and older prior to treatment with antimalarials (Ghana Health Service., 2009). Yet presumptive treatment of fevers as malaria is common practice in sub-Saharan Africa (Reyburn et al., 2007, Hamer et al., 2007). The WHO Global Malaria Program's T3: Test.Treat.Track initiative (T3) issued in 2012 emphasizes the centrality of diagnostic testing to effective malaria control. T3 advocates donor and policymaker support to expand universal coverage of diagnostic testing, treatment and surveillance for malaria in endemic countries. The initiative is founded on three core WHO documents on malaria (Kilian et al., 2000): (1) Guidelines for the treatment of malaria, second edition (2010); (2) Universal access to malaria diagnostic testing: an operational manual (2011); and (3) Disease surveillance for malaria control and elimination (2012).

Extensive financing and implementation of malaria control over the past decade have substantially reduced the disease burden including in some high transmission settings within sub-Saharan Africa (Durairaj, 2010). According to the WHO, global malaria mortality has declined from 985,000 deaths in 2000 to about 660,000 deaths in 2010 (World Health Organization., 2012b, World Health Organization., 2009). Murray and others (2012) dispute these figures, suggesting that they substantially under-estimate malaria mortality particularly in sub-Saharan Africa (Shah et al., 2012, Snow et al., 2005). Despite debates on the precision, sources and methods informing estimates of the malaria burden, there is general agreement that the significant impact of current interventions represents major achievements in global malaria control. There is also growing advocacy to sustain this momentum (Shah et al., 2012, World Health Organization., 2012b). Declining malaria transmission in endemic settings (Durairaj, 2010, O'Sullivan et al., 2011), emerging parasitic resistance to effective and yet costly drugs (White, 2004, World Health Organization., 2012a) and the thin pipeline for developing new antimalarials (Grimberg and Mehlotra, 2011, Burrows et al., 2011, Lim et al., 2013) have increased support for universal coverage of diagnostic testing in endemic areas (D'Acremont V., 2009, World Health Organization, 2010).

Nevertheless, malaria remains the leading cause of morbidity and mortality in sub-Saharan Africa where more than 90% of the global burden is located. Children younger than five years of age account for a majority of malaria deaths in this region every year (Breman et al., 2001, Breman, 2004, Durairaj, 2010, Snow et al., 2005). There is also increasing concern that progress towards global malaria control targets is waning in tandem with declining funding support in recent years (World Health Organization., 2012b).

Several challenges impede effective malaria control in endemic areas. Clinical presentation of malaria is highly variable and closely mimicked by several common tropical illnesses. These include self-limiting viral and potentially fatal bacterial infections such as meningitis and pneumonia (Durrheim, (in press), Kallander et al., 2004). Diagnostic testing enables targeted use of antimalarials by reducing over-diagnosis of malaria and the consequent over-consumption of antimalarials. Inappropriate antimalarial consumption also includes improper dosing for repeated infections in highly endemic areas, further draining household, national and donor resources (Amexo et al., 2004, Bell, 2008). Targeted antimalarial use is essential to contain emerging drug resistance and to promote better management of non-malarial fevers commonly mis-diagnosed as malaria (Koram and Molyneux, 2007, Hopkins, 2009, White, 2004). Accurate diagnostic testing also facilitates the necessary reporting to assess intervention impact in high transmission areas, to detect potential outbreaks and to prevent reintroduction where malaria transmission has successfully been interrupted (O'Sullivan et al., 2011, Kilian et al., 2000).

Rapid diagnostic tests (RDTs) allow parasite-based diagnosis and support prompt delivery of effective treatment in resource-poor settings where quality-assured microscopy is unsustainable (Perkins and Bell, 2008, WHO Global Malaria Programme, 2011). However, RDT use among healthcare providers in endemic areas remains sub-optimal. Furthermore, where available, providers frequently diagnose and treat patients inconsistently with test results (Bisoffi et al., 2009, English M, 2009 , Reyburn et al., 2007, Msellem et al., 2009). Understanding which factors facilitate or limit RDT use for malaria diagnosis is fundamental to expanding coverage of diagnostic testing and appropriate treatment in endemic settings (Asiimwe et al., 2012, Hopkins, 2009, Chandler CI., 2010, Ezeoke et al., 2012).

**Objective**

The aim of this review was to assess current evidence on barriers and facilitators regarding RDT use for malaria diagnosis in sub-Saharan African primary healthcare delivery settings.

**Methods**

NYB conducted a comprehensive search and subsequently reviewed relevant published and grey literature using established guidelines for conducting systematic reviews in health promotion and public health interventions (Armstrong R, 2007).

Search strategy

NYB conducted a comprehensive search for peer-reviewed and non peer-reviewed literature in November 2011. To verify the appropriateness of search terms including *rapid diagnosis, rapid diagnostic tests, RDTs* and *malaria* for identifying relevant literature, these terms were compared to controlled vocabulary terms such as Medical Subject Headings (MeSH) terms and key index terms from known references on rapid malaria diagnosis. A search strategy comprising a combination of the verified search terms with key phrases such as 'use', 'utilization', 'implementation' and 'Africa south of the Sahara' was applied to the following bibliographic databases: PubMed/MEDLINE, Global Health, EMBASE, CINAHL and Web of Science. A manual search of references from retrieved articles, databases including ProQuest Dissertations and Theses, and stakeholder websites including Malaria No More, Africa Fighting Malaria, The Global Fund to fight AIDS, Tuberculosis and Malaria, and the World Health Organization (WHO), yielded relevant, non-peer reviewed (grey) literature. For completeness, manual searching also included the reference lists of recent issues from relevant journals including *Malaria Journal.* The search strategy cast a wide net to capture pertinent literature on RDT use and implementation across sub-Saharan Africa. This was important to identify studies reporting limiting and facilitating conditions for RDT use that may not have included the terms "barriers" and/or "facilitators". The search was re-run in January 2012 and March 2013 to identify recent publications of potential relevance to the review. Appendix 1-1 outlines the complete search strategy used to identify articles included in this review.

Study eligibility criteria

One reviewer (NYB) scanned titles and two reviewers (NYB and DM) independently screened and selected abstracts of relevant citations using pre-defined inclusion criteria (Appendix 1-2). Inclusion was limited to studies conducted in sub-Saharan Africa and which investigated factors affecting RDT use (i.e. impact *on* rather than impact *of)* by healthcare providers at peripheral facilities. Studies on malaria diagnosis that did not involve RDT use or that did not report factors potentially influencing RDT use among healthcare providers were excluded. Studies involving malaria diagnosis in non-traditional settings such as home-based or health volunteer-facilitated malaria management were also excluded.

Data collection and analysis

NYB and DM independently tested the data extraction form (Appendix 1-3) using a random sample of about 10% of the included studies. This process enabled necessary revision to establish reliability for independent data extraction. NYB extracted data extraction from the remaining studies. This included information on study design, healthcare delivery settings, healthcare provider cadres, and reported barriers and facilitators with respect to RDT use.

NYB created a list of terms used to describe barriers and facilitators in the included studies. These terms were revised through comparison with known references in the literature and in consultation with a topic expert (JHA). The revised list was used to categorize and organize qualitative findings that included positive or negative provider perceptions surrounding RDT use. This involved coding - systematically identifying and labeling - key words or phrases associated with barriers and facilitators to RDT use identified in the included studies. Thematic analysis (MacQueen, 2012) was used to describe and to organize barriers and facilitators into one or more of four broad themes identified to influence RDT use. NYB categorized and tabulated the identified barriers and facilitators within the four major themes with reference to the nature of their influence on RDT use. As an illustration, barriers such as 'limited RDT availability', 'stock outs' and 'lack of ancillary supplies' were categorized as either 'infrastructural constraints' or 'resource constraints' and categorized thematically as "health system capacity" factors. Other health system barriers relating to 'inadequate staffing levels' and 'poor inventory and supply management' were further categorized as 'systemic constraints' affecting healthcare delivery and invariably, RDT implementation.

DM, JHA and SY reviewed the categorization of barriers and facilitators and provided input to improve their organization and to verify the accurate use of terminology. JHA further reviewed the outlined categories to establish their practical relevance to current evidence on RDT implementation in sub-Saharan Africa. NYB entered data into Atlas.ti qualitative data analysis software (ATLAS.ti Scientific Software Development GmbH) to create a graphical representation of barrier and facilitator categories, which illustrated their interactive nature and influence on RDT use. The findings were summarized using narrative review (Green et al., 2006, Popay et al., 2006).

Quality assessment of included studies

NYB assessed the methodological quality of the included studies using established criteria for critical appraisal of quantitative, qualitative, and mixed methods studies (Pluye, 2011). Quantitative assessments were centered on hierarchical categorization of study design (i.e. randomized, non-randomized, quasi-experimental or observational), sampling strategies and participant response rates. Qualitative criteria were based on methodological rigor of data collection, trustworthiness of data sources, and the transparency of the researcher(s)' role and influence on the research process and outcome (Shenton, 2004). The quality of mixed methods studies was determined by the relevance of the design to the research question, the integration of methods used to produce findings, and the inherent limitations of each method.

**Results**

A total of 1821 studies were identified from the literature search, with 916 remaining after removing duplicates. Based on the limited availability of literature on routine RDT implementation in sub-Saharan settings, the search strategy widely captured potentially relevant articles including those that did not include the specific terms 'barriers' or 'facilitators'. After scanning the titles of all 916 articles, 128 abstracts were retained for screening based on their apparent relevance to the review objective. Among these 40 articles were selected for full text review. NYB and DM independently reviewed the 40 potential inclusions against pre-specified inclusion and exclusion criteria that were based on the review objectives (Appendix 1-2). This effectively reduced the sample to 15 articles that fully satisfied all inclusion criteria. Any discrepancies on inclusion and exclusion were resolved through consensus (NYB and DM) and expert consultation (JHA). The search process is summarized in a PRISMA flow diagram (Figure 1-1).

Study design

Six of the 15 studies involved qualitative designs, 7 used quantitative designs and 2 incorporated mixed methods (both quantitative and qualitative) designs. Data collection methods in the studies included interviews (9 studies), surveys (6 studies), and records reviews (3 studies). Several studies involved multiple data collection methods such as interviews alongside observational surveys using a checklist of standard steps for conducting RDTs (3). The essential characteristics of all the studies are summarized in Table 1-1.

Characteristics of the included studies

*Geographical spread across sub-Saharan Africa*

The review comprised studies conducted in 8 countries across East, West and Southern Africa, and Sudan as follows: East Africa (5): Uganda (4), Tanzania (1); West Africa (4): Ghana (1), Nigeria (3); Southern Africa (4): Malawi (1), South Africa (2); and Sudan (2).

*Healthcare delivery settings*

All but 2 studies involved primary healthcare facilities only. Six studies in Angola (1), Malawi (1), Nigeria (1), South Africa (1) and Sudan (1) involved providers at district hospitals (district-level facilities), clinics and health centers (sub-district level facilities), and community-level facilities such as basic health units, health posts, dispensaries, pharmacies, and patent medicine dealers. The represented facility types were typical of organized primary healthcare delivery settings in sub-Saharan Africa. Two studies conducted in Sudan (1) and Tanzania (1) included only community-level facilities while 7 studies conducted in Ghana (1), Nigeria (1), Uganda (4), and South Africa (1) involved sub-district facilities only. One South African study included providers from regional hospitals. Another study conducted in Nigeria included providers at a teaching hospital. Regional and teaching hospitals are considered secondary and tertiary facilities respectively, providing referral and specialized care.

*Cadres of healthcare providers*

A total of 1140 healthcare providers participated in all 15 studies, representing diverse cadres including physicians, physician assistants, clinical officers, nurses, healthcare assistants, pharmacists, licensed drug retailers and laboratory technicians. The general representation of provider cadres implied direct

involvement with malaria diagnosis and/or prescription of antimalarials. Healthcare provider cadres and facility designations in the included studies were predicated on existing Ministry of Health (MOH) structure and function classifications in the respective countries. The represented cadres were comparable across the studies, as MOH facility and staff classifications are largely similar across sub-Saharan Africa.

Quality of included studies

Most of the studies satisfied a majority of the essential quality assessment criteria indicating that the general quality of included studies was standard (Table 1-2). For a few of the quantitative studies, information regarding the participant response rates was unclear. A common issue among the qualitative studies and related components of mixed methods studies was a lack of clarity regarding the researcher's role and potential influence in the research process. This is an essential criterion for evaluating the trustworthiness of qualitative findings (Shenton, 2004). The quantitative studies mostly satisfied all essential criteria. The only included randomized controlled trial (RCT) did not include blinding - keeping the investigators and/or the participants unaware of the exposure (intervention) or outcome classifications - to minimize bias (Oleckno, 2002). This study randomized providers at 30 facilities to implement one of 3 diagnostic modes for malaria including clinical diagnosis, microscopy, or RDT use (Batwala et al., 2011). Random allocation of the intervention in this study was also compromised by the existing mode of diagnosis at the various facilities. Moreover, it was impractical to blind the healthcare providers or their patients to the mode of diagnosis being used for malaria. Consequently, the quality of the RCT was compromised.

Barriers and facilitators to RDT use

Barriers and facilitators in the included studies were associated with one or more of four main thematic areas. These were: 1) health system capacity, (2) healthcare providers' perceptions and preferences, (3) policy guideline information, and (4) characteristics features of RDTs.

Barriers to RDT use

Barriers to RDT use were reported in all 15 studies, 13 of which included factors related to health system capacity. Healthcare providers' perceptions and preferences were reported as barriers in 10 studies. Barriers related to characteristic features of RDTs (9 studies) and to policy guideline information (6 studies) were also common. Several of the reported barriers were associated with more than one of the 4 main thematic areas. Barriers to RDT use identified in each study are summarized in Table 1-3.

*Health system capacity as a barrier*

The management of uncomplicated malaria in Ghana and other sub-Saharan settings falls within the domain of primary healthcare (Ghana Health Service., 2009). Limited health system capacity is common across in these environments. Consequently, the quality of primary healthcare delivery at the facility level is fraught with resource and infrastructural constraints including scarcity of essential healthcare commodities. Several infrastructural health system barriers to RDT use were identified in this review, including a lack of basic amenities such as running water at several facilities, frequent and prolonged stock out periods of RDTs and ACTs (Abdelgader et al., 2012). RDT use was also constrained by systemic constraints to healthcare delivery including inadequate in-service training and insufficient staffing levels, which in turn contributed to a shortage of appropriately skilled staff. The resulting heavy patient caseloads typically constrain providers in poor-resource settings from implementing best practices (Mills, 2006). Chandler et al. (2010) reported health system barriers to RDT implementation that included weak management and accountability structures, a lack of motivation among healthcare providers, and limited stakeholder support. Findings from a similar study conducted in Nigeria revealed that a lack of government advocacy and supervision over the immediate 12-month period following RDT introduction at health facilities undermined healthcare providers' commitment to adhere to RDT results when managing malaria (Uzochukwu et al., 2011). Systemic healthcare delivery constraints to RDT use identified in this review included weak regulatory frameworks leading to poor quality assurance and control procedures, such that RDTs supplied to healthcare providers were sometimes defective (Kyabayinze et al., 2012a). Studies conducted in South Africa (Moonasar et al., 2009) and Sudan (Seidahmed et al., 2008) also reported an association between defective RDT devices and difficulties with use experienced by providers.

*Healthcare providers' perceptions and preferences as a barrier*

Implementing parasite-based diagnosis necessitates acceptance of a new diagnostic technology and an attendant paradigm shift among providers in low-resource, malaria-endemic settings (English M, 2009 , Perkins and Bell, 2008). Studies that reported barriers to RDT use resulting from negative providers' perceptions associated these barriers with inadequate case management knowledge and preparedness (Abdelgader et al., 2012, Kyabayinze et al., 2012a, Moonasar et al., 2007), sub-optimal skill and proficiency regarding RDT use (Moonasar et al., 2009, Seidahmed et al., 2008), individual preferences for other modes of diagnosis (Uzochukwu et al., 2010) and providers' inertia to change existing practice (Chandler CI., 2010). These barriers generally resulted in limited RDT use among providers (Asiimwe et al., 2012, Ezeoke et al., 2012).

*Policy guideline information as a barrier*

Implementing broad health sector policies at the facility level is influenced by the political, historical and socio-economic environment within which policy implementation occurs (Birn, 2009). Consequently, poor planning for policy change undermines the implementation of best practices at the point of care (Mills, 2006). The lack of government emphasis and poor guideline dissemination in support of RDT use contributed to low levels of guideline awareness and knowledge among providers. This in turn hindered routine and effective RDT use. Findings from studies conducted in Ghana (Chandler CI., 2010), Uganda (Asiimwe et al., 2012), and Tanzania (Williams et al., 2008) indicated barriers including inconsistent guideline information due to frequent policy changes. The lack of clarity and consistency guideline information created confusion and discouraged providers from integrating RDTs into routine malaria diagnosis.

*Characteristics of RDTs as a barrier*

Eight studies identified barriers related to technical limitations of RDTs. Five out of these 8 reported provider difficulties with using the blood collection device provided with the test kits (Asiimwe et al., 2012, Ezeoke et al., 2012, Moonasar et al., 2009, Seidahmed et al., 2008, Uzochukwu et al., 2011). Difficulties with RDT use that were associated with poor test quality commonly led to a lack of providers' confidence in RDT results, especially those that were negative (Asiimwe et al., 2012, Batwala et al., 2011, Chandler CI., 2010, Ezeoke et al., 2012, Moonasar et al., 2007, Seidahmed et al., 2008, Tavrow,

2000, Uzochukwu et al., 2011). This lack of confidence further discouraged routine RDT use among providers' for diagnosing malaria.

Facilitators to RDT use

Eight studies identified facilitators to healthcare providers' use of RDTs in routine malaria diagnosis, all of which included factors related to characteristics of RDTs. Other facilitators were associated with providers' perceptions and preferences surrounding RDT-based malaria diagnosis, with particular emphasis on case management knowledge, skill and proficiency (2 studies) and health system capacity (2 studies). The identified facilitators are organized with respect to the 4 thematic areas of influence on RDT use and summarized in Table 1-4.

*Health system capacity as a facilitator*

Abdelgader et al. (2012) found that healthcare providers' compliance with case management guidelines improved in facilities with adequate and readily available RDT and ACT supplies. However, unlike infrastructure constraints that are effectively addressed through resource allocation, efficient management systems at the facility level were more useful in circumventing systemic barriers to RDT use (Mills, 2006) . Efficient staff management procedures were associated with sustained RDT use. Interruptions to testing due to staff absences were minimized at facilities where RDT use was not restricted to laboratory or specially trained personnel (Batwala et al., 2011). Improved regularity of use was also reported at facilities where RDT use was assigned on rotational bases among various staff persons (Williams et al., 2008).

*Healthcare providers' perceptions and preferences as a facilitator*

High RDT utilization rates were reported among healthcare providers in Uganda who received formal as well as informal (peer) training on RDT use (Kyabayinze et al., 2012b). In contrast to this, Tavrow and collaborators (2000) observed improved RDT performance among providers in Malawi who received clear and concise manufacturers' instructions with or without formal training.

*Characteristics of RDTs as a facilitator*

Positive provider perceptions of RDTs contributed to a preference for their use and enhanced their acceptability. Providers who saw RDTs as symbols of "professionalism" and "empowerment" in the care-giving process were more inclined to change existing (presumptive diagnostic) practices (Asiimwe et al., 2012, Chandler CI., 2010). Positive perceptions were generally associated with advantages of RDT use over other modes of diagnosis including simplicity (Chandler CI., 2010), shorter waiting times for test results (Batwala et al., 2011) and suitability for practice in remote settings (Asiimwe et al., 2012, Uzochukwu et al., 2011, Williams et al., 2008). Previous experience with other non-malarial RDTs in the setting including tests for pregnancy and blood sugar levels might have contributed to providers' favorable perceptions of RDT use based on familiarity with the simplicity of rapid testing procedures.

**Discussion**

The role and significance of RDTs in malaria control is likely to expand given increasing global emphasis on test-based malaria management and cost-effective expansions to intervention coverage (Bell et al., 2006, Bell, 2008, Bisoffi et al., 2009). This review provides a timely synthesis of current evidence on barriers and facilitators to routine RDT use for malaria diagnosis. Previous reviews focused on diagnostic accuracy and quality (Abba et al., 2011, Forney et al., 2003, Murray et al., 2008, Wongsrichanalai et al., 2007). Recent advocacy for accurate and accessible diagnostic tools to meet global targets for malaria control warrants similar investment to address challenges with RDT implementation in endemic settings (English M, 2009 , Perkins and Bell, 2008, WHO Global Malaria Programme, 2011). Understanding the barriers and facilitators to RDT adoption among healthcare providers is essential for developing interventions to promote uptake and to improve overall malaria management.

The findings suggest that barriers and facilitators to RDT use are primarily associated with health system capacity, individual healthcare provider perceptions and preferences, policy guideline information, and features of the RDTs themselves. Most of the included studies reported factors that related to more than one of the 4 thematic areas representing barriers and facilitators with respect to RDT use. This finding suggests that these factors occur concurrently and work interactively rather than independently to influence RDT use. As an example, systemic barriers to healthcare delivery such as poor inventory management, inefficient distribution procedures, and a lack of quality assurance and control contributed to limited and irregular RDT and ACT availability and defective test kits at health facilities. These factors in turn undermined providers' confidence in the veracity of RDT results and limited their use for routine malaria diagnosis (Abdelgader et al., 2012, Chandler CI., 2010, Asiimwe et al., 2012). The interaction among barriers and likewise among facilitators indicates mutual reinforcement of their combined influence on RDT use among providers. These interactions are illustrated in the graphic representations of the identified barriers and facilitators (Appendices 1-4 and 1-5) and are discussed in further detail below.

The lack of essential commodities restricts the effectiveness and utility of RDT-supported malaria diagnosis. Without adequate and available ACT supply, providers who correctly diagnosed malaria using

a RDT could not further manage their cases in accordance with existing treatment guidelines (Abdelgader et al., 2012, Asiimwe et al., 2012, Rowe et al., 2009, Williams et al., 2008, World Health Organization, 2010). Limited health sector resources adversely affect the quality of in-service training and reinforce other barriers. Insufficient in-service training results in sub-optimal providers' case management knowledge, skill and proficiency, which limits the uptake of new diagnostic technologies including RDTs. Findings from a study in Uganda reported a 75% RDT utilization rate among healthcare providers over the 6-week period following a 1-day training session on RDT use (Kyabayinze et al., 2012b). Other studies debate the adequacy of a day's training for RDT use (Asiimwe et al., 2012, Chandler CI., 2010, Rowe et al., 2009). Yet, formally trained healthcare providers in the Ugandan study were able to successfully train their peers.

Systemic barriers to healthcare delivery including weak staff management and promotional structures led to chronically overworked and demoralized staff (Asiimwe et al., 2012, Chandler CI., 2010), with negative effects on the uptake of best practices (Mills, 2006). Williams et al. (2008) reported that high case loads (>25 patients per healthcare provider per day) were associated with a reduced frequency of RDT use among healthcare providers in Angola. This finding was consistent with earlier evidence that the feasibility and perceived utility of testing every febrile patient and waiting for test results to guide case management diminishes with increasing patient caseloads in high transmission areas (Snow et al., 2005).

Technical limitations of RDTs contributed toward negative provider perceptions, which limited RDT use (English M, 2009 , Chandler CI., 2008). Poor test kit quality raised concern among providers about the reliability of negative RDT results. These concerns centered on the risks of missing a true case of malaria, considered inexcusable in high transmission settings (Asiimwe et al., 2012, Chandler et al., 2008, Chandler CI., 2008, Chandler CI., 2010, Ezeoke et al., 2012, Reyburn et al., 2004). The safety of withholding antimalarials from febrile, RDT negative children has been demonstrated in in low- to moderate malaria transmission settings in Tanzania and Uganda (D'Acremont, 2010). An earlier investigation in Uganda produced comparable findings (Njama-Meya et al., 2007) Yet debates persist over appropriate case management of vulnerable populations in high transmission settings (Bisoffi et al., 2009, D'Acremont V., 2009, English M, 2009 )These debates often result from inconsistent, poorly

disseminated policy guidelines and a lack of advocacy on the part of national governments. As was evident in this study, the lack of clarity contributes to confusion, poor compliance with case management guidelines (Abdelgader et al., 2012, Asiimwe et al., 2012, Batwala et al., 2011, Chandler CI., 2010, Kyabayinze et al., 2012a, Uzochukwu et al., 2010), and reluctance among providers to adopt improved methods for diagnosing malaria (D'Acremont et al., 2007).

Most of the studies that identified facilitators to RDT use were conducted as part of operational research. This is understandable in the light of limited literature on routine RDT implementation that would inform experimental studies to better understand potential facilitators (Asiimwe et al., 2012). Nonetheless, providers who adopted RDT use in place of presumptive practices generally expressed positive perceptions about the advantages of RDT use including simplicity of the test procedure and shorter wait times for test results (Batwala et al., 2011, Chandler CI., 2010, Williams et al., 2008). RDT use and healthcare providers' compliance with the confirmatory testing guideline for managing malaria improved significantly at facilities with adequate RDTs and ACT supply, especially among providers who received training on the revised malaria management protocol (Abdelgader et al., 2012). This finding supports the notion of interaction among the various factors that influence RDT use. Likewise, enhancing the quality of RDT packaging and the clarity of manufacturer's instructions available to healthcare providers in Malawi resulted in parallel improvements in correct performance of the recommended steps for conducting RDTs. This finding also indicated a connection between regulatory (quality assurance and control) structures, healthcare providers' proficiency and comfort with RDT use, and a likely increase in RDT uptake (Tavrow, 2000).

As with other primary healthcare delivery programs, successful RDT implementation at the facility level requires comprehensive rather than isolated supporting interventions. Because these factors generally occur concurrently and interactively influence RDT use, multi-faceted strategies are required to address the identified barriers. Where resource constraints do not permit broad and comprehensive initiatives, incremental strategies to address barriers should be considered in order to sustain gradual improvements over time (Mills, 2006). Addressing systemic barriers to RDT use such as insufficient staff capacity may require long-term and capital-intensive solutions (Palmer et al., 2004, Schieber et al., 2006). These might include revisions to healthcare training programs with appropriate incentives to

recruit, equip and retain suitably qualified staff especially in under-served areas (Hensher, 2001, Preker, 2003). Community health worker initiatives are a common strategy for bolstering primary healthcare delivery in many rural African settings (Bryan, 2010). These programs offer limited training, which often does not adequately prepare the workers for the roles they assume where formally trained professionals are lacking. Organized healthcare delivery that relies substantially on informally trained providers should accommodate the existing skill levels of the represented provider cadres. Furthermore, training programs should appropriately target interventions to improve healthcare providers' knowledge, skill and proficiency and the overall quality of care delivery by incorporating supportive supervision and regular evaluations at the facility level.

More than 40 countries in sub-Saharan Africa have adopted the WHO recommendation of confirmatory malarial testing prior to treatment with antimalarials, particularly for patients aged five years and older (World Health Organization., 2012b). Consistent policy emphasis, supportive supervision and comprehensive in-service training are necessary to facilitate RDT uptake and to enable guideline implementation at peripheral facilities. The moderate effect of training alone on RDT use among healthcare providers' suggests the importance of identifying non-monetary incentives to improve performance for overall malaria management in under-resourced areas (Jayasuriya, 2012, Razee et al., 2012, Rowe et al., 2009, Rao et al., 2013).

Healthcare delivery in low- and middle- income countries (LMICs) is inextricably linked with the socio-cultural environment (Mills, 2006, Palmer et al., 2004, Sachs and Malaney, 2002, Worrall et al., 2005). Socio-cultural understandings of malaria influence the uptake of prevention and treatment interventions in sub-Saharan African settings (Maslove et al., 2009). Chandler and others (2012) also identified that RDTs and antimalarials formed an essential part of the social interaction between Cameroonian providers and patients and were not merely considered biomedical aspects of case management (Chandler et al., 2012). Nevertheless, there is limited literature on interactions between the social environment and healthcare providers' performance especially in resource-limited environments (Razee et al., 2012). Social interactions were however not emphasized in this review, as they were not addressed in the studies included in this review. However, this knowledge is important to advise the development of cost-effective strategies to improve providers' performance, motivation and commitment

to quality care delivery, which includes the uptake of best practices. This review focused on RDT use in sub-Saharan African settings. However, where appropriate, other factors based on studies conducted in other non-African, malaria-endemic settings were used to inform the interpretation of the findings from this review.

Limitations

This review focused on studies that described barriers and facilitators to RDT use for routine malaria diagnosis in sub-Saharan African settings. The related body of literature is scant. The overall review therefore included a small number of studies conducted in only 8 of the 43 sub-Saharan African countries that have currently adopted a confirmatory testing approach to malaria management. However, these 8 countries represented areas in East, West and Southern Africa as well as Sudan where RDT implementation is ongoing. African countries within the various regions tend to share similar epidemiological profiles for malaria, which increases the likelihood of the findings being applicable to RDT implementation beyond the borders of the included countries. In this regard, the findings of this review are likely to be transferable to settings with similar economic, socio-cultural, or political characteristics that were identified to influence health system capacity and function, and invariably RDT implementation in the study countries.

**Conclusion**

Malaria management is a core component of primary healthcare delivery in poor-resource, endemic settings. RDTs are currently the primary means of implementing confirmatory testing to improve malaria management at peripheral facilities. This review assessed and synthesized current evidence on barriers and facilitators to RDT use in sub-Saharan Africa. The findings are useful to diverse stakeholders working with limited available resources to improve malaria control in endemic settings. Beyond ensuring availability, accessibility, and affordability, effective RDT implementation requires strategic support to realize the potential benefits of accurate diagnosis, treatment and surveillance of malaria. Barriers to RDT use must be addressed using interventions that target factors at the health system and individual healthcare provider levels. Health system improvements to ensure adequate resource availability, reliable inventory and staff management, and effective regulatory enforcement are critical to the success of RDT implementation. Improved provider education and regular, supportive supervision will better inform preferences and perceptions relating to RDTs and will promote their integration into routine malaria management. Supportive supervision should also inform feedback mechanisms to improve current RDT capacity by routinely engaging healthcare providers' perspectives on RDT-supported malaria diagnosis. This will enhance the utility of RDT-supported malaria diagnosis in limited-resource, endemic environments. National governments in malaria endemic countries should support Ministry of Health initiatives to emphasize clearly communicated and consistent guideline information. This will promote guideline awareness and knowledge to improve RDT uptake among providers. The findings of this review highlight the important consideration that isolated strategies such as in-service training or increased resource availability are necessary but insufficient on their own for successful RDT implementation. Multi-faceted approaches should be considered to strengthen accurate diagnosis of malaria in low-resource settings. This will enable cost-effective expansions to diagnostic and treatment intervention coverage for malaria in Africa.

**Reviewers' contributions**

Nana Yaa Boadu, MPH **(NYB)** is a PhD Candidate in Public Health Sciences at the School of Public Health, University of Alberta in Edmonton and the primary author of this review. Dev Menon, PhD **(DM)** is a member of NYB's PhD Supervisory Committee. DM provided guidance, facilitated data extraction and provided feedback on draft and final versions of the manuscript. DM was also an independent reviewer for study selection, inclusion and data abstraction. John H. Amuasi, MBCHB, MPH **(JHA)** is a Fellow at the Humphrey Center for Global Change at the University of Minnesota in Minnesota, USA. JHA provided guidance on the accuracy and practical relevance of terms used in representation of the results. JHA also provided guidance on consensus decisions regarding study inclusion where discrepancies existed between reviewers' assessments. Stephanie Yanow, PhD **(SY)** is the primary supervisor for NYB's PhD program at the School of Public Health, University of Alberta in Edmonton. SY provided guidance during data extraction and facilitated synthesis of the results and manuscript writing. Edna Einsedel, PhD **(EE)** is a member of NYB's PhD Supervisory Committee. EE provided guidance during the original design of the review and provided feedback on draft and final versions of the manuscript.

**Tables in Chapter One**

Table 1-1: Descriptive characteristics of included studies

| Primary Author | | Year of Publication | Study design | Study Methods | Country | Setting | Participants |
|---|---|---|---|---|---|---|---|
| 1 | Abdelgader | 2012 | Quantitative<br>Observational<br>Cross-sectional<br>Analytic | Survey:<br>Health facility assessment<br>Interviews<br>Records review | Sudan | **Level of care delivery**<br>Hospitals<br>Health centers<br>Basic health units<br>**Access to services: public/private**<br>Public<br>**Ownership/operating authority**<br>Government<br>Non-governmental organization (NGO)<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Nationwide<br>Geographical spread<br>**Representation proportion**<br>244/5716 public health facilities nationwide | **Health workers: 294**<br>Doctors (79)<br>Medical assistants (129)<br>Nurses (37)<br>Community Health Workers (37)<br>Other cadres (12) |
| 2 | Asiimwe | 2012 | Qualitative<br>Cross-sectional<br>Descriptive<br>Nested | Interviews<br>Questionnaires | Uganda | **Level of care delivery**<br>Health centers<br>**Access to services: public/private**<br>Public<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural<br>Urban<br>**Representation/stratification criteria**<br>Malaria epidemiology/transmission High/Moderate/Low<br>Rural/urban localities<br>**Representation proportion**<br>21/167 health centers in study area | **Health workers: 63**<br>Clinical officers<br>Laboratory technicians<br>Records assistants<br>General service support staff:<br>Health educators<br>Nursing assistants<br>Vaccinators |
| 3 | Batwala | 2011 | Quantitative<br>Experimental<br>Randomized Controlled Intervention trial<br>Comparative | Records review (weekly) | Uganda | **Level of care delivery**<br>Health center<br>**Access to services: public/private**<br>Public<br>**Ownership/operating authority**<br>Government<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Malaria epidemiology/transmission intensity High/Low<br>**Representation proportion**<br>30/35 health centers in study area | **Health workers: 133**<br>Clinical officers (24)<br>Nursing officers (13)<br>Enrolled or registered nurses (13)<br>Midwives (30)<br>Nursing assistants (36)<br>Laboratory assistants (15)<br>Additional health workers (12) – not specified |
| 4 | Chandler | 2010 | Qualitative<br>Cross-sectional<br>Descriptive<br>Nested | Interviews | Ghana | **Level of care delivery**<br>Health centers<br>Clinics<br>**Access to services: public/private**<br>Private<br>Public<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural | **Health workers: 11**<br>Prescribers<br><br>**Other stakeholders: 2**<br>District Health Management Team representatives<br>Malaria interest persons |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Representation/stratification criteria**<br>Not reported<br>**Representation proportion**<br>4/17 community health facilities in study area | |
| 5 | Ezeoke | 2012 | Qualitative<br>Descriptive | Interviews | Nigeria | **Level of care delivery**<br>Health centers<br>Patent medicine dealers<br>Pharmacies<br>**Access to services: public/private**<br>Private<br>Public<br>**Ownership/operating authority**<br>Government<br>Private<br>**Environment/locality**<br>Rural<br>Urban<br>**Representation/stratification criteria**<br>Rural/urban localities<br>Geographical spread<br>Healthcare provider cadres<br>**Representation: sample/population**<br>Sample – 26 health facilities in study area<br>Population – Not reported | **Health workers: 26**<br>Drug retailer/pharmacist (15)<br>Nurses (2)<br>Additional health workers (9)<br>Nursing assistants<br>Community Health Extension Workers (CHEWs)<br>Other cadres (not specified) |
| 6 | Kyabayinze | 2012(a) | Quantitative<br>Observational<br>Cross-sectional<br>Descriptive<br>Nested | Quantitative component<br>Survey - observations using checklists<br>Interviews using pre-coded questionnaires | Uganda | **Level of care delivery**<br>Health centers (Levels II and III)*<br>**Access to services: public/private**<br>Missions<br>Private<br>Public<br>**Ownership/operating authority**<br>Faith-based<br>Government<br>Private<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Malaria epidemiology/transmission<br>Geographical spread<br>**Representation proportion**<br>125 out of 250 health centers in study area | **Health workers: 131**<br>Clinical officers (9)<br>Midwives (8)<br>Nursing aides or assistants (86) |
| 7 | Kyabayinze | 2012(b) | Mixed methods<br>Quasi-experimental<br>Health facility-based<br>Nested | Qualitative component<br>Interviews<br>Participant observation<br><br>Quantitative component<br>Records review | Uganda | **Level of care delivery**<br>Health centers (Level II)*<br>**Access to services: public/private**<br>Public<br>**Ownership/operating authority**<br>Government<br>Non-governmental organization (NGO)<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Malaria epidemiology/transmission<br>Geographical spread<br>**Representation proportion**<br>20 out of 58 health centers in study area<br>Population: Not reported | **Health workers: 135**<br>Clinical officers (8)<br>Nurses (48)<br>Nursing assistants (65)<br>Laboratory technicians (2) |

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|---|---|---|---|---|---|---|---|
| 8 | Moonasar | 2007 | Observational Descriptive | Qualitative Interviews | South Africa | **Level of care delivery**<br>Hospitals<br>Health centers<br>Clinics<br>**Access to services: public/private**<br>Not reported<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Level of care delivery<br>Healthcare provider cadres<br>Local malaria control stakeholders<br>**Representation proportion**<br>3 hospitals (population size of hospitals not reported)<br>10 out of 100 clinics<br>7 out of 35 health centers | **Health workers: 20**<br>PHC Nurses (17)<br>Hospital nurses (3)<br><br>**Other key informants: 10**<br>Hospital pharmacy representative (3)<br>Regional pharmacy manager (1)<br>District malaria managers (3)<br>Researchers (2) |
| 9 | Moonasar | 2009 | Observational Descriptive | Quantitative Survey | South Africa | **Level of care delivery**<br>Clinics<br>Health centers<br>**Access to services: public/private**<br>Not reported<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Malaria epidemiology/transmission<br>**Representation proportion**<br>25 out of 50 clinics and health centers in study area | **Health workers: 25**<br>Qualified nurses (18)<br>Nursing assistants (7) |
| 10 | Rowe | 2009 | Observational Analytic Cross sectional | Quantitative Interviews Records review Survey | Angola | **Level of care delivery**<br>Hospitals<br>Health centers<br>Health posts<br>**Access to services: public/private**<br>Private<br>Public<br>**Ownership/operating authority**<br>Government<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Nationwide<br>Geographical spread<br>**Representation proportion**<br>244 out of 5716 public health facilities nationwide | **Health workers: 93**<br>Physicians (2)<br>Nurses (91) |
| 11 | Seidahmed | 2008 | Quasi-experimental Health facility-based | Quantitative Survey | Sudan | **Level of care delivery**<br>Health dispensaries<br>**Access to services: public/private**<br>Not reported<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Not reported<br>**Representation/stratification criteria**<br>Not reported<br>**Representation proportion** | **Health Workers: 6**<br>Nurses (4)<br>Medical assistants (2) |

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| | | | | | | Not reported | |
| 12 | Tavrow | 2000 | Qualitative<br>Quasi-Experimental<br>Repeated surveys<br>Comparative | Rapid appraisal<br><br>Interviews<br>Observation<br>Records review | Malawi | **Level of care delivery**<br>Hospitals<br>Clinics<br>Dispensaries<br>Health posts<br>**Access to services: public/private**<br>Not reported<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural<br>**Representation/stratification criteria**<br>Cadres of health professionals<br>**Representation proportion**<br>Not reported | **Health Workers: 43**<br><br><u>Survey I and pre-/post- RDT use interview:</u> 19<br>Medical assistants (2)<br>Health assistants (1)<br>Enrolled nurses (5)<br>Health surveillance assistants (11)<br><br><u>In-depth interviews:</u> 4<br>Head of facility - Clinics (4)<br><br><u>Survey II:</u> 20<br>Clinical officers (2)<br>Registered nurses (4)<br>Enrolled nurses (6)<br>Health surveillance assistants (8) |
| 13 | Uzochukwu | 2010 | Observational<br>Descriptive<br>Nested | Qualitative<br>Interviews | Nigeria | **Level of care delivery**<br>Health centers<br>**Access to services: public/private**<br>Private<br>Public<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural<br>Urban<br>**Representation/stratification criteria**<br>Cadres of healthcare providers<br>**Representation proportion**<br>4 out of 12 public health centers in the study area | **Health workers: 74**<br>Doctors (23)<br>Nurses (12)<br>Community Health Extension Workers (CHEWs) or Community Health Officers (CHOs) (22)<br>Laboratory technicians (7) |
| 14 | Uzochukwu | 2011 | Observational<br>Cross-sectional<br>Analytic | Quantitative<br>Survey | Nigeria | **Level of care delivery**<br>Clinics<br>Health centers<br>District hospitals<br>Teaching hospitals<br>**Access to services: public/private**<br>Private<br>Public<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural<br>Urban<br>**Representation/stratification criteria**<br>Cadres of healthcare providers<br>**Representation proportion**<br>74 out of 82 eligible public and private health facilities in the study area | **Health workers: 32**<br>Staff nurse/midwife (8)<br>Community Health Extension Worker (CHEW) (19)<br>Pharmacy Technician (4)<br>Doctors (1) |
| 15 | Williams | 2008 | Quasi-experimental<br>Health- | Mixed methods | Tanzania | **Level of care delivery**<br>Dispensaries<br>**Access to services:** | **Health workers: 21**<br>Clinical officers |

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| | | | facility based | Qualitative<br>Focus groups<br>Interviews<br>Quantitative<br>Records review<br>Survey | | **public/private**<br>Public<br>**Ownership/operating authority**<br>Not reported<br>**Environment/locality**<br>Rural<br>**Representation/stratification criteria**<br>Lowest level of healthcare delivery<br>Supervision areas of health management<br>**Representation proportion**<br>6/14 public dispensaries in the study area | 11<br>Others 10 |

Table 1-2: Quality assessment of included studies

| Quality Assessment instrument | | Included studies (primary author, year of publication) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of study | Methodological quality criteria | Qualitative (6) | | | | | | Quantitative (7) | | | | | | | Mixed methods (2) | |
| | | Asiimwe 2012 | Chandler 2010 | Ezeoke 2012 | Moonasar 2007 | Uzochukwu 2011 | Tavrow 2000 | Abdelgader 2011 | Batwala 2011 | Kyabayinze 2012a | Moonasar 2009 | Rowe 2009 | Seidahmed 2008 | Uzochukwu 2010 | Kyabayinze 2012b | Williams 2008 |
| **All study designs: qualitative, quantitative and mixed methods** | **Are there clear qualitative and quantitative research questions (or objectives)* or a clear mixed methods question (or objective)*?** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **Do the data collected allow the research question (or objective)* to be appropriately addressed?** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **1. Qualitative** | **1.1 Are the sources of qualitative data (archives, documents, informants, observations, etc.) relevant to address the research question (or objective)*?** | Yes | Yes | Yes | Yes | Yes | Yes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | Yes |
| | **1.2 Is the process for analyzing qualitative data** | Yes | Yes | Yes | Yes | Yes | Yes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | Yes |

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| | **relevant to address the research question (or objective)*?** | | | | | | | | | | | | | | | |
| | **1.3 Is appropriate consideration given to how findings relate to the context, e.g. the setting in which then data were collected?** | Yes | Yes | Yes | Yes | Yes | Yes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | Yes |
| | **1.4 Is appropriate consideration given to how findings relate to the researcher's influence, e.g. through their interactions with participants?** | Unclear | Yes | No | No | Yes | No | N/A | N/A | N/A | N/A | N/A | N/A | N/A | No | Yes |
| **2. Quantitative randomized controlled trials** | **2.1 Is there a clear description of the randomization (or an appropriate sequence generation)?** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | | | | | | |
| | **2.2 Is there a clear description of the allocation concealment (or blinding when applicable)?** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | | | | | | |
| | **2.3 Are there complete** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | | | | | | |

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| | **outcome data (80% or above)?** | | | | | | | | | | | | | | | |
| | **2.4 Is there low withdrawal/drop-out (below 20%)?** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | | | | | | |
| **4. Quantitative descriptive** | **4.1 Is the sampling strategy relevant to address the quantitative research question (or quantitative aspect of the mixed methods research question (or objectives)*?** | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **4.2 Is the sample representative of the population under study?** | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **4.3 Are measurements appropriate (clear origin or validity known or standard instrument)?** | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **4.4 Is there an acceptable response rate (60% or more)?** | N/A | N/A | N/A | N/A | N/A | N/A | Yes | N/A | Unclear | Yes | Yes | Unclear | Yes | No | Unclear |
| **5. Mixed methods** | **5.1 is the mixed methods research design relevant to address the qualitative and** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | Yes |

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| | **quantitative research questions (or objectives)* or the qualitative and quantitative aspects of the mixed methods question (or objective)*?** | | | | | | | | | | | | | | | |
| | **5.2 Is the integration of qualitative and quantitative data (or results)* relevant to address the research question (or objective)?** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes | Yes |
| | **5.3 Is appropriate consideration given to the limitations associated with this integration e.g. the divergence of qualitative and quantitative data (or results)* in a triangulation design?** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | No | No |

Table 1-3: Barriers to RDT use in sub-Saharan Africa

| Category of Barrier | Primary Author | Publication Year | Barriers to RDT Use |
|---|---|---|---|
| **A. Health system capacity: systemic** | | | |
| I. Weak supporting interventions | | | ***Insufficient in-service training*** |
| | | | |
| | Abdelgader | 2012 | < 50% (43.2%) of HCPs[2] had received NMCP[3]-facilitated training<br>< 25% of HCPs had received training on IMCI[4] policy<br>> 75% of HCPs had no training on malaria RDT use<br>> 45% (47%) of HCPs had no training on ACT-based case management |
| | Asiimwe | 2012 | Lack of on-the-job, real-time, coaching and general supervision of HCPs |
| | Chandler | 2010 | Limited formal mechanisms for learning available to HCPs at the health facility level |
| | Kyabayinze | 2012 (a) | <50% (47%) of the HCPs were sufficiently knowledgeable in identifying clinical signs and symptoms of severe malaria |
| | Kyabayinze | 2012 (b) | Over-representation of informally trained HCP cadres (e.g. nurse aides) in the work-force<br>Existing coverage and levels of training offered did not appropriately accommodate the skill sets of informally trained HCPs |
| | Moonasar | 2007 | Limited training on RDT use among primary healthcare workers |
| | Uzochukwu | 2010 | None of the HCPs had received government-provided, formal training on RDT use |
| | | | ***Limited supportive supervision*** |
| | Abdelgader | 2012 | 64% of HCPs had not received a supervisory visit in the previous 6 months<br>19% of HCPs had received a supervisory visit that included malaria management in the previous 6 months |
| | Chandler | 2010 | Limited stakeholder support and advocacy for clinical and operational aspects of RDT implementation<br>Limited time dedicated for implementation |
| | Kyabayinze | 2012 (a) | Informal HCP cadres comprising 66% of the workforce had received only limited and irregular supportive supervision to improve performance<br>Only 10% of HCPs had ever received supervision from district malaria focal person<br>45% of HCPs had not received malaria-related supervision in the previous 6 months<br>Lack of qualified staff and logistical constraints hampered supervision |
| II. Weak management and regulatory structures | | | ***Constrained local leadership capacity*** |
| | Chandler | 2010 | Centralized management and ineffective promotional structures undermined incentives to improve HCP performance at the facility level<br>No local capacity to evaluate RDT uptake and use |

[2]HCPs: healthcare providers

[3]NMCP: National Malaria Control Program

[4] IMCI: Integrated Management of Childhood Illnesses

| | | | |
|---|---|---|---|
| | Kyabayinze | 2012(a) | 1/3 of staff had no appointment letters or job descriptions delineating accountability and supervision<br>Only 15% of facilities had appropriately trained leaders |
| | | | ***Poor quality assurance (QA) and quality control (QC) procedures*** |
| | Kyabayinze | 2012 (a) | No defined internal laboratory QC procedures<br>No participation in any external QA schemes |
| | Moonasar | 2007 | Ad hoc testing of RDT accuracy |
| | Tavrow | 2000 | RDT manufacturers' instructions lacked clarity and were poorly communicated on the package inserts |
| | | | ***Poor supply chain and inventory management systems*** |
| | Abdelgader | 2011 | 21% of surveyed health centers had no malaria diagnostic equipment available<br>26% of surveyed facilities had no ACTs in stock<br>RDT and ACT stock outs were frequent at the surveyed facilities, particularly at basic health units |
| | Kyabayinze | 2012 (a) | > 50% of facilities had experienced frequent and prolonged stock out periods (< 3 months) of antimalarial drugs, syringes and intravenous fluids |
| III. Health workforce constraints | | | ***Inadequate staff management systems*** |
| | Asiimwe | 2012 | Patient demand for testing added to HCPs' work load and pressure |
| | Chandler | 2010 | Heavy workloads limited the practicality of testing every patient and waiting for results to guide diagnosis and treatment decisions |
| | Kyabayinze | 2012 (a) | Only 18% of positions recommended at surveyed facilities were occupied by appropriately qualified HCPs<br>66% of the workforce comprised informally trained HCP cadres with limited pre-service training<br>Shortage of qualified HCPs contributed to chronically overworked staff |
| | Rowe | 2009 | Heavy patient caseloads (>25/HCP per day) limited routine RDT use in case management |
| | Williams | 2008 | RDT use added strain to already stretched normal operations of care delivery<br>Staff shortages limited the feasibility of RDT use<br>HCPs felt that additional remuneration was needed as motivation for adding RDT use to routine case management activities |
| **B. Health system capacity: infrastructural and resource capacity** | | | ***Stock outs of essential healthcare commodities*** |
| | Abdelgader | 2012 | Only 33% of basic health units surveyed had any functional diagnostic service<br>Only 16% of basic health units and health centers had non-expired RDTs in stock<br>Only 42.2% of facilities surveyed had functional microscopy available<br>21% of health centers surveyed had no available parasitological diagnosis<br>26% of all facilities surveyed had no ACTs in stock |
| | Asiimwe | 2012 | Frequent stock outs led to HCP rationing of ACT supplies to preserve them for more vulnerable patients |
| | Ezeoke | 2012 | Lack of adequate testing equipment and facilities |
| | Kyabayinze | 2012 (a) | Limited RDT availability - only 20% of facilities had RDTs in stock<br>Only 24% of facilities surveyed had any available parasitological diagnosis<br>Only 29% of facilities surveyed had functional |

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| | | | microscopy: 29%<br>Limited availability of any antimalarials including ACTs |
| | Moonasar | 2007 | Sporadic RDT stock outs during peak transmission seasons<br>Inadequate RDT storage facilities and monitoring of conditions |
| | Uzochukwu | 2010 | Only 32.4% of facilities surveyed had RDTs in stock<br>Sources of RDTs were usually pharmacies and local NGOs<br>Only 12.5% of facilities received RDTs from government sources |
| | Uzochukwu | 2010 | > 60% of facilities had no available RDTs at time of survey<br>Only 12.5% of facilities received RDTs from government sources<br>Cost of purchasing RDTs was a barrier to use<br>Erratic RDT supply, with facilities having to seek sources from the open market<br>Limited ACT availability |
| | | | ***Lack of ancillary supplies*** |
| | Abdelgader | 2012 | < 60% of the surveyed facilities had a functional weighing scale<br>< 50% of the surveyed facilities had a functional thermometer |
| | Asiimwe | 2012 | HCPs generally had no watches, wall clocks or timers to accurately time reading of RDT results |
| | Kyabayinze | 2012 (a) | Lack of thermometers, weighing scales, hand-held glucometers |
| | Rowe | 2009 | HCPs did not have watches or timers to accurately time result reading |
| | Williams | 2008 | Watches were not always functioning leading to problems with accurate timing for reading results |
| | | | ***Lack of basic amenities for care delivery*** |
| | Abdelgader | 2012 | < 75% of the surveyed facilities had available running water<br>< 50% of the surveyed facilities had electricity |
| | Asiimwe | 2012 | No running water made it difficult to ensure clean fingers prior to finger prick for blood samples in an agro-economically driven setting |
| | Kyabayinze | 2012 (a) | No running water at all lower level health centers<br>Inadequate storage space for RDTs and other commodities<br>Inadequate infection control equipment and safe bio-waste disposal mechanisms |
| | Moonasar | 2007 | Inadequate temperature monitoring and storage capacity |
| **Healthcare providers' (HCPs) perceptions and preferences** | | | ***Case management knowledge, training, skill and proficiency*** |
| | Abdelgader | 2012 | Only 43.2% of HCPs had received NMCP [a] -facilitated training<br>< 25% of HCPs had received training on IMCI[b] policy<br>76% of HCPs had no training on malaria RDT use<br>47% of HCPs had no training on ACT-based case management |
| | Asiimwe | 2012 | HCPs demonstrated sub-optimal proficiency with conducting the recommended RDT procedures |

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| | | | 46% of HCPs did not correctly perform all required steps |
| | Rowe | 2009 | Poor HCP knowledge regarding eligibility criteria for recommending a malaria test to patients |
| | Seidahmed | 2008 | HCPs experienced difficulty performing blood collection procedures |
| | Kyabayinze | 2012 (a) | Sub-optimal HCP case management knowledge<br>Only 36% of HCPs correctly identified signs and symptoms of severe malaria<br>Only 43% correctly identified 2 or more forms of severe malaria<br>< 40% of HCPs correctly identified 2 important life-saving practices for severe malaria |
| | Moonasar | 2009 | Sub-optimal HCP proficiency with conducting recommended RDT procedures including:<br>Difficulty identifying false negatives<br>Difficulty performing blood collection procedures<br>Unsafe or unsterile blood collection practices |
| | | | ***Preferences for other modes of diagnosis*** |
| | Chandler | 2010 | Extensive background knowledge of malaria risks reinforced a preference for presumptive treatment and hesitation to adopt new practices |
| | Uzochukwu | 2010 | HCPs preferred other modes of diagnosis over RDTs |
| | | | ***Negative perceptions of RDTs or RDT use*** |
| | Asiimwe | 2012 | RDT use is restrictive as it imposes treatment decisions on HCPs<br>RDTs undermine HCPs' credibility with patients |
| | | | ***Lack of trust in test results*** |
| | Chandler | 2010 | Concern over risks associated with missing a true case of malaria |
| | Ezeoke | 2012 | HCP uncertainty over test result accuracy due to a lack of trust in competence of laboratory personnel |
| | Rowe | 2009 | Most of the HCPs did not trust negative RDT results |
| | Tavrow | 2000 | HCPs did not 'believe' negative test strip results. |
| | Uzochukwu | 2010 | HCPs commonly cited unreliability of RDTs a reason for non-use<br>Lack of trust in negative RDT results linked with concerns over risks of missing a true case of malaria |
| | | | ***Provider-patient interactions*** |
| | Asiimwe | 2012 | HCPs prescribed non-ACTs to satisfy patient expectations despite negative RDT results |
| | Chandler | 2010 | Patient preferences for diagnosis and treatment of malaria<br>Perceived subsequent patient treatment seeking behavior in response to negative results and no antimalarial prescription<br>Potential damage to provider-patient relationship |
| | Ezeoke | 2012 | HCPs considered additional costs of testing burdensome for patients<br>Selectively recommending testing based on perceived patients' vulnerability, presenting symptoms, and willingness to accept test |
| | Chandler | 2010 | Previous knowledge and experience with malaria |
| **Policy guideline information** | | | ***Limited access to case management protocol*** |
| | Abdelgader | 2011 | 60% of HCPs had no access to personal/facility copy of national malaria treatment protocol |
| | Kyabayinze | 2012 (a) | 14% of facilities had no available copy of treatment |

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| | | | protocol<br>None of the facilities had any available referral guidelines |
| | Rowe | 2009 | Ambiguous, overly complex policy guidelines with Frequent changes, poorly communicated guideline information |
| | Uzochukwu | 2010 | Sub-optimal HCP awareness of RDTs (61.1%)– this varied by cadre of HCPs, by setting, and by type of health facility<br>Lack of political will - none of the HCPs had learned about RDTs through government sources<br>No government monitoring or supervision of RDT use by HCPs in the immediate 12-month period following introduction |
| | | | ***Inconsistent policy guideline information*** |
| | Asiimwe | 2012 | Ambiguous national policy guidelines for malaria diagnosis<br>HCP confusion over who should be tested<br>HCP confusion over RDT role in case management |
| | Chandler | 2010 | Ambiguity over the role of RDTs in malaria treatment guidelines |
| | Uzochukwu | 2010 | Lack of national policy guideline regarding RDT use which conflicted WHO malaria testing policies at the time |
| **Characteristics of the diagnostic technology (RDTs)** | | | ***Difficulty using the device*** |
| | Asiimwe | 2012 | Majority of HCPs had difficulty using the blood transfer device<br>HCP confusion over expiration dates |
| | Batwala | 2011 | HCPs had difficulty particularly using the loop device for collecting blood from children < 5 years<br>This difficulty was especially common among nursing assistants |
| | Chandler | 2010 | Disparity between RDT results and clinical judgment<br>Lack of trust in test results, particularly negative results |
| | Moonasar | 2007 | Possibility that RDTs do not accurately detect majority of cases in the setting |
| | Tavrow | 2000 | Blood collection procedures was the biggest challenge to HCPs, especially when used with children |
| | Seidahmed | 2008 | > 5% of HCPs experienced difficulty performing blood collection procedures, comparable on 2 different RDTs<br>HCP errors were more frequent with dipstick format (Optimal IT) than cassette format (Malaria Pf) tests<br>65% of HCP errors with Optimal IT resulted from defective test kits |
| | Uzochukwu | 2011 | HCPs experienced difficulty performing blood collection procedures<br>HCPs also had difficulty interpreting faint positive test lines particularly those with poor eyesight<br>HCPs also performed unsafe handling and disposal of sharps |
| | Williams | 2008 | HCPs commonly cited experiencing difficulty performing blood collection procedures<br>RDT results were difficult to read in ambient light particularly during heavy rains<br>Reading thin/faint test lines was difficult, particularly |

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| | | | for HCPs with poor eyesight |
| | | | ***Technical limitations*** |
| | Asiimwe | 2012 | Limited parasite speciation capacity<br>No parasite quantitation capacity<br>Failure to detect low parasite concentrations |
| | Chandler | 2010 | Slow in comparison to clinical diagnosis |
| | Ezeoke | 2012 | Inconsistent test results based on repetitive (RDT) or confirmatory testing using microscopy<br>Questionable accuracy of test results undermined the importance of testing among HCPs |
| | Tavrow | 2000 | Test kits frequently did not include all the needed items, e.g. lancets<br>Poor manufacturers' labeling of type of kit and expiration dates created confusion<br>A specific brand/type of RDT (FLOW RDT) required refrigeration which is a challenge in low-resource settings where a lack of electricity is common, and fuel supply for petrol generators is sporadic; this limited RDT usability among HCPs |
| | Williams | 2008 | Inconsistent results when comparing consecutive readings from the same test over a relatively short time interval |

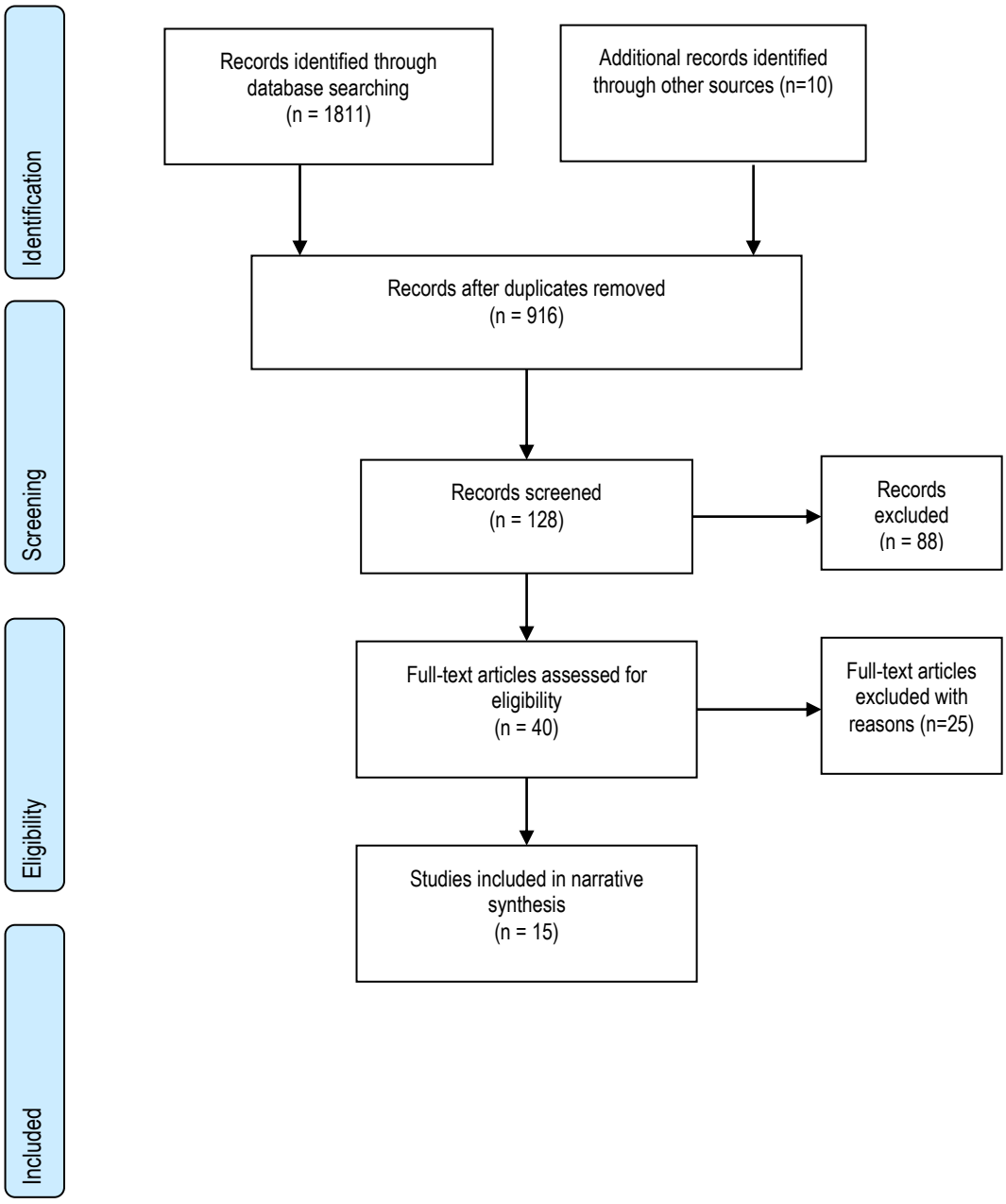
Table 1-4: Facilitators of RDT use in sub-Saharan Africa

| Category of Facilitator | Primary Author | Publication Year | Facilitator to RDT Use |
|---|---|---|---|
| **Health system capacity** | | | ***Availability of essential healthcare commodities*** |
| | Abdelgader | 2011 | HCPs' RDT use among febrile patients tested increased from 45.8 to 66.8%<br>HCP compliance with case management protocol increased from 34.5% to 50.5% |
| **Healthcare providers' perceptions and preferences** | | | |
| | | | ***Case management training, skills and proficiency*** |
| | Kyabayinze | 2012(b) | 1-day HCP training contributed to high levels of RDT use for malaria diagnosis 6 weeks post-training - 76% of presenting patients<br>Antimalarial drug prescriptions reduced from 56% to 33% during the same time period |
| | Rowe | 2009 | Knowledge of clinical signs and symptoms of severe malaria - elevated patient temperatures were positively associated with RDT use |
| | | | ***Positive perceptions of RDTs or RDT use*** |
| | Asiimwe | 2012 | Increased HCP sense of professionalism<br>Increased individual HCP confidence<br>Enabled better patient engagement for decision making |
| | | | ***Advantages to practice*** |
| | Chandler | 2010 | Limits the guesswork with clinical diagnosis<br>Improved HCP confidence in diagnostic decision making<br>Encouraged better practice when HCPs probed further for differential diagnosis<br>HCPs were able to personally observe accuracy of the tests in reference to clinical or microscopic diagnosis |
| | Williams | 2008 | Majority of HCPs felt RDTs made their work easier as they were more confident in their diagnostic decisions, and could also focus on alternative diagnosis |
| | Tavrow | 2000 | RDTs ensured timely diagnosis and appropriate treatment in remote settings with limited electricity and technician availability |
| | | | ***Benefits provider-patient relationship*** |
| | Chandler | 2010 | Improved patient satisfaction and confidence in the HCP<br>The novelty was popular among patients |
| | | | |
| | Williams | 2008 | HCPs generally felt that RDT use improved the process of diagnosis and led to greater patient satisfaction |
| | | | ***Individual provider preferences*** |
| | Uzochukwu | 2010 | High preference for RDTs over other modes of diagnosis |
| **Characteristics of the diagnostic technology (RDTs)** | | | ***Shorter turn around time for results than microscopy*** |
| | Batwala | 2011 | Greater convenience to HCPs by reducing patient waiting time compared to microscopy<br>Allowed more patients to be tested within the same time period than was possible with microscopy |

| | | | |
|---|---|---|---|
| | Chandler | 2010 | Allowed faster patient diagnosis<br>Avoided time wasting |
| | Uzochukwu | 2011 | Allowed fast diagnosis |
| | | | ***Simplicity and ease of use*** |
| | Batwala | 2011 | As RDTs did not require specialized skills, use was not restricted to laboratory assistants or other special staff, which minimized service interruptions due to lab staff absences |
| | Chandler | 2010 | HCPs reported finding them simple to use<br>Other HCPs including laboratory personnel could verify the results<br>Minimizes the work load for laboratory personnel |
| | Rowe | 2009 | Enhanced manufacturer's instructions improved HCP accuracy and ease of RDT performance |
| | Tavrow | 2000 | After two revisions of the original manufacturer's inserts, correct HCP performance of the recommended steps for RDT went up from 57% in an initial group who received training to 80% in a new group of HCPs who did not receive training<br>Performance after product insert revision was better although the initial group of HCPs received additional training on RDT use, and the second group did not |
| | Williams | 2008 | HCPs perceived RDTRs as quick, easy to use and simple |
| | | | ***Benefits provider-patient relationship*** |
| | Chandler | 2010 | Improved patient satisfaction and confidence in the HCP<br>The novelty was popular among patients |
| | Rowe | 2009 | Enhanced manufacturer's instructions improved HCP accuracy and ease of RDT performance |
| | Williams | 2008 | HCPs generally felt that RDT use improved the process of diagnosis and led to greater patient satisfaction |

**Figures in Chapter One**

Figure 1-1: PRISMA flow diagram of literature search



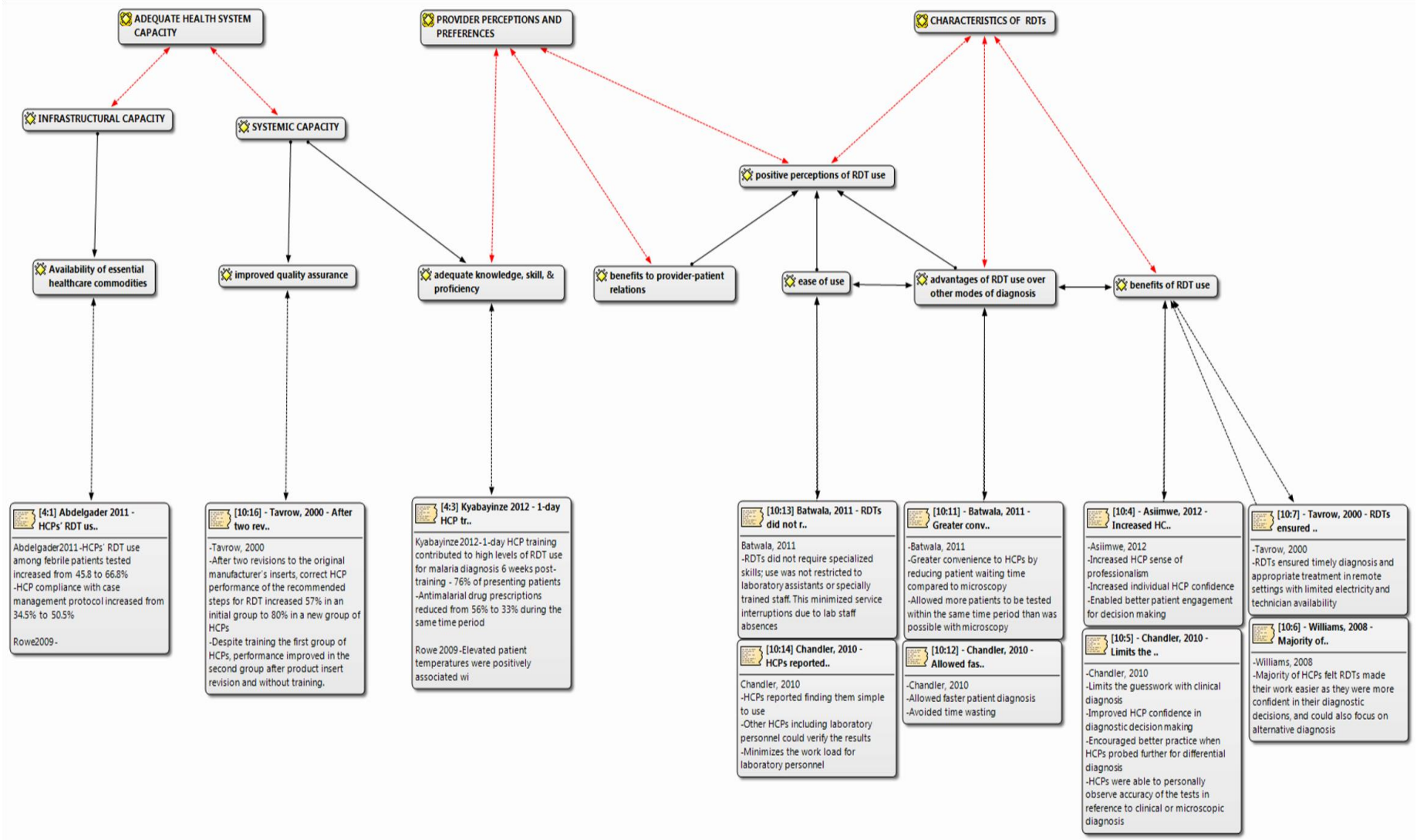



**Figure 1-2: Barriers to RDT use in sub-Saharan Africa**

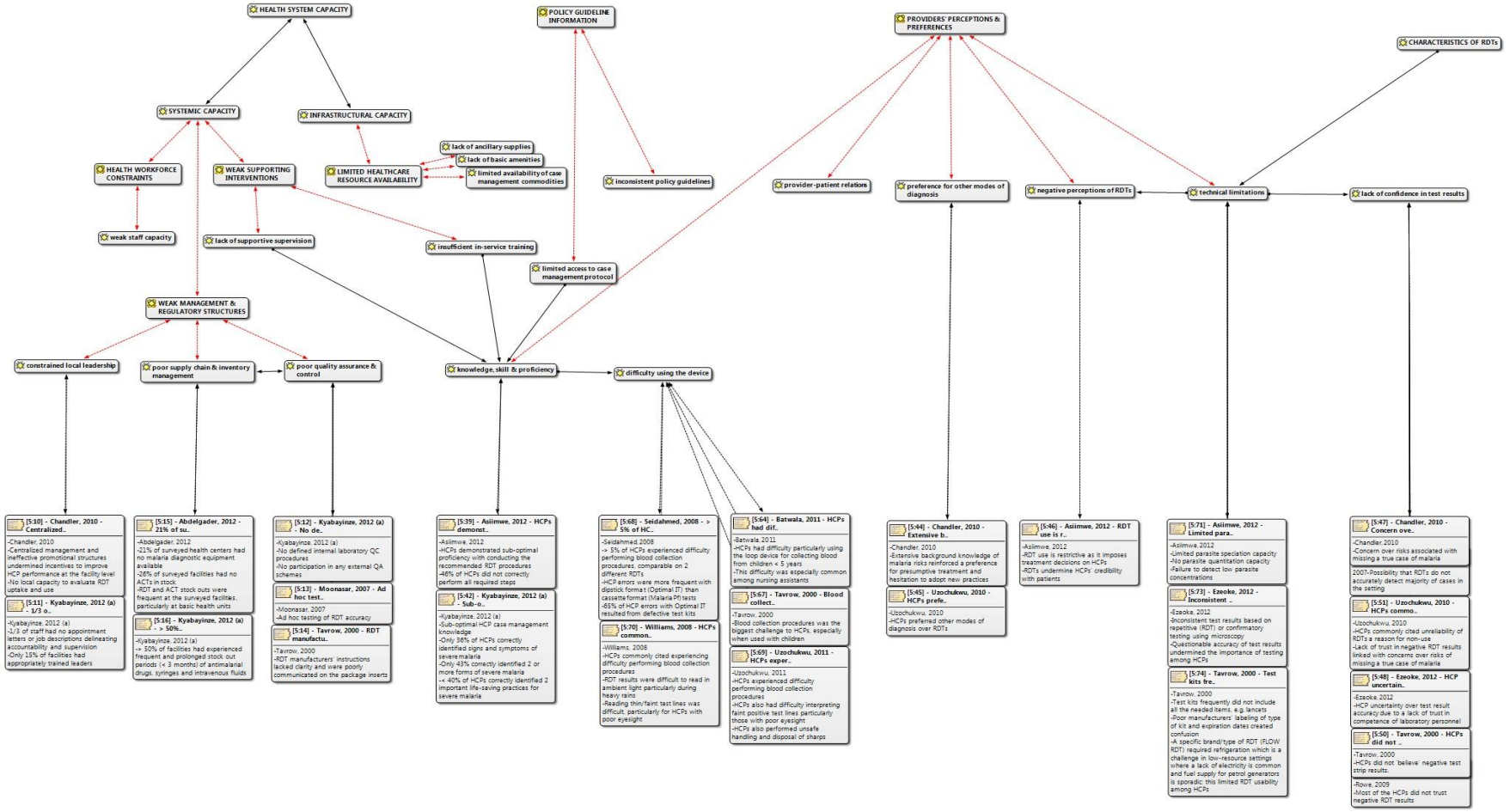



**Figure1-3: Facilitators to RDT use in sub-Saharan Africa**

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**CHAPTER TWO**

# THE USE OF FOCUSED ETHNOGRAPHY IN HEALTHCARE RESEARCH: AN EXPOSITION ON METHODOLOGY[5]

[5] A version of this chapter has been accepted for publication. Boadu & Higginbottom (2015). Springer Series on Qualitative Nursing Research (1).

## INTRODUCTION

Focused Ethnographies (FEs) evolved in the field of sociological ethnography and are rooted in classical anthropological ethnography. FEs concentrate on specific elements of society. They are therefore suitable for studying cultural perspectives surrounding specific issues among defined sub-groups of society. FEs generate specific knowledge to address distinct research questions and are useful in applied research that aims to inform policy and practice. The approach is fitting to study health and illness beliefs, behaviors and attitudes among specific provider or patient populations in order to improve healthcare delivery processes and outcomes. Traditional ethnographies are time extensive and experientially rich. FEs on the other hand are *data intensive* in that large volumes of data are collected from multiple sources and analyzed within a relatively short time period. From the standpoints of time and funding constraints, FEs adapt suitably to modern healthcare and policy research studies. The growing representation of focused ethnographical studies in the healthcare literature underscores their importance and legitimacy for informing policy and practice.

### Purpose of the paper

This paper presents a practical overview of a focused ethnographical study in healthcare. Against this backdrop the paper aims:

1) To outline the theoretical foundational principles of focused ethnography;
2) To demonstrate congruence between the underlying philosophical assumptions, the methodological approach and the research objectives presented, and
3) To elucidate the suitability of a focused ethnographical approach for investigating healthcare providers' compliance with guidelines for malaria diagnosis in a limited resource setting.

The information is context-specific. The principles however are broadly applicable to the use of FEs across a diverse spectrum of research disciplines.

## Focused ethnographies in health care research

FEs evolved from classical anthropological ethnography particularly among sociological ethnographers (Knoblauch, 2005). Consequently, they maintain several distinctive features of traditional ethnography (Cruz & Higginbottom 2013; Muecke 1994), (Table 2-1). However, FEs are guided by a specific research question and conducted among a small group of people within a particular context. FEs elicit specific information useful for decision-making regarding a distinct problem (Knoblauch 2000; Mayan, 2009). Based on their *focused* nature (Morse, 1987; Richards & Morse, 2007), such studies are also termed mini-ethnographies (Leininger, 1985) or micro-ethnographies (Werner & Schoepfle, 1987). FEs employ anthropological research methods to generate targeted information in a shorter time frame than traditional ethnographies (Knoblauch, 2005). This makes the approach suitable for studying cultural perspectives, behaviors and beliefs surrounding healthcare issues in order to inform policy or practice perspectives in a timely manner (Higginbottom, Pillay & Boadu, 2013; Roper & Shapira, 2000; Thomson, 2011). The World Health Organization (WHO) has successfully adapted the FE approach (Table 2-2) in their study of behaviors and perceptions related to the management of infectious diseases in developing country contexts (Cove & Pelto, 1993; Hudelson, 1993; Stewart et al. 1993). Higginbottom and others (2013) also demonstrated the versatility and usefulness of FEs in healthcare research (Table 2-3).

## Research title

Using Malaria Rapid Diagnostic Tests (RDTs) in Ghana: Understanding healthcare providers' compliance with guidelines for malaria diagnosis in peripheral facilities

## Research objectives

This study aimed to explore healthcare providers perspectives regarding guideline compliance for rapid malaria testing in peripheral health facilities in Ghana with the specific objectives being:

1) To identify the factors influencing healthcare providers' compliance with guidelines for rapid malaria testing at peripheral healthcare facilities in Ghana

2) To understand how the factors that influence healthcare providers' compliance with guidelines for rapid malaria testing affect case management of malaria at peripheral healthcare facilities in Ghana

3) To determine how an understanding of healthcare providers' compliance with guidelines for rapid malaria testing can be used to improve case management of malaria at peripheral healthcare facilities in Ghana.

## Research background

### *The significance of malaria in Ghana*

Malaria is the leading cause of morbidity and in-hospital mortality in Ghana with over 3 million cases occurring each year (Ghana Health Service (GHS), 2009; WHO, 2012). Over 40% of all hospital outpatient department (OPD) visits and 30% of admissions are attributable to this disease. Malaria is a major cause of death among pregnant women and accounts for 30% of all-cause mortality among children under five years of age in Ghana (Ghana Statistical Service (GSS)/ GHS, 2009). All areas of the country are considered hyper-endemic for malaria, with stable, year-round transmission (GHS, 2009). However, transmission intensity peaks during the rainy seasons from May to July and from September to mid-November (Baiden et al., 2012; Dery et al. 2009; Krefis et al., 2011). Under the auspices of the Ministry of Health (MOH) and the Ghana Health Service (GHS), the National Malaria Control Program (NMCP) provides direction and oversight to nation-wide malaria control activities. Key intervention areas for malaria control in Ghana include prevention using insecticide treated bed-nets, active case detection with microscopy or rapid diagnostic tests (RDTs) and effective treatment with artemisinin-based combination therapies (ACTs) (GHS/NMCP 2009).

### *The importance of accurate diagnosis of malaria in Ghana*

The World Health Organization (WHO) currently recommends confirmatory testing prior to treating suspected malaria cases of all ages in endemic regions (WHO, 2010). The objective of this policy guideline is to curb irrational consumption of antimalarials and to reduce the emergence of parasitic resistance to effective drugs (English et al., 2008; WHO, 2010a). Prior to the policy revision, symptomatic diagnosis of malaria largely based on the history of fever was common in Ghana. The practice is also widespread across sub-Saharan Africa where limited health system capacity restricts the availability of expert microscopy in remote settings (Ansah et al. 2010; Baiden et al. 2012; Chandler, Whitty, & Ansah, 2010; GHS, 2009). Presumptive treatment of fever as malaria was practical to ensure

prompt delivery of effective treatment especially for young children and pregnant women in endemic areas who are vulnerable to complications and death from severe malaria (WHO/UNICEF, 2005; English et al. 2009). Presumptive treatment practices were further entrenched as a result of inadequate laboratory infrastructure in rural and remote areas and the availability of inexpensive antimalarials that are currently ineffective due to parasite resistance (Drakely & Reyburn, 2008; WHO, 2006).

Ghana adopted the WHO-recommended 'test-before-treat' approach for managing malaria in 2010 (GHS/NMCP, 2009). Despite national guideline adoption, only a third of all reported malaria cases in Ghana are laboratory confirmed (GHS/NMCP, 2009; WHO, 2012). The persistence of presumptive treatment practices among many practitioners in Ghana leads to routine mis-diagnosis of non-malarial fevers and over-consumption of antimalarials (Ansah et al., 2010; Reyburn et al., 2004). This delays appropriate treatment of non-malarial fevers and worsens health outcomes (Amexo et al., 2004). Inappropriate antimalarial consumption further contributes to the spread of parasite resistance and drains household, health system and donor resources (Amexo et al., 2004; Ansah et al., 2010; Bell & Perkins, 2008; Reyburn et al., 2008; Chandler et al., 2010). Prompt treatment with effective antimalarials is an essential component of the WHO Global Malaria Action Plan (WHO/RBM, 2008; WHO, 2010a). Emerging antimalarial resistance therefore threatens the clinical and economic viability of expanding treatment access to affected populations (Hopkins et al., 2009; WHO, 2010b). Containing the spread of parasite resistance is of significant concern, considering the thin pipeline for developing new antimalarials (Grimberg & Mehlotra, 2010; Burrows, Chibale & Wells, 2011).

Research Problem

Rapid Diagnostic Tests (RDTs) are simple, field-ready test kits used to detect the presence of malaria parasites in fresh blood (WHO, 2003). RDTs do not require laboratory infrastructure or specialized end user skills (Baiden et al., 2009; WHO, 2003; WHO 2010a). Despite wide RDT deployment (Ansah et al., 2010; Baiden et al., 2010; GHS, 2009), in one trial conducted in Ghana, almost 45% of RDT negative cases were prescribed antimalarials (Ansah et al., 2010; Chandler et al., 2010). Other studies conducted in Africa have reported rates as high as 80% (Msellem et al., 2009; Uzochukwu et al., 2011) of RDT negative cases being prescribed antimalarials. The practice is rampant in under-resourced peripheral

facilities, which serve as gatekeepers to the health system for more than half of the populace, especially the rural poor (Ansah et al., 2010; Baiden et al., 2012). Success with implementing current malaria diagnosis and treatment guidelines as well as cost effectiveness for test-based management of fevers in general, hinges on the healthcare providers' commitment to comply with the guideline. Guideline compliance in this regard implies that a healthcare provider tests and consequently treats or otherwise manages suspected cases of malaria consistently with test results (Baiden et al., 2009; Chandler et al., 2010; English et al., 2008; Lubell et al., 2008). Poor healthcare providers' compliance is widely documented across sub-Saharan Africa including Ghana (Ansah et al., 2010, Chandler et al., 2010, Baiden et al., 2010), Sudan (Abdelgader et al., 2012), Uganda (Asiimwe et al., 2010; Kyabayinze et al., 2010), Nigeria (Uzochukwu et al., 2012) and Tanzania (Chandler et al., 2010; Williams et al., 2008). Nonetheless, the underlying causes of poor guideline compliance are barely understood. Moreover, research to inform strategies that effectively address this challenge is limited (Abdelgader et al., 2012; Ansah et al. 2010; Chandler et al., 2010; Lubell et al., 2008; Williams et al., 2008).

Research Significance

Understanding healthcare providers' compliance is essential to facilitate guideline implementation for test-based malaria management in Ghana. The aim of this research was to generate knowledge to enable a better understanding of the determinants of healthcare providers' compliance and subsequently, to inform strategies for improving compliance with the confirmatory testing guideline for malaria at the primary healthcare level in Ghana.

**Research design: epistemology, theoretical perspective, methodology and methods**

Crotty (1998) suggests four elementary processes in any research study. These involve the specific methods used to address a particular research objective, which are governed by particular methodological principles. The choice of methodological principles is influenced by the researcher's theoretical perspective or philosophical assumptions. These assumptions are embedded in the epistemological and ontological perspectives held towards knowledge and reality. Crotty (1998) further explains that ontology refers to 'what is', the nature of existence, and the structure of reality, while epistemology addresses the nature and basis of knowledge (or reality), it's scope, and possibility

(Hamlyn, 1995). Epistemology is concerned with providing philosophical grounds for decisions on the adequacy and legitimacy of knowledge (Carter & Little, 2007; Crotty, 1998; Maynard, 1994). Ontological perspectives therefore describe assumptions about reality, while epistemological perspectives involve assumptions about how to make meaning of such reality based on the primary assumptions surrounding reality in the first place (Dew, 2007; Mayan, 2009).

A researcher's philosophical assumptions provide the central guiding principles for the research conducted and are usually implicit in the research design (William & Slife, 1995). Cresswell (2007) stresses the importance of identifying these assumptions in order to validate a researcher's choice of methodology and methods for addressing their objectives. Cresswell (2007) presents four main worldviews discussed in the literature to which researchers align namely (1) positivism/post positivism, (2) constructionism/constructivism, (3) advocacy/participatory, and (4) pragmatism. The assumptions held towards knowledge within these worldviews and the types of research with which they are typically aligned are summarized in Tables 2-4 and 2-5.

Cresswell (2007) defines the researcher's philosophical assumptions or 'worldview' as a set of basic beliefs that guide action (Guba, 1990). Worldviews are also referred to as paradigms (Cresswell, 2007; Lincoln & Guba, 2000) or epistemological and ontological perspectives (Crotty, 1998) in the literature. These describe the researcher's general orientation about the world (the nature of reality or *ontology*) and the approach to discovering and constructing or making sense of this reality (*epistemology*) (Carter & Little, 2007; Crotty, 1998; Guba & Lincoln, 1994). These terms are sometimes used interchangeably by different authors to refer to the existence of knowledge and the approach to meaningfully engaging this knowledge (Crotty, 1998; Guba & Lincoln, 2005). The use of several and inconsistent terminology when discussing the foundational concepts of epistemology, ontology, research paradigms, worldviews or theoretical perspectives as outlined above is an inherent issue with social sciences research (Cresswell, 2007).

Basic definitions of these terminologies are provided here to clarify their use in this thesis. This clarification is further intended to enhance the utility of the knowledge presented in the thesis for informing stakeholder discussions on improving malaria control in limited-resource settings. Research

paradigms or worldviews refer to the underlying philosophical assumptions that guide the entire research design and process (Cresswell, 2007). Ontology addresses the concept of the nature of existing knowledge while epistemology refers to the approach towards meaningfully engaging this knowledge (Crotty, 1998; Hamlyn, 1995; Carter & Little, 2007). Theoretical perspectives refer to the framework within the epistemological approach that influences the choice of research methodology and methods.

Epistemological perspective (pillar one)

A constructionist epistemology is founded on the assumption that meaning is *constructed* rather than discovered through social interaction (Cresswell, 2007; Crotty, 1998; Mertens, 1998). Cresswell (2007) explains this assumption in that people seek understanding of their daily living and working worlds and develop subjective meanings of their life experiences. These multiple and varied meanings are attached to certain objects or things and are formed through social interactions as well as through cultural and historical routines of daily life (Lincoln & Guba, 2000; Schwandt, 2001). Furthermore, different people construct meaning differently about the same phenomenon (Crotty, 1998). A constructionist epistemology acknowledges that multiple realities and multiple truths can co-exist about a particular phenomenon or life situation (Denzin & Lincoln, 2005; Mayan, 2009; Nicholls, 2009a).

A constructionist (or constructivist) epistemological perspective was consistent with the aim and objectives of this study. This standpoint was coherent with eliciting perspectives of guideline compliance among different cadres of healthcare providers and local health administrative and policy officials. Additionally, a constructionist epistemological perspective holds the view that meaning is directed towards certain objects or things (Cresswell, 2007), which necessitates a researcher identifying and understanding the social, cultural and historical contexts that are significant to these meanings (Cresswell, 2007; Crotty, 1998). A comprehensive review of the literature identified RDTs as existing diagnostic tools to support the implementation of confirmatory testing guidelines for malaria in Ghana (Abdelgader et al., 2012; Ansah et al., 2010; Baiden et al., 2009; Baiden et al., 2012; Bell & Perkins, 2008; Chandler et al., 2010, 2012; Drakely & Reyburn, 2008). The literature therefore supports implicit assumptions in the study design leading to the expectation that among healthcare providers in this study, RDTs are symbolic of guidelines governing malaria diagnosis. Healthcare providers would therefore attach specific meanings to using RDTs to guide the management of suspected malaria

patients (Chandler et al. 2010, 2012). This study investigated healthcare providers' perspectives of guideline compliance in direct relation to RDT use for malaria testing at their facilities.

Theoretical perspective (pillar two)

This study attempted to access the internal beliefs, perceptions and knowledge (Lincoln & Guba, 1985) of participating healthcare providers in order to understand guideline compliance from their point of view. Conducting the study in the natural practice settings for malaria management was consistent with an *interpretivist* theoretical perspective, particularly that of *naturalistic inquiry* (Lincoln & Guba, 1985; Nicholls, 2009c). Interpretivist research looks for "culturally derived and historically situated interpretations of the social life world" (Cresswell, 2007; Crotty, 1998). An interpretive paradigm was necessary to identify cultural, social and historical influences (Cresswell, 2007; LeCompte & Schensul, 1999; Lincoln & Guba, 2000; Schwandt, 2000) of malaria and its diagnosis on healthcare providers' compliance. Within interpretivist traditions, naturalistic inquiry acknowledges multiple realities (Nicholls, 2009a; Schwandt, 2000) and postulates that phenomena can only be understood within their natural setting (Cresswell, 2007; Lincoln and Guba, 1985). Previous research established the importance of historical experiences, beliefs and traditions in shaping the cultural significance of malaria in Ghana. These factors are implicit in the meanings attached to existing methods of malaria diagnosis and treatment by providers and patients (Ahorlu et al., 2007; Asase & Oppong-Mensah, 2009; Chandler et al., 2010). Emphasis on these factors was essential considering that guideline compliance occurs during provider-patient encounters, which are influenced by several characteristic features of the health system. The health system is itself influenced by the cultural, historical, political and socio-economic factors that characterize Ghana as a nation (MOH/GHS 2007).

Methodology (pillar three)

Research methodology describes the "strategies of inquiry" (Cresswell, 2007) or the "strategy, plan of action, process or design" guiding the selection and use of specific methods to address research objectives (Crotty, 1998). The methodological approach must be consistent with the epistemological (pillar one) and the theoretical (pillar two) perspectives underlying the research. Methodological and theoretical coherence ensures that appropriate methods are used and this coherence enhances the quality of data generated (Crotty, 1998; Cresswell, 2007; Schwandt, 2000).

The methodology of choice for this research was focused ethnography (FE). FE is a methodology that employs anthropological research methods to investigate discrete elements or sub-cultures within specific communities or contexts of contemporary society (Cruz & Higginbottom, 2013; Knoblauch, 2005). Mayan (2009) defines FE as *"a targeted form of ethnography… led by a specific research question, conducted within a particular context or organization, among a small group of people to inform decision-making regarding a distinct problem."* FE evolved from the field of classical anthropological ethnography within sociological ethnographic traditions (Knoblauch, 2005). Consequently, FEs maintain several distinctive features of traditional ethnography (Cruz & Higginbottom, 2013; Muecke, 1994). Traditional anthropological ethnography typically involves a broad understand all aspects of unfamiliar cultures. FEs on the other hand are guided by a specific research question and conducted among smaller groups of people within a particular context of familiar societal settings (Mayan, 2009). They are therefore suitable for studying cultural perspectives on specific issues among defined sub-groups of society (Higginbottom, Pillay & Boadu, 2013). Contemporary societies are highly differentiated and fragmented, socially, culturally and professionally. This fragmentation necessitates focused studies that yield specific knowledge to effectively inform problem-solving strategies (Higginbottom et al., 2013; Knoblauch, 2005).

FEs generate precise knowledge that is useful in applied research to inform decision-making regarding a distinct problem (Cruz & Higginbottom, 2013; Higginbottom, 2011; Higginbottom et al., 2013; Knoblauch, 2005; Mayan, 2009). Within healthcare disciplines, FEs are used to investigate beliefs, behaviors, or perceptions among specific patient populations or sub-cultures of providers regarding particular health conditions or processes (Magilvy et al., 1987; McElroy et al., 2011; Muecke, 1994). The World Health Organization (WHO) successfully adapted this approach in their study of behaviors and perceptions related to the management of infectious diseases in developing country contexts (Cove & Pelto, 1993; Hudelson, 1993; Stewart et al. 1993), (Table 2-2). Higginbottom et al. (2013) explored the versatility of FEs in healthcare and nursing research studies (Table 2-3). The growing representation of FE studies in the healthcare literature suggests their importance and legitimacy for use in applied research that can efficiently inform policy and practice (Morse, 2010).

FEs share several definitive features of traditional ethnographies with respect to the inherent methods of data collection and analysis (Knoblauch, 2005; Muecke, 1994), (Table 2-1). A key difference lies in the fact that FEs can be used to generate specific information within a few months at the least, relative to several years that are typically required for traditional ethnographical studies (Knoblauch, 2005; Roper & Shapira, 2000; Mayan, 2009). Traditional ethnographies are time extensive and experientially rich. FEs however are *data intensive* in that large volumes of data from multiple sources are collected and analyzed over a relatively short time period (Knoblauch, 2005). Based on their focused nature (Morse, 1987; Richards & Morse, 2007) such studies are also termed mini-ethnographies (Leininger, 1985) or micro-ethnographies (Werner & Schoepfle, 1987). FEs may therefore not allow in-depth exploration of a broad range of factors, unless these are directly relevant to the research objective, and are within the defined scope of the research question. The key comparisons between the characteristic features of focused and traditional anthropological ethnography are presented in Table 2-1.

The investigation of guideline compliance documented in this paper was guided by pre-determined research questions and targeted a specific sub-population of healthcare providers in specific Ghanaian settings (Knoblauch, 2005; Mayan, 2009; Richards and Morse, 2007). This study aimed to elicit and to understand the providers' perspectives and beliefs about guideline compliance within their natural practice settings. A focused ethnography was therefore a suitable approach for this research (Table 2-6). The FE approach supported the overall aim of eliciting specialized knowledge (Muecke, 1994) to inform policy and practice (Higginbottom et al., 2013; Mayan, 2009; McMahon et al. 1987) in order to strengthen guideline implementation for malaria diagnosis in Ghana. This methodology is also consistent with the constructionist epistemological (pillar one) and interpretivist theoretical (pillar two) perspectives outlined above.

The focus of anthropological ethnography is usually the discovery of new cultures to which the researcher is unfamiliar. The ethnographer then strives to describe the experience from the 'native's point of view'. Ethnographies can also be conducted by individuals who may be familiar with certain aspects of the culture under study, and are interested in further exploring these or other elements of this culture (Hodgson, 2000). The anthropological ethnographer characteristically confronts the issue of strangeness in foreign cultures (Richards & Morse, 2007) earning the fitting description of 'professional

stranger' (Agar, 1996). FEs align with sociological ethnographic traditions (Knoblauch, 2005) which involve familiar rather than unfamiliar cultures and societal settings (Higginbottom et al., 2013). This type of ethnography involves *alterity* in familiar settings rather than strangeness. Knoblauch (2005) describes alterity as a phenomenon where the researcher and the participants share a common implicit and explicit knowledge of the larger society or culture under investigation. This commonality facilitates the researcher's access to the specific participants, settings, and situations of interest to the research objectives. In a sense, the researcher assumes an 'alter ego' where he/she possesses a certain naïveté about the specific aspects of the culture being investigated. The researcher regards these aspects of the otherwise familiar society through the lens of an investigator, in spite of the shared commonality and background knowledge of the larger societal frame. Simultaneously, the researcher maintains the shared commonality with the participants about other general elements within the culture of interest. Against this backdrop of commonality, FEs attempt to uncover specific differences or similarities among settings and participants and to discover meanings attached to these characteristics that can provide useful information for addressing the study objectives (Knoblauch, 2005). To the extent that 'strangeness' is the hallmark of anthropological ethnography, Knoblauch (2005) suggests alterity is an integral component of FEs.

NYB is a young, female researcher with a Ghanaian upbringing, who completed her graduate education outside of Ghana. Issues of alterity in this study therefore revolved around shared Ghanaian heritage, upbringing, and knowledge of cultural and societal norms shared between the researcher and participating healthcare providers. Additionally, a common interest in improving malaria diagnosis in the study setting was a central element of alterity in this study. Consistent with Knoblauch's (2005) description, differences existed between the researcher and the participants in spite of shared commonality. These differences related to the researcher's and the healthcare providers' roles with regards to malaria diagnosis. Alterity therefore involved a delicate balance of shared and yet different identities. A quote from a healthcare provider in this study aptly conveyed this sentiment. At the beginning of the interview, the researcher expressed gratitude for the healthcare provider's time and knowledge considering their busy schedule. The healthcare provider responded, "you know, *we* are all doing *the same work*" (Healthcare provider, in-depth interview, district health facility). Reflexive contemplation on the provider's inclusive reference to the researcher embedded in the words "*we"* and

*"the same work"* revealed a shared commonality related to the study objectives. This common interest transcended shared Ghanaian heritage and also involved differences between the researcher's and the participants' roles in the research.

FEs are time- and data- intensive and require extensive background knowledge of the context to enable meaningful investigation (Knoblauch, 2005). Background knowledge to facilitate the research process was obtained through a comprehensive, *a priori* review of the literature on rapid malaria testing in sub-Saharan Africa. The review provided insights regarding the context of guideline compliance for rapid malaria diagnosis in Ghana and other sub-Saharan settings. Healthcare providers are on the frontlines of guideline implementation in their facilities and their compliance with guidelines for malaria testing is variable and often poor (Bisoffi et al., 2009; English et al., 2009; Hamer et al., 2007; Reyburn et al., 2007). Yet few studies have investigated healthcare providers' perspectives on guideline compliance (Ansah et al., 2010; Chandler et al., 2010). The literature review therefore established the significance of the research presented in this thesis. Moreover, an internship opportunity with the National Malaria Control Program (NMCP) in Accra, Ghana, provided prior experience of the policy development context for malaria control at the national level. This opportunity facilitated close interaction and collaboration with key stakeholders whose perspectives were instrumental in distilling the specific research objectives and in validating their significance in Ghana. This interaction also influenced the choice of the study setting as the Atwima-Nwabiagya district within the Ashanti Region of Ghana (Table 2-7).

Research Methods (pillar four)

Research methods are the specific techniques and procedures used for data collection, analysis and interpretation (Brewer, 2000; Cresswell, 2007). Several methods can potentially be employed within a given methodology (Carter & Little, 2007; Crotty, 1998; Mayan, 2009). The appropriate use of methods and techniques guides the researcher's perceptions about the research topic and ensures integrity of the data (Cresswell, 2007; Crotty, 1998; Dew, 2007; Fetterman, 2010). Data collection procedures in this study involved trademark ethnographic methods including non-participant observation, individual and focus group interviews and document analyses (Mayan, 2009; Nicholls, 2009c; Roper & Shapira, 2000). These methods are consistent with the principles of naturalistic inquiry (Guba & Lincoln, 1985). The use

of several concurrent data collection methods allowed triangulation of the information generated in this study. Triangulation involves the use of two or more data sources, methodological approaches, theoretical perspectives, or analytical approaches within the same study (Lincoln & Guba, 2000; Thurmond, 2001). This allows verification of the findings or of data interpretation using the different sources (Kimchi et al., 1991). Triangulation in this study involved using data obtained during non-participant observations to corroborate information gathered during participant interviews (Roper & Shapira, 2000; Fetterman, 2010). This was beneficial to identify dissonance between observed (actual) and reported behavior (LeCompte & Schensul, 1999; Thurmond, 2001) with respect to guideline compliance among participating healthcare providers'. Comparison between observed and self-reported behavior among providers confirmed the accuracy and enhanced completeness of the data being generated (Thurmond, 2001).

*Study Setting*

Atwima-Nwabiagya is the third largest among 27 districts in the Ashanti Region of Ghana, comprising 157, 181 residents in 92 communities (GHS/Atwima-Nwabiagya District Directorate, 2012). The district is peri-urban (semi-rural). Many communities are inaccessible by road transportation especially during the rainy seasons from May to July and from September to mid-November. The district is considered hyper-endemic for malaria, as are all areas of the country, with stable transmission that peaks in intensity during the rainy seasons (GHS/NMCP, 2009). Based on the most current data available at the time of the study, malaria was consistently the leading cause of morbidity, outpatient attendances and hospital admissions in the district from 2009 through 2012. A mid-year performance report for the district in 2012 indicated that a third of all-cause mortality among children below the age of five was also attributable to malaria (GHS/Atwima-Nwabiagya District Directorate, 2012).

Twi-speaking Akans form the predominant ethnic group (77.4%). Christianity is the major religion (75.7%), followed by Islam (13.2%). Traditionalists (1.3%), other religions (0.9%) and those who do not identify with any particular religion (9.0%) constitute the remainder of the population. Agriculture provides the main livelihood, employing over 50% of the labor force, followed by the industrial sector (17.4%), trades and services (GSS/GHS/ICF Macro, 2009; GHS/Atwima-Nwabiagya District Directorate, 2012). The Nkawie-Toase Government Hospital is the main referral facility. The doctor-to-population

ratio was 1:30,000, and the nurse-to-population ratio was 1:2015 in 2011. Medical assistants numbered only 8 in the entire district in 2012 and generally headed most of the health facilities in the district (GHS/Atwima-Nwabiagya District Directorate, 2012; GSS/GHS/ICF Macro, 2009).

*Choice of study setting*

The choice of the study district was practical (Miles, Huberman, & Saldaña, 2014) based on recommendations from the field advisor with an affiliate institution in the region. The field advisor's support was secured through prior networking with stakeholders in Ghana. The field advisor is a medical practitioner and is familiar with malaria case management in the region. He is also an established researcher, well known to providers and various leaders in the study communities. He identified 3 key informants who were knowledgeable in different aspects of community life within the district. These included a primary healthcare provider, a local community opinion leader, and a representative of a local chief. Having established a study advisory group comprising the field advisor and the 3 key informants, this study benefited from pooling and leveraging their unique and collective knowledge and influence in the district. This facilitated access to gatekeepers (Higginbottom, 2004; Roper & Shapira, 2000) including representatives of the district health management team and heads of facilities that the group recommended for inclusion in the study. Establishing prior relations with and securing the support of the gatekeepers - evidence of which was available in a signed letter from the district directorate of health services - likely contributed to the positive response towards participation and support of the study activities at the various facilities. Practical considerations for selecting healthcare facilities included geographical and logistical feasibility of access. This was important since certain areas within the district are inaccessible by road during the rainy season (GHS/Atwima-Nwabiagya District Directorate, 2012).

*Sampling and recruitment*

Quantitative studies focus heavily on sample size and generalizability whereas qualitative research studies espouse smaller sizes and characteristic samples that provide the requisite depth and detail to address the research objectives (Higginbottom, 2004; Miles, Huberman, & Saldaña, 2013; Patton, 2002). Consequently, decisions regarding the sample size, sampling frame and strategy used were predicated on the study purpose (Ezzy, 2002; Tuckett, 2004). The sample was purposefully selected. Crookes and Davis (1998) describe purposeful or purposive sampling as a researcher's judgmental and

conscious selection of participants and other sources of data to include in the study (Higginbottom, 2004). Purposive sampling is common in ethnographic studies where judgments regarding participant selection are based on the participants' membership within the group or sub-culture being investigated. This strategy is useful for determining and accessing an appropriate sample that provides the necessary information to effectively address research objectives. Purposeful sampling is particularly helpful in consideration of time and funding constraints that characterize contemporary research studies (Higginbottom, 2004). Key informants are individuals or gatekeepers in the study setting who can expedite or simplify the process of gaining access to the study population (Fetterman, 2010; Higginbottom, 2004; Roper & Shapira, 2000). Key informants for this research assisted with identifying sampling units from which to recruit healthcare providers.

Sampling units comprised 6 purposively selected peripheral health facilities from a sampling frame of 17 district facilities in total. Five of the district facilities were government-run and the remaining 12 were privately owned. Health facilities in the district included 5 maternity homes at the community sub-level, 7 health centers and a clinic as sub-district facilities, and 4 hospitals providing care at the district level (GHS/Atwima-Nwabiagya District Directorate, 2012). Four of these facilities offered microscopy for malaria diagnosis. The study sample included two facilities representing each of the three levels within primary healthcare delivery in the district and nationwide. These are community, sub-district, and district level facilities (GHS/GSS/ICF Macro, 2009). Each pair was complementary, comprising a government- and a privately owned facility. Purposive sampling to include the different types of primary care facilities highlighted the existing diversity with respect to healthcare infrastructure, staff cadres, and basic amenities at the represented levels of care delivery (GHS/MOH 2007; GHS/Atwima-Nwabiagya District Directorate, 2012).

To explore the full range of possible perspectives (Roper & Shapira, 2000; Higginbottom, 2004) surrounding guideline compliance, it was important to capture potential differences that might relate to specific provider roles, cadres, gender, and other characteristics represented within the different practice settings. The wide range of participants involved ensured substantial heterogeneity or within-sample variation (Higginbottom, 2004; Miles, Huberman, & Saldaña, 2014) to facilitate this purpose. Within-sample variation in qualitative research studies allows representation of the full range and extent of a

phenomenon under study. This is termed maximum phenomena variation, which is significant as the diverse perspectives enrich data interpretation and meaning (Higginbottom, 2004; Mays & Pope, 2000; Miles, Huberman, & Saldaña, 2014). Maximum phenomena variation is also essential to recognize when data saturation has been achieved in a study. Data saturation is described as the stage at which additional data collection does not shed any further light on the issue being investigated (Charmaz, 2006; Walker, 2012). Uncomplicated malaria is managed at the primary care level in Ghana. Therefore, purposive selection of specific primary healthcare facilities as sampling units ensured that participating providers were individuals who had rich experience with malaria case management involving RDT use. The knowledge generated was therefore specific (Ezzy, 2002; Mays & Pope, 1995; Richards & Morse, 2007) and useful for addressing the research objectives (Higginbottom, 2004).

*Participant selection*

The sample comprised 50 healthcare providers recruited directly (on-site) at the selected facilities. The sample size was based on the available numbers of providers directly involved in malaria management at the study sites. Previous qualitative studies involving RDT use in malaria management in Ghana (Chandler et al. 2010) and elsewhere in Africa (Moonasar et al., 2007; Tavrow et al., 2000) demonstrated the ability to achieve data saturation and to produce useful findings from similar sample sizes. District facilities are the gatekeepers and the operational unit of the health system in Ghana (Baiden et al., 2012; MOH, 2007) where malaria transmission is hyper-endemic nationwide (GHS/NMCP, 2009; Ansah et al., 2010). Consequently, healthcare providers in peripheral facilities are familiar with routine malaria management. RDT use has also been widely promoted at peripheral facilities in Ghana (Ansah et al., 2010; Baiden et al., 2012a) and across malaria endemic settings in sub-Saharan Africa in recent years (Drakely & Reyburn, 2008; English et al. 2009; Williams et al., 2008). Participant selection was therefore appropriate, since primary healthcare providers at peripheral facilities are directly responsible for guideline implementation involving RDT use for malaria diagnosis in Ghana (GHS/NMCP 2009; WHO, 2006), (Tables 2-8 and 2-9).

**Ethical Approval**

The Health Research Ethics Board at the University of Alberta in Canada and the Committee for Health Research Publications and Ethics at the Kwame Nkrumah University of Science and Technology in

Kumasi, Ghana approved the study protocol. All participants provided individual informed consent prior to observations, interviews and focus group discussions. HCPs obtained verbal consent from patients or their caregivers prior to being observed during clinical encounters. Study-generated identification was used for transcripts and participant quotes where these were necessary to provide emphasis. This preserved participant anonymity and confidentiality. Digital recordings and study information were securely stored at the Research and Development Unit at the Komfo Anokye Teaching Hospital in Kumasi, Ghana, and later at the School of Public Health, University of Alberta, Canada.

## Data Collection

### *Non-participant (direct) observation*

Ethnographic studies involve participant- and non-participant observation (Roberts, 2009). Participant observation is a form of data collection made possible through participating in and 'becoming a part of ' the daily lives of the group being studied (Richards & Morse, 2007; Roper & Shapira, 2000). In non-participant observation, the researcher purely observes and records happenings in the setting (Denscombe, 2003; Roberts, 2009).

Weekly observations involved at least 3 hours per day at each study facility and generated information on observed providers' practices that may not have been available through other methods of inquiry (Roper & Shapira, 2000). This information was also used to verify data obtained through providers' responses in subsequent interviews such that any dissonance between observed and reported behavior could be investigated (LeCompte & Schensul, 1999). Several factors including the nature and specific needs of the study, the setting, and the participants determine the extent of a researcher's participation in ethnographic observations (Bogdewic 1999; Roper and Shapira, 2000). Ethical and practical considerations in this study influenced the decision to use *non*-participant or *direct* observations (Roper and Shapira, 2000; Brink, 1982) of healthcare providers in daily clinical encounters with suspected malaria patients at their facilities. The researcher is not a trained clinician and could therefore not 'participate' in the care-giving process along with healthcare providers. Non-participant observations allowed the researcher's role to be conspicuous to providers and their patients or caregivers of younger patients receiving care. This called for continuous negotiation of informed consent such that participating

providers and patients who were incidentally observed were under no coercion during observations (Richards & Morse, 2007; Roper & Shapira, 2000) This ensured transparency and trustworthiness in the data collection process (Lincoln & Guba, 1995; Nicholls, 2009c).

Observations began with broad descriptions of several activities and issues of interest in the practice settings. With time and repeated visits, observations became more focused on selective and relevant activities (Miles, Huberman &, Saldaña, 2014; Spradley, 1980) such as instances when a provider did or did not request a test during clinical encounters with patients. Non-participant observations have been used successfully in previous investigations of providers' practices in the context of malaria diagnosis and treatment in African settings (Chandler et al. 2009; Chandler et al, 2010). These studies did not report significant changes in providers' behavior that may have resulted in harm to the patients as a result of having an observer present. Non-participant observations were therefore appropriate and safe to document observed rather than reported practices (LeCompte & Schensul, 1999) among the healthcare providers.

Audio-recorded and hand written notes during observations served as documentation (Davies, 2007) which was helpful for distinguishing between actual observations and the researcher's perceptions of these observations (Bryman, 2008; Roper & Shapira, 2000). The researcher is the human instrument in ethnographic data collection (Richards & Morse, 2007; Roberts, 2009; Roper & Shapira, 2000). It is therefore important to ensure that data interpretation is guided by the participants' rather than the researcher's views. Grounding data interpretation in the participants' meanings is essential in naturalistic inquiry to ensure credibility of the findings (Guba & Lincoln, 1985) and requires that a researcher continually documents and reflects on personal biases or perceptions that might influence the conduct or outcome of the research process (Doyle, 2013). This process of documentation and reflection enhanced trustworthiness of the findings by providing the researcher with a personal account indicating how her evolving perceptions might have influenced the research process or outcome, or how these perceptions may have been influenced by interactions in the study setting. This is useful for evaluating the credibility of a study's findings as the documentation provides a reference for independent assessment of the extent to which personal beliefs or perceptions may have influenced data collection and interpretation (Carter & Little, 2007; Lincoln & Guba, 2000).

*Interviews*

Interviews are a primary data gathering technique commonly used for data collection in qualitative research (Mason, 2002) to provide context and explanation to observations made in the field (DiCicco-Bloom & Crabtree, 2006; Kvale, 1996). Interviews provide the researcher with opportunities to ask questions regarding observations of interest and to seek further clarification of these observations (Roberts, 2009). Interviews types used in this study included informal, in-depth and focus group interviews (DiCicco-Bloom & Crabtree, 2006). Each of these were used to obtain specific information (Bogdan & Biklen, 1982; Kvale, 1996) from providers in order to understand guideline compliance. Interviews were audio-recorded using a hand-held digital device.

*Informal interviews*

Informal interviews targeted laboratory personnel who were responsible for conducting malaria testing with RDTs. Clinicians who are expected to rely on RDT results for diagnosis and treatment were also included. These interviews allow relevant questions to be embedded in routine conversation, which encourages participants to share information more comfortably (DiCicco-Bloom & Crabtree, 2006). This helped to establish rapport before introducing potentially sensitive discussions (Fetterman, 2010) such as discrepancies between observed and recommended practices for diagnosing malaria. Continual review of the data generated through observations provided indication of topics that were of particular concern to providers warranted in-depth exploration through individual interviews. In this regard, observations enable a researcher to ask insightful questions during informal interviews and for participants to clarify their behavior or responses. This clarification ensures that the participants' views are represented during data interpretation and enhances the credibility of research findings (Bogdewic, 1999; Cresswell, 2007). Progressive interactions with participating providers enabled a better understanding of the setting and activities that were relevant to the research objectives (Bogdewic, 1999; Roper & Shapira, 2000; Spradley, 1980). Informal interviews were also beneficial for generating information that was used to develop a list of relevant topics (topic guide) to discuss during subsequent semi-structured interviews (Richards & Morse, 2007; Roper & Shapira, 2000) with the healthcare providers. An additional benefit to using informal interviews in this study was the flexibility that they allowed for gathering relevant information from other key informants including health administrative and policy officials. These officials had limited availability with frequent schedule changes that would have

posed substantial challenges to scheduling formal interviews. They may also not have been willing to formally discuss matters that involved government perspectives on health policy implementation in the setting. Informal interviews with these individuals ensured a comfortable environment for natural dialogue (DiCicco-Bloom & Crabtree, 2006; Fetterman, 2010), which generated information that was vital to understanding the policy context in the study setting. Through informal discussions, these individuals provided additional perspectives that clarified previously obtained information (Gilchrist & Williams, 1999; DiCicco-Bloom & Crabtree, 2006). Key informants and local experts facilitated access (Agar, 1996; Fetterman, 2010) to local, regional, and national health policy representatives of relevant institutions (Table 2-9)

*Semi-structured, in-depth interviews (IDIs)*

Semi-structured interviews involved selected providers who were directly involved in malaria diagnosis and treatment at their facilities. In-depth interviews are typically conducted on individual basis and are beneficial for exploring complex social issues that influence interactions in healthcare settings (DiCicco-Bloom & Crabtree, 2006). This method was appropriate for exploring challenges healthcare providers experienced with guideline implementation involving RDT use. It was important to listen attentively, (Bogdewic, 1999) and use gentle probes including repeating unfinished participant responses, to encourage complete information, while ensuring that participants were comfortable (Roper & Shapira, 2000). In-depth interviews generally lasted 90 minutes and continued across all the facilities until no new information was being identified through additional interviews.

*Focus group interviews (FGIs)*

NYB began manual data analysis concurrently with data collection. Concurrent data collection and analysis procedures are characteristic of qualitative research designs (Rope & Shapira, 2000). This process directs subsequent data collection activities to fully explore relevant issues raised by participants and is also essential to recognize when data saturation had been achieved. Recurring topics such as commonly held perspectives of guideline compliance were identified during analysis and highlighted as potential topics for focus group interviews. Focus group interviews concentrated on central issues that revealed consensus building among providers or the lack thereof such as the correct

management of RDT-negative cases febrile. These were used to develop a topic guide to encourage group discussion (Barbour, 2005). Barbour (2005) defines focus groups as any group discussion where a researcher actively encourages and is attentive to group interaction. This study included one small (4 persons) and two mid-size (6-8 persons) focus group interviews at selected participating facilities to further explore commonly cited perspectives surrounding guideline compliance. The smallest group interview was conducted in Akan/Twi (the local dialect) and translated by NYB into English prior to analysis. These perspectives provided natural starting points for comfortable conversation in the groups. Despite prior scheduling, the final representation of provider cadres during group interviews was based on their availability to participate on the scheduled date of the interview. Data from FGIs provided essential information regarding the underlying rationale and processes of consensus building (Barbour, 2005; Belzile & Öberg, 2012; Morgan, 1988) among the healthcare providers with respect to guideline compliance.

*Document review*

Documents are similar to oral traditions in non-western cultures that preserve and provide a record of activities, events, and practices with cultural, historical, and political significance in society (Nicholls, 2009c). This information enhances the ethnographic researcher's understanding of the context. Document analysis in qualitative research involves a review of any culturally significant text in the setting. *Documents* in this regard can be in written or image format among others and generally include official government reports or policies, photographs, or even poetry (Nicholls, 2009c). NYB reviewed print and electronic material including the current strategic plan (2008-2015) for malaria control in Ghana (GHS/NMCP, 2009a), case management guidelines for malaria (GHS/NMCP, 2009b), and information on malaria diagnosis and diagnostic technologies in the setting. The review also included district health directorate reports of RDT allocation and distribution to healthcare facilities. This information was useful for exploring providers' knowledge of existing national guidelines and for understanding health system capacity constraints that restricted guideline implementation. Document analyses also enabled an understanding of broad health sector policies including a capitated fee reimbursement pilot program in the study region. This program formed part of economic reform initiatives within the national health insurance scheme (NHIS) in Ghana and was reported to substantially influence guideline implementation among providers. Using document analyses, NYB was also able to confirm healthcare

providers' reports of long stock out periods for RDTs and to identify gaps in RDT distribution and delivery to the facilities.

Data Analysis

In-depth interviews and focus group discussions were audio-recorded, transcribed verbatim and checked for accuracy shortly after each interview (Richards & Morse, 2007). Areas needing further investigation through follow-up interviews were identified through simultaneous analysis of transcripts with ongoing data collection (Miles, Huberman, & Saldaña, 2014). Ethnographic analysis followed Roper & Shapira's (2000) outline. This began with coding which identified and labeled key words and recurring phrases that were relevant to guideline compliance. Coding facilitated the process of sorting the relevant data segments into categories and sub-categories where appropriate, based on similarities or differences in the uses or meanings attached to the labeled keywords or phrases. Sorting the key words into various categories allowed the identification of potential associations between the categories (Roper & Shapira, 2000) and encouraged reflection on how these associations were relevant in addressing the research objectives (Miles, Huberman, & Saldaña, 2014). Similar analysis of focus group interview data revealed patterns regarding shared rationale, collective actions and perceptions among the participants (Barbour, 2005). Further analysis led to the identification of patterns and relationships within and across the different categories, which supported the development of the major themes recurring in the data. Identifying peculiar (or negative) cases that contrasted the majority of participant responses (Richards & Morse, 2007; Roper & Shapira, 2000) was also important to appreciate the range of perspectives surrounding guideline compliance.

Atlas.ti (qualitative data analysis software) was used to facilitate data organization. This software allows a process titled 'querying' the data (Friese, 2012). Querying involves using the tools provided to investigate the characteristics of various relationships of interest within the data. Saving records of these analytic processes in 'memos' provided an audit trail that supported data interpretation (Cutcliffe & McKenna, 2004; Shenton, 2003). This enhanced the integrity and rigor of data analysis (Roper & Shapira, 2012) and provided clear linkage between interpretations and the data (Friese, 2012). This process enabled analysis to progress from descriptive coding stages to the development of more

abstract concepts by relating the data to relevant literature (Richards & Morse, 2007; Roper & Shapira, 2007) on malaria diagnosis and guideline compliance in resource-constrained settings.

**Reflexivity**

Reflexivity describes a researcher's continuous process of reflection on how their personal values, behavior or interaction with the participants might influence the interpretation of participants' responses (Doyle, 2013; Parahoo, 2006). This study involved the use of non-participant observations, interviews and focus groups all of which involve varying degrees of researcher interaction with participants in the setting (Bogdewic, 1999; Roberts, 2009). Reflexivity was essential to understand how the researcher's personal biases and preconceptions might have influenced data collection and interpretation (Jootun, McGhee, & Marland, 2009) in this study. NYB engaged in key reflexive processes including continuous personal scrutiny and internal dialogue throughout the duration of the study (Doyle, 2013). These processes were important as they allowed NYB to identify and to evaluate a dynamic balance between trust and responsibility with regards to accessing, acquiring and translating knowledge among the stakeholders as the study progressed. This led to greater clarification for data interpretation by raising awareness as to when to 'prompt, probe and encourage' participants' views (Hertz, 1997) especially where these related to areas for which NYB might have had a prior opinion and a potential bias. Reflexive processes also included memoing, which documented inherent researcher biases held prior to conducting field investigations (Morse & Field, 1999; Roper & Shapira, 2000). Memos helped to identify any changes in initial perceptions during the research process. This ensured the researcher's sense of self-awareness throughout the research process (Parahoo, 2006). Memos also allowed the researcher to compare previously held assumptions and even expected outcomes with the actual data obtained (Richards & Morse, 2007; Shenton, 2004). Maintaining careful documentation of background knowledge acquired prior to field investigations was also essential to ensure that this information did not interfere with the essence of learning from and understanding participants' perspectives in the field (Jootun, McGhee, & Marland, 2009; Parahoo, 2006). Data collection and concurrent analysis prompted further investigation, which generated more complete insider knowledge (Nicholls, 2009). This was instrumental with achieving data saturation (Walker, 2012). Achieving data saturation also indicated the legitimate stage at which data collection could be considered complete.

**Rigor**

Rigor addresses measures of quality applied before, during, and after conducting a study that determine the trustworthiness of research findings (Morse et al. 2002; Nicholls, 2009c). Lincoln & Guba (1985) document the criteria of confirmability, dependability, credibility, and transferability of findings as measures of rigor in qualitative research. These strategies employed to ensure rigor in this study are outlined in Table 2-8. Methodological coherence - a 'good fit' between the underlying philosophical assumptions, the methodology of choice and the prescribed research methods - (Nicholls, 2009c) established confirmability, credibility and dependability of the information produced. Additionally, the use of purposive sampling ensured that relevant data would be generated, as participants selected were well informed about issues relevant to the research objectives (Higginbottom, 2004). Maximum phenomenal variation (within-sample variation) enabled full representation of the possible range of perspectives (Miles, Huberman, & Saldaña, 2014) surrounding guideline compliance. Multiple methods of data collection using document analysis, observations, informal and in-depth interviews, focus group interviews allowed NYB to verify subsequently collected data with information obtained during earlier phases of the study. Interview transcripts were carefully compared to the audio-recordings before analysis to identify, clarify, and address any discrepancies. Data collection and concurrent manual transcript analysis highlighted any potential gaps in the data for which further investigation was necessary (Nicholls, 2009c). Key points from transcripts were summarized and discussed with participants for clarification, enhancing the authenticity, confirmability, and dependability of data interpretation (Lincoln & Guba, 1995; Richards & Morse, 2007). Regular memoing and reflections on guiding assumptions and rationale for decision-making during data collection and analysis also ensured a transparent process and provided audit trails (Shenton, 2004). This enhanced the confirmability, credibility, and dependability of the findings and provided valuable information by which to assess transferability of the findings to other contexts. Continually negotiating consent from participants throughout the research process ensured that no participants provided data under duress, coercion or other undue influence (Roper & Shapira, 2000).

**Discussion and Conclusion**

Extensive background information on the research topic and the context is important to ensure that meaningful investigations can be conducted within the time boundaries of FE studies (Knoblauch, 2005). Background knowledge in this study was obtained through reviewing local policy and practice guideline documents, from prior knowledge of the context as a Ghanaian citizen and through various formal and non-formal interactions with key stakeholders for malaria control in Ghana. Although background knowledge was highly valuable for guiding the research design and process, NYB maintained reflexive and continual awareness of how this knowledge might influence the processes of data collection and analysis (Kingdon, 2005). This was essential to ensure that the participants' perspectives were 're-presented' through their responses (Mayan, 2009). NYB continually confirmed developing interpretations of the data across different participant categories in the setting to ensure that data interpretation was anchored in participants' meanings.

Ethnographic studies involve close researcher-participant interactions. Early rapport- and trust building can be delicate, often requiring that the researcher clarify unrealistic or uninformed expectations among participants (Roper & Shapira, 2000). Prior to data collection, NYB had concerns about how she might be perceived in the field, as an insider or an outsider, or even a "halfie" - not quite an insider and not very much an outsider as well (Agar, 1986). Through tactful negotiation, NYB was able to honestly emphasize her 'learner' role, which helped to secure the support of key informants (LeCompte & Schensul, 1999; Roper & Shapira, 2000). Progressive communication clarified erroneously held ideas that NYB's purposes included facilitating RDT supply to the included facilities based on their responses. This clarification was of prime importance to avoid social desirability bias with participants' expressed responses and to ensure the credibility of the study's findings.

Frequent schedule changes were common among participating healthcare providers based on heavy workloads and limited time availability. However, NYB remained flexible with changes to scheduled activities at short-notice, as accommodating participants' schedules is considered common courtesy in return for their accommodation of the researcher's curiosity (Roper & Shapira, 2000).

Using concurrent data collection methods and sources allowed methodological and data triangulation, which was beneficial to ensure that the information obtained was credible (Halcomb, 2005). Other considerations in this study included flexible use of data collection methods to elicit specific information from various participant groups (Cresswell, 2007). Informal interviews allowed policy and administrative officials to provide their valued opinions, which were critical to comprehensively describe guideline compliance in the setting. These perspectives may not have been secured in a timely manner had only formal interview processes been employed. Semi-structured interviews followed a topic guide (Gilchrist & Williams, 1999; Richards & Morse, 2007). This focused on the issues under investigation and provided guidance to the conversations while allowing participants to broadly share additional relevant information (Roper & Shapira, 2000). The inherent heterogeneity resulting from maximum variation sampling techniques ensured that the full extent and range of perspectives were explored (Higginbottom, 2004) as they related to guideline compliance in the setting.

Limitations

This study investigated guideline compliance to generate knowledge for guiding improvements to policy implementation for managing malaria in Ghana. RDT use is fundamental to guideline implementation and compliance in the setting. However, RDT availability was consistently limited during the study. This may have negatively influenced participants' perspectives regarding RDT use in case management of malaria. In this regard, it is also possible that participants' responses may be affected by recall bias resulting from past and infrequent rather than current RDT use. Congruent with sample sizes in qualitative research studies, this study employed a sample size of 50 participants, as generalizability was not the primary objective for the research (Miles, Huberman, & Saldaña, 2014). Previous studies relating to healthcare provider's use of RDTs and guidelines in malaria management produced useful findings based on comparable sample sizes (Chandler, 2010; Tavrow, 2000). The study clearly documents data collection and analysis procedures to inform readers who can consequently make an informed decision regarding the transferability of the findings (Cutcliffe & McKenna, 2004). These may include policy or technology development for malaria diagnosis in other settings beyond the study district and region in Ghana or similar endemic settings in and outside of sub-Saharan Africa.

**Tables in Chapter Two**

Table 2-1: Comparison of focused and traditional ethnographies

| **Focused Ethnography** | **Traditional Ethnography** |
|---|---|
| Extensive background knowledge | Extensive insider knowledge |
| Communicative activities | Social fields |
| Short-term field visits | Long-term field visits |
| Researcher as 'field-observer' | Researcher as participant |
| Time intensive | Time extensive |
| Recording | Writing |
| Field notes and transcripts | Field notes |
| Data/analysis intensive | Experientially intensive |
| Data session groups | Solitary data collection and analysis |
| Focused | Open |
| Conservation | Subjective understanding |
| Coding and sequential analysis | Coding |

Source: Cruz and Higginbottom, 2013

Table 2-2: Focused ethnographies by WHO in developing country settings

| **Primary Author/s**<br><br>**(Publication year)** | **Study Title** |
|---|---|
| Cove and Pelto (1993) | Focused ethnographical studies in the WHO programme for the control of acute respiratory infections |
| Hudelson (1993) | The management of acute respiratory infections in Honduras: A field test of the focused ethnographic study (FES) |
| Stewart (1993) | Acute respiratory infections (ARI) in rural Bangladesh: Perceptions and practices |
| McElroy (2011) | Navigating a way forward: using focused ethnography and community readiness to study disability issues in Ladakh, India |

Table 2-3: Focused ethnographies in healthcare research

| **Primary Author/s (Publication year)** | **Study Objectives** | **Participants/context** |
|---|---|---|
| Daarck-Hirsch and Gamboa (2010) | Beliefs regarding the causes, prevention and treatment of cleft-lip | Cleft lip patients in the Philippines |
| Higginbottom (2008) | Meanings and consequences of hypertension | People of Afro-Caribbean descent living in the UK |
| Spiers and Wood (2010) | Experiences, perceptions and actions engaged in during brief therapy with patients | Community health nurses |
| Wilkinson and Callister (2010) | Perceptions of childbirth | Child-bearing Ghanaian women |

Table 2-4: Major research paradigms

| Research paradigm | Origins and influential authors | Characteristic features of research aligned to this worldview |
|---|---|---|
| **Post-positivism**<br><br>Influential authors include:<br><br>Comte, Mill,<br><br>Durkheim, Newton,<br><br>Locke<br>(Smith, 1983)<br><br>Philips & Burbules (2000) | 1980s<br><br>Challenged the traditional positivist notion of absolute truth of knowledge<br><br>Acknowledges an inability to be 'positive' about our claims of knowledge when studying human behavior and actions | Deterministic<br><br>Causes probably determine outcomes<br><br>Experimental and reflects the need to identify and assess causes that influence outcomes<br><br>Empirical observation and measurement<br><br>Knowledge generation is based on careful observation and measurement of the objective reality that is assumed to exist<br><br>Essential aspects include developing numeric measures of observations and studying individuals' behavior<br><br>Typically comprises an initial theory, data collection which refutes or supports this theory, and necessary revisions before further testing of the theory<br><br>Reductionism<br><br>Aims to reduce ideas into a small, discrete sets which can be tested, e.g. the variables that comprise hypothesis and research questions<br><br>Theory verification<br><br>Laws or theories that govern the world must be tested, verified, or refined to enhance our understanding of the world<br><br>Seeks to develop true and relevant statements that describe causal relationships or explain the situations of interest<br><br>Advances a relationship among variables in the form of a hypothesis or theory<br><br>Objectivity<br><br>Competent research must essentially be objective<br><br>Examines methods and conclusions for bias<br><br>Includes standards of reliability and validity |
| **Constructivism**<br>Influential authors include:<br><br>Mannheim<br><br>Berger & Luekmann, 1967 | 1960s<br>Knowledge, meaning, reality, or truth do not exist independently of an individual's experience and is therefore subjective rather than objective<br><br>Positivism/post-positivism does | Multiple participant meanings<br>Individuals develop subjective meanings of their experiences<br><br>Meanings are directed towards certain objects of things, hence are multiple and varied<br><br>Seeks complexity of views rather than narrow |

| | | |
|---|---|---|
| Lincoln & Guba, 1985 | not accommodate subjective and multiple realities that are inherent in society comprising many varied individuals<br><br>Knowledge or meaning is constructed by individuals in the process of engaging with the world they are interpreting | categories or ideas of explanation<br><br>Relies on participants' views and meanings of issues under study<br><br>Social and historical construction<br><br>Subjective meanings are socially and historically negotiated, i.e. formed through interaction with others and events<br><br>Address specific interactions among individuals<br><br>Focus on the specific contexts within which people live and work<br><br>Acknowledges the influence of the researcher's historical and social background on the interpretation of meaning<br><br>Theory generation<br><br>Patterns of meaning or theory are developed inductively from the data geenrated during the research process<br>Understanding<br><br>Individuals seek to understand their living and working worlds<br><br>Seeks to interpret participants' meanings about the world |
| **Advocacy or participatory**<br><br>Influential authors include:<br><br>Adorno, Freire, Habermas, Marcuse, Marx (Neumann, 2000)<br><br>Fay (1987)<br><br>Heron & Reason (1997)<br><br>Kemmis & Wilkinson (1998) | 1980s and 1990s<br>Post-positivist paradigms imposed structural laws<br><br>These laws and theories that did not properly fit or address marginalization or social justice issues affecting individuals or groups of individuals in society<br><br>Constructivist paradigms potentially enhance understanding of marginalization or social justice issues<br><br>These efforts fall short of producing the necessary advocacy or reform agenda to effectively address marginalization and social justice issues | Collaborative<br><br>Focuses on the needs of potentially marginalized or disenfranchised individuals or groups in society<br><br>May integrate various theoretical perspectives such as feminist perspectives, racialized discourse, or critical theory that are instrumental in framing the particular issue being examined<br><br>Concerned with not marginalizing participants in the research process<br><br>Participants may be engaged in study design, data collection and analysis, or derive benefit from research outcomes<br><br>Change oriented<br><br>Becomes the participants' voice and raises their consciousness regarding the conditions or situations warranting the research<br><br>Represents a united voice that advances reform and change to improve participants' lives, living or working conditions<br><br>Empowerment issue-oriented |

| | | |
|---|---|---|
| | | Address specific topics related to social issues of relevance to the participants or society as a whole<br><br>Explores relevant issues related to alienation, domination, inequality, oppression, or suppression as a focal point<br>Political<br><br>Research theory needs to be intertwined with politics and a political agenda<br><br>Contains an action agenda for reform that may influence the lives of participants, the institutions in which they live and work and the researcher as well |
| **Pragmatic**<br>Authors whose works have influenced this philosophy include:<br><br>Pierce, Mead, James, Dewey (CherryHolmes, 1992)<br><br>Murphy (1990)<br><br>Patton (1990)<br><br>Rorty (1990)<br><br>Morgan (2007) | Early 1990s<br><br>Arises from actions, situations and consequences rather than from antecedent conditions, as is the case in post-positivism | Consequences of actions<br><br>Arises out of actions, situations and consequences rather than antecedent conditions (e.g. post-positivism)<br><br>Pluralistic<br><br>Not committed to a particular philosophy or reality<br><br>Use of pluralistic approaches to derive knowledge and understanding about the problem<br><br>Problem-centered<br><br>Focuses on the research problem rather than methods<br><br>Focuses on application of solutions that effectively address problems<br><br>Real world practice-oriented<br><br>Research always occurs in historical, social, political or other contexts<br><br>Situations of interest or problems are connected to these contexts |

Table 2-5: Research designs, methodologies, methods, and paradigms

| **Key characteristic features** | **Research designs** | | |
|---|---|---|---|
| **Tend to or typically…** | **Qualitative** | **Quantitative** | **Mixed Methods** |
| Align with these philosophical assumptions | Constructivist<br><br>Advocacy or participatory | Post-positivist | Pragmatic |
| Employ these strategies of inquiry | Case study<br><br>Ethnography<br><br>Grounded Theory<br><br>Narrative<br><br>Phenomenology | Experiments<br><br>Surveys | Concurrent<br><br>Sequential<br><br>Transformative |
| Employ these methods | Open-ended questions<br><br>Emerging approaches<br><br>Image or textual data | Closed-ended questions<br><br>Predetermined approaches<br><br>Numeric data | Open- and closed-ended questions<br><br>Emerging and predetermined approaches<br><br>Qualitative and quantitative data collection and analysis procedures |
| Use these practices of research in which the researcher… | Positions him- or herself in context of data generation and interpretation<br><br>Collects participant meanings<br><br>Focuses on a single concept or phenomenon<br><br>Brings personal values into the study<br><br>Studies the context or setting of participants<br><br>Validates the accuracy (confirmability) of findings<br>Makes interpretations of the data<br><br>Creates an agenda for change or reform<br><br>Collaborates with the participants | Tests or verifies theories or explanations<br><br>Identifies variables to study<br><br>Relates variables in questions or Hypotheses<br><br>Uses standards of validity and reliability<br><br>Observes and measures information numerically<br><br>Uses unbiased approaches<br>Employs statistical procedures in data analysis | Collects both quantitative and qualitative<br>Data<br><br>Develops a rationale for mixing methods<br><br>Integrates the data at different stages of inquiry<br><br>Presents visual pictures of the procedures in the study<br><br>Employs the practices of both qualitative and quantitative research |

Source: Cresswell (2003).

Table 2-6: Focused ethnography - application in the research process

| **Characteristic** | | **Applications within the investigation guideline compliance** |
|---|---|---|
| 1 | Problem-focused | Poor guideline compliance among primary healthcare providers |
| 2 | Context-specific | Rapid malaria testing and case management in primary healthcare settings |
| 3 | Focus on a discrete community, organization, or social phenomenon | Primary healthcare providers in a selected district, involved directly in malaria case management; the district health management team responsible for facilitating policy guideline implementation throughout the district; health policy officials knowledgeable on the issue of healthcare providers' compliance and other challenges to primary healthcare delivery in Ghana |
| 4 | Requires extensive background knowledge | The conceptual framework and the research questions were informed through:<br><br>A priori literature review of RDT use and guidelines for rapid malaria testing in Ghana and sub-Saharan Africa as a whole<br><br>Experiential knowledge of malaria control policy development through a policy research internship with the National Malaria Control Program in Accra, Ghana<br><br>Close interaction, consultative discussion and feedback with local experts, and key stakeholders throughout the duration of the study |
| 5 | Conceptual orientation of a single researcher | Although informed from several perspectives, the guiding conceptual framework was not a joint community initiative, but was presented by the researcher as follows:<br><br>Guideline compliance occurs as a composite interaction involving 3 primary constructs<br><br>- Technology - RDTs<br>- Policy – the guideline for rapid testing; and<br>- Practice – primary healthcare providers, at the frontline of malaria case management in Ghana<br><br>Interactions occur at the various interfaces between each of these three and each contribute to influence guideline compliance |
| 7 | Typically involves a limited number of participants | 55 individuals<br>- 50 healthcare providers<br>- 5 health administrative and policy officials<br><br>30 interviewees<br>- 25 healthcare providers<br>- 5 health administrative and policy officials<br><br>45 interviews<br>- 34 with healthcare providers and 11 with health administrative and policy officials<br>- 12 in-depth, semi-structured with healthcare providers<br>- 22 informal with healthcare providers<br>- 11 informal (consultative discussions) with health policy and administrative officials |
| 8 | Participant observation is episodic | April – May, 2013<br>2,3 and 5 days a week based on facility size, patient volume/traffic and healthcare providers' availability |

| | | |
|---|---|---|
| 9 | Participant knowledge is usually specific | Healthcare providers were knowledgeable in case management, nature and risk of infection, diagnosis and treatment, and could inform the research question, based on their perspectives of regarding revised case management guidelines |
| 10 | Used in academia | Field investigation supported the primary author's doctoral thesis |
| 11 | Used for the development of healthcare services | Research aim was to generate information to improve the implementation of test-based management of malaria (TBMM) in Ghana. Knowledge translation activities will target different levels:<br><br>Local: to inform practice at local levels of healthcare delivery, by way of feedback<br><br>National: to generate discussion towards developing and testing interventions to improve TBMM.<br><br>International: To expand current knowledge, and inform policy/practice debates regarding healthcare providers' compliance with guidelines for rapid malaria testing in limited resource environments |

Notes:
Adapted from Cruz and Higginbottom, 2013
Column 1 outlines the distinct characteristics of Focused ethnographies.
Column 2 illustrates how each of the outlined characteristics were applied within the study of healthcare providers' compliance.

Table 2-7: Characteristics of interviewed healthcare providers

| Level of care Delivery | Informal interviews (INFIs) | | In-depth interviews (IDIs) | | Number of healthcare provider interviewed | Total number of interviews |
|---|---|---|---|---|---|---|
| | Number | Cadre | Number | Cadre | | |
| **Private** | | | | | | |
| Community | 3 | Healthcare Assistant (2) Midwife (1) | X | X | 3 | 3 |
| Sub-District | 3 | Medical Officer (2) Clinical Testing Officer (1) | 1 | Medical Officer (1) | 2 | 4 |
| District | 5 | Laboratory Staff (3) Medical Officer (1) Nurse (1) | 1 | Facility Administrator (1) | 6 | 6 |
| **Public/Government** | | | | | | |
| Community | 3 | Laboratory Staff (2) Physician Assistant (1) | 2 | Nurse Prescriber (1) Physician Assistant (1) | 4 | |
| Sub-District | 3 | Laboratory Staff (2) Physician Assistant (1) | 4 | Nurse Prescriber (2) Physician Assistant (2) | 5 | |
| District | 5 | Laboratory staff (4) Nurse Manager (1) | 4 | Medical Officer (1) Nurse Manager (3) | 5 | |

Table 2-8: Characteristics of consulted health policy officials

| Institution or Organization | Level of administration or Policy Oversight | Number of consultative discussions held |
|---|---|---|
| **District (local)** | District Health Management Team DHMT | 3 |
| **Regional** | Regional Medical Stores | 3 |
| | Regional Malaria Control | 2 |
| **National** | Society of Private Medical and Dental Practitioners – Ghana<br>SPMDP - Ghana | 2 |
| | National Health Insurance Authority | 1 |

Table 2-9: Strategies to ensure rigor

| **Study Aspect** | **Data Collection Method** | | | | |
|---|---|---|---|---|---|
| | Field observation | Informal Interviews<br><br>(INFIs) | Individual, in-depth interviews (IDIs) | Focus Group Discussions<br><br>(FGDs) | (Informal) Key Informant Interviews (KIIs) |
| **Phase** | 1 | 2 | 3 | 4 | 5 |
| **Participants involved** | Consenting frontline healthcare providers laboratory personnel | Selected frontline healthcare providers laboratory personnel, | Heads of Facility (HOFs), selected frontline healthcare providers, district health management (DHMT) representative | Selected frontline healthcare providers, laboratory personnel | District Regional and National health policy officials |
| **Data generated** | First-hand information on provider practices involved in consultations with suspected malaria patients | Provider-reported challenges with RDT use and test result application in case management of febrile patients | Provider perspectives on guideline compliance, and attendant challenges in their settings | Provider agreement, disagreement, and consensus surrounding key elements of guideline compliance | Policy officials' perspectives on elements of provider-reported challenges with guideline compliance |
| **Research Questions (RQs) addressed** | RQ 1<br>RQ 2 | RQ 1<br>RQ 2 | RQ 1<br>RQ 2 | RQ 1<br>RQ 2<br>RQ 3 | RQ 1<br>RQ 2<br>RQ 3 |
| **Elements of Rigor addressed** | **Credibility, Dependability, Transferability, Confirmability** | | | | |

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**CHAPTER THREE**

UNWILLING OR UNABLE? A FOCUSED ETHNOGRAPHICAL STUDY OF HEALTHCARE PROVIDERS' COMPLIANCE WITH GUIDELINES FOR RAPID MALARIA TESTING IN GHANA

**Introduction**

The World Health Organization (WHO) estimates between 100 to 300 million cases of malaria occur worldwide leading to about a million deaths each year [1, 2]. Almost 90% of this burden occurs in Ghana and other sub-Saharan African countries, where young children below the age of five years account for more than 80% of global malaria deaths [1, 3]. Early diagnosis and effective treatment within the first 24 hours of symptom onset are vital to prevent complications or death from malaria, especially among young children and pregnant women [4].

Microscopy is the primary mode of malaria diagnosis and involves a trained technician detecting *Plasmodium* parasites in a patient's blood sample [5, 6]. However, for decades febrile illnesses in Ghana and other African settings were treated as malaria to enable prompt delivery of life-saving treatment for vulnerable populations in limited-resource environments [7]. Poor sustainability of quality-assured microscopy and wide availability of inexpensive antimalarials including chloroquine and sulfadoxine pyrimethamine resulted in this strategy being regularly extended beyond the initial high-risk group of children less than five years of age [8]. However, the complete clinical presentation of malaria is highly variable, making it poorly distinguishable from several other tropical diseases [9-11]. Presumptive treatment practices therefore lead to increased morbidity from routine misdiagnosis of non-malarial fevers and unnecessary antimalarial consumption[7, 12]. Indiscriminate antimalarial consumption also includes incomplete dosing for repeated malarial infections in high transmission areas which further contributes to drug resistance development, exacerbates a vicious cycle of illness and further impoverishment among the poor, and drains limited national and donor resources [13, 14].

The WHO now recommends confirmatory testing prior to treating all suspected cases of malaria with antimalarials. The objective of this guideline is to ensure targeted use of antimalarials as a means of containing antimalarial resistance and is premised on three critical factors – emerging parasitic resistance to antimalarials, declining malaria transmission, and available diagnostics for accurate malaria diagnosis in limited-resource environments [7, 8, 15]. By 2009, Ghana and 42 other African countries had adopted Artemisinin-based combination therapies (ACTs) as first-line antimalarials to counter parasite resistance to formerly used drugs including chloroquine and sulphadoxine-pyrimethamine [16]. The increasing need to expand intervention coverage among the poorest

populations and the thin development pipeline for new antimalarials necessitate targeted ACT consumption to contain emerging resistance to artemisinin [13, 17, 18]. Furthermore, increased global emphasis on malaria control has led to declining transmission in affected countries, suggesting a concomitant rise in clinical significance of non-malarial fevers. This evidence has promoted renewed interest in confirmatory malaria testing to potentially improve overall fever management in all transmission settings [19, 20]. The availability of rapid diagnostic tests (RDTs) for malaria over the recent decade presents a huge opportunity to shift from presumptive to confirmatory diagnosis of malaria in resource-constrained, endemic settings. RDTs do not require the infrastructure or technical expertise necessary for microscopy thereby diminishing the need for presumptive treatment practices in remote settings where microscopy is unavailable [9, 21]. However RDT implementation in Ghana and other sub-Saharan African countries with limited health system capacity has not achieved the expected potential [22-24]. Optimizing RDT implementation in limited-resource environments is vital to achieving global targets of universal diagnostic coverage for malaria, while ensuring rational use of antimalarials [25, 26].

Malaria is the leading cause of morbidity in Ghana. The entire population of 25 million is at risk of malaria infection year-round, with all areas of the country experiencing high (hyper-endemic) transmission. Transmission intensity peaks during the two rainy seasons from May to July, and September to November [27]. About 90 - 98% of cases nationwide are falciparum malaria, the most deadly among human malarial infections and the most common in sub-Saharan Africa. The remaining 2 - 9% of malaria cases in the country are caused by p. malariae, with only 1% being p. ovale cases [28-31]. Although mortality from malaria has reportedly declined steadily over the past decade, almost 40% of all outpatient illnesses and hospital admissions nationwide are attributable to malaria. Malaria causes a third of all-cause mortality and almost 50% of hospital admissions among children below five years of age [32].

The current strategic plan for malaria control in Ghana employed by the National Malaria Control Program (NMCP) is based on millennium development goal (MDG) 6 that aims for a 75% reduction of malaria morbidity and mortality by 2015, using rates in 2006 as the baseline [33, 34]. Alongside expanding nationwide prevention and treatment coverage, a key focus of the strategy is to improve early

diagnosis and effective disease management and to strengthen diagnostic capacity for malaria at health facilities nationwide [35]. Despite national adoption of a test-before-treat guideline for malaria in 2010, presumptive treatment practices remain common in Ghana and across sub-Saharan Africa [36, 37]. Less than 33% of all presumed malaria cases in Ghana were confirmed through parasitological diagnosis in 2012 [1]. Relative to urban areas of the country, rural and remote access to diagnostics for malaria is particularly poor, although the latter bear a disproportionate share of the disease burden [31, 38]. Even where RDTs are used, authors of a study conducted in 2010 found up to 45% of RDT-negative patients in a Ghanaian setting received antimalarial treatment [36]. Findings from studies in other malaria-endemic African settings indicate poor and variable rates of compliance with the confirmatory testing policy for malaria, with between 10% and 80% of test negative patients receiving antimalarial treatment [23, 24, 37].

Previous research involving test-based malaria management extensively documented healthcare providers' prescription behavior, with a few exploring patient and community expectations, perceptions and socio-cultural perspectives regarding RDT use [38-42]. Yet little is known about the underlying determinants of poor healthcare providers' compliance with the confirmatory testing guideline in endemic settings. In this focused ethnography, healthcare providers' perspectives were explored to identify the determinants of poor compliance with guidelines for rapid malaria diagnosis in Ghana. The knowledge yield is highly informative to technology developers, policy and program managers concerned with expanding diagnostic and treatment coverage for malaria in poor-resource settings.

**Methods**

In this study, guideline compliance for rapid malaria testing is defined as a healthcare provider's commitment to test a patient suspected of having malaria using a RDT and to subsequently manage the case consistently with the test results as recommended by the current NMCP guideline [33]. Previous studies established that the healthcare provider's use of RDTs and recommended application of test results in case management of fever demonstrates compliance with current guidelines for managing malaria in poor-resource, endemic regions [43-45].

The conceptual model

Evidence from relevant literature on healthcare providers' routine use of RDTs in sub-Saharan African settings suggests that guideline compliance for confirmatory malaria diagnosis is influenced by three primary interactions [40, 41, 44, 46]. These are interactions between: (1) providers and technology (or RDTs), which have a bearing on perceptions of RDT utility, suitability and effectiveness in practice; (2) providers and the policy guideline, which influence providers' knowledge, perceptions, and understanding of case management recommendations for malaria; and (3) providers and patients, representing the primary locus of guideline compliance in practice. This locus also represents the hub of technology, policy and practice for malaria diagnosis and treatment in the study setting. The conceptual model (Figure 3-1) was developed using information from relevant literature on test-based malaria management, RDT acceptance and use in sub-Saharan African settings [41, 44]. This allowed the accommodation within the study design of contextual and structural components of the setting, including health system, historical, socio-economic, and political factors and the anticipation of their invariable influence on malaria management. By outlining the essential constructs and interactions relevant to guideline compliance in this study, the model served as a guiding framework for analysis, and in which participants' perspectives were anchored in order to interpret the data. Appendix 3-1 provides a detailed description and explanation of the conceptual model.

Study setting

The study was conducted in Atwima-Nwabiagya, the third largest among 27 districts in the Ashanti Region, located within the rainforest zone in Ghana. This peri-urban district includes 5 sub-districts

comprising 92 communities with 157,181 residents. About a third of these communities are inaccessible by road transportation particularly during the rainy seasons. Agriculture provides the main livelihood, employing over 50% of the labor force in the district. At the time of this study, 5 out of the 17 healthcare facilities in the district were operated by the Ghana Health Service (GHS). The 5 GHS facilities included 4 health centers, with 1 district hospital serving as the main referral facility. The remaining 12 privately owned facilities included 3 hospitals, 3 health centers, 1 clinic, and 5 maternity homes. Six Community Health Planning and Services (CHPS) compounds had been proposed to provide basic care in the district. Three CHPS compounds had been completed and only 1 was functional at the time of the study [47]. The doctor-to-population ratio was 1:30,000 and the nurse-to-population ratio 1:2015 in the Ashanti region from 2011 to 2012. The district had 8 medical assistants in 2012 heading most of the facilities, due to the critically small number of available doctors. At the time of the study, the Ashanti Region had been selected by the National Health Insurance Scheme (NHIS) to pilot a capitated reimbursement program for health services delivery. The 2012 annual report from the district health directorate specified a negative impact of capitated reimbursement rates on facility attendance as a key challenge to effective care delivery in 2011 [48].

Malaria is the leading cause of morbidity in Atwima-Nwabiagya and has been for the past 3 years. Malaria transmission in the district is hyper-endemic and stable malaria with peaks in intensity correlated with the rainy seasons. At 160,000 cases, malaria far outnumbered the 40,000 recorded cases of acute respiratory infections (ARI) and 16,000 hypertension cases in the district in 2011. More than 40% of all hospital admissions in the district in 2011 were caused by malaria. Among children below the age of five, 60% of all-cause mortality and 30% of health facility admissions in 2011 was directly attributable to malaria [48].

Sampling

The study district was chosen through prior networking with a local advisor from an affiliate institution in the region. Six facilities were purposively selected from a sampling frame of 17 in the district. These 6 facilities were located in 3 out of 5 sub-districts in Atwima-Nwabiagya and were selected in consultation with a study advisory group comprising local leaders and key informants from neighboring communities. Practical considerations informing site selection included road accessibility to the communities and the

feasibility of collecting data with minimal interruptions to routine facility activities. Inclusion criteria were government or private ownership, service delivery at community-, sub-district-, and district operational levels, year-round geographical access by road transportation, and consent from heads of the facilities (HOFs). The principal investigator (NYB) considered RDT use at the facilities a key criterion for inclusion based on the research interest being guideline compliance within the context of rapid malaria testing. However, representatives of the district health directorate indicated that RDTs when available were supplied to all facilities in the district, making all 17 facilities eligible for inclusion.

Sample description

The six purposively selected study facilities included a complementary pair of 1 government- and 1 privately owned community, sub-district and district health facility, representing each of the three operational levels of primary healthcare delivery in Ghana [31]. Complementary pairing was helpful in order to identify any potential differences in providers' perspectives on guideline compliance that may have been relevant to differences in conditions of service delivery and provision between private and government facilities. Private facilities in the study area were for-profit facilities. Public institutions included in the study were government-operated facilities. Purposive sampling across the spectrum of existing primary healthcare facility types in the district was essential in order to capture a potential range of perspectives on guideline compliance related to the inherent diversity of facilities, ownership, infrastructure, basic amenities, and cadres of healthcare providers at the represented levels of primary healthcare. The smallest health facility (health facility I - HFI) was a private maternity home, headed by a nurse midwife whose responsibilities included prescribing medication such as antimalarials for patients as necessary. The two largest facilities were a private and a government hospital, each with one medical doctor. Prescribing duties at both hospitals were jointly carried out by the doctors, physician assistants, and nursing staff (Table 3-1).

Participant selection and recruitment

District facilities are the gatekeepers and the operational unit of the Ghana Health Service. Uncomplicated malaria is managed at the primary care level through these facilities [49, 50]. Purposive selection of healthcare providers (HCPs) at these facilities, familiar with routine malaria management including RDT use therefore ensured that the participants' would provide vital information for addressing

the study objectives. After initial discussions with the district health directorate and with the heads of included facilities, a total of 50 healthcare providers were directly approached at all 6 participating facilities, provided information, encouraged to discuss any questions or concerns, and invited to participate in the study. The sample size was based on available, consenting providers and administrative/policy representatives whose responsibilities included guideline development, dissemination and implementation for malaria diagnosis and treatment in the study setting (Table 3-2). Previous qualitative studies involving healthcare providers' use of RDTs for managing malaria in Ghana [41], South Africa [51], and Angola [52], have produced useful findings based on similar sample sizes.

Data collection

*Non-participant (direct) observation*

NYB directly observed participating healthcare providers at all 6 study facilities over 6 weeks during daily clinical encounters with patients suspected of having malaria. Observations centered on routine situations involving guideline compliance and lasted 2-3 hours per day at smaller health facilities and 5-8 hours per day at larger facilities with longer duration of steady attendance and where consultation and testing were typically conducted at different locations within the facility. Initially, observations included detailed descriptions of the setting, events and background activities of interest and subsequently focused on specific activities that informed the research objectives [53, 54] These included providers' requests for RDTs for patients and their reactions to negative test results. Data generated during observations illuminated providers' behavior with regards to guideline compliance and provided opportunities to engage them in informal interviews during which they clarified some of the observed behaviors [55].

*Interviews*

NYB was introduced to participants as a graduate student researcher and personally conducted all interviews in English with consenting healthcare providers, administrators, and policy officials. Only one focus group was conducted in Akan/Twi – the local dialect – in order to accommodate the request of the staff at this facility. Interviews occurred in private at the participants' respective health facilities, offices, or preferred locations and followed a topic guide centered on guidelines governing RDT use for malaria

testing. Socio-demographic information captured prior to beginning each semi-structured interview included the provider's age, years of clinical experience and the number of years spent in practice at their current facility (Table 3-3). Semi-structured interviews primarily involved frontline health services delivery providers whose use of RDT results in diagnosis and treatment decisions demonstrated guideline compliance. Informal interviews included laboratory personnel who conduct patient testing including malaria RDTs in the setting. NYB audio recorded and captured handwritten notes during each interview. Where necessary, follow up interviews included face-to-face and telephone formats.

*Consultative discussions*

Concurrent data analysis of ongoing interviews highlighted key provider concerns about guideline compliance, some of which were better understood through conversations with health administrative and policy officials. Key informants and local experts facilitated access to representatives of relevant policy institutions. These discussions centered on guideline information and dissemination, as well as other broad health sector policies including a capitated fee-based pilot program instituted in the Ashanti region at the time of the study under the National Health Insurance Scheme (NHIS). Consultative discussions with 5 local, regional, and national health administrative and policy officials elicited informed perspectives from administrative and policy officials, whose constrained schedules were non-conducive to the formality and protocol of in-depth interviewing (Table 3-4).

*Focus group interviews (FGIs)*

This study included one small (4 persons) and two mid-size (6-8 persons) focus group interviews (FGIs) at three selected facilities. Focus groups comprising 6 – 8 participants are considered optimal as they allow time for each participant to adequately air their views and for informative group interaction and dynamics. Although concerns of limited interaction arise with groups involving less than 5 participants [56, 57], the smallest FGI in this study comprising 4 participants involved significant interaction, provided insights for data analysis and included all available staff at that particular facility. A topic guide with open-ended questions encouraged group interaction and explored shared rationale and consensus building [56, 57] around guideline compliance. Topics were based on commonly cited perspectives of guideline compliance identified during individual interviews and iterative data analysis. The two larger

FGIs were conducted in English with NYB facilitating and taking notes. The smallest FGI held in a remote setting included a co-moderator (a public health nurse well known in the community with relevant research experience) to accommodate the participants' preference to hold the discussion in the local Akan/Twi dialect. FGIs targeted different healthcare provider cadres whose final representation depended on availability at the selected facility at the scheduled time of discussion (Table 3-2).

*Document review*

NYB reviewed pertinent national and stakeholder documents in order to understand providers' expressed perspectives within the existing context for guideline implementation. Documents reviewed included Ghana's current strategic plan for malaria control [33], guidelines for malaria management [58] and RDT allocation and distribution records accessed from the health directorate in the study district.

Data management and analysis

NYB directly transcribed digital recordings following each in-depth interview and focus group discussion, translated the one conducted in Akan/Twi to English, and checked each transcript for accuracy. Summary notes were prepared for each interview and group discussion. This assisted with assessing topic saturation or needed changes to the topic guide and identifying issues requiring further investigation through follow-up interviews [59]. Ethnographic analysis followed Roper & Shapira's outline [60]. First, coding identified key words and recurring phrases in participants' responses that were used to descriptively label segments of the data that were relevant to guideline compliance. Defining each of the codes used facilitated sorting these descriptive labels into various categories based on similarities or differences and in relation to topics outlined in the interview guide. Sorting identified patterns and relationships within and among the different categories of codes that depicted the meanings providers attached to various perspectives of guideline compliance. Similar analysis of focus group data revealed patterns involving collective perceptions, shared rationale, and providers' individual observed and reported behavior.

*Coding, sorting, identifying patterns and generating themes*

Comparison of the codes and categories with the conceptual model outlined for this study (Figure 3-2) and relevant literature supported the identification of recurring themes in the data. Themes were progressively developed through further organization of the codes and categories in the data in relation to each identified theme. Discussions held at various stages of analysis with local study affiliates provided clarification and confirmation of the data where necessary. Moreover, paying attention to peculiar (or negative) cases that contrasted the majority of participants' responses was essential in order to understand the range of perspectives [60] surrounding guideline compliance. Atlas.ti software (ATLAS.ti Scientific Software Development GmbH) facilitated data management and organization [61]. Using tools provided in the software, NYB queried the data to uncover key data segments that described the determinants of guideline compliance in the participants' voice. Following this, data abstraction which involved relating the findings to available literature on RDT-aided malaria diagnosis in resource-constrained settings provided insights that allowed progressive data analysis from descriptive to interpretive and conceptual stages [62, 63]. Memos that documented the analytic processes provided an audit trail that supported the interpretation of the findings. Memos also included personal values and reflections on researcher-participant interactions that could potentially influence decisions concerning the research process. Progressive querying, abstraction and memoing provided clear linkage between the data and its interpretation, which enhanced integrity and rigor with the conduct and findings of this research [64, 65].

**Ethics**

The Health Research Ethics Board at the University of Alberta in Canada and the Committee for Health Research Publications and Ethics at the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana approved the study protocol. All participants provided individual informed consent prior to observations, interviews and focus group discussions. HCPs obtained verbal consent from patients or their caregivers prior to being observed during clinical encounters. Study-generated identification was used for transcripts and participant quotes where these were necessary to provide emphasis. This preserved participant anonymity and confidentiality. Digital recordings and study information were securely stored at the Research and Development Unit at the Komfo Anokye Teaching Hospital in Kumasi, Ghana, and later at the School of Public Health, University of Alberta, Canada.

**Results**

The study design enabled progressive researcher-participant interaction and earlier phases of data collection to inform subsequent data collection activities. A total of 50 healthcare providers at 3 private and 3 government primary healthcare facilities in the study district participated in observations, 3 FGIs, 12 in-depth and 45 informal interviews. Informal interviews included 11 consultative discussions with 5 representatives of local, regional and national health administrative and policy institutions. There were no refusals to participate.

Individual provider characteristics

The age range for female participants in this study was 21 – 77, and for males 31 - 65 years. Half of the interviewed providers were above 50 years of age among whom clinical experience ranged from 17 to 56 years. Younger providers were between 21 and 35 years of age with 3 – 9 years of clinical experience. This information was useful to assess variations in perspective in relation to individual similarities or differences.

Awareness and knowledge of the confirmatory testing guideline

Overall awareness of a confirmatory testing guideline for malaria was consistent across interview responses of all represented provider cadres. However, in reference to the National Malaria Control Program (NMCP) guidelines, differences in guideline knowledge emerged when comparing provider roles and responsibilities at their respective facilities. These differences were irrespective of providers' ages, years spent at their current facility or in overall practice experience. Heads of facilities (HOFs), other prescribers and laboratory personnel comprehensively communicated guideline content and the underlying rationale as illustrated in the quotes below:

*"… Any patient that… a prescriber suspects… has malaria… we are supposed to use the RDTs to be sure whether it's really malaria or it's not malaria. Because it's not just malaria that presents with fever symptoms."* (HCP, HOF, IDI, HF 3)

*"… When you suspect, you have to confirm… before you treat… So we are using RDT and then the 'mps' (microscopy) as well."* (HCP, nurse manager, IDI, HF 6)

*"The policy says we should use the RDT and then the microscopy… to use the clinical symptoms is not a full diagnostic measure… recently they introduced the RDT… But the microscopy is not outmoded."* (HCP, prescriber, FGI, HF 6)

*"…If you think about the patient alone, you will give them (antimalarials)… at the end of the day you will have resistance. And it takes a lot of money to come out with a new drug."* (HCP, prescriber, FGI, HF 5)

*"… The drugs… they are chemicals… you should also be careful about… side effects… they said that "rational use of drugs". It means that the rationale should be there, while you are giving it to the person."* (HCP, prescriber, FGI, HF 5)

*"… Previously, we weren't testing suspected cases… if you noticed the signs and symptoms… you might suspect malaria, while it may not be malaria, there could be another cause of the signs and symptoms that you might mistakenly consider to be malaria… now they instructed that in order to be sure, we should confirm whether a suspected case is or is not malaria."* (HCP, prescriber, HF 1)

Providers who were neither facility heads nor laboratory personnel demonstrated a lack of clarity about guideline content, evident in responses that communicated partial guideline knowledge or the former presumptive treatment approach. The quote below from a provider who described her duties as only 'occasionally including prescribing' captured the disparity in guideline knowledge among providers:

*"…When our patients come to the facility…mostly it is with fever. So we check for fever… if it's above 38 (°C, referring to temperature)… with other signs… vomiting especially, sometimes, we decide to treat for malaria even if we have not checked… that is the guidelines I know…"* (HCP, IDI, HF 5)

Information available from the NMCP indicates that where possible, microscopy can be used as confirmation, to better guide case management for providers who are in doubt of a negative RDT result. However, other responses on guideline knowledge including the excerpt below from a FGI conducted at a community-level facility highlighted the possibility that mixed training messages contributed to the lack of clarity about the guideline.

*"Moderator 2: So if you had a microscope, would you still consider RDTs useful at your facility?*

*Male participant 1: Ok, before they were introduced, we attended a workshop on RDTs. And we were told that medical assistants in the consulting rooms must have RDTs with us at the ready. So after the person comes back from the lab, the medical assistant would use the RDT to confirm."*

Perceptions surrounding RDTs and the confirmatory testing guideline for malaria

All interviewed providers perceived the confirmatory testing guideline was useful for improving malaria management. However, they also cautioned about neglecting clinical judgment in favor of a malaria test result citing prevalence in the setting and the known risks and consequences of delayed treatment. Participating providers commonly associated guideline implementation with RDT use. At higher levels of care delivery, providers acknowledged a preference for microscopy and asserted that RDTs were better suited to remote facilities offering basic care and without laboratories. These perspectives are captured in the quotes presented here:

*"… It (RDT) makes your work easier… and then you don't do much errors. You go straight to the point treating the person, and it also saves time."* (HCP, IDI, HF 6)

*"It's good, like the pre-amble to this research says that you will have to treat it only when it is malaria. Looking at the prevalence… and… the number of mosquitoes around that are biting everybody every time… not treating it and going only by the lab tests… may present some problems… You may see a patient whom you think might have malaria because of the pattern of fever… the way the child looks… when you do the test it may be negative… in a few cases, I may still go ahead and give… some antimalarial, thinking… it's not going to cause any harm. But if we hadn't treated then probably we may run into complications of malaria." (HCP, IDI, HF 2)*

*"… In the typical hinterlands, it (RDT) is the best thing for them. Because they can't get the lab…"*

*(HOF, IDI, HF 6)*

*Perceptions of the guideline were similar among interviewed providers with no noted differences with respect to age, gender, or the number of years of experience in clinical practice. These similarities were*

*also common when comparing providers' responses across both public and private facilities. Older providers (>50 years) were confident in their clinical judgment of symptomatic malaria. Younger providers (≤35 years) including those with less than 2 years of clinical experience agreed with their older colleagues on the necessity of presumptive treatment when in doubt over negative RDT results. These similarities are illustrated below:*

*"… It is not easy sending everybody to be sure… whether it's malaria or not… some of us have been doing the work for so many years and if you see and if you take very good history, as I told you the last time, you will be able to arrive at the diagnosis."* (Male HCP, 56 years, IDI, HF 5)

*"… The symptoms are what determine what happens. If the person complains of a bitter taste in the mouth, once they mention that, you have to know that it's malaria. Even though the test result is negative, you have to treat it as malaria… granted, the guideline says not to do things that way, but the patient's recovery is really essential."* (Female HCP, 21 years, FGI, HF 1)

*"… We are not always going to be able to comply with the guideline. Because looking at the child, they appear to have malaria. And half of these children are dying from this same malaria!"*
(HCP, female, 77 years, FGI, HF 1)

In-service training

Almost all interviewed providers had received training on RDT use. This included formal training, described as organized workshops with incentives including career development credits towards professional licensure, renewals, or promotion and travel/transport per diem payments (T & T). Informal training included on-the-job or peer training within the facility without any incentives. Female providers in both age brackets at private and government facilities attributed sub-optimal guideline knowledge to insufficient in-service training and a shortage of suitably qualified staff to facilitate guideline implementation. This perspective was apparent in responses that indicated a tendency to advocate for comprehensive training to mitigate knowledge, skill and proficiency gaps associated with high staff turn over. Male providers on the other hand generally acknowledged limited training opportunities as typical in scarce-resource settings. Gender-related differences were also noted in providers' perceptions regarding the content, mode and quality of in-service training opportunities, which often targeted heads

of facilities and laboratory personnel. Moreover, providers' descriptions of the training they received on RDT use suggested inadequate supervision to support correct RDT use and proper guideline implementation in accordance with training recommendations. The selected quotes below relay these perspectives:

"…We are having so many… newly qualified nurses in the system, and some of the old nurses are also pursuing their schooling… people are leaving and others are also coming in. So it… calls for regular training of the personnel in the facility…" (Female HCP, IDI, HF6)

*"… Some (providers)… didn't go for the training therefore they don't know the benefit of doing the test… and therefore they are not willing to comply… If somebody goes for a workshop… and the person comes in to educate or teach others, some people don't find it serious to adhere to whatever they are being taught by a colleague… So…I think… the training should go on with very qualified people so that the depth of the training itself will get to the…people using the… (RDT)."*
(Female HCP, IDI, HF6)

*"… There are new things coming up and sometimes you are not even aware of what is happening… if there are workshops and… we are being kept abreast of whatever is happening, we will all go according to… like, testing before treating... But if there are no workshops… we will do the same things that we have been doing..."* (Female HCP, IDI, HF 5).

*"…Not everybody can go (for training). But the people who are at the helm of affairs, like me who is a prescriber. Like the lab technicians, who deals directly with the RDTs, they are usually the people they (training programs) identify… when you come back they also empower you to also train the people in this health center to also understand."* (Male HCP, IDI, HF 5)

*"We don't hide knowledge from anybody… those who are actually in that area are those who are actually involved in the training… our place, the staff, they are over hundred. I don't expect everybody to know about RDTs. Even though ideally they should know"* (Male HCP, IDI, HF5)

Provider practices observed during routine clinical encounters

NYB conducted 120 hours of daily non-participant observation over 6 weeks at all 6 study facilities (Tables 3-1 & 3-2). Observations involved recording field notes and when possible, engaging providers in informal (conversational) interviews to clarify observed practices and activities. HOFs preferred that observations were conducted during steady clinic hours. This period extended from 9:00 am or 10:00 am until midday and occasionally until 2:00 pm at smaller facilities and until 4:00 pm or 5:00 pm at larger facilities.

Observed providers routinely prescribed antimalarials for febrile patients without initially confirming a clinical suspicion of malaria. The most commonly cited reasons for this practice included limited and irregular RDT availability (Table 3-1) and insufficient time to wait for test results to inform diagnosis and subsequent case management. Based on historical malaria prevalence in the area, providers considered clinical suspicion adequate grounds for presumptive treatment. Longer clinic hours on busier days were also cited as a disincentive to routine requests for malaria tests when available. Providers pointed out Tuesdays during which NYB observed an influx of patients after midday at almost all participating facilities. Tuesdays were designated market days in the district during which residents engaged in economic livelihood activities earlier in the day.

Providers at facilities with available microscopy requested malaria tests for febrile patients more routinely than those at smaller facilities where testing was more dependent on RDT supply from the district health directorate, which they described as sporadic at best. Same-day post-malaria test review at larger facilities was often associated with admitted or detained cases that had invariably been treated prior to test results becoming available. Providers also reported prescribing antimalarials for febrile patients in spite of negative test results. This practice was observed at 4 study facilities with any RDTs in stock (albeit limited) during the observation period (Table 3-1). Overall, providers deemed presumptive treatment with or without a test result necessary to prevent avoidable cases of severe malaria or death.

Availability and perceived quality of RDTs

Providers at all the included facilities described challenges with RDT implementation including erratic and inadequate supply and unsatisfactory storage and distribution systems. They also reported that RDT

stocks reaching their facilities were usually either expired or nearing expiry. However, these reports could not be verified directly as RDT stocks were mostly not available at the facilities. Providers also suspected that poor storage conditions including prolonged exposure to sunlight compromised RDT quality. Previous studies identified similar barriers to RDT uptake in comparable settings [41, 44, 46, 66]. Moreover, weak regulatory procedures evident in a lack of regular monitoring, quality assurance and control eroded providers' confidence in the accuracy of RDT results and diminished their willingness to comply with the guideline. These challenges were recounted at all levels of care delivery with no identifiable differences in relation to providers' age, gender or cadres. The responses below illustrate the challenges regarding RDT availability:

*"… Before we got our current supplies I think we were out for almost four months!"*
(HCP, FGI, private, community facility)

*"… The main factor that will affect the use of the RDT will be the availability… for the past three days we haven't been able to purchase any… therefore for the past three days I haven't done any of the testing."*
(HCP, IDI, private, sub-district level facility)

*"I think for almost two months we haven't had supplies."* (HCP, IDI, government sub-district facility)

*"… The main problem with this rapid diagnostic test kit is the erratic availability of the test kit."*
(HCP, IDI, government district facility)

*"… What I have observed is that sometimes they bring them (RDTs) here and they are left with about one month or two months to expire. So they may be giving you fake results."*
(HCP, IDI, government, sub-district facility)

*"What is the quality control system that is in place? … for the blood film, although it was not perfect, there was a quality control behind it, coming to test the slides for false positivity and… false negativity…These are pure technical issues."* (HCP, IDI, government district facility)

Providers also asserted that challenges with availability were more pronounced in remote settings.

*"… As you go deeper in the hinterland, the availability of tests also goes down and the rate of blind treatment rises…"* (HCP, IDI, government district facility)

Although challenges with irregular RDT availability were common, differences emerged when comparing their responses to these challenges. Government sector providers described frequent interruptions to confirmatory malaria testing due to unreliable RDT quality and supply as illustrated below:

*"… When… we ask and they don't have… we sit and wait until when they have it. That is the problem."* (HCP, IDI, government sub-district facility)

On the contrary, private providers took proactive and decisive recourse including seeking alternative sources of supply from independent wholesalers or retailers. At HF 3 (a private hospital with a well-equipped laboratory and university-educated laboratory staff) the HOF decided to forgo RDT use altogether citing clinical, economic and technical advantages of microscopy as additional basis for this decision. This sentiment was captured in the following quotes:

*"… When you go to our lab, you see that the place is well stocked? We believe in diagnosis and having the diagnostic tools available to do your work and do it well…. all our lab technicians are biomedical scientists… if I have all these people on hand to do the work, why would I want to go for RDT?"*
(HOF, IDI, private district facility)

*"… When I use… microscopy I am just spending 0.10 GHs* 0.10 per client… for the RDT it's about GHs 2.00. So I would want to go for the cheaper and most efficient one… even should the government provide it, we will still use the microscopy."* (HCP, IDI, private district facility)

RDT use at health facilities

Providers alluded to a lack of clear allocation in the guideline of primary responsibility for RDT use at their facilities. Inconsistent guideline information also hampered routine RDT use for malaria diagnosis.

RDTs were considered 'lab tests' or 'labs' typically conducted by laboratory personnel. Consequently, not all providers whose work routinely involved prescribing had personally conducted a RDT on a patient. This was common at larger facilities with more diversified staff roles and responsibilities. HF 1 and HF 2 (a private maternity home and clinic respectively) did not have laboratories. The midwife in charge and/or a healthcare assistant conducted clinical testing in the consulting room. A records officer at the clinic conducted RDTs in a designated area of the main corridor where waiting patients were accommodated on benches. HF 6 (a government-operated district hospital) was the only facility with a pictorial job-aid on RDT use at the laboratory. FGI participants at this facility indicated that they first learned about RDTs from a similar job-aid located at the emergency ward where RDTs were sometimes used. These posters were not in areas widely accessible to all providers and were not always accompanied by verbal communication or training to enhance their usefulness. A provider at a district hospital described her first encounter with RDTs as follows:

*"The first time I saw it (RDT) in a poster on the (emergency) ward but I really I didn't know what it was."* (FGI participant, HF 6)

Major themes and determinants of guideline compliance

Several groups of related codes that were relevant to test-before-treat guideline implementation were identified during analysis of individual and focus group interview responses. The grouped codes were organized into broader categories that led to the identification of recurring themes in the data representing the main determinants of guideline compliance (Table 3-5). Theme generation and data interpretation was therefore anchored in the participants' responses and meanings [60, 67]. Three main recurring themes in the data that corresponded to the primary determinants of guideline compliance in the study setting were (1) Tension between recommended and achievable standards of practice for malaria diagnosis; (2) Uncertainty surrounding the management of suspected malaria based on RDT results; and (3) Precautionary provider behavior relative to patient testing and treatment (Figure 3-2). Further analysis of the recurring themes within the context of participants' responses indicated several secondary factors contributing to the identified determinants of guideline compliance. Reviewing the determinants and the secondary contributing factors in comparison with existing literature was essential to understand how each of these determinants influenced guideline compliance along the interaction of

policy, practice and technology. These interfaces are outlined in the conceptual model for this study (Figure 3-1) and explained in detail in Appendix 2-1. The key attributes of this model are also outlined in Table 3-6. This process allowed meaningful interpretation of the findings in order to understand how the underlying determinants contributed to poor guideline compliance in the study setting. The major themes along with the relevant codes and code categories that anchored these themes to the raw data are outlined in Table 3-5. The themes, each of which represents an underlying determinant are explained in further detail below.

*(1) Tension between recommended and achievable standards of practice for malaria diagnosis*

Providers drew several contrasting illustrations between the expectations inherent in the guideline and the existing capacity for its implementation in routine practice. These contrasts emphasized a recurring theme of tension between guideline information and implementation capacity. Limited health system capacity compromised providers' ability to implement the guideline, offsetting its potential benefit to practice and further undermining their willingness to comply. Limited in-service training opportunities and heavy workloads were also cited as deterrents to guideline compliance during routine malaria management. Providers further disputed the feasibility of testing all suspected cases due to high patient volumes. The quotes represented below illustrate these perspectives:

*"…It's (the guideline) good as a developing country. But it's… difficult… where you have one person… taking the consultation, and then each patient that you suspect malaria should go to the lab and then come back… it prolongs your duration of… managing the clients… And I will say it's good because eh, it's an improved method… "* (HCP, IDI, HF 4)

"… A client may come in and… the un-qualified one (staff) will be there… And that affects… implementing the policy of using them (RDTs) …" (HCP, IDI, HF 6)

*"The RDTs, it's done in the lab… we can also do it in the consulting room, but most times we just send them to the lab…. You also saw how busy our clinic is. It's not like… Canada where you can see only five patients a day and you're done. Here I see about 150 - 200 patients a day… in Africa, I cannot get that time to do that."* (HCP, IDI, HF 5)

Several providers including laboratory personnel commonly described RDTs as being 'fast' and 'time-saving', and mentioned that a 5-minute wait was sufficient to read results. This was regardless of the fact that case management guidelines for malaria in Ghana state that "… test results must be read within the time specified by the manufacturer" and RDT manufacturers mostly specify a 15 – 20 minute wait to read results [68]. During observations at a community-level government facility, NYB noticed wait times exceeding thirty minutes for RDT results to be returned from the laboratory to the healthcare provider in the consulting room. This was independent of patient wait times associated with initial consultation and subsequent queuing for post-test review and further case management instructions. NYB also observed that laboratory personnel delivered test results in batches rather than after each individual result became available. Providers explained batch testing and presumptive treatment as essential when managing high patient volumes or potentially sicker patients. This observation contrasted the rationale promoted by policy officials at local, regional and national levels that RDT use saved time for both providers and patients. Although wait times in relation to malaria testing have not expressly been studied in Ghana, this finding revealed perceptions of imbalance and resulting tension between the guideline as policy and its implementation in practice as captured in the following quotes:

*"As per their guidelines any patient that comes, presents fever symptoms and the rest, I'm supposed to send the patient to the lab to do malaria test before I treat. When will the patient leave the hospital?... That is how come we don't follow the guidelines. We use the clinical judgment.*" (HFA, IDI, HF 3)

*"… You cannot let the person go and queue at the line, so you start the treatment, then you… check if there is malaria... because… they queue to have them tested."* (HCP, IDI, HF 5)

Providers also alluded to tension in terms of "seeing" vs. "saying" where they juxtaposed their clinical experience with inconsistent RDT results or impractical expectations of guideline implementation. The quotes presented below emphasize this tension, which was also related to perceived expectations of policy makers. Policymakers were described as being detached from the variability of patient interaction that providers experienced on daily bases and therefore perceived as holding unrealistic expectations of guideline implementation in routine practice.

*"They are saying… test. And if it's positive then you treat. If it is negative, you don't treat. A case can be negative but when you look at it clinically it tells you that this patient will be having malaria…"*
(HCP, IDI, HF 4)

*"You are seeing the patient… what the patient is going through… what the patient is feeling. The person who has written the guideline doesn't even come near a patient. So you want to follow what he is saying? … if you follow it, you will be killing people.* (HCP, IDI, HF 4)

Widespread provider dissatisfaction was noted with a capitated fee-based pilot program instituted in the Ashanti region under the National Health Insurance Scheme (NHIS) at the time of the study. Providers' concerns included low reimbursement rates (tariffs) and late payments that were sometimes more than 6 months in arrears. Providers attributed reduced overall service utilization during the pilot program to accumulated costs incurred to facilities as a result of delayed reimbursements, which were typically passed on to the patients and were considered to potentially limit routine facility attendance. Concerns with low and late reimbursements were similar across private and public facilities. Policy officials who were consulted suggested that private providers in the region had the option of not participating in the program, and some had refused to provide services to patients covered under this arrangement to avoid late reimbursements, which were also considered insufficient for services rendered. Providers associated these challenges with inconsistent policy guideline information, which hindered RDT use and guideline compliance at their facilities. National case management guidelines at the time did not specify responsibility or location for RDT use at peripheral facilities. However training workshops generally targeted laboratory personnel, endorsing popular opinion of RDTs being 'lab tests' that are usually restricted to use by laboratory personnel in the setting. Moreover, heavy patient caseloads at most facilities precluded RDT use during patient consultation. Consequently, although free in principle, patients paid for RDTs as they would other diagnostic services for which they are routinely assessed standard fees. This inconsistency between policy and practice around the idea of 'fee'd' vs. 'free' malaria testing created tension that further stalled guideline compliance. Some providers suggested that presumptive treatment avoided the potential consequences of untreated malaria and simultaneously reduced financial loss to the patient and to the facility. Consultative discussions with representatives of health administrative, policy and professional institutions revealed general agreement that the potential

benefits of the capitated fee program were undermined by limited health system capacity, poor planning and implementation at the regional level and limited provider engagement in strategy formulation prior to implementing the capitation initiative. The quotes below illustrate these tensions:

*" … If you give low tariffs to the health center… you will run the health center down… they mostly ask the patients to subsidize… you will write a lab for the patient to go and do, the patient will come back – "I couldn't pay…"* (HCP, IDI, HF 4)

*"…The tariffs for the insurance is very low…if you send almost everybody to diagnose like when you are using RDTs, then the clinic will collapse. So you try as much as possible to use… your clinical judgment."* (HCP, IDI, HF 5)

*"… Sometimes they (the district health directorate) will be asking you that the facility if you want you should go and buy it (RDTs). And RDTs are supposed to be free. But if you go and buy it from outside… this health insurance… it's… fixed tariffs. You can't incorporate it into the tariffs. So if you don't take time you will be running at a loss."* (HCP, IDI, HF 4)

*"… Why would they write in the policy guideline "where lab is not available" and then when it comes to the facility they are stringent on the lab doing it (RDT)?"* (HCP, IDI, HF6)

*"… The patient load is barring us from doing RDTs in the consulting room. But ideally you should be able to do it in the consulting room."* (HCP, FGI, HF 5)

*"I know they (RDTs) are supposed to be free. But, the various heads of institutions that we are under, they've made it that they (patients) pay. And we can't do anything. We just have to compromise with it."* (HCP, IDI, HF 4)

Although acknowledged as more time-consuming, providers considered microscopic diagnosis with its visual representation of parasites as being more reliable than the indication of parasite presence available with RDTs. Providers indicated having to balance the need for rapid and what they considered

reliable test results, although the reliability of microscopy depends on several factors including the technical expertise of the microscopist, the quality of the reagents, and the functionality of the microscope [69]. Nevertheless, presumptive treatment practices were persistent and malaria testing was often described in the context of post-treatment verification of clinically suspected cases. At larger facilities presumptive treatment was associated with inconsistent policy guideline information and constrained practice conditions whereas the concern in remote settings was access to guideline information. The following quotes capture these perspectives:

*"Sometimes it (the guideline) can be stocked up at the district (health directorate or facility level). And at the sub-district (facility level) you may not get it."* (HCP, IDI, HF 4)

*"… Rarely do they (patients)… go to the lab the first time they come with such complaints. It's only after that treatment, the patient comes back with the same sets of complaints then they want to find out what is really going on, then they request for the lab… assuming that everybody who comes here is sent to the lab, our patients will leave here after six hours."* (HFA, IDI, HF 3)

*"… This test (RDT) is restricted to the laboratory… take this hospital for example. After the outpatient and the laboratory closes… nobody diagnoses malaria… with a RDT till the following day. So if the person comes with a temperature of 37.5 (°C) and above, the first shot is artemether… the lab is confirmed later! It's a post-treatment confirmation, which I think is wrong..."* (HCP, IDI, HF 6)

Providers often quoted varying versions of the guideline relative to information available from the NMCP, further demonstrating Inconsistent guideline information. During a FGI at a community facility, providers explained what they had learned during a formal training session as illustrated by the excerpts below:

*"Moderator 2: Really? So after the patient has had a lab test using microscopy, you are asked to repeat the test using RDT?*

*Male HCP 1: Yes, after they come from the lab.*

*Female HCP 1: The reason for this is that sometimes the labs are too busy… so maybe the lab personnel might mix up the results…*

*Moderator 2: … And you are saying that if you're not sure of the lab test, use RDTs to confirm?*

*Male HCP 1: Yes, we have to do the RDT even if we have a lab and the patient has already had a lab test (microscopy) done.*

*Moderator 2: … what happens if you run out of both… and don't have enough of either test to serve your patients?*

*Male HCP 1: Ok, Ok. The reason for this instruction is that they said the RDT is very fast. As you know the microscope is a machine and it can malfunction. So you should always have the RDT handy…*

*Female HCP 2: And whether or not there are power cuts you can work with the RDT…*

*Male HCP 1: … It's important to have both. So wherever you have a problem with understanding, especially with the microscope, which being a machine can make you get confused, then at least you can use the RDT."*

*"Moderator 2: … So they asked you to keep them handy in the consulting room? If you don't have labs?*

*Male HCP 1: Yes, we should have them there!*

*Male HCP 2: And even if they have labs, after the technician has done a BF (blood film) using the microscope, they must keep the RDTs for some sort of comparison of both results. Maybe the lab results were negative but you might get a positive result with the RDT.*

*Male HCP 1: Yes, it's exactly as he has explained.*

*(2) Uncertainty surrounding RDT results*

Sources of tension that hampered guideline implementation additionally contributed towards providers' uncertainty with basing case management decisions on RDT results. Providers acknowledged that factors associated with limited health system capacity including delayed RDT distribution, limited storage capacity, poor quality assurance and control compromised test quality and undermined their confidence in test accuracy. Providers routinely experienced tension between the technical advantage of rapid testing and the clinical limitation of potentially missing true cases as false negatives. This resulted in uncertainty with basing a patient's diagnosis and subsequent treatment on RDT results, particularly for negative cases. This uncertainty was often justified on the basis of high malaria prevalence in the

setting, knowledge of the potential risks and consequences of severe malaria, and perceived benefits of presumptive treatment. In comparison with microscopy, providers suggested that further development of RDTs to distinguish and quantitate specific types of malarial parasites would improve test utility and bolster their confidence in test results. Provider uncertainty was evident in selected quotes presented here:

*"We will still need to treat because if you don't take time it will complicate to severe malaria. And that has daring (severe) consequences."* (HCP, IDI, HF 4)

*"… In our set up, with this malaria-prone zone…I sometimes give treatment for malaria even when… the test has come out negative."* (HCP, IDI, HF 2)

*"…The RDT will just tell you it's positive or negative... but if you take blood film… you are able to get to know whether it's few mps (malarial parasites) just 1+, 2+…"* (HCP, IDI, HF 5)

Providers' commonly expressed uncertainty through doubting and seeking to verify negative RDT results and concern for the patient's well being. Providers doubted negative RDT results when clinical signs and symptoms indicated malaria. Doubt often led to self-questioning and second guessing decisions to withhold antimalarial treatment from RDT negative cases. Expressions of uncertainty and doubting negative RDT results were also noted during group interviews as demonstrated in this excerpt taken from the focus group conducted at a private maternity home:

*"Moderator 1: So what do you know about using RDTs at your facility?*
*Female participant 1: Well, if anyone shows up at your facility that you suspect of having malaria, previously they would take a BF (blood film) at the hospitals prior to starting malaria treatment. So that's exactly what we do here. So if it's positive, then we know. But that's what also poses a challenge. Because sometimes you suspect someone has malaria. But unfortunately, when you run the test, the result is negative.*
*Moderator 2: So the guidelines recommend that you should treat when the test result is positive. Does this pose a problem in situations where you get negative RDT results?*

*Male participant 1: Yes, because then the signs and symptoms clearly point to malaria. But the test will say the person is negative… when that happens, we are not sure of what to do."*

Where microscopy was unavailable to verify RDT result, providers typically opted for presumptive treatment. The lack of quality assurance and control measures to affirm providers' confidence in RDT results and the inability to verify negative test results raised concerns over professional and moral failure of missing a true case of malaria and potentially causing loss of life due to withheld or delayed antimalarial treatment.

*"… You use the RDTs… and it will tell you that there is no malaria parasite or it is negative. If you do not cross check and you agree that actually what the test is telling you is it and you don't treat for malaria, you may lose the patient… don't just take it for granted that once the test has said it is negative, then you don't treat malaria. You have to do a microscopic test to see whether you can actually see the parasites in the blood because the RDTs can sometimes fail you."* (HCP, IDI, HF 4)

*"…I depend mostly on my clinical judgment… even though it (RDT) was negative but looking at the patient clinically, I thought there was something wrong… most people who come here they are children… So to be on the safer side you have to treat them… if you don't treat the children in Africa, they get cerebral malaria. They convulse and it can damage the brain…"* (HCP, IDI, HF 5)

*"So we would rather try them, start with precautionary treatment and ask the mother to bring the child back in about three days for a review. If it's malaria, we will know, and if it is not, we will also find out. For some of them, the child gets better by the time they return to the facility (after presumptive treatment). Which means it had to have been malaria."* (HCP, FGI, HF 1)

Providers concerns related to uncertainty with RDT-based fever management also included questioning the competence of laboratory staff who conduct RDTs in the setting.

*"I would still not be satisfied with it (negative RDT result). It's a human being who is doing it. He is saying he didn't see any malaria parasite. It's possible that his sight is not good!"* (HCP, IDI, HF 4)

*"… You will not feel so satisfied… so many thoughts… was the examination done properly? Are the RDTs potent enough? Am I dealing with quality RDTs? Eh, is it that the lab man did not take his time to do it? Is the RDT nearing expiry? Has it expired? Are the lab people having the patience to do this job for me? Has the patient… started treatment before coming?"* (HCP, IDI, HF 5)

However, private facility providers at higher levels of care delivery were less anxious about the competence of their laboratory staff than their colleagues at government facilities with less autonomy over hiring decisions and processes at their facilities.

*"… When you when you go to our lab, you see that the place is well stocked? We believe in diagnosis and having the diagnostic tools available to do your work and do it well… all our lab technicians are biomedical scientists."* (HFA, IDI, HF 3)

*(3) Precautionary provider behavior relative to patient testing and treatment*

Providers' responses to uncertainty over RDT-based malaria diagnosis and management revealed a pattern of precautionary behavior with respect to patient testing and treatment. When in doubt, providers opted for presumptive treatment as a precautionary strategy when test kits were unavailable and when uncertain of test results. In light of the potential risks involved with not treating an undetected case of malaria and a history of sporadic RDT supply, providers felt justified in treating presumptively 'just in case'.

*"… If you want to follow according to what the RDTs are telling you and you do not treat for malaria on that patient… you may lose the patient. So sometimes when we even realize it is so, and with the spiking temperature… with convulsions in children, you don't have to wait. You still have to treat for malaria… sometimes we've done that and… we've gotten good results. We've been able to save the life of a patient."* (HCP, IDI, HF4)

Other practices through which providers exhibited precautionary behavior included rationing available test kit supplies to preserve limited supplies in anticipation of stock outs and for use with more vulnerable populations. Providers rationalized precautionary behavior by situating guideline compliance

within a practice context characterized by limited implementation capacity and uncertainty surrounding diagnosis or mis-diagnosis of malaria.

*"Normally they (RDTs) are not readily available, so we are very careful. Because most suspected cases of malaria, if we want to test them with RDTs, then it will just finish within a short time, because… we don't normally get supply."* (HCP, IDI, HF 4)

*"… The problem is… we don't normally use it at our end. Frankly speaking, because sometimes it's not available. Most of the time it's not available…"* (HCP, IDI, HF 5)

Precautionary behaviors constituted poor compliance with the nationally recommended test-before-treat guideline for malaria and were similar across facility types and provider cadres. However, private providers appeared to be affected to a lesser extent than their government service colleagues by the uncertainty associated with limited RDT availability. During stock outs, private service providers at higher levels of healthcare delivery usually sought supplies from independent sources including wholesalers or retailers. Others reported purposefully restricting malaria testing at their facilities to microscopy to avoid disruptions to diagnostic testing during RDT stock outs. Providers in government facilities with less decision-making autonomy over inventory and services at their facilities adopted a more passive stance.

*"… When the district runs out, then we have to go buy. And that's the cost we don't recoup… some of the medical stores have them for sale."* (Female private HCP, FGI, HF1)

*"…They send it (RDT) when they have it. But when they don't have and we ask and they don't have, then we sit and wait until when they have it. That is the problem."* (Male government HCP, IDI, HF 5)

Constrained healthcare delivery capacity appeared to be the fundamental limiting factor to providers' capacity for guideline compliance and led to hesitation with them implementing the guideline in routine malaria management. Providers' responses to this uncertainty were expressed as precautionary behaviors. All of these determinants individually and interactively undermined guideline compliance for rapid malaria testing as discussed in the following section.

**Discussion**

This study documents the first in-depth exploration of healthcare providers' compliance with the test-before-treat guideline for managing malaria in a Ghanaian setting. Previous studies on guideline compliance in sub-Saharan settings focused extensively on prescription behavior relative to RDT results. This study significantly advances the state of this knowledge by elucidating the underlying determinants of guideline compliance. The findings also demonstrate an interactive and mutually reinforcing effect of these determinants on guideline compliance.

The conceptual model that informed the design and conduct of this study (Figure 3-2) allowed guideline compliance to be situated in direct relation to the implementation context. Three essential interactions relevant to guideline compliance were outlined in the model. These interactions provided the basis for understanding how each determinant contributed to poor compliance and occurred between healthcare providers and: (1) RDTs, the prime locus where perceptions of the technology and its utility in practice are formed; (2) the policy guideline, which encompassed perceptions of the utility and feasibility of guideline implementation with reference to health system infrastructure, resource availability and allocation; and (3) patients, representing the intersection of technology, policy and practice within which guideline compliance is routinely demonstrated. The conceptual model additionally depicted socio-economic, political and historical factors characteristics of implementation context that impinge on healthcare delivery capacity and invariably, on providers' compliance when managing malaria. These factors were taken into account during analysis to identify systemic impediments to guideline compliance and to support recommendations involving structural- (health system, socio-economic, and political) and individual level interventions to improve compliance. A detailed description of the model is outlined in Appendix 3-1.

The emphasis among providers that limited healthcare delivery capacity undermined guideline compliance is supported by previous research associating poor guideline implementation with limited health system resources in malaria-endemic settings [17, 41, 43, 44, 46, 66]. This finding implies infrastructural and systemic constraints related to acquisition, distribution and management of essential healthcare resources at facility, district, regional and national levels. It also highlights the importance of a coordinated policy implementation framework to ensure adequate availability, timely distribution and

effective management of essential commodities at the primary care level. To be effective, this framework should acknowledge and applicably address the determinants of guideline compliance beyond the notions of resource provision and allocation.

Among participating providers, the general perception of the guideline being useful to improve current practice suggests acceptance in principle of the confirmatory testing approach for managing malaria. This indicates a potential opportunity to promote the shift from presumptive to test-based malaria management at all levels of primary healthcare delivery, the current exception being home management of malaria [33]. Nonetheless, maximizing this opportunity requires that healthcare providers are adequately equipped with the necessary knowledge, skill and proficiency to implement the guideline.

Despite general guideline awareness, knowledge of the actual content varied considerably among interviewed providers. Heads of facilities and laboratory personnel were more knowledgeable about the guideline than providers who occasionally handled patient consultation. This might reflect selective training programs that target providers based on their specific responsibilities with malaria management. Although indicative of cost-containment, this finding reveals gaps in the structure and effectiveness of existing in-service training programs. Inadequate staffing levels at peripheral facilities in sub-Saharan settings imply that healthcare personnel routinely provide services beyond their professional designation or qualification especially in remote facilities [70]. High staff turnover alluded to by participating providers further supports the notion of multiple roles and responsibilities regardless of job description where available. Training programs that extend RDT use beyond the laboratory would enhance cost-effectiveness and cohesion with the policy objective of accessible, accurate, and reliable malaria diagnosis at all levels of primary healthcare delivery. Targeted training for case management of malaria must therefore be strategic to avoid gaps in providers' knowledge, skill and proficiency as has been reported elsewhere in Africa. A recent survey conducted in Sudan found that 76% of providers nation-wide had not received training on RDT use, 47% of them had never been trained on ACT-based malaria management and less than 50% had ever received any training through the Sudanese National Malaria Control Program [43].

The reality of limited resources appears to justify selective healthcare provider training. However, the consequences of a poorly qualified and inadequate healthcare workforce countermand any economic benefit and necessitate a review of current training approaches. Peer training models should be assessed beyond traditional notions of cost-effectiveness by incorporating benchmarks of coverage and efficiency among the representative provider cadres at the peripheral level. This may require operational research to assess case management knowledge in relation to peer training curricula over extended periods that reflect routine situations. This would inform comprehension and retention strategies that suitably accommodate the frequency of in-service trainings, a feature that may be difficult to replicate under experimental conditions. Such assessments should essentially consider the capacity, quality and role of supportive supervision to reinforce training messages in order to improve guideline compliance in routine practice. Strategies to improve compliance that target healthcare provider training should investigate and providers' concerns with the perceived progressive loss of effectiveness associated with cascade training models both within and beyond the study setting. Where identified, these concerns may be addressed through a collaborative facilitation model involving internal and external supervision, and routine refresher training to ensure consistent content and quality of training across the different primary healthcare settings responsible for managing malaria in Ghana.

Limited healthcare delivery resources also created tension for providers, which they noted as imbalances between recommended and achievable standards of practice for malaria diagnosis. This finding reiterates the importance of resource availability and allocation to providers' self-efficacy with implementing the guideline in their respective facilities. An exploratory study in Uganda found that providers' self-efficacy considerably influenced their adoption and use of RDTs [44].

Social cognitive theories of health promotion give primacy to self-efficacy in determining behavior adoption or modification. Self-efficacy is considered important as it can directly influence behavior or how an individual perceives environmental impediments or facilitators to behavior adoption [71]. Frequent and prolonged stock outs of essential healthcare supplies led providers to question the utility of guideline implementation, which may have reduced their self-efficacy for compliance. Almost all interviewed providers identified RDT availability as the prime factor influencing their ability to implement and in effect to comply with the guideline. RDTs were supplied and funded by the government to both public and private facilities in the district, yet regular availability of RDTs was a common concern.

Limited ACT and RDT availability is further associated with broader characteristics of constrained health systems in African settings. These include economic scarcity, weak infrastructure, poor staff and inventory management and an unreliable health commodity supply chain [38, 41, 72]. These in turn can be related to poor economic, political and social programs common in many developing countries (CSDH, 2007). Limited RDT supplies undermine providers' ability to implement the test-before-treat guideline. Limited ACT availability further impedes the effectiveness of guideline implementation and contributes to common perceptions of limited guideline utility in practice. The marked emphasis on healthcare delivery capacity and resource availability at all levels of healthcare delivery reinforced the identification of tension as a predominant theme and determinant of guideline compliance.

Healthcare providers also described being *unwilling* to use RDTs when they were made available after prolonged, repeated stock out periods. This suggests that poor guideline compliance resulted from providers being *unable* (i.e. without the necessary resources or training), and also *unwilling* to use RDTs based on other concerns including minimizing disruptions to testing associated with sporadic RDT availability. Unwillingness was also related to negative perceptions of RDTs and individual preferences for alternative diagnostic practices. These findings illustrate the importance of distinguishing providers' perceived ability from their willingness to comply with confirmatory testing guidelines when developing interventions to improve compliance. Providers associated their perceived ability to comply with healthcare resource availability and infrastructural capacity. However, willingness to comply appeared to be influenced by socio-economic, historical, and political factors affecting the provider-patient interaction during consultations involving malaria. Consideration of patients' affordability of testing and subsequent treatment for malaria, long-standing acceptance of presumptive treatment, and the controversies between fee'd and free malaria testing in the setting appeared to adversely influence guideline compliance among providers. Research conducted in well-resourced settings established the import contextual factors to the implementation and uptake of health technology or guidelines [73-76]. Findings from a recent study in Uganda indicated that providers' willingness substantially influenced their acceptance and use of RDTs on routine bases [44]. Ensuring the availability of essential healthcare commodities should be prioritized in resource-poor environments. Nonetheless, the influence of contextual factors on guideline compliance should not be overlooked, as this is essential to advise cost-effective and multi-dimensional interventions to improve compliance.

Healthcare providers also indicated a need for clear and consistent policy guideline information regarding RDT use. Evidence of mixed training messages and gaps in guideline knowledge among providers suggests concurrent challenges with guideline dissemination and in-service training. The existing guideline implied but did not specifically allocate the responsibility of RDT use to laboratory staff at health facilities. Nonetheless, training on RDT use targeted laboratory personnel and heads of facilities and inadvertently restricted RDT use to the laboratory. This was observed at the 4 of the 6 study facilities that had laboratory facilities. Some policy officials supported the notion of RDT use in the consulting room to immediately inform diagnosis and treatment decisions. This idea is supported by the rationale of enabling prompt and accurate malaria diagnosis at facilities without laboratory infrastructure. However, providers considered RDT use in the consulting room was impractical considering the existing time, resource and workload constraints to routine care delivery. Earlier studies in other African settings reported inconsistent policy guideline information as a hindrance to effective RDT use in routine malaria management [41, 44]. This study expands existing knowledge by specifying ambiguity surrounding assigned responsibility for RDT use as a definite gap in policy guideline information. This finding highlights a potential opportunity to enhance cost-effective and targeted interventions focused on clear and consistent guideline dissemination, education, and communication.

Additional policy inconsistencies related to the NHIS capitated fee pilot program instituted in the study region during the conduct of this research. The capitation program restricted reimbursements to facilities for the costs of malaria testing to the use of microscopy. RDTs were supplied through the Ministry of Health (MOH) at no cost to government facilities in order to offer free testing to insured patients. However, inconsistent supplies meant that facilities often sought RDTs from independent sources where available. The perception of RDTs being “lab tests” which attract standard fees, and costs of purchasing RDTs from independent suppliers resulted were of necessity passed on to patients including the insured. Moreover, late payments and low reimbursement rates implied that the costs of essential reagents for microscopy were not adequately recovered. This further discouraged providers from routinely testing suspected malaria patients. Providers again faced tension between implementing the guideline or treating presumptively to avoid burdening needy patients and to keep facility operations afloat. Strategies to improve compliance must critically assess policy guideline information in conjunction with the structure and curriculum of training programs. Supporting interventions should also be based on

harmonized health, social, and political sector policies that emphasize clear, consistent, and achievable policy objectives. This will limit confusion from the lack of standards for guideline implementation across the different primary healthcare settings. Minimizing policy guideline ambiguity has been recognized as important to the success of test-based malaria management in limited-resource settings [77]. Coordinated inter-sectoral support will positively influence providers' perceptions of guideline utility and encourage compliance for better malaria management.

RDTs were considered helpful and useful especially at basic levels of care. This finding indicates conceivable acceptance of a recent diagnostic technology and highlights an opportunity to establish confirmatory testing practices for malaria. However, private hospital providers with state-of-the-art laboratories were less likely to integrate RDT use into routine clinical practice than their colleagues at facilities offering basic care. Initiatives to expand RDT coverage including technological support and resources should therefore be suitably tailored to accommodate available infrastructure and provider cadres at varied levels of primary healthcare delivery.

Although RDTs were considered useful, the often-cited caveat that clinical judgment was superior to RDT results particularly in negative cases implies partial guideline acceptance among providers. Other studies in comparable settings have shown that although providers appreciate the benefits of RDT use, they have concerns about the implications of their technical limitations in clinical practice [22-25, 41, 42, 46]. Providers disapproved of RDTs being unable to detect or quantitate several species of malaria parasites, features they considered essential to guide practice by enabling early detection of poor treatment response, which some described as 'resistant cases'. Information, education and communication strategies should substantially address providers' concerns in order to build their confidence, to sustain RDT use and to improve guideline compliance for better malaria management. A common finding was that providers often used RDTs after presumptively treating patients, to verify their initial clinical suspicion of malaria. Guideline dissemination should highlight the objective of pre-treatment confirmation rather than post-treatment verification of clinically suspected malaria.

Older providers in this study with decades of clinical practice experience were confident in their clinical judgment whenever this did not align with RDT results - a perception that was echoed among their

younger, less experienced colleagues. Younger providers who are less familiar with presumptive treatment practices might be expected to demonstrate greater credibility in RDT results. However, providers who typically engaged in patient consultations had at least 3 or more years of experience, suggesting that their pre-service training occurred in the presumptive treatment era, prior to guideline revision in 2009. Additionally, daily encounters with patients and older peers who are familiar with symptomatic malaria management might reinforce this paradigm, calling for deliberate advocacy and emphasis to ensure guideline compliance [78]. Pre-service education and training programs should emphasize the import of guideline compliance into their curricula to improve providers' understanding of the guideline and the underlying rationale. The potential influence of socio-demographic factors such as age or experience categories that may pre-dispose providers to more readily accept particular emphases of guideline communication such as the safety of withholding antimalarials from RDT-negative patients, should also be explored in order to strategically target training messages across the represented demographic categories of healthcare providers. Investigating the potential influence of such factors on providers' compliance will improve the efficiency of in-service training. Peer training programs should explore means by which to engage experienced providers in facilitator and mentor roles at their facilities to establish a pro-confirmatory culture of malaria diagnosis. Building providers' confidence in the effectiveness of available diagnostics and the utility of confirmatory testing is essential to encourage a paradigm shift towards test-based malaria management. It is necessary that these efforts involve technology developers and manufacturers to ensure that end user feedback is taken into account for optimal RDT use in limited-resource settings.

The inclination among female providers towards advocacy for comprehensive in-service training compared to their male counterparts is indicative of socio-political emphasis on women's education and economic development in Ghana. Among Ghanaian school children, more females have primary education as their highest attained level of education compared to males. Females are more likely to drop out of school before attaining secondary or higher levels of education than males [79]. Females also constitute 53% of the labor force (mostly in the agricultural sector) in the country and are many times breadwinners, bearing the responsibility of homemakers and family caregivers [80]. Most of the female providers interviewed were mothers and likely to have been familiar with initiatives to improve female education including nationwide abolishment of fees for basic education. Every region and district

of Ghana has a girls' education unit with a responsible officer to promote female education, to sustain improvements in gender parity, and to enhance socio-economic development among women [81]. Not surprisingly, male providers who have historically enjoyed preference for educational opportunities considered limited in-service training a reality to be acknowledged rather than an issue to be addressed through expanded training programs. The possibility remains that the apparent lack of advocacy for more comprehensive training among male providers in this study might have been simply a result of the fact that most of the heads of facilities and the laboratory persons were male. Consequently, training programs targeting these roles would in essence include more male providers than their female counterparts.

Overall however, perspectives surrounding guideline compliance in the study setting did not differ widely across the represented facility types, levels of care delivery, and provider cadres. The study district is peri-urban (semi-rural) with cultural, historical, and socio-economic similarities among patient populations in catchment areas for the different facilities. These factors are known to influence patient and provider perspectives regarding the management of malaria in Ghana and other African settings [82, 83]. This suggests possible similarities in provider-patient encounters and peer interactions which are central to guideline compliance and that might explain similar and shared perspectives of guideline compliance reflected in the study findings. The broader commonalities in the setting may therefore have overshadowed any subtle differences in perspective among the individual providers.

Interaction among the determinants of guideline compliance

As discussed above, each determinant - tension, uncertainty, and precautionary behavior - influences guideline compliance on its own merit. More importantly, these determinants work in tandem to reinforce their individual effects. Limited health system capacity was identified as a major source of tension between recommended and achievable standards of practice. Factors associated with tension included inadequate RDT supplies, irregular RDT availability, poor distribution and storage systems, inadequate in-service training and staffing capacity. The lack of essential resources directly undermined guideline compliance by restricting providers' ability to effectively implement the guideline. Inadequate in-service training contributed to sub-optimal case management preparedness and poor perceptions of RDTs, which undermined providers' confidence in the veracity of RDT results. This lack of confidence was

worsened by poor inventory management, quality assurance and control, contributing to uncertainty about managing suspected malaria cases in accordance with (negative) RDT results. This finding illustrates the interaction between tension and uncertainty. Similarly, precautionary behavior was influenced by environmental factors including disease prevalence and epidemiology in the study area, historical emphasis on presumptive treatment and knowledge of the risks and consequences of malaria, and preferences for alternative diagnostic methods to which providers attached greater certainty. In the absence of quality-assured diagnostic procedures, providers felt more confident to treat presumptively. Precautionary behavior - presumptive treatment, rationing RDT supplies and selective testing of eligible patients – amounted to guideline compliance, the rationale for which was reinforced by the irregular availability of essential commodities and the lack of quality assurance systems for RDTs, all of which diminished providers' willingness to comply with the confirmatory testing guideline. Willingness to comply was further influenced by incongruent broader health sector policies at the national level and socio-economic concerns relating to the financial viability of the facilities and patients' wellbeing. This finding illustrates the interaction between the three primary determinants of compliance identified in this study. It also demonstrates interaction between structural and individual characteristics of the context of guideline implementation for malaria diagnosis in the study district and the reinforcing nature of this interaction on guideline compliance as a whole. This underscores the necessity of ensuring that the adoption of broad health sector policies are accompanied by adequate consideration of how they affect implementation of individual or disease-specific initiatives such as the recommended shift to test-based malaria management. Although not observed in this study, a potential concern among providers could be the loss of jobs related to dedicated laboratory testing with increased RDT use at the point of care. Further to scientific research evidence, strategy formulation for effective guideline implementation should essentially engage diverse stakeholder perspectives including those of technology developers and manufacturers, government, policy, program managers, healthcare practitioners and patient communities.

Limitations

The aim of this study was to investigate the determinants of guideline compliance for rapid malaria diagnosis, with emphasis on the structural elements of the existing implementation context. The study was therefore designed to accommodate and to demonstrate a range of perspectives on guideline

compliance with respect to the diversity of practice settings. This design did not support the prediction of causal associations or effects of individual factors. The findings therefore highlight important limitations of this research. The finding that differences based on the individual explanatory factors such as providers' age or gender were subtle, may have been due to the study design not reliably detecting these effects.

The study findings are mainly based on reported responses from provider interviews. Non-participant observation carried out prior to interviews allowed considerable verification of the findings. Continued engagement with key informants and stakeholders further enhanced the reliability of data interpretation. However, the possibility remains of an inherent degree of measurement error, recall or social desirability bias [84]. Of particular consideration is a potential Hawthorne effect [84] - the influence of an observer's presence on participants' behavior - during observed provider encounters with suspected malaria patients. However, this possibility was marginal for two reasons. First, NYB paid several visits to establish rapport and trust with providers prior to conducting observations and interviews. These visits were essential: (1) to provide repeated emphasis on the study objectives; (2) to explain ethical responsibilities involving confidentiality and anonymity; and (3) to address and clarify potential misconceptions of a secondary motive for observations such as assessments for reporting to authorities. Secondly, providers were aware of their non-compliant behavior evident in the various justifications they offered in their defense. These justifications were ultimately related to reducing morbidity and mortality as an unintended consequence of guideline compliance. This factor substantially reduced the possibility that an observer's presence would influence routine providers' behavior given the rationale of avoiding complications or death from severe malaria if left untreated.

**Conclusion**

This study documents a primary investigation of the determinants of guideline compliance for rapid malaria diagnosis in a Ghanaian district. Using a qualitative approach, the study was situated within the context of routine malaria diagnosis. This enabled in-depth investigation to understand how the identified determinants influenced compliance. Poor compliance was associated with providers' perceptions of restricted ability for effective guideline implementation. These restrictions were related to limited health system capacity, which created tension between recommended and achievable standards of practice and undermined the utility of guideline compliance. Providers also associated guideline implementation with RDT use. Dissatisfaction with RDT performance therefore created uncertainty about the veracity of test results and diminished providers' willingness to guide diagnosis and treatment decisions with RDT results. Concern over risks and consequences of mis-managing a true case of malaria in a high prevalence setting characterized by tension and uncertainty, resulted in precautionary behaviors among providers. These included rationing RDT supplies among patients and treating presumptively to prevent severe malaria or death from delayed or withheld treatment.

These findings present new insights on the topical issue of healthcare providers' compliance to advance test-based malaria management in sub-Saharan and other malaria endemic environments. The study included facilities at the three main levels of primary healthcare delivery in Ghana. Considering that uncomplicated malaria is managed within the jurisdiction of primary healthcare, the knowledge yield is informative to diverse stakeholders including policy and program managers, technology developers and manufacturers, funding agencies, and healthcare practitioners. Targeted policy and program interventions to improve healthcare providers' compliance should pursue broad inter-sectoral collaboration, engage diverse stakeholders, and prioritize local knowledge for developing actionable steps to address each of these determinants based on scientific evidence. The findings may be transferable to advise guideline implementation for malaria testing in similar contexts. Nevertheless, such application would require appropriate consideration of similarities and differences relative to this study's context.

**Tables in Chapter Three**

Table 3-1: Characteristics of included facilities

| Study ID | Operating authority | Facility type | Level of primary healthcare delivery | Head of Facility | Available health services | Available diagnostic service for malaria | Challenges with diagnostic availability |
|---|---|---|---|---|---|---|---|
| Health facility (HF) 1 | Private | Maternity home | Community | Nurse or nurse midwife | Basic preventive<br><br>Curative for minor ailments | None | Prolonged district-wide RDT stock-outs including private wholesale/retail suppliers |
| HF2 | Private | Clinic | Sub-district | Medical Officer (Doctor) | Preventive<br><br>Limited curative | RDT – limited, irregular supply | Prolonged district-wide RDT stock-outs including private wholesale or retail suppliers |
| HF3 | Private | Hospital | District | Medical Officer (Doctor) | Curative<br>Limited specialist services E.g. surgery, delivery | Microscopy – routine use | HOF preference backed by infrastructural capacity for quality-assured microscopy |
| | | | | | | | |
| HF4 | Government | Health center (small) 40 – 50 patients per day | Community | Physician assistant | Basic preventive<br><br>Curative for minor ailments | RDT – limited, irregular supply<br>Microscopy - limited basis | Prolonged district-wide RDT stock-outs<br>Limited recovery on facility costs for reagents needed for microscopy |
| HF5 | Government | Health center (large) 100 – 200 patients per day | Sub-district | Physician assistant | Preventive<br>Limited curative | RDT - limited supply<br>Microscopy - limited basis | Prolonged district-wide RDT stock-outs<br>Limited recovery on facility costs for reagents needed for microscopy |
| HF6 | Government | District hospital | District | Medical Officer (Doctor) | Curative<br>Limited specialist services E.g. surgery, delivery | RDT - limited supply and use<br>Microscopy – routine use | Prolonged district-wide RDT stock-outs |

Table 3-2: Characteristics of participating healthcare providers

| Study Facility | Facility type | Data collection method(s) (Number held, if applicable) | Participating provider cadre(s) (Number per data collection method) | Total number of participating providers per included study facility |
|---|---|---|---|---|
| HF 1 | Maternity home<br>Private<br>Community level | Non-participant observation<br>2 hours x 5 days = 10 hours | Nurse mid-wife (1)<br>Healthcare assistants (2) | 4 |
| | | Informal interviews (3) | Nurse mid-wife (1)<br>Healthcare assistants (2) | |
| | | Focus group discussion (1) | Nurse mid-wife (1)<br>Healthcare assistants (2)<br>Nurse (1) | |
| HF 2 | Clinic<br>Private<br>Sub-district level | Non-participant observation<br>3 hours x 5 days = 15 hours | Medical officer (1)<br>Biostatistician/Records Officer/Testing Officer (2) | 3 |
| | | Informal interview (2) | Medical officer (1)<br>Biostatistician/Records Officer/Testing Officer (2) | |
| | | In-depth, semi-structured interview (1) | Medical doctor (1) | |
| HF 3 | Hospital<br>Private<br>District level | Non-participant observation<br>8 hours x 5 days = 40 hours | Medical officer (1)<br>Nurses (7)<br>Nurse/midwife (1)<br>Laboratory personnel (3) | 12 |
| | | Informal interviews (5) | Medical doctor (1)<br>Nurse (1)<br>Lab persons (1) | |
| | | In-depth, semi-structured interview (1) | Health Facility Administrator | |
| HF 4 | Health center (small)<br>Government<br>Community level | Non-participant observation<br>3 hours x 5 days = 15 hours | Physician assistant (1)<br>Laboratory personnel (2)<br>Nurses (2)<br>Health care assistants (1) | 6 |
| | | Informal interviews (3) | Physician assistant (1)<br>Laboratory personnel (2) | |
| | | In-depth, semi-structured interview (2) | Physician assistant (2) | |
| HF 5 | Health Center (large)<br>Government<br>Sub-district level | Non-participant observation<br>3 hours x 5 days = 15 hours | Physician Assistant (2)<br>Laboratory Personnel (2)<br>Health extension worker (2) | 11 |
| | | Informal interviews (3) | Physician assistant (1)<br>Laboratory personnel (2) | |
| | | In-depth, semi-structured interview (4) | Physician assistant (1)<br>Nurse (prescriber) (2) | |
| | | Focus group discussion (1) | Physician assistant (2)<br>Enrolled Nurse Superintendent (1)<br>Nurse/midwife (1)<br>Health care assistant (1)<br>Dispensing technician (1) | |
| HF 6 | | Non-participant observation<br>5 hours x 5 days = 25 hours | Medical doctor (1)<br>Nurse (3)<br>Physician assistant (1)<br>Laboratory personnel (4) | 14 |

| | | | | |
|---|---|---|---|---|
| | Hospital<br>Government<br>District level | Informal interviews (5) | Medical doctor (1)<br>Nurse manager (1)<br>Laboratory personnel (3) | |
| | | In-depth, semi-structured interview (4) | Medical doctor (1)<br>Nurse manager (1) | |
| | | Focus group discussion (1) | Nurse Manager (1)<br>Nurses (3)<br>Laboratory personnel (1)<br>Healthcare assistant (1) | |
| **Overall total** | | | | **50** |

Table 3-3: Socio-demographic characteristics of healthcare provider sub-groups

| Health facility (HF) | Healthcare provider qualification | Gender | Age (years) | Years of practice experience | Years of practice at current facility |
|---|---|---|---|---|---|
| HF 1 Maternity home Private Community level | Nurse mid-wife (HOF) | Female | 77 | 56 | 16 |
| | Healthcare assistant | Male | 25 | 4 | 4 |
| | Healthcare assistant | Female | 21 | 3 | 1 |
| HF 2 Clinic Private Sub-district level | Medical doctor (HOF) | Male | 65 | 38 | 29 |
| HF 3 Hospital Private District level | Medical doctor (HOF) | Male | 35 | 9 | 2.5 |
| | Health facility administrator (HOF) | Female | 34 | 9 | 2.5 |
| HF 4 Health center (small) Government Community level | Physician assistant (HOF) | Male | 51 | 14 | 5 |
| | Physician assistant | Male | 31 | 7 | 2 |
| HF 5 Health center (large) Government Community level | Physician assistant (HOF) | Male | 56 | 24 | 18 |
| | Nurse | Female | 32 | 9 | 7 |
| | Nurse | Male | 32 | 4 | 2.5 |
| HF 6 Hospital Government District level | Medical doctor (HOF) | Male | 51 | 28 | 1 |
| | Nurse Manager | Female | 55 | 17 | 1 |

Table 3-4: Health administrative/policy representation

| Institution or organization | Representative level of administration/policy oversight | Number of consultative discussions held |
|---|---|---|
| **District (local)** | District Health Directorate | 2 |
| | District Health Management Team DHMT | 1 |
| **Regional** | Regional Medical Stores | 3 |
| | Regional Malaria Control Office | 2 |
| **National** | Society of Private Medical and Dental Practitioners – Ghana SPMDP - Ghana | 2 |
| | National Health Insurance Authority | 1 |

Table 3-5: Key attributes of the conceptual model

| Implementation Factor | Definition | Affected Relationships |
|---|---|---|
| **Learnability** | A healthcare provider's ability to:<br><br>Correctly perform a RDT, and<br><br>Accurately read and interpret the result. | Healthcare provider &<br><br>Technology (RDT) |
| **Willingness** | A healthcare provider's intention to:<br><br>Conduct a RDT for each eligible patient;<br><br>Wait for the test result, and<br><br>Apply the RDT result to diagnosis and treatment decisions as recommended by the guideline | Healthcare Provider &<br><br>Technology (RDT)<br>&<br>Policy Guideline |
| **Suitability** | A healthcare provider's perception that:<br><br>The RDT is relevant to his/her practice; and,<br><br>RDT results accurately indicate the presence or absence of malarial infection | Healthcare provider &<br><br>Technology (RDT) |
| **Satisfaction** | A healthcare provider's perception that:<br><br>The RDT is convenient to conduct<br><br>He/she enjoys the process of conducting RDTs | Healthcare provider &<br><br>Technology (RDT) |
| **Efficacy** | A healthcare provider's ability to:<br><br>Make the effort and time to conduct a RDT<br><br>Read, interpret, and record RDT result<br><br>Apply the RDT result to diagnosis and treatment decisions as recommended by the guideline | Healthcare Provider & the following:<br><br>Technology (RDT)<br><br>Policy Guideline<br><br>Health System |
| **Effectiveness** | Aspects of the health system to ensure enabling organizational and supporting systems for implementing the guideline, including:<br><br>Supporting interventions e.g. training, supervision and feedback<br><br>Clinical and operational monitoring and evaluation of RDT implementation<br><br>Job aids, ancillary supplies<br><br>Adequate RDTs and antimalarial drugs<br><br>Storage and disposal facilities<br><br>Clear guidelines and support to appropriately manage RDT-negative cases | Healthcare Provider & the following:<br><br>Technology (RDT)<br><br>Policy Guideline<br><br>Health System |

Table 3-6: Major themes identified in the data

| Theme | Main code categories and related code(s) | Interface of guideline Compliance |
|---|---|---|
| **1. Tension between recommended and achievable standards of practice** | **Content vs. capacity** for guideline implementation<br><br>Limited resource capacity: limited/erratic RDT availability, stock outs<br><br>Limited regulatory capacity: poor quality assurance/control<br><br>Limited storage capacity<br><br>Weak supply chain and distribution systems<br><br>Insufficient in-service training and sub-optimal provider preparation<br><br>Poor staff management and motivation programs<br><br>Inadequate staffing levels and heavy work loads | Provider - Policy Guideline |
| | **Information vs. application**<br><br>Inconsistent guideline information<br><br>Sub-optimal guideline dissemination and restricted access<br><br>Provider willingness vs. ability<br><br>Provider-patient proximity vs. policy maker distance | Provider – Health System |
| | **Fee vs. free**<br><br>Controversial national health insurance policies<br><br>"No cost" *in principle* for RDTs vs. facility charges for laboratory services | Provider - Policy Guideline |
| | **Satisfaction vs. security**<br><br>Healthcare provider role vs. healthcare staff function<br><br>Socio-economic concerns for patients<br><br>Avoiding institutional confrontation | Provider - Health System |
| | **Seeing vs. saying**<br><br>Proximity to the patient vs. distance from | Provider – Policy Guideline<br>Provider – Patient |

| | | |
|---|---|---|
| | the policy maker<br><br>Technical advantages and clinical disadvantages of RDTs<br><br>Observable signs vs. biomedical indication of malaria<br><br>Observable parasites vs. 'presence/absence' of malaria | Provider-Technology |
| | **Rapid vs. reliable testing**<br><br>Quick results with RDTs vs. accuracy with (expert) microscopy | Provider - Technology |
| | **Confirmation vs. verification**<br><br>Pre-treatment testing to confirm clinical suspicion of malaria vs. post-treatment testing to verify clinical diagnosis of malaria | Provider - Technology |
| | **Compliance vs. consequence**<br><br>Guidelines implementation at the potential risk of losing a patient | Provider – Policy Guideline<br>Provider – Patient<br>Provider- Technology |
| **2. Uncertainty in case management decision-making based on RDT results** | **Doubt**<br><br>Questioning negative RDT results<br><br>Questioning RDT potency in cases of negative results<br><br>Self-questioning case management decisions when withholding treatment | Provider-Patient |
| | **Constant double checking**<br><br>Seeking to verify a clinical diagnosis of malaria<br><br>Seeking to confirm negative RDT results<br><br>Discomfort with not being able to confirm negative RDT results | Provider-Patient<br>Provider-Technology |
| | **Concern**<br><br>Risk of professional failure to detect a true case of malaria<br><br>Risk of moral failure in avoidable loss of life due to undetected malaria<br><br>Risks to untreated patients with missed diagnoses of malaria | Provider-Patient |
| | **Lack of confidence** | Provider – Patient |

| | | |
|---|---|---|
| | Unwillingness to make a clinical decision based on RDT negative results<br><br>Unwillingness to integrate RDT results into clinical decision making | Provider – Policy Guideline<br>Provider – Technology |
| | **Inertia**<br><br>Insufficient case management knowledge, skill, or proficiency<br><br>Inconsistent policy guideline information<br><br>Limited government/national advocacy for guideline compliance<br><br>Weak supporting interventions to facilitate guideline implementation | Provider – Patient<br>Provider – Policy Guideline |
| **3. Precautionary provider behavior relative to patient testing and treatment** | **Presumptive treatment**<br><br>Prescribing antimalarial treatment 'just in case'<br><br>Avoiding severe or complicated malaria<br><br>Preventing avoidable deaths from missed cases<br><br>Satisfying patient expectations and demands | Provider – Patient<br>Provider – Policy Guideline |
| | **Selective compliance with testing febrile patient**<br><br>Rationing test kits (RDTs) and other essential healthcare supplies<br><br>Socio-economic and cultural influences | Provider – Patient<br>Provider - Technology |

**Figures in Chapter Three**

Figure 2-1: Reported deaths from malaria in Ghana (2000 - 2010)

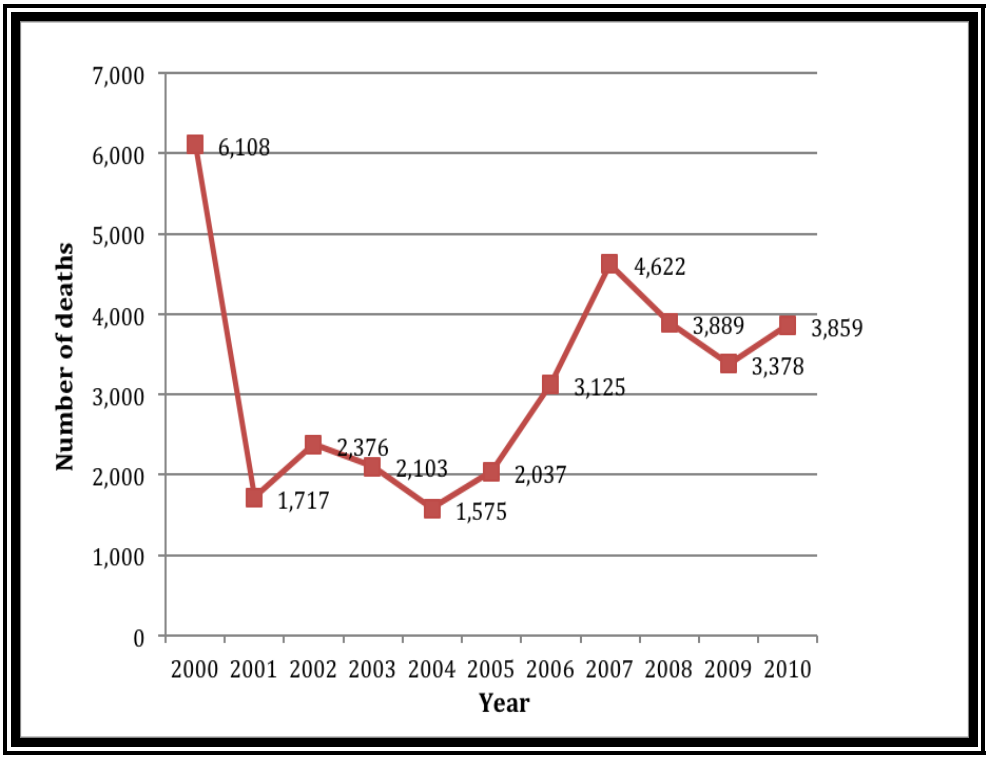


Figure 3-2: Conceptual framework for investigating guideline compliance

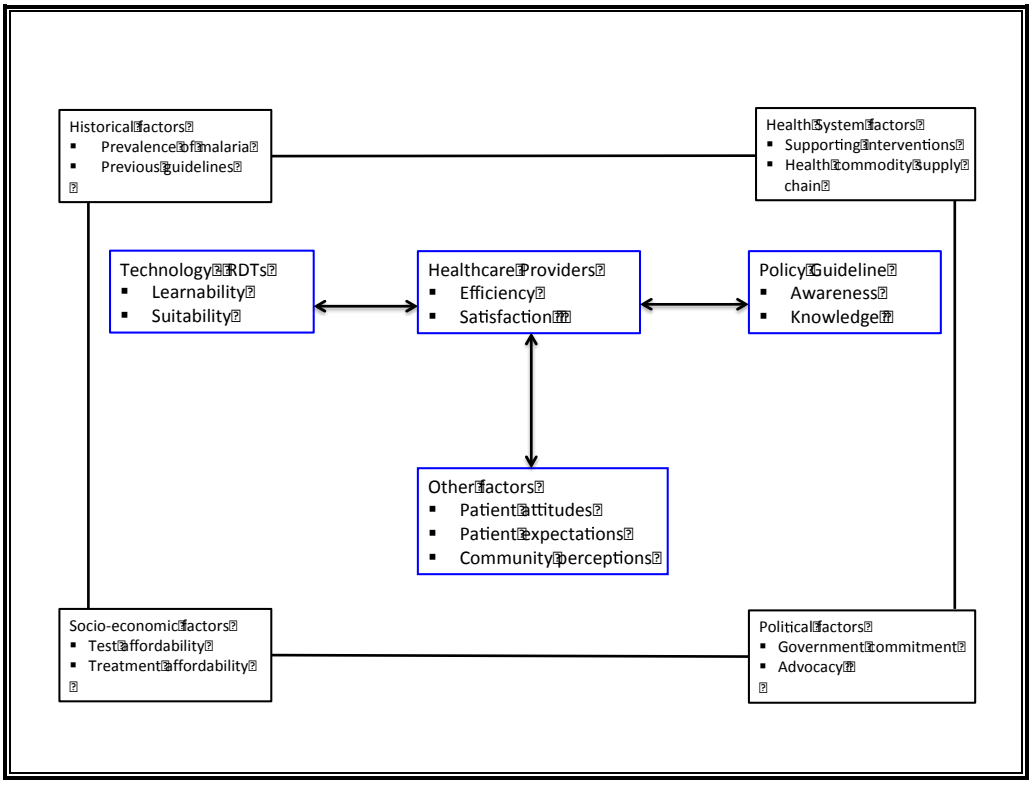
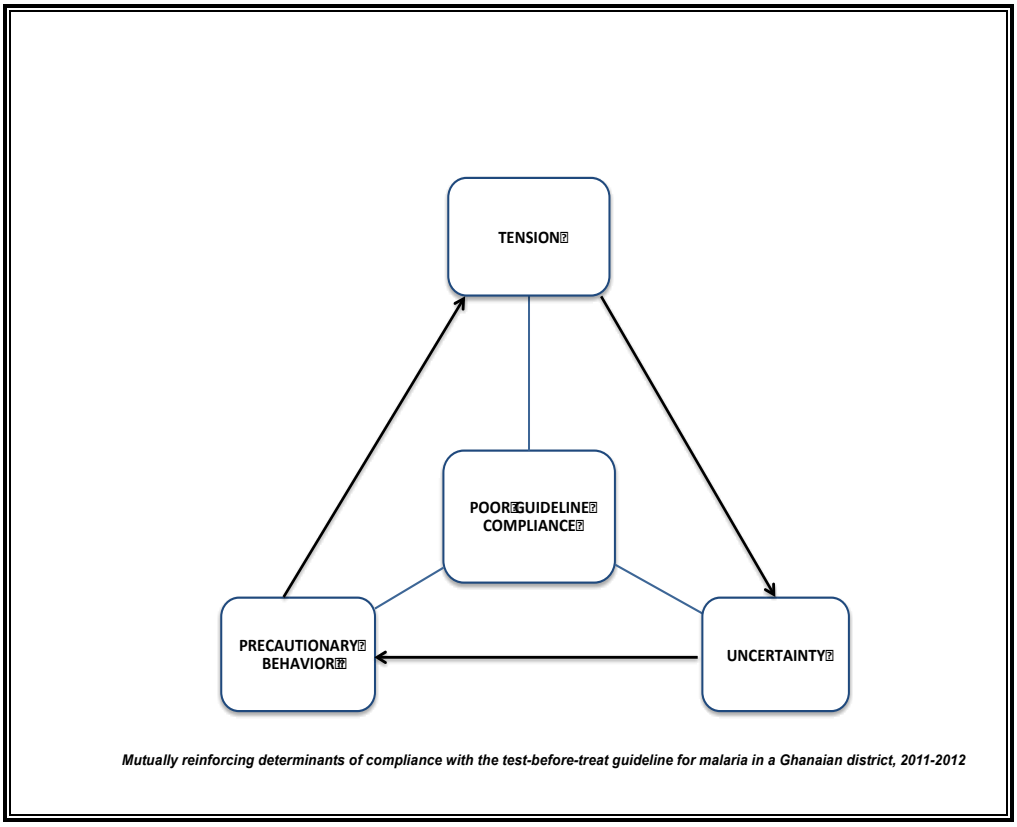


Figure 3-3: Determinants of guideline compliance for confirmatory malaria testing in Ghana



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## GENERAL DISCUSSION AND CONCLUSION

The research findings presented in this thesis are based on a focused ethnographical study of guideline compliance among primary healthcare providers in Ghana. The study was conducted at six peripheral health facilities in Atwima-Nwabiagya, a peri-urban district in the Ashanti Region of Ghana. The key findings presented are the determinants of poor healthcare providers' compliance with the confirmatory testing guideline for malaria in Ghana. The nature of the determinants and how they contribute to poor healthcare providers' compliance is also described. This research significantly advances the state of the knowledge on healthcare providers compliance with recently revised WHO policy guidelines for malaria diagnosis in endemic countries.

The centrality of RDT use to the implementation of confirmatory malaria testing at peripheral health facilities in Ghana was demonstrated in the research findings. Consequently, guideline implementation and compliance were subject to the factors that primarily influenced RDT use in these settings. The main factors influencing RDT use in Ghana and other sub-Saharan settings are health system capacity, healthcare providers' perceptions and preferences regarding methods and tools for malaria diagnosis, advantages and disadvantages of RDT use in clinical practice, and policy guideline information and dissemination. The literature review presented in Paper I verified the legitimacy of this finding [1-4]. The findings of the focused ethnography presented in Paper III of this thesis for which Paper II provides a detailed methodological account, are also supported by the information identified in the literature review.

Limited health system capacity translates into limited healthcare delivery resources [1, 4-6]. This was evident in the lack of essential healthcare commodities, frequent and prolonged RDT stock-outs identified in the study district. These challenges substantially impeded routine guideline implementation in clinical practice and contributed to providers' perceptions of being unable to implement the guideline on routine basis. This finding has been reported in studies conducted in similar settings across sub-Saharan Africa [1, 3, 4, 6-9]. Although limited economic resources affect all aspects of national development, its relevance to the health sector in Ghana cannot be overstated. Ghana has identified overall health status as being at the core of national wealth. Progressive socio-economic development in Ghana therefore depends on a healthy and economically active proportion of the population [10]. This proportion has progressively declined over the past two decades [11]. Hyper-endemic malaria

transmission implies that morbidity and mortality from the disease contribute substantially to undermining economic productivity and socio-economic development in Ghana as well as in other areas of sub-Saharan Africa [12]. A review and readjustment of resource allocation is necessary to strengthen primary healthcare delivery and to support guideline implementation for case management of malaria.

Limited health system capacity was evident through resource and infrastructure constraints as well as in systemic gaps affecting the organized delivery of care. A finding of this thesis research was that systemic constraints related to staffing, inventory management, healthcare commodity supply and distribution logistics as well as policy guideline dissemination also contributed to perceived inability among providers to effectively implement the guideline in practice. Inconsistent policy guideline information may have resulted from a variety of factors including a lack of competent planning, appropriate skill sets or political commitment to the responsibility of malaria control policy development. These factors have been identified elsewhere in sub-Saharan Africa [3, 8] but have not been reported in Ghana. Ghana's National Malaria Control Program (NMCP) has demonstrated consistent capability and progress towards national and global targets for reducing morbidity and mortality from malaria [13-16]. Nonetheless, limited health system capacity is characteristic of developing economies and adversely affects policy dissemination. Ineffective or insufficient policy dissemination efforts result in inconsistent guideline information and poor guideline knowledge among providers. Clear and consistent policy information supported with advocacy for implementation is therefore essential to encourage guideline compliance among providers' [5, 8, 17].

Limited healthcare delivery resources led to characteristic tension for providers between the expected and the achievable standards of practice for managing malaria. This tension restricted the utility of guideline implementation and undermined compliance among providers. Providers in this study additionally expressed a lack of confidence in RDT negative results when dealing with clinically suspected cases of malaria. Weak quality assurance and control systems associated with limited health system capacity undermined providers' confidence in the veracity of RDT results. This finding highlighted the multi-dimensional effects of limited health system capacity on providers' compliance.

Providers' perceptions of the guideline and RDTs influenced the preferences they attached to existing methods for diagnosing malaria. Findings from previous studies conducted in Ghana and Tanzania revealed that providers' perceptions and preferences towards particular modes of diagnosing malaria are influenced primarily through their interactions with peers, the diagnostic technology, the guideline, and patients [5, 18]. In-service training should target and clarify providers' misconceptions about RDT use and should stress the importance of confirmatory diagnosis. Supporting interventions targeting providers' education and training should be designed to build self-efficacy and confidence in the effectiveness of RDT use [1]. This will encourage providers to take ownership of guideline adoption at the primary care level and will promote better management of malaria and other fevers in Ghana. Dissemination of local and international scientific research findings including advancements to RDT features and technology should appropriately target the representative literacy levels among healthcare provider cadres managing malaria at different levels of primary healthcare delivery.

A key finding of this research was that the underlying determinants of poor guideline compliance included factors related to the healthcare providers' perceived ability for guideline implementation as well as their willingness to comply if or when enabled. Ability and willingness were interrelated and interactively influenced guideline compliance. Providers' also associated their willingness to comply with resource availability (ability) and with their perceptions and preferences regarding various methods of diagnosing malaria. Poor guideline compliance was demonstrated through a lack of confirmatory testing and/or prescribing antimalarials in spite of RDT negative results. Both behaviors indicated presumptive (or symptomatic) treatment of malaria mainly on the basis of fever. Providers explained presumptive treatment practices as a result of being unable to implement the confirmatory testing guideline because they lacked essential healthcare commodities including RDTs. Private providers autonomously omitted RDT use in preference of microscopy where available, or presumptive treatment in order to minimize frequent interruptions from RDT stock outs that were witnessed at government facilities. Differences in providers' reactions to erratic RDT availability across government and private facilities were likely a result of greater autonomy among private providers, who regulated their own resource availability. However, factors associated with providers' willingness to comply were not restricted to private providers. Some government service providers also indicated not being willing to use RDTs for various reasons including sporadic availability and a lack of confidence in the veracity of RDT results. Poor

quality assurance and control - a common health system constraint in limited-resource environments – also contributed to this lack of confidence in RDT results. This finding highlighted the interaction between factors influencing providers' ability and their willingness to comply with the guideline.

Successful implementation of confirmatory testing policies for malaria in Ghana and other endemic settings should aim to address factors related to healthcare providers' ability as well as their willingness to comply.

Operational research of ongoing RDT implementation should be employed at the various levels of primary healthcare delivery to identify grassroots issues for which practical solutions require less overhead capital. Incremental integration of evidence from investigations at district, regional and national levels may present an economically viable strategy to progressively improve malaria management. These efforts should be supported with regular monitoring and evaluation with appropriate consideration given to any differences in settings that may influence guideline implementation at the different levels of primary healthcare. The platform presented in this thesis provides a foundation for identifying priority research areas to support the implementation of confirmatory malaria testing and to conclusively advise the development of interventions on a national scale. Building on this platform and other relevant operational research would provide useful information for developing measurable performance indicators for malaria management at district, regional and national levels – from the consulting rooms of primary care delivery to the boardrooms of policy development. Locally informed benchmarks can be used to guide routine progress evaluations towards national and global targets for strengthening diagnostic capacity for malaria. Documentation of such evaluations will additionally promote knowledge translation among diverse stakeholders for malaria control in Ghana and other endemic settings. The integration of local research findings into policy development will also lead to better engagement between providers and policymakers to improve guideline implementation for primary healthcare delivery as a whole.

Strategies to improve guideline compliance must strive for closer collaboration between policy makers and providers to ensure that interventions are appropriately structured to address gaps in staffing, healthcare providers' skill sets and training, and resource availability in different primary healthcare settings to avoid duplication of efforts that drain already limited resources [19, 20]. Local research should highlight the relevant socio-cultural, historical, and political factors that impinge on guideline compliance

in order to identify feasible and cost-effective strategies for improvement. Information including market days in various districts might indicate important management considerations to address systemic issues with care delivery that stymie guideline implementation. Such considerations might include adjustments to staffing such as staggered schedules to accommodate patient volumes during seasons, events, or times of the day when additional manpower is required to implement confirmatory testing. This will minimize interruptions to testing and the tendency for presumptive treatment of febrile patients during peak clinic hours.

Gender implications of local and operational research are important considerations when developing interventions to improve guideline compliance. This study found that female providers were more inclined to perceive in-service training opportunities as feasible strategies to address gaps in guideline knowledge and compliance than their male colleagues regardless of age. Such findings warrant further investigation to understand how gender differences might influence perceptions, acceptance, planning and uptake of in-service training opportunities in order to maximize cost-effectiveness. Ghana has developed a progressive agenda for female education and development over the past two decades [21]. Policymakers should explore opportunities inherent in this agenda to promote female and overall health worker education and training. The scope of such initiatives might include community education on the importance of prevention, early diagnosis and effective treatment. Engaging the support, participation and activism of female community leaders, resource persons and national figures on committees to promote more comprehensive healthcare providers' education and training will raise national and international awareness and encourage funding support. Numerous international celebrities continually support and promote efforts that widely and rapidly expanded funding and enabled wider coverage and access of essential therapy for millions suffering from HIV/AIDS particularly in Africa. This strategy can successfully be emulated to sustain momentum for effective control, and to bolster the necessary efforts towards the eventual elimination of malaria in endemic regions. Integrating in-service training with female education agendas may result in more equitable allocation of funds to better support primary healthcare delivery in conjunction with rural health worker education, training and health workforce development. The potential successes of such initiatives may be inferred by the commendable progress Ghana has made towards global malaria control targets under the leadership of the current manager of

the National Malaria Control Program – Dr. Constance Bart-Plange – who is a female medical practitioner.

With numerous issues of national importance vying for attention and limited resources, capital-intensive health sector investments in Ghana and other low- to middle-income countries (LMICs) typically rely on external funding and partnerships. These initiatives usually involve substantial time commitments for appropriate planning, organization and implementation. These externally funded disease-specific (vertical) programs typically channel funding and health workforce investments and resources towards the specified disease program and in so doing, attract poorly paid, unmotivated healthcare providers from public sector jobs. This weakens overall health system capacity for primary healthcare delivery [22, 23]. Health workforce development should be envisaged as a long-term strategy for health system strengthening. Health worker training and health workforce development should be prioritized in order to address gaps in the delivery of primary healthcare as a whole [19, 24, 25]. More than 90% of funding for malaria management in Ghana is made available through external sources including the Global Fund to fight HIV/AIDS, Tuberculosis, and Malaria (GFATM or The Global Fund), the World Bank, and other bilateral initiatives [22, 26]. Nonetheless, there is a potential benefit to overall health system strengthening because malaria management occurs within the domain primary healthcare delivery. To realize this potential, national ministries of health in Ghana and other endemic countries should develop standard requirements that promote integration of externally funded (vertical) programs with nationally-mandated healthcare delivery (horizontal programs). This will enable progressive and sustainable health system strengthening [19, 24, 25]. This also implies a shift from biomedical models of treatment to embrace a public health approach that accommodates the implementation of confirmatory malaria diagnosis and supports proactive strategies to address the root causes of poor guideline implementation. This approach would favor incremental improvements to guideline compliance for malaria management that are achievable given the existing capacity for primary healthcare delivery in Ghana.

Understanding the multi-factorial elements of healthcare providers' compliance is critical to inform technology development. This information is valuable to optimize RDTs and other available diagnostics for malaria for use within different epidemiological and healthcare delivery settings. Such developments

will require targeted strategies to identify and define end user profiles - education, training, qualifications, skills, routine duties performed - paying appropriate attention to their specific setting and context, as well as structural components such as overarching socio-political and economic agendas for national development. These considerations are important to the successful introduction, uptake and sustained use of new and existing diagnostic technologies particularly in resource-limited environments. Furthermore, technology developers should invest in research to understand social or gender-based concerns that affect use, willingness and expectations regarding RDTs or other diagnostic technologies for malaria in the various use settings. Ongoing in-service training is necessary to inform and encourage desired behavior and to empower end users to make appropriate and informed choices regarding diagnostic practices for malaria. This will enable providers to better understand existing diagnostic tools including their limitations and clinical implications. Further provider support to encourage RDT uptake may include enabling immediate or remote access to troubleshooting resources and support. Supportive supervision should also inform feedback mechanisms to improve current RDT capacity by routinely engaging healthcare providers' perspectives on RDT-supported malaria diagnosis. This will enhance the utility of RDT-supported malaria diagnosis in limited-resource, endemic environments. Emphasis on supportive supervision is also necessary to reinforce routine implementation of training messages. These should include the importance of waiting for the correct duration of time to read RDT results, in order to minimize the potential of false negative results for febrile patients, which then creates uncertainty among providers.

This study did not consider patient perspectives given that the objective was to understand guideline compliance from the healthcare providers' perspective. Given the time and funding constraints, exploring the issue of patient attitudes and expectations from the providers' point of view would not have been accompanied by the requisite investigation among patient communities to ascertain these perspectives. However, patient education to manage expectations during clinical encounters has been identified as beneficial to improving provider-patient interactions [27, 28]. Such initiatives should be prioritized in settings where this has been identified as a deterrent to guideline compliance. Public education and communication campaigns targeting patient and caregiver communities should advocate guideline compliance and clarify the rationale for confirmatory malaria testing. This will likely ease patient pressure on providers to prescribe antimalarials without testing [5, 18, 29-31]. Likewise, clarifying inconsistent

policy guideline information is essential to facilitate guideline implementation among providers. Policy dissemination and communication should include clear accountability regarding who conducts RDTs and where rapid testing should be conducted in primary healthcare facilities with or without laboratory facilities. Ensuring clear and consistent policies have far reaching implications for malaria management in Ghana and beyond. This must be viewed as an essential step to strengthen overall diagnostic capacity for malaria testing which will promote routine testing, reporting and surveillance for malaria at the national level. Moreover, proper policy guideline communication will empower and adequately prepare providers for case management to promote quality patient care at the facility level. Providers who are knowledgeable about the existing guideline will be more confident to implement it in routine practice and will be better prepared to educate unwilling patients and caregivers on its importance where necessary. This is likely to instill an increased sense of professionalism that will benefit provider-patient relations and promote better guideline uptake [1, 32].

**Policy implications**

The findings of this research indicate substantial imbalance between available policy guideline information and the capacity for implementation. This suggests a need to improve policy development at the national level, to include thorough and routine evaluation of implementation capacity prior to the adoption of broad health sector policy and disease-specific policies. Such evaluations might inform policy officials to plan for incremental adoption of global recommendations from the WHO such as RDT use for guiding malaria management. Lessons learned from regional implementation within Ghana can then support a feedback mechanism to enhance national roll out and to improve cost effectiveness.

Furthermore, discussions on the longstanding issue of better management of febrile, RDT-negative patients should be prioritized at both international and national levels, in order to ensure improved case management of malaria and fever.

National level policies should provide clear and consistent messages to improve implementation at the local level. These should necessarily consider clarification of the role and place for RDT use in the various primary healthcare settings where malaria is managed. Moreover, inconsistencies between policy and practice including the limitation of test-before-treat guidelines to patients aged five years and above should be assessed to identify its utility in practice, as this may contribute towards providers'

confusion with guideline implementation. Local guideline implementation must also be supported by healthcare provider training that focuses on clarifying commonly held perceptions around the accuracy of clinical diagnosis, microscopy and RDT use, and that emphasizes the increasing significance of non-malarial fevers in endemic settings.

Given the reality of limited economic resources, interventions to improve guideline compliance in Ghana should be incremental. They should also be targeted to accommodate differences in healthcare delivery capacity within the diverse primary healthcare settings in Ghana where routine malaria management occurs. This approach will encourage and sustain the uptake of best practices for malaria diagnosis despite limited health system resources. The findings presented in this thesis should create the necessary dialogue and debate among policy and practice circles to promote confirmatory testing and improved management of malaria in Ghana and other comparable low-resource settings where the disease is endemic.

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**APPENDICES**

APPENDICES TO CHAPTER ONE

**Appendix 1-1: Search strategy used for literature review**

**Dates on which search was conducted**
November 4 and 5, 2011

January 10, 12 and 31, 2012

March 12, 2013

**Main search concepts**
1. Malaria

AND

2. Rapid diagnostic testing OR rapid detection OR...

AND

3. sub-Saharan Africa OR...

**Detailed outline of database searches**

MEDLINE, 1946 - present with in-process citations
426 results in total

1. exp malaria/

2. malaria.ti.

3. 1 or 2

4. (rapid diagnos* or (rapid adj2 test*) or rapid detect* or field test* or field diagnos* or point of care test*).ti,ab.

5. rapid.mp.

6. diagnosis/

7. exp Malaria/di [Diagnosis]

8. 6 or 7

9. 5 and 8

10. 4 or 9

11. ((("sub" or south) adj2 sahara*) or (Mauritania or Gambia* or ghana* or guinea or liberia or nigeria or sierra leone or benin or burkina faso or cote d'ivoire or mali or niger or senegal or togo or angola or burundi or congo or rwanda* or sao tome or cameroon or central african republic or chad or gabon or sudan or burundi or kenya* or tanzania* or uganda* or djibouti or eritrea or ethiopia* or somalia* or

botswana or comoros or lesotho or madagascar or malawi or mozambique or namibia or seychelles or south africa* or swaziland or zambia* or zimbabwe)).ti,ab.

12. exp "Africa South of the Sahara"/

13. 11 or 12

14. 3 and 10 and 13

EMBASE, 1974-March 11 2013
471 results in total

1. exp malaria/

2. malaria.ti.

3. 1 or 2

4. ((("sub" or south) adj2 sahara*) or (Mauritania or Gambia* or ghana* or guinea or liberia or nigeria or sierra leone or benin or burkina faso or cote d'ivoire or mali or niger or senegal or togo or angola or burundi or congo or rwanda* or sao tome or cameroon or central african republic or chad or gabon or sudan or burundi or kenya* or tanzania* or uganda* or djibouti or eritrea or ethiopia* or somalia* or botswana or comoros or lesotho or madagascar or malawi or mozambique or namibia or seychelles or south africa* or swaziland or zambia* or zimbabwe)).ti,ab.

5. exp "Africa South of the Sahara"/

6. 4 or 5

7. (rapid diagnos* or (rapid adj2 test*) or rapid detect* or field test* or field diagnos* or point of care test*).ti,ab.

8. rapid diagnostic test.mp.

9. exp diagnostic test/ and rapid.mp.

10. or/7-9

11. 3 and 6 and 10

12. limit 11 to embase

Global Health 1910-present
484 results in total

1. exp malaria/

2. malaria.ti.

3. 1 or 2

4. exp "africa south of sahara"/

5. ((("sub" or south) adj2 sahara*) or (Mauritania or Gambia* or ghana* or guinea or liberia or nigeria or sierra leone or benin or burkina faso or cote d'ivoire or mali or niger or senegal or togo or angola or burundi or congo or rwanda* or sao tome or cameroon or central african republic or chad or gabon or sudan or burundi or kenya* or tanzania* or uganda* or djibouti or eritrea or ethiopia* or somalia* or botswana or comoros or lesotho or madagascar or malawi or mozambique or namibia or seychelles or south africa* or swaziland or zambia* or zimbabwe)).ti,ab.

6. 4 or 5

7. diagnosis/

8. diagnostic techniques/

9. (rapid diagnos* or (rapid adj2 test*) or rapid detect* or field test* or field diagnos* or point of care test*).ti,ab.

10. rapid.mp.

11. (7 or 8) and 10

12. 9 or 11

13. 3 and 6 and 12

CINAHL
35 results in total

malaria* AND ( (diagnos* AND rapid) OR "field testing" OR "rapid detection" OR "rapid testing" )

AND

(MH "Africa South of the Sahara+") OR ( Mauritania or Gambia* or ghana* or guinea or liberia or nigeria or sierra leone or benin or burkina faso or cote d'ivoire or mali or niger or senegal or togo or angola or burundi or congo or rwanda* or sao tome or cameroon or central african republic or chad or gabon or sudan or burundi or kenya* or tanzania* or uganda* or djibouti or eritrea or ethiopia* or somalia* or botswana or comoros or lesotho or madagascar or malawi or mozambique or namibia or seychelles or south africa* or swaziland or zambia* ) OR zimbabwe

Web of Science
468 results

Topic=("sub saharan africa" or Mauritania or Gambia or ghana or guinea or liberia or nigeria or sierra leone or benin or burkina faso or cote d'ivoire or mali or niger or senegal or togo or angola or burundi or congo or rwanda or sao tome or cameroon or central african republic or chad or gabon or sudan or burundi or kenya or tanzania or uganda or djibouti or eritrea or ethiopia or somalia or botswana or comoros or lesotho or madagascar or malawi or mozambique or namibia or seychelles or south africa or swaziland or zambia OR zimbabwe) AND Topic=(malaria* AND ( (diagnos* AND rapid) OR "field testing" OR "rapid detection" OR "rapid testing" ))

Timespan=All Years. Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH.

Lemmatization=On

**Appendix 1-2: Study inclusion criteria checklist**

This form outlines in detail the criteria applied for selecting studies to be included in this review.

Study title:_____ Ref.no. _____

Primary author: _____ Reviewer: _____

**Key search concepts: (1) Malaria; (2) Rapid diagnostic testing; and (3) sub-Saharan Africa**

**Criterion A - Study design: must be yes to #1 and yes to #2, OR #3, OR #4, OR #5**

1. English language study or review, published from 2000 onwards

   ☐ yes ☐ no

   Rationale: Rapid Diagnostic Test (RDT/s) development has been ongoing since the 1990s. However, most of the relevant literature on routine use of RDTs in sub-Saharan Africa (SSA) has occurred within the past decade. Wide scale deployment of RDTs has largely been in response to the emergence of artemisinin-resistance by malaria parasites over the past 4-6 years.

2. Study was conducted using quantitative methods

   ☐ yes ☐ no

3. Study was conducted using qualitative methods

   ☐ yes ☐ no

4. Study was conducted using mixed methods (i.e. quantitative and quantitative methods)

   ☐ yes ☐ no

5. Review is a systematic- or a policy- or other scholarly review

☐ yes ☐ no

**Criterion B - Geographical location: must be yes to #6**

6. Study or review focuses on the use of malaria RDTs in sub-Saharan Africa

☐ yes ☐ no

Rationale: Thirty-five countries in Africa have the world's highest malaria burden and accounted for more than 90% of global malaria deaths in 2010. Most of these deaths were caused by p. falciparum, the most dangerous type of malaria infection. falciparum malaria. Most of the relevant literature on RDT use focuses on SSA, since the majority of RDTs available on the global market are designed to detect p. falciparum malaria.

**Criterion C – Diagnostic technology reported on in the study: must be yes to #7 and no to #8**

7. Study or review reports on the use of RDTs for malaria diagnosis

☐ yes ☐ no

Rationale: This review aims to identify barriers and facilitators to the rapid malaria testing in sub-Saharan Africa. The review excludes all other rapid testing such as pregnancy, which identifies a status, whereas malaria testing is to guide treatment decisions. Testing.. for HIV/AIDS might involve stigmatization issues not reported with malaria, which might account for facilitators and barriers that are not relevant to malaria.

8. Study or review reports on diagnosis of malaria only by microscopy, PCR or other laboratory-based technology

☐ yes ☐ no

**Criterion D - Comparative studies: must be yes to #9**

9. Study/review compares the diagnosis of malaria by RDTs to microscopy, or to symptom-based (clinical) diagnosis

☐ yes ☐ no

Rationale: RDT use is recent, and considered complementary to microscopy and clinical diagnosis - the main methods for diagnosing malaria in much of SSA.. Where available, the use of PCR is generally restricted to reference laboratories.

**Criterion E - Outcomes: must be yes to # 10**

10. Study or review must report on RDT use, utilization, uptake, or implementation, by health workers under field conditions

☐ yes ☐ no

**Key words:**

RDTs

Rapid

Diagnostic/diagnosis

Test*

Africa; sub-Saharan Africa; Africa, south of the Sahara

Malaria, *p.* falciparum malaria

Uptake, use, utilization

**Appendix 1-3: Data extraction form for empirical studies included in the literature review**

## A. Publication details

| | |
|---|---|
| Author(s) | |
| Year of publication | |
| Country | |
| Study Title | |
| Publication/Publisher | |
| Volume, Issue, Pages | |

## B. Study Description

Setting

| | |
|---|---|
| Environment - rural, urban, etc. | |
| Location – health facility, community, etc. | |
| Single or multi-site | |

Methodology

| | |
|---|---|
| Study design | |
| Study dates and duration | |
| Sample size and description | |
| Sampling and recruitment methods | |
| Inclusion criteria | |
| Exclusion criteria | |
| Data collection methods | |

| | |
|---|---|
| Data analysis methods | |
| Additional information | |

Health workers demographic information

| | |
|---|---|
| Age (mean/median/range) | |
| Gender | |
| Occupation/function/job role | |
| Additional information | |

**C. RDT (test) characteristics**

| | |
|---|---|
| RDT(s) brand/type<br>- HRP2, LDH, etc.<br>- Single- or pan-malaria species | |
| RDT selection criteria: | |

**D. Outcomes and Results**

Outcomes

| | |
|---|---|
| 1 | |
| 2 | |

Results

| | |
|---|---|
| 1 | |
| 2 | |

**E. Barriers and facilitators to RDT use**

| | Barriers |
|---|---|

| | |
|---|---|
| 1 | |
| 2 | |
| | Facilitators |
| 1 | |
| 2 | |

**F. Strengths and limitations**

| Strengths | |
|---|---|
| 1 | |
| 2 | |
| Limitations | |
| 1 | |
| 2 | |

**F. Author/s' Conclusion**

**G. Reviewer's Notes**

**Appendix 1-4: Barriers to RDT use in sub-Saharan Africa**

**Appendix 1-5: Facilitators of RDT use in sub-Saharan Africa**

**Appendix 2-1: Research methodology**

Purpose of the Appendix

In Chapter 2 of this thesis a focused ethnographical study of healthcare providers' compliance with guidelines for rapid malaria testing at peripheral facilities in a Ghanaian district is presented. This appendix contains additional detail in support of the research methodology for this thesis that was presented in Chapter 2. In this appendix, the methodology is situated more comprehensively within the relevant qualitative research literature. This aim is therefore to reinforce the justification for employing the methodological approach used in the research. The information presented expands on the objectives addressed in Chapter 2 and reiterated here:

4) To outline the philosophical and theoretical foundational principles of focused ethnography
5) To demonstrate congruence between the underlying philosophical assumptions, the methodological approach and the thesis research objectives
6) To elucidate the suitability of a focused ethnographical approach for investigating healthcare providers' perspectives regarding guideline compliance with respect to rapid malaria diagnosis in primary healthcare settings in Ghana.

## Research objectives

The overall objective of the research presented in this thesis was to understand healthcare providers' perspectives surrounding compliance with guidelines for rapid malaria testing at peripheral health facilities in Ghana. To address this objective, the research was guided by the following questions previously outlined in Chapter 2 and re-stated below:

1. Which factors influence the use of rapid diagnostic tests (RDTs) for routine malaria diagnosis in sub-Saharan African settings?
2. How do the factors influencing rapid diagnostic test (RDT) use affect guideline implementation for malaria testing and treatment at facilities with limited or no laboratory service in Ghana?
3. How might an understanding of the factors influencing guideline implementation for rapid malaria testing and treatment improve case management of malaria at facilities with limited or no laboratory service in Ghana?

## The Research Significance

The aim of this research was to generate knowledge that would inform policy and strategies for improving malaria management at the primary healthcare level in Ghana. Understanding healthcare providers' compliance is essential to improve the implementation of test-based malaria management in Ghana.

## Research Background

### *The global burden and significance of malaria*

According to the World Health Organization (WHO) more than 200 million cases of malaria occur each year leading to more than 660,000 deaths worldwide (WHO, 2012a). These estimates are cautiously interpreted as they are based on reports that include several non-standardized sources as a result of incomplete reporting and poor surveillance in many malaria endemic countries (Sachs & Malaney, 2002; WHO, 2012a). Murray et al. (2012) have asserted that reports from the WHO substantially underestimate the global malaria burden with particular reference to mortality among adults in sub-Saharan Africa. Discrepancies notwithstanding, the overall evidence indicates a majority of cases and

deaths occur in sub-Saharan Africa where 43 countries including Ghana account for 90% of the global malaria burden (WHO, 2012a). Malaria exacerbates a vicious cycle of illness and poverty in these countries by increasing workplace and school absenteeism and adding pressure to already overburdened healthcare delivery systems (Amexo et al. 2004; Asante & Asenso-Okyere, 2003; Sachs & Malaney, 2002). Young children below the age of five years and pregnant women in endemic areas are highly vulnerable to severe infection. This can rapidly progress to death in the absence of effective treatment within the first 24 -48 hours of illness onset (WHO/UNICEF, 2003; WHO, 2006). Sustaining momentum for malaria control and progressive elimination in endemic areas is critical to support the achievement of broader health and developmental goals in low- and middle-income countries (LMICs) (Murray et al., 2012; Economic Commission for Africa/African Union/African Development Bank Group, 2009; United Nations, 2012).

*Challenges with malaria control*

In spite of declining transmission in several high burden areas (D'Acremont et al., 2008; WHO 2010, 2011, 2012a) the management and control of malaria in many endemic areas is fraught with persistent challenges. Weak health system infrastructure is typical of most developing country settings, and undermines efforts to expand coverage of proven strategies for prevention, early diagnosis and effective treatment of malaria. Comprehensive control efforts are essential to reduce morbidity and mortality from the disease (Mills, Rasheed, & Townsend, 2006). There is evidence of both over-diagnosis and under-reporting of malaria cases in various settings across sub-Saharan Africa (Ansah et al., 2010), both of which compromise planning and efficiency of control initiatives. Over-diagnosis of malaria and the concomitant over-consumption of antimalarials contribute to the spread of parasitic resistance to effective drugs (Perkins & Bell, 2008; White, 2004, 2009). This undermines efforts to increase widespread access to essential drugs among the poor (Hopkins, Asiimwe, & Bell, 2009) and raises concern in light of the thin pipeline for developing new antimalarials (Grimberg & Mehlotra, 2011; Anthony, Burrows, Duparc, Moerhle, & Wells, 2012).

To ensure targeted antimalarial use and to contain emerging parasitic resistance current WHO guidelines recommend parasitological confirmation of all suspected cases prior to treatment with

antimalarials (Reyburn, 2008; WHO, 2010). Ghana adopted this policy in 2010 to guide malaria management at the facility level and to enhance the feasibility of expanding access to diagnostic testing for malaria on a national scale (Chandler, Whitty, & Ansah, 2010; Ghana Health Service [GHS], Ghana, 2008).

*Malaria burden and control in Ghana*

Malaria is the leading cause of morbidity and in-hospital mortality in Ghana. More than 40% of all hospital outpatient department (OPD) visits, 30% of admissions and all-cause mortality among children less than five years of age in 2011 were attributable to malaria (GHS, 2009, 2010a). The entire country is hyper-endemic for malaria. Peaks in annual transmission occur during the rainy seasons from May to June, and from September to mid-November (Baiden et al., 2012; GHS, 2009). The National Malaria Control Program (NMCP) provides direct oversight of nation-wide malaria control activities under the auspices of the Ministry of Health (MOH) and GHS (Appendix A 2, Table 2).

Prior to adopting a test-based approach in 2010, symptomatic diagnosis based largely on the presence or history of fever was common practice (Ansah et al., 2010; Baiden et al., 2012; Chandler et al., 2010; GHS, 2008, 2009). This practice was formerly endorsed by the WHO to reduce mortality among young children in highly endemic areas who are at risk of complications and death from severe malaria (WHO/UNICEF, 2005; English et al., 2009). Practical and logistical limitations to expert microscopy and the availability of cheap antimalarials (now no longer recommended for treatment) further entrenched presumptive treatment practices in Ghana and in other malaria-endemic regions across sub-Saharan Africa (Drakely & Reyburn, 2008; WHO, 2006). Despite national guideline adoption in 2010 only a third of all reported malaria cases in Ghana are confirmed in the laboratory (GHS, 2009; WHO, 2012a). Presumptive treatment practices lead to routine mis-diagnosis of non-malarial fevers and over-consumption of antimalarials (Ansah et al., 2010; Reyburn et al., 2004; Hamer et al. 2007). Moreover, delays in the appropriate treatment of undetected causes of fever worsen health outcomes and further drain household, health system and donor resources (Amexo et al., 2004; Reyburn, 2008; Chandler et al., 2010). Rapid Diagnostic Tests (RDTs) have been widely deployed to enable parasitological diagnosis at peripheral facilities in Ghana. However up to 45% of RDT negative cases in some areas of

the country are prescribed antimalarials (Ansah et al., 2010; Chandler et al., 2010). Findings from studies in other African countries indicated that providers prescribed antimalarials for up to 85% of RDT negative cases (Msellem et al., 2009; Uzochukwu et al. 2010; Uzochukwu et al. 2011). This practice is rampant in under-resourced peripheral facilities, which serve as gatekeepers to the health system for more than half of the populace including the rural poor (Ansah et al., 2010; Baiden et al., 2012; Hamer et al., 2007; Reyburn et al., 2007).

Success with test-based management of malaria hinges on the healthcare providers' commitment to test and consequently to treat or otherwise manage suspected cases consistently with test results (Abdelgader et al. 2012; Baiden et al., 2009 Chandler et al. 2010). Poor healthcare providers' compliance with confirmatory testing guidelines for malaria remains a topical issue across sub-Saharan Africa and has been documented in Ghana (Ansah et al. 2010, Chandler et al. 2010, Baiden et al. 2010); Sudan (Abdelgader et al. 2011); Uganda (Asiimwe et al., 2010; Kyabayinze et al. 2010; Tusiime et al. 2010); Nigeria (Uzochukwu et al. 2012) and Tanzania (Chandler et al. 2010; Williams et al. 2011). Nonetheless, the underlying causes of poor guideline compliance are barely understood and there is limited research to inform strategies to address this challenge (Abdelgader et al. 2012; Ansah et al. 2010; Bisoffi et al., 2009; Lubell et al., 2008; Williams et al. 2011). Calls for social research to better understand healthcare providers' compliance with the confirmatory malaria testing guideline indicate the limited understanding of the subject (Ansah et al., 2010, Chandler et al., 2009; Chandler et al., 2010; Williams, 2008). The vast majority of research conducted in this area measured rates of guideline compliance among providers with very little focus on the determinants of guideline compliance (Hamer et al., 2007; Kyabayinze et al., 2012, Masaninga et al., 2012). A qualitative research approach was suitable for conducting an in-depth investigation of healthcare providers' compliance with the recently revised policy guideline for managing malaria in Ghana.

*Guideline compliance for confirmatory malaria testing*

Compliance in the medical literature primarily addresses patient behavior with respect to treatment regimen and therapy. However, recent studies addressing these concepts are focused on the provider's role, the essence of provider-patient relations, and mutual partnership towards achieving improved

patient compliance and treatment outcomes (Martin et al., 2005). Compliance in relation to healthcare providers' behavior focuses on the use of clinical guidelines and protocols in practice (Neugaard et al., 2004). The recent WHO recommendation for confirmatory malaria testing prior to treatment emphasizes guideline compliance among healthcare providers as a multi-level responsibility that is essential to improve fever and malaria management at the facility level, to ensure rational drug use at local and national levels, and to reduce emerging parasitic resistance to effective antimalarials. These strategies are necessary to promote cost effective malaria management (Perkins & Bell, 2008; Shillcutt et al., 2008; WHO, 2010). Yet implementation of the confirmatory malaria testing guideline among healthcare providers in malaria-endemic regions falls below expectation. This has led to increasing advocacy among stakeholders for research to enable a better understanding of healthcare providers' compliance with respect to malaria diagnosis and management (Abdelgader et al. 2012; Baiden et al. 2010; D'Acremont et al., 2008; English et al. 2009; Hamer et al. 2007; Lubell et al. 2007).

This study uses the terms 'healthcare providers' compliance', 'providers' compliance' or 'guideline compliance' interchangeably in reference to compliance among healthcare providers' with the confirmatory testing guideline for malaria. Key stakeholders for malaria control in Ghana easily recognized and related to these terms, which facilitated discussions that established the significance of the study. Several stakeholders were consulted at various stages of the research and their perspectives were instrumental in informing the design and conduct of the study (Appendix 2 A, Table 2.7).

*Importance of context in the investigation of guideline compliance*

Evidence on the acceptance, uptake and utilization of new research evidence (Bradley et al., 2004; Walley, 2007), digital or health technologies (Jeng, 2005; Karsh et al.,2004) underscores the importance of cultural, organizational, and human factors that influence the implementation context (Greer, 1988; Greenhalgh et al., 2004; Rogers, 2004). Asiimwe and collaborators (2012) suggest that similar investigations in resource-limited settings are limited and yet concur with these reports. Findings from their study on healthcare providers' acceptance and use of RDTs in Uganda indicate a multifactorial landscape for the introduction of new health technologies in resource-constrained areas. These include individual and health system factors, socio-cultural, economic and political aspects of the implementation context. Reports from studies in Ghana (Ansah et al., 2010; Baiden et al., 2010; Chandler et al., 2010), Nigeria (Ezeoke et al., 2012; Uzochukwu et al., 2010; Uzochukwu et al., 2011); South Africa (Moonasar

et al., 2007), and Tanzania (Chandler et al., 2009; Williams et al., 2008), support these findings. Based on this evidence, it was important to outline factors within the implementation context that potentially influence guideline compliance for malaria testing in Ghana.

Peripheral facilities in Ghana and in many African countries generally lack the requisite infrastructure to support laboratory microscopy (English et al., 2009; Reyburn et al., 2008). Where available, routine microscopy falls substantially below standard. Weak quality assurance, regulatory, and supervisory structures further contribute to poor quality of malaria diagnostic services and widespread presumptive treatment in under-resourced facilities (Drakely & Reyburn., 2008; English et al., 2009; Long, 2009). The concept of 'rapid testing' is also incoherent with microscopy in limited resource settings, considering the requisite technical expertise, procedures, and the longer wait times for providers to receive test results in order to guide practice (Uzochukwu et al., 2010; Williams et al., 2008). Guideline compliance at primary healthcare facilities is heavily dependent on the availability and recommended use of RDTs to enable parasitological diagnosis.

Summary of the conceptual model

This study defines guideline compliance for rapid malaria testing as the healthcare providers' commitment to test a patient suspected of having malaria and to further treat or otherwise manage the case consistently with the test results. The primary healthcare provider's implementation of confirmatory testing and subsequent case management as guided by the test result constitutes compliance (or a lack thereof) with current guidelines for managing malaria in endemic regions (Abdelgader et al., 2011; Asiimwe et al., 2012; Ansah et al., 2010). The conceptual model guiding the investigation of guideline compliance study (Appendix 2 B, Figure 2.1) was based on previous research on RDT acceptance and use in the context of confirmatory malaria testing in Ghana and other sub-Saharan settings (Asiimwe et al., 2012; Chandler et al. 2010). The model is presented in Appendix 2 B, Figure 2.1. A detailed discussion of the constructs of this model is outlined in Appendix 3 C.

Research design

*Essential criteria for selecting a research design*

Cresswell (2003) describes a framework for research design as the plans and procedures for conducting a study. The design is informed by the researcher's worldview (philosophical assumptions), the procedures of inquiry (strategy or methodology) and the detailed methods of data collection and analysis (Carter & Little, 2007). Essential considerations for selecting a particular research design include the nature of the research problem, the researcher's personal experiences, and the target audience for the study findings (Cresswell, 2003; Mayan, 2009; LeCompte & Schensul, 1999). The researcher's philosophical assumptions, methodology of choice, and methods prescribed within the selected methodology form the elemental pillars of a qualitative research study (Carter & Little, 2007; Dew, 2007). These concepts are discussed in detail in subsequent sections of this appendix.

*Rationale for the research design*

Qualitative research designs are a longstanding tradition in the social sciences and therefore allow adequate exploration of lay and professional health beliefs that may not be entirely feasible with quantitative research approaches (Pope & Mays, 1995). Qualitative research methodologies emphasize the importance of studying variables in their naturally occurring settings (naturalistic), allow theories and hypothesis to progressively evolve as data is collected (inductive) and are aimed at providing a better understanding or interpretation of phenomena. These interpretations rely substantially on the meanings that people attach to their experiences of various phenomena (interpretive research) (Denzin, 1994; Jacob, 1988; Mayan, 2009). Established qualitative methodologies (and their focal areas of study in parentheses) include ethnography (culture), phenomenology (lived experience), grounded theory (process) discourse analysis (language), ethnomethodology (social practice) and action research (change) (Dew, 2007). Qualitative research is beneficial as a prerequisite to quantitative studies on issues about which little is known (Richards & Morse, 2007). Furthermore, qualitative approaches are well suited to the growing complexity of modern healthcare services delivery settings characterized by increasing diversity of provider specialization, patient expectations and service provision (Goodson & Vassar, 2011; Pope & Mays, 1995; Tavakol & Zeinaloo, 2004). This diversity and complexity in health services delivery leads to the supposition by Morse (2010) that qualitative health research potentially amounts to a unique sub-discipline requiring specialized attention within the fields of both healthcare and qualitative research. Whereas quantitative research highlights trends in health-related behavior to predict probable causal associations between risk factors and various conditions, qualitative designs are

used to explore the root causes of, and meanings attached to health-related behavior, health seeking or care delivery experiences. Qualitative research designs can be used to capture patient and provider perspectives related to healthcare services delivery that can inform policy formulation and implementation at local and national levels (Bryman, 2008).

The relative merits of qualitative versus quantitative research have long been debated among proponents of both tradition (Holloway & Wheeler, 2002). Giles (2002) posits that the increasing use of mixed methods approaches that include both qualitative and quantitative components of a study indicates a growing acceptance of both designs in various disciplines. Mixed methods are gaining popularity among pragmatic researchers whose focus is more the research problem than the methods. Pragmatic researchers therefore employ pluralistic approaches to understand a problem (Morgan, 2007; Patton, 2002; Tashakkori & Teddlie, 2003). Crotty (1998) attributes the differences between qualitative and quantitative approaches to their inherent research methods. Corbetta (2003) suggests that the key differences are found in the nature of the resulting data in that quantitative designs yield objective and standardized data whereas qualitative studies generate rich data with more depth of meaning. Qualitative data provides a story behind the numbers and gives meaning to quantitative or numerical data (Mayan, 2009). Differences between qualitative and quantitative study designs also relate to the core methodological processes including a researcher's *objective* distance from the *subject* in quantitative designs versus *subjective* engagement with *participants* in qualitative approaches all of which are reflected in the resulting data (Mayan, 2009). These differences relating to researcher objectivity and subjectivity stem from deeper-rooted philosophical assumptions regarding the nature of existing knowledge *(ontology*) and the approach to understanding knowledge *(epistemology)*.

*Epistemology, theoretical perspective, methodology and methods*

Crotty (1998) suggests that there are four elementary processes in any research study. These involve the specific methods used to address a particular research objective, which are governed by particular methodological principles. The choice of methodological principles is influenced by the researcher's theoretical perspective or philosophical assumptions. These assumptions are embedded in the epistemological and ontological perspectives held towards knowledge and reality. Crotty (1998) further explains that ontology refers to 'what is', the nature of existence, and the structure of reality, while

epistemology addresses the nature and basis of knowledge (or reality), it's scope, and possibility (Hamlyn, 1995). Epistemology is concerned with providing philosophical grounds for decisions on the adequacy and legitimacy of knowledge (Carter & Little, 2007; Crotty, 1998; Maynard, 1994). Ontological perspectives therefore describe assumptions about reality, while epistemological perspectives involve assumptions about how to make meaning of such reality based on the primary assumptions surrounding reality in the first place (Dew, 2007; Mayan, 2009).

A researcher's philosophical assumptions are the central guiding principles for the research conducted and are usually implicit in the research design (William & Slife, 1995). Cresswell (2003) stresses the importance of identifying these assumptions in order to validate a researcher's choice of methodology and methods for addressing their objectives. Cresswell (2003) presents four main worldviews discussed in the literature to which researchers align namely (1) positivism/post positivism, (2) constructionism/constructivism, (3) advocacy/participatory, and (4) pragmatism. The assumptions held towards knowledge within these worldviews and the types of research to which they typically align are summarized in Table 2.4 and further explained in Table 2.5 of Appendix 2 A.

Cresswell (2003) defines the researcher's philosophical assumptions or 'worldview' as a set of basic beliefs that guide action (Guba, 1990). Worldviews are also referred to as paradigms (Cresswell, 2003; Lincoln & Guba, 2000), or epistemological and ontological perspectives (Crotty, 1998) in the literature. These describe the researcher's general orientation about the world (the nature of reality, or *ontology*) and the approach to discovering and constructing or making sense of this reality (*epistemology*) (Carter & Little, 2007; Crotty, 1998; Guba & Lincoln, 1994). These terms are sometimes used interchangeably by different authors to refer to the existence of knowledge and the approach to meaningfully engaging this knowledge (Crotty, 1998; Guba & Lincoln, 2005). The use of inconsistent terminology in discussions on the foundational concepts of epistemology, ontology, research paradigms, worldviews or theoretical perspectives is common in social research (Cresswell, 2003).

Basic definitions of these terminologies are provided here to clarify their use in this thesis. Research paradigms or worldviews refer to the underlying philosophical assumptions that guide the entire research design and process (Cresswell, 2003). Ontology addresses the concept of the nature of existing

knowledge while epistemology refers to the approach to meaningfully engaging this knowledge (Crotty, 1998; Hamlyn, 1995; Carter & Little, 2007). Theoretical perspectives refer to the framework within the epistemological approach that informs the choice of research methodology and methods.

*Epistemological perspective (pillar 1)*

A constructionist epistemology is founded on the assumption that meaning is *constructed* rather than discovered and is constructed through social interaction (Cresswell, 2003; Crotty, 1998; Mertens, 1998). Cresswell (2003) explains this assumption in that people seek understanding of their daily living and working worlds and develop subjective meanings of their life experiences. These multiple and varied meanings are attached to certain objects or things and are formed through social interactions as well as through cultural and historical routines of daily life (Lincoln & Guba, 2000; Schwandt, 2001). Furthermore, different people construct meaning differently about the same phenomenon (Crotty, 1998). A constructionist epistemology therefore acknowledges multiple realities and multiple truths regarding a particular phenomenon or life situation (Denzin & Lincoln, 2005; Mayan, 2009; Nicholls, 2009a).

A constructionist epistemological perspective was consistent with the aim and objectives of this study. This standpoint was coherent with eliciting perspectives of guideline compliance among different cadres of healthcare providers and local health administrative and policy officials. Additionally, a constructivist epistemological perspective involves the assumption that meaning is directed towards certain objects or things (Cresswell, 2003). Constructivist research aims to interpret symbolic aspects of social, cultural and historical contexts that are relevant to the research objective and/or participants (Cresswell, 2007; Crotty, 1998). A comprehensive review of the literature identified RDTs as existing diagnostic tools malaria that enable implementation of confirmatory testing guidelines for malaria in Ghana (Abdelgader et al. 2012; Ansah et al. 2010; Baiden, et al. 2009; Baiden et al. 2012; Bell & Perkins, 2008; Chandler et al. 2010; Drakely & Reyburn, 2008). The literature therefore supports implicit assumptions in the study design that among healthcare providers in this study, RDTs are symbolic of guidelines governing malaria diagnosis. Healthcare providers would therefore attach specific meanings to RDTs and their use in their management of suspected malaria patients (Chandler et al. 2010, 2012). This study therefore investigated healthcare providers' perspectives of guideline compliance in direct relation to RDT use for malaria testing at their facilities.

Historical experiences, beliefs and longstanding traditions contribute substantially to the cultural significance of social phenomena (Fetterman, 2010). The influence of these factors is evident in the meanings attached to malaria and the various methods of its management in Ghana (Ahorlu et al., 2007; Chandler et al., 2010). This study of guideline compliance involved both ideational and materialist assumptions (Fetterman, 1988; LeCompte & Schensul, 1999). The ideational perspective leads to an understanding of guideline compliance as a behavior that is influenced by a healthcare provider's knowledge, ideas, beliefs and perceptions surrounding malaria, and the tools and strategies for its management. On the other hand, despite variations in providers' qualifications, services provided and the capacity for care delivery at the different levels of primary health care, the patient-provider milieu within which malaria management occurs is a microcosm of the health system, which is itself embedded in the cultural, historical, political and socio-economic rubric of Ghana as a nation (Ahorlu, 2007; Asante and Asenso Okyere, 2003; MOH/GHS, 2007). From a materialist viewpoint, healthcare providers' behavior can be viewed as a response to political, and economic and social structures that characterize the health system and invariably determine healthcare delivery capacity in Ghana. This assumption was helpful in understanding how guideline compliance might be influenced by market, policy, and regulatory forces acting within and outside of the health system that influence the availability of essential case management resources including RDTs. The emphasis on the cultural context of guideline implementation supported the use of a constructivist paradigm. This viewpoint was also useful for anticipating the discovery of multiple perspectives on guideline compliance, such that cata collection was designed to broadly capture these perspectives. This led to the inclusion of a diverse range of healthcare provider cadres and policy officials in the study sample. The theoretical perspective employed in this research was therefore a relativist ontological perspective. Relativism embraces multiple perspectives regarding what constitutes social reality (Denzin & Lincoln, 2005). The methodology of choice for this study was a focused ethnography. This methodology was consistent with the subjectivist epistemology inherent in this study. Subjectivism emphasizes the co-creation of understanding and knowledge based on extensive interaction between the researcher and the participants in partnership (Mayan, 2009). The principles and methods of data collection and analysis within a focused ethnography are based on interaction between the researcher and the participants. This results in the co-creation of knowledge and understanding (Mayan, 2009; Denzin & Lincoln, 2005).

Congruence between the theoretical perspective, methodology, epistemology and ontology, and methodology in this study were critical to the integrity, quality, and trustworthiness of the research process and outcome (Denzin and Lincoln, 2005; Mayan, 2009).

*Theoretical perspective (pillar 2)*

The aim of this study was to understand guideline compliance from the healthcare providers' point of view by accessing their internal beliefs, perceptions and knowledge (Lincoln & Guba, 1985) of compliance. Conducting the study in the natural clinical practice settings was consistent with an *interpretivist* theoretical perspective, particularly that of *naturalistic inquiry* (Lincoln & Guba, 1985; Nicholls, 2009c). Interpretivist research involves "culturally derived and historically situated interpretations of the social life world" (Cresswell, 2007; Crotty, 1998). An interpretive paradigm was important in this study in order to identify cultural, social and historical influences (Cresswell, 2007; LeCompte & Schensul, 1999; Lincoln & Guba, 2000; Schwandt, 2000) of malaria and its diagnosis on healthcare providers' compliance. Within interpretivist traditions, naturalistic inquiry is also consistent with multiple perspectives of reality (Nicholls, 2009a; Schwandt, 2000). Naturalistic inquiry further postulates that phenomena can only be understood within their natural setting (Cresswell, 2007; Lincoln and Guba, 1985). Previous research established the importance of historical experiences, beliefs and traditions in shaping the cultural significance of malaria in Ghana. These factors are implicit in the meanings attached to various methods of malaria diagnosis and treatment by providers and patients (Ahorlu et al., 2007; Asase & Oppong-Mensah, 2009; Chandler et al., 2010). Emphasis on these factors was essential in this study considering that guideline compliance occurs during provider-patient encounters, which are influenced by the cultural, historical, political and socio-economic factors that characterize the health system in Ghana (MOH/GHS 2007).

*Methodology (pillar 3)*

Research methodology describes the "strategies of inquiry" (Cresswell, 2006) or the "strategy, plan of action, process or design" underlying selection and use of specific methods to address research objectives (Crotty, 1998). The methodological approach must be consistent with the epistemological (pillar one) and the theoretical (pillar two) perspectives underlying the research. Methodological and theoretical coherence ensures that appropriate methods are used, which enhances the quality of data

generated (Crotty, 1998; Cresswell, 2006; Schwandt, 2000). The methodology of choice in this thesis was focused ethnography. This methodology has its roots in traditional anthropological ethnography.

*Ethnography*

Ethnography is one of the major qualitative research traditions. The aim of ethnographic research is to explain the explicit and tacit elements of culture (Wolcott, 1999). The product of an ethnographical study is also referred to as ethnography. These accounts tends to be the researcher's (an outsider's or *etic*) description constructed with the aim of understanding life from 'the participant's (insider's or emic) point of view (Agar, 1996; Brink & Edgecombe, 2003; Spradley, 1980). Ethnography traces its origins to cultural anthropology (Mackenzie, 1994) and sociological research (Knoblauch, 2005) both of which share common aims of identifying cultural and societal rules, rituals, and beliefs (Morse, 1992). Understanding the participant's point of view on cultural norms and behaviors to inform the researcher's point of view is foundational to ethnographical research (Agar, 1996). Learning *from* people is inherent to the process of gaining an informed understanding of their culture (Malinowski, 1922). Traditional ethnographers consequently spent extensive time periods immersed in the culture they investigated (Hammersley & Atkinson, 1995). In contrast, many contemporary ethnographic studies focus on cultures and beliefs in familiar settings and units of society (Boyle, 1994; Higginbottom, Pillay, & Boadu, 2013).

*Types of ethnographical studies*

Ethnography can take many forms based on the theoretical standpoint of the ethnographer. Savage (2006) explains that the researcher's epistemological stance (how they approach, understand and explain what exists) and ontological (what they believe to be the nature of what exists) perspective ultimately guides and shapes an ethnographical study. Within the cultural aspects of modern society critical, feminist or institutional ethnographers focus on issues of power, knowledge and identity (Savage, 2006; Skeggs, 2001). The work of critical, feminist and institutional ethnographers raise questions about taken-for-granted assumptions with the intent to expose hidden imbalances in power, gender and knowledge relations respectively (Thomas, 1993). Such works raise awareness while advocating change to existing inequities, inhibitions, and repression of certain people groups by others in institutional or societal settings (Mayan, 2009; Morse, 2007),

*Focused ethnography*

Focused ethnographies (FEs) also described as mini-ethnographies or *micro*-ethnographies can involve several theoretical perspectives (Mayan, 2009). FEs concentrate on specific behaviors within a particular group of individuals in a specified societal setting (Knoblauch, 2005; Muecke, 1994) unlike traditional ethnographies that encompass entire cultural systems (Wolcott, 1990). In spite of the apparent complexity of genres, Lambert (2010) recounts a simple definition of ethnography by Savage (2006) as "a way of collecting data *(a set of research methods)*; the principles that guide the production of data *(methodology)*; and/or a product *(the written account of a particular ethnographic study)*. The aims of ethnography center on exploring social phenomena, patterns and processes (Hodgson, 2000; Wolcott 1990). Field-orientated activity and cultural interpretation are definitive features of this methodology (Lambert, 2010). Essential elements of ethnography include naturalistic data collection (Spradley, 1980; Fetterman, 2010), contextualization of social phenomena, (LeCompte & Schensul, 1999), emic and etic interpretations of meaning (Agar, 1996; Hume & Mulcock, 2004), analytic induction, and reflexivity, which involves self-awareness on the part of the researcher (Boyle, 1994; Doyle, 2013; Morse and Field, 1995; Parahoo, 2006).

*Ethnography in health sciences research*

Goodson and Vassar (2011) suggest that clinical settings are characterized by a myriad of variables that are best studied using open-ended research. Consequently qualitative studies particularly ethnographies are suitable for research in the health disciplines. Whereas quantitative measures may be instrumental in tracking patterns of illness, hospitalization rates or trends in behavior, ethnography is useful for exploring attitudes, perceptions, relational dynamics and cultures within healthcare settings in which health-related behaviors are rooted (Garro, 1982; Goodson & Vassar, 2011). Ethnographical studies are also well suited to explore the dynamics of provider-patient relationships and communication (Rice & Ezzy, 1999; van der Geest & Finkler, 2004). The resulting knowledge yield is useful to inform interventions that improve the experience, process and outcomes of healthcare delivery.

*Focused ethnographies in health sciences research*

FEs evolved within the field of sociological ethnography (Knoblauch, 2005) and share several similarities with traditional anthropological ethnography (Cruz & Higginbottom 2013; Muecke, 1994). FEs are guided

by a specific research question and conducted among a small group of people within a particular context. These studies generate targeted information for decision-making regarding a distinct problem (Knoblauch, 2005; Mayan 2009). The main similarities and differences between focused and traditional ethnographies are outlined in Table 2.1 of Appendix 2 A. Higginbottom et al. (2013) outline several healthcare studies involving the use of FEs. The range and diversity of the various study objectives underscore the versatility inherent in the FE approach. Daarck-Hirsch and Gamboa (2010) used this approach to investigate patients' beliefs regarding the causes, prevention and treatment of cleft-lip. Higginbottom (2008) also conducted a FE to understand meanings and consequences of hypertension among people of Afro-Caribbean descent. The FE approach has also been employed to study healthcare providers' roles and interactions in specific healthcare settings (Smallwood, 2009), to describe the experiences, perceptions and actions of community health nurses in the context of brief therapy (Spiers and Wood, 2010), and to describe perceptions of childbirth among child-bearing Ghanaian women (Wilkinson and Callister, 2010).

Focused ethnography employs anthropological research methods to investigate specific elements or sub-cultures within discrete communities or contexts of contemporary society (Cruz & Higginbottom, 2013; Knoblauch, 2005). Mayan (2009) defines focused ethnography (FE) as *"a targeted form of ethnography… led by a specific research question, conducted within a particular context or organization, among a small group of people to inform decision-making regarding a distinct problem."* FEs generate precise knowledge that is valuable for developing targeted solutions to specified problems (Cruz & Higginbottom, 2013; Higginbottom, 2011; Higginbottom et al., 2013; Knoblauch 2005; Mayan, 2009). Within healthcare disciplines, FEs are useful for investigating specific beliefs, behaviors, or perceptions among discrete communities or sub-cultures of patients or providers regarding particular health conditions or processes (Magilvy et al., 1987; McElroy et al., 2011; Muecke, 1994). The World Health Organization (WHO) successfully adopted and developed this approach in their study of behaviors and perceptions related to the management of infectious diseases in developing country contexts (Cove & Pelto, 1993; Hudelson, 1993; Stewart et al. 1993), (Appendix 2 A, Table 2.2). Higginbottom et al. (2013) explored the versatility of FEs in healthcare and nursing research studies (Appendix 2 A, Table 2.3). The growing representation of FE studies in the healthcare literature suggests their importance and legitimacy for use in applied research that can efficiently inform policy and practice (Morse, 2010). FEs

share several definitive features of traditional ethnographies with respect to the inherent methods of data collection and analysis (Knoblauch, 2005; Muecke, 1994). However, FEs generate targeted information in a shorter time frame than traditional ethnographies (Knoblauch, 2005; Roper & Shapira, 2000). Whereas traditional ethnographies are time extensive and experientially rich, FEs are *data intensive* in that large volumes of data from multiple sources are collected and analyzed over a relatively short time period (Knoblauch, 2005).

Having pre-determined the research questions, the settings, and the specific sub-population for this study, a focused ethnography was well suited to the research paradigm (Knoblauch, 2005; Mayan, 2009; Richards and Morse, 2007) for investigating guideline compliance among primary healthcare providers in Ghana, a developing country that is hyper-endemic for malaria. The aim of this study was to elicit and to understand the providers' perspectives and beliefs about guideline compliance within their natural practice settings. This methodological approach was consistent with the constructionist epistemological (pillar 1) and interpretivist theoretical (pillar 2) perspectives outlined above. Moreover, the FE approach was consistent with the aim of eliciting specialized knowledge (Muecke, 1994) to inform policy and practice (Higginbottom et al., 2013; Mayan, 2009; McMahon et al. 1987) that will strengthen guideline implementation for malaria diagnosis in Ghana.

Traditional anthropological ethnography generally focuses on discovering new cultures to which the researcher is unfamiliar and strives to describe the experience from the 'natives' point of view' (Hodgson, 2000). The anthropological ethnographer is confronted with the issue of strangeness in unfamiliar cultures (Richards & Morse, 2007) earning the fitting description of 'professional stranger' (Agar, 1996). Sociological ethnography a tradition with which FEs align (Knoblauch, 2005) is conducted in familiar (rather than unfamiliar) societies and cultures (Higginbottom et al, 2013). In this regard, focused ethnographers involve *alterity* in familiar settings rather than strangeness. Knoblauch (2005) describes alterity as a phenomenon where the researcher and the participants share a common implicit and explicit knowledge of the larger society or culture under investigation. This commonality facilitates the researcher's access to the specific participants, settings, and situations that are relevant to the research objectives. The researcher can be thought of as having assumed an 'alter ego' where on the one hand he/she possesses a certain naïveté about specific aspects of the culture of interest and

regards these aspects through the lens of an investigator. On the other hand, he/she shares common background knowledge with the participants about other aspects of the society or culture of interest. Against this backdrop of commonality, FEs attempt to uncover specific differences among settings and participants that are meaningful within the study context (Knoblauch, 2005). To the extent that 'strangeness' is the hallmark of anthropological ethnography, Knoblauch (2005) suggests that alterity is a necessary prerequisite for FEs.

Issues of alterity in this study revolved around shared Ghanaian heritage, upbringing, and knowledge of cultural and societal norms, between the researcher and participating healthcare providers. A common interest in improved malaria diagnosis in the study setting was also central to alterity in this study. Consistent with Knoblauch's (2005) description of alterity differences existed between the researcher and the participants in spite of shared commonality. These differences related to the researcher and healthcare providers' (practitioner) roles relating to the shared interest in malaria diagnosis. Alterity in this study therefore involved a delicate shared identity, simultaneously comprising sameness and difference. A quote from a healthcare provider in this study aptly conveyed this sentiment. At the beginning of the interview, the researcher expressed gratitude for the healthcare provider's time and knowledge, considering their busy schedule. The healthcare provider responded, "you know, *we* are all doing *the same work*" (Healthcare provider, Atwima-Nwabiagya district, *personal communication*). The researcher's reflexive contemplations on the use of "*we"* and *"the same work"* revealed a shared commonality of interest in the study objectives. This commonality of interest transcended shared Ghanaian heritage and differences related to the researcher being educated outside of Ghana.

FEs are time- and data- intensive and require extensive background knowledge of the field of study to enable meaningful investigation (Knoblauch, 2005). This study addressed this requirement through a comprehensive literature review of rapid malaria testing in sub-Saharan Africa prior to field investigations. The review provided insights regarding the context of guideline compliance for rapid malaria diagnosis in Ghana and other sub-Saharan settings. Healthcare providers are on the frontlines of guideline implementation in their facilities and their compliance with guidelines for malaria testing is poor or variable at best (Bisoffi et al., 2009; English et al., 2009; Hamer et al., 2007; Reyburn et al., 2007). Yet few studies have investigated healthcare providers' perspectives on guideline compliance

(Ansah et al., 2010; Chandler et al., 2010) to identify the underlying determinants of this behavior. The literature review therefore established the significance of the research. Additionally an internship opportunity with the National Malaria Control Program (NMCP) in Accra, Ghana provided prior experience of the national policy development context for malaria control. This opportunity facilitated close collaboration and discussion with key stakeholders whose perspectives were instrumental in distilling the specific research objectives and validating their significance in Ghana. This collaboration also influenced the choice of the study setting as the Atwima-Nwabiagya district within the Ashanti Region of Ghana (Appendix 2 A, Table 2.7).

Research Methods (pillar 4)

Research methods are the specific techniques and procedures used for data collection, analysis and interpretation (Brewer, 2000; Cresswell, 2006). Several methods can potentially be employed within a given methodology (Carter & Little, 2007; Crotty, 1998; Mayan, 2009). The appropriate use of methods and techniques guides the researcher's perceptions and ensures the integrity of the data (Cresswell, 2006; Crotty, 1998; Dew, 2007; Fetterman, 2010). Methods of data collection in this study involved trademark ethnographic methods including non-participant observation, individual and focus group interviews and document analysis (Mayan, 2009; Nicholls, 2009c; Roper & Shapira, 2000) and the principles of naturalistic inquiry (Guba & Lincoln, 1985). The use of serveral concurrent data collection methods allowed triangulation of the information generated in this study. Triangulation involves the use of two or more data sources, methodological approaches, theoretical perspectives, or analytical approaches within the same study (Lincoln & Guba, 2000; Thurmond, 2001). This allows verification of the data or of its interpretation using the different sources (Kimchi et al. 1991). Non-participant observations generated data that was used to corroborate information gathered during participant interviews (Roper & Shapira, 2000; Fetterman, 2010) allowing triangulation of the data. Triangulation was essential to recognize dissonance between observed (actual) and reported behavior (LeCompte & Schensul, 1999; Thurmond, 2001) as it related to guideline compliance among healthcare providers' in this study. This enhanced completeness and confirmation of findings (Thurmond, 2001).

*The study setting*

Prior networking with key stakeholders in Ghana led to local support for this study in the person of a field advisor, an established researcher and medical practitioner with an affiliate institution in the study region. The choice of the study district was therefore practical (Miles, Huberman, & Saldaña, 2014), based on recommendations from the field advisor.

Atwima-Nwabiagya is the third largest among 27 districts in the Ashanti Region of Ghana, comprising 157, 181 residents in 92 communities (GHS/Atwima-Nwabiagya District Directorate, 2012). Although road access the capital township in Nkawie is fairly good, many communities in this peri-urban (semi-rural) district are inaccessible by road particularly during the rainy seasons (May to July and September to mid-November). Relative humidity is high year-round with fairly constant temperatures ranging between 27°C in August and 31°C in March (GHS, 2012). The district is bounded by Offinso Municipal on the North, Amansie-West on the South, Kumasi Metropolis on the East and Atwima-Mponua & Ahafo Ano South districts on the West (Appendix C 4, Figure 1). Residents take pride in the Barekese and Owabi dams as the two main tourist attractions in the district.

*Ethnicity, Culture and Religion*

Twi-speaking Akans form the predominant ethnic group (77.4%). Christianity is the major religion (75.7%), followed by Islam (13.2%). Traditionalists (1.3%), other religions (0.9%) and those who do not identify with any particular religion (9.0%) constitute the remainder of the population (GHS, 2012).

*Economic Activities*

Agriculture provides the main livelihood, employing over 50% of the labor force, followed by the industrial sector (17.4%), trades and services (GSS/GHS/ICF Macro, 2009; GHS/Atwima-Nwabiagya District Directorate, 2012). Tuesdays are considered market days in the district during which residents engage in economic livelihood activities beginning at daybreak. These include buying, selling, and trading fresh produce and other goods and services (GHS, 2010; GHS, 2012; GSS, 2010)

*Healthcare delivery*

Districts are the operational units of the health system in Ghana (Baiden et al., 2012). Atwima-Nwabiagya has 17 primary healthcare facilities including 5 government-owned and 12 private facilities. Among these 5 maternity homes provide services at the community level, 7 health centers and 1 clinic provide services at the sub-district level, and 4 hospitals offer district level services. The Nkawie-Toase Government (district) Hospital is the main referral facility. This structure mirrors the organization of nation-wide healthcare delivery in Ghana (GHS, 2010; MOH, 2007). The Ghana Health Service (GHS) relies on a Community Health Planning Services (CHPS) compounds model to strengthen basic health services delivery at the community level by reducing geographical barriers to access in poor and remote areas (Nyonator et al., 2005). Out of 6 planned CHPS compounds for Atwima-Nwabiagya, only 1 was functional during the time of the study (GHS, 2012). Considerable diversity exists across facilities, staff and amenities at the various levels of healthcare delivery. The doctor-to-population ratio was 1:30,000, and the nurse-to-population ratio was 1:2015 in 2011 (GHS, 2012; GSS, 2009; Nyonator et al., 2005; The Population Council, 2012). The district had 8 medical assistants in 2012 heading most of the facilities, due to the limited number of available doctors. At the time of the study, the Ashanti Region had been selected by the National Health Insurance Scheme to pilot a capitated reimbursement program for health services delivery. The 2012 annual report from the district health directorate specified a negative impact of capitated reimbursement rates on facility attendance as a key challenge to effective care delivery in 2011 (GHS, 2012; GSS/GHS/ICF Macro, 2009)

*Malaria transmission in Atwima-Nwabiagya*

Malaria is the leading cause of morbidity in Atwima-Nwabiagya and has been for the past 3 years. Like all areas of Ghana, the district is hyper-endemic for malaria, with stable and peaks in intensity correlated with the rainy seasons. At 160,000, malaria cases far outnumbered the 40,000 cases of acute respiratory infections (ARI) and 16,000 hypertension cases reported in the district in 2011. More than 40% of all hospital admissions in the district in 2011 were caused by malaria. Among children below the age of five, 60% of all-cause mortality and 30% of health facility admissions in 2011 were directly attributable to malaria (GHS, 2012; GSS/GHS/ICF Macro, 2009).

*Sampling*

Quantitative studies involve emphasis on sample size and generalizability. Qualitative research studies typically involve smaller sizes and characteristic samples that allow in-depth exploration and detail to comprehensively address the research objectives (Higginbottom, 2004; Miles, Huberman, & Saldaña, 2014; Patton). Qualitative designs inherently involve bias towards participants who are better informed or have a depth of experience which serves to enrich the description and meaning of the phenomenon under study (Mayan, 2009; Richards & Morse, 2007). Sampling decisions for this study (size, frame, and strategies) were predicated on the research purpose (Ezzy, 2002; Tuckett, 2004). The sample was therefore purposefully selected. Crookes and Davis (1998) describe purposeful or purposive sampling as a researcher's judgmental and conscious selection of participants and other sources of data to include in the study. Purposeful sampling is also known as judgmental sampling and involves the identification and selection of participants with known characteristics, features or affiliations within the culture of interest that ensure that their perspectives are useful for addressing the research objectives (Ezzy, 2002; Higginbottom, 2004; Reed, 1996). Purposive sampling is common in ethnographic studies, where judgments regarding participant selection are based on the participants' membership within the group or sub-culture being investigated. This strategy is useful for determining a pragmatic sample size to address research objectives especially where there are time and funding constraints (Higginbottom, 2004). Purposeful rather than random sample selection was preferable in this study to elicit informed rather than generally representative perspectives on guideline compliance.

*Sampling frame and unit selection*

NYB purposively selected 6 peripheral health facilities from the sampling frame of 17. The 6 sampling units comprised two facilities selected from each of the three main levels within primary healthcare delivery, namely community, sub-district, and district sub-levels of primary healthcare (GHS/GSS/ICF Macro, 2009). Each pair was complementary, comprising a government- and a privately owned facility. The sample included a private maternity home and a small government health center (community facilities); a private clinic and a large government health center (sub-district facilities); and a private hospital and a district government hospital (district facilities). Purposive sampling allowed the inclusion of a wide range of provider cadres at the different facility types in order to capture a diverse range of perspectives on compliance (GHS/MOH 2007; GHS/Atwima-Nwabiagya District Directorate, 2012).

Existing diversity among healthcare facilities and cadres of providers in Atwima Nwabiagya (GHS, 2010; GHS, 2012) was important for ensuring within-sample variation. The broad range of included participants allowed possible variations in perspective among these participants to be explored (Marshall, 1996; Roper & Shapira, 2000; Higginbottom, 2004) that might have related to differences in age, gender, qualifications or skill levels among providers. Within-sample variation in qualitative research studies allows substantial heterogeneity which ensures that the data collected includes representation of the full range and extent of the phenomenon under study (Higginbottom, 2004; Miles, Huberman, & Saldaña, 2014). This is termed maximum phenomena variation (Higginbottom, 2004; Mays & Pope, 2000; Miles, Huberman, & Saldaña, 2014). Within-sample variation enhanced data interpretation, as diverse participant meanings enriched the researcher's understanding of guideline compliance. This information was beneficial for developing recommendations for improving malaria management at the various levels of primary healthcare delivery in the setting.

*Participant selection and recruitment*

The choice of primary healthcare providers as participants in this study was based on a comprehensive review of relevant literature, the conceptual model and familiarization with malaria control policy frameworks in Ghana. Malaria is hyper-endemic across the entire country and is the leading cause of morbidity and under-five mortality in the study district (GHS/MOH, 2007, 2010; GHS/NMCP, 2009; Ansah et al., 2010). District facilities provide the first point of call for patients accessing the health system in Ghana (Baiden et al. 2012; MOH/GHS, 2007). Consequently, healthcare providers in peripheral facilities are familiar with routine malaria diagnosis and management. RDT use is promoted in peripheral settings in Ghana (Ansah et al., 2010; Baiden et al., 2012a) and widely across Africa (Drakely & Reyburn, 2008; English et al., 2009; Williams et al; 2008). Primary healthcare providers' daily experiences with malaria management involving RDT use implied that their perspectives would richly inform an understanding of guideline compliance. Purposeful selection of participants (Ezzy, 2002; Mays and Pope, 1995, Richards and Morse, 2007) in this study enabled NYB to access the healthcare providers' internal beliefs and perspectives about guideline compliance within their natural practice settings.

The sample comprised 50 healthcare providers recruited on-site at the selected facilities. The sample size was conveniently based on the available numbers of providers involved in malaria management at the included study facilities. Previous qualitative studies involving RDT use in malaria management in Ghana (Chandler et al. 2010) and elsewhere in Africa (Moonasar et al., 2007; Tavrov et al., 2000) demonstrated the ability to achieve data saturation and to produce useful findings from similar sample sizes. Recruitment involved visiting the facilities to hold in-person discussions with the facility head and providing study information to potentially interested healthcare providers. Prior to any data collection, participants were invited to discuss consent procedures and concerns including anonymity and confidentiality information. Consenting providers were all literate and provided signatures as proof with none needing a witness or thumbprint to signify their consent.

*Key informants*

Key informants are individuals, or gatekeepers in the study setting, who are able to expedite or simplify the process of gaining access to the study population (Fetterman, 2010; Higginbottom, 2004; Roper & Shapira, 2000). Key informants in this study assisted with identifying sampling units from which to recruit participants for this study. The field advisor assisted with identifying 3 key informants who were knowledgeable in different aspects of community life within the district. These included a primary healthcare provider, a local community opinion leader, and a representative of a local chief. NYB established a study advisory group comprising the field advisor and the 3 key informants, and leveraged their combined influence in the study communities to facilitate rapport building (Higginbottom, 2004; Roper & Shapira, 2000) with heads of facilities and other gatekeepers in the district. Gatekeepers included representatives of the district health management team and heads of facilities that the group recommended for inclusion in the study. The group identified potential facilities for inclusion and provided recommendations to guide the final selection of 6 out of 17 district health facilities as sampling units in this study. Several areas of the district are inaccessible by road particularly during rainy seasons (GHS/Atwima-Nwabiagya District Directorate, 2012). Practical considerations therefore included geographical and logistical feasibility of access to health facilities.

**Ethical considerations**

The Health Research Ethics Board 1 at the University of Alberta in Canada, and the Committee for Health Research and Publications Ethics (CHRPE) in Kumasi, Ghana approved the study protocol. NYB obtained additional support from the Director for Health Services in the study district, who provided a letter to all health facilities in the district, expressing his support and encouraging their cooperation to facilitate the research activities.

**Data collection**

Data collection involved definitive ethnographic methods of non-participant observation with field notes, interviews including focus groups and document review (Agar, 1996; Fetterman, 2010; Hammersley & Atkinson, 1995). NYB employed the various data collection methods such that data generated at earlier stages of collection corroborated information generated in subsequent stages of data collection (Appendix 2 A, Table 2.11). This enabled data and methodological triangulation and enhanced the trustworthiness of the data. Observations and informal interviews with heads of study facilities and laboratory staff were essential in determining what issues were relevant to the providers and warranted further investigation through subsequent individual and focus group interviews.

Non-participant (direct) observation

Participant observation is a form of data collection made possible through participating in and 'becoming a part of ' the daily lives of the group being studied (Richards & Morse, 2007; Roper & Shapira, 2000). This method of eliciting data is characteristic of ethnography (Roberts, 2009). With non-participant observation, the researcher purely observes and records happenings in the setting (Denscombe, 2003; Roberts, 2009). Several factors determine the degree of a researcher's participation in ethnographic observations. These include the nature and specific needs of the study, the setting, and the degree to which participants are comfortable with the researcher's participation (Bogdewic, 1999; Roper & Shapira, 2000). Ethical and practical considerations in this study influenced the decision to use *non*-participant observations (Roper and Shapira, 2000; Brink, 1982) in this study. The researcher is not a trained clinician and could not legitimately participate in care-giving activities. The researcher's role was therefore conspicuous to providers and to patients or caregivers of younger patients being observed.

This called for continuous negotiation of informed consent (Richards & Morse, 2007; Roper & Shapira, 2000) and ensured transparency and trustworthiness in the data collection process (Lincoln & Guba, 1995; Nicholls, 2009c). Initial data collection broadly encompassed descriptions of the setting, events and background activities of interest. Observations progressively focused on specific activities that were of greater relevance to the research objectives (Miles, Huberman &, Saldaña, 2014; Spradley, 1980). Such activities included providers' decisions to request a RDT for a patient as well as their reactions to a negative test result. Non-participant observations were convenient for obtaining information on the participants' behavior that may not have been available through other methods of investigation (Roper & Shapira, 2000). Chandler et al. (2010) successfully used non-participant observation for studying the context of malaria diagnosis and treatment in Ghana and in Tanzania (Chandler et al. 2009). These studies did not report any significant changes in providers' behavior as a result of having an observer present that may have influenced the findings or caused harm to patients.

Audio-recorded and hand written field notes during observations (Davies, 2007) were essential in order to distinguish between actual observations and NYB's perceptions about these observations (Bryman, 2008; Roper & Shapira, 2000). This required recognition and continual documentation of personal perceptions and biases prior throughout the study (Doyle, 2013). The researcher is the human instrument in ethnographic data collection (Richards & Morse, 2007; Roberts, 2009; Roper & Shapira, 2000). There is therefore a need to ground interpretation in the data and the participants' meanings, which is essential in naturalistic inquiry to ensure credibility of the findings (Guba & Lincoln, 1985). Field notes during non-participant observations and memos (personal notes, ideas, reflections and reminders) enhanced trustworthiness of the findings. This documentation allow independent assessment of the extent to which personal beliefs or perceptions may have influenced data collection and interpretation (Carter & Little, 2007; Lincoln & Guba, 2000).

NYB directly observed participating healthcare providers at all 6 study facilities over 6 weeks during daily clinical encounters with patients suspected of having malaria. Non-participant observations centered on routine situations involving guideline compliance and lasted 2-3 hours per day at smaller health facilities, and 5-8 hours per day at larger facilities with longer duration of steady attendance. Observations generated information that highlighted providers' behavior with respect to guideline compliance and

provided opportunity to engage them in informal interviews during which they could explain and clarify some of the observed behaviors (Clarke, 2009). This allowed NYB to corroborate observed and reported behavior and to explore any related dissonance (LeCompte & Schensul, 1999). NYB considered the legitimate concern that healthcare providers' might behave differently with regards to guideline compliance during observation periods, due to the presence of an observer. This phenomenon is referred to as a "Hawthorne effect" (Aschengrau & Seage, 2013). However, the possibility of a change in behavior was minimal for two main reasons. First, NYB paid multiple visits to the study facilities prior to beginning data collection. These visits provided opportunities to establish rapport, to build trust with the healthcare providers, and to clarify misconceptions regarding the purpose of the observations. This minimized the likelihood of a change in behavior during observations. Secondly, healthcare providers were aware of their behaviors which constituted poor compliance, as was evident from their responses in subsequent interviews. These responses also conveyed their rationale for this behavior as the need to prevent complications and death from severe malaria. Consequently, a change in routine practice that providers perceived as potentially harmful to patients was unlikely in this study.

## Interviews

Interviews are a primary data gathering technique that provide context and explanation to observations made in the field (DiCicco-Bloom & Crabtree, 2006; Kvale, 1996). Interviews are commonly used for data collection in qualitative research (Mason, 2002) as they allow the researcher to ask questions or to seek further clarification regarding observations of interest (Roberts, 2009). Qualitative interviews include informal, in-depth and focus group interviews (DiCicco-Bloom & Crabtree, 2006). This study included these three types of interviews to elicit participants' perspectives (Bogdan & Biklen, 1982; Kvale, 1996) that were pertinent to guideline compliance.

### *Informal interviews*

Informal interviews involved laboratory personnel who primarily conduct malaria testing with RDTs in the setting and clinicians who are expected to use RDT results for diagnosis and treatment. Informal interviews created a natural setting for providers to share their perspectives by embedding interview questions in routine conversation (DiCicco-Bloom & Crabtree, 2006). This helped to build rapport before

introducing potentially sensitive discussions (Fetterman, 2010) related to observed differences in the prescribed and actual uses of RDT results in malaria diagnosis. Informal interviews allowed participants to provide clarification to insightful questions arising from prior observations. This ensured representation of participants' meanings, further enhancing the credibility of data interpretation (Bogdewic, 1999; Cresswell, 2006). Continuous interactions with the providers over time helped NYB to develop a better understanding of characteristics that providers considered important (Bogdewic, 1999; Roper & Shapira, 2000; Spradley, 1980) that were relevant to guideline compliance. Relevant topics for in-depth interviews were identified from data generated through informal interviews (Richards & Morse, 2007; Roper & Shapira, 2000).

*In-depth, semi-structured interviews*

In-depth interviews are particularly useful for exploring complex social issues that are relevant within healthcare settings These interviews use open-ended questions to encourage participants' to further explicate the meanings they attach to the topic being investigated (DiCicco-Bloom & Crabtree, 2006). This method was appropriate for exploring issues related to challenges healthcare providers experienced when implementing guidelines for malaria diagnosis using RDTs. The use of attentive listening (Bogdewic, 1999) and gentle probing strategies such as repeating unfinished participant responses encouraged providers to share their perspectives extensively (Roper & Shapira, 2000).

NYB was introduced to participants as a graduate student researcher and personally conducted all interviews in English with consenting healthcare providers, administrators, and policy officials. Interviews occurred in private at the participants' respective health facilities, offices, or preferred locations and followed a topic guide centered on guidelines governing RDT use for malaria testing. Semi-structured interviews primarily included frontline health services delivery providers whose use of RDT results in diagnosis and treatment decisions reflected guideline compliance. NYB audio recorded and captured handwritten notes during each interview. Where necessary follow up interviews included face-to-face and telephone conversations with providers. In-depth interviews generally lasted 90 minutes, and continued across all the facilities until data saturation was achieved. At this stage, additional data collection did not lead to the discovery of any new perspectives or information on guideline compliance.

Relevant health policy issues were identified during concurrent data analysis of providers' interview responses for which greater clarification could be obtained through consultations with policy officials. s required. Key informants and local experts facilitated access to local, regional, and national health administrative and policy officials from relevant institutions (Appendix 2 A, Table 2.10). Informal discussions created a comfortable environment for natural dialogue (DiCicco-Bloom & Crabtree, 2006; Fetterman, 2010) with health administrative and policy officials whose limited availability was not conducive to scheduling formal interviews. These officials may also not have been willing to formally discuss matters that involved government perspectives on health policy implementation in the setting. Healthcare providers' alluded to challenges with the implementation of an ongoing pilot initiative for capitated fee reimbursements for services provided to insured patients. Local health policy officials were responsible for ensuring implementation of the initiative at the facility level. Obtaining their perspectives therefore clarified the information obtained through prior interviews (Gilchrist & Williams, 1999; DiCicco-Bloom & Crabtree, 2006) with the healthcare providers.

*Focus group interviews (FGIs)*

Issues surrounding guideline compliance that required further exploration were identified through concurrent analysis of data obtained through in-depth interviews (Barbour, 2005). Topics for group interviews were based on perspectives of guideline compliance that providers commonly cited during individual interviews. These issues provided natural starting points for comfortable conversation in the group discussions (Belzile & Öberg, 2012). Barbour (2005) defines focus groups as any group discussion where a researcher actively encourages and is attentive to group interaction. Focus group interviews (FGIs) were particularly useful for exploring consensus building and shared rationale on through group interaction (Barbour, 2005; Belzile & Öberg, 2012; Brown, 1999; Morgan, 1988, 2010) among providers regarding guideline compliance in their practice settings. Groups included different cadres of healthcare providers based on their availability at the facility on the scheduled date of the discussion. This study included one small (4 persons) and two mid-size (6-8 persons) focus group interviews (FGIs) at three selected study facilities. Groups of 6 – 8 participants are generally considered optimal to ensure adequate time for each participant to air their views and for informative group interaction and dynamics. Although concerns of limited interaction rise with less than 5 participants (Brown, 1999; Morgan, 2010), the smallest FGI in this study comprising 4 participants demonstrated

significant interaction, provided insights for data analysis, and included all the staff at the facility. The two larger FGIs were conducted in English with NYB facilitating and taking notes. The smallest FGI was in a remote setting for which NYB employed the assistance of a co-moderator (a public health nurse known in the community with relevant research experience) to accommodate the participants' preference of holding the discussion in the Akan/Twi language. FGIs targeted different healthcare provider cadres whose final representation depended on their availability at the selected facility at the scheduled time of the discussion [Appendix 2 A, Table 2.9].

Document review

Documents much like oral traditions in non-western cultures, preserve and provide a record of activities, events, and practices that hold cultural, historical, and political significance in society (Nicolls, 2009c). This information enhances the ethnographic researcher's understanding of the context. Document analysis in qualitative research involves a review of any culturally significant text in the setting. *Documents* in this regard can be in written or image form among others. These can include government policies, photographs, or even poetry (Nicholls, 2009c). Documents reviewed in this study included Ghana's existing strategic plan (2008-2015) for malaria control (GHS/NMCP, 2009a), case management guidelines for malaria (GHS/NMCP, 2009b), and instructional materials related to malaria diagnosis in the setting. The review also included district directorate reports indicating allocation and distribution of RDTs to healthcare facilities. This information was useful for assessing healthcare providers' knowledge of the guideline. District health directorate records were also useful for confirming healthcare provider reports of long stock out periods for RDTs and for identifying gaps in RDT distribution and delivery to the facilities.

Data management and storage

All study data were secured in locked storage facilities located in the Research and Development Unit at the Komfo Anokye Teaching Hospital in Kumasi, Ghana. Identifiers including demographic data were separately stored and subsequently omitted from interview transcripts for analysis. The principles of informed consent, confidentiality and anonymity were continually negotiated throughout field research, data storage and management and will continually be upheld in any resulting publications. For

publications where participants' quotes are deemed necessary for emphasis, generic identifiers pseudonyms were used to maintain anonymity.

**Data Analysis**

In-depth interviews and focus group discussions were audio-recorded, transcribed verbatim and checked for accuracy shortly after each interview (Richards & Morse, 2007). Preliminary analysis of transcripts identified areas needing further investigation through follow-up interviews (Miles, Huberman, & Saldaña, 2014). Ethnographic analysis followed Roper & Shapira's (2000) outline. This began with coding which identified and labeled key words and recurring phrases relevant to guideline compliance. Coding facilitated the process of sorting and grouping the relevant data segments into categories and sub-categories where appropriate, based on similar or differences. Potential associations between the categories were also identified through the sorting process (Roper & Shapira, 2000), and how these were relevant in addressing the research objectives (Miles, Huberman, & Saldaña, 2014). Similar analysis of focus group data revealed patterns between shared rationale and collective actions or perceptions regarding guideline compliance (Barbour, 2005). Patterns and relationships within and across the various categories were gradually identified and established within and across the different categories. This process supported the identification and development of recurring themes in the data. Identifying peculiar (or negative) cases that contrasted the majority of participant responses (Richards & Morse, 2007; Roper & Shapira, 2000), was important for understanding the range of perspectives surrounding guideline compliance. Atlas.ti (qualitative data analysis software) was used to facilitate data management and organization. Software procedures were followed to 'query' the data (Friese, 2012), using tools provided. This involved identifying the characteristics of relationships of interest within the data. Saving records of these analytic processes provided an audit trail that supported data interpretation (Cutcliffe, J., & McKenna, H., 2004; Shenton, 2003). This enhanced the integrity and rigor of data analysis (Roper & Shapira, 2012) and provided clear linkage between interpretations and the data (Friese, 2012). This process supported gradual progression from descriptive coding to more conceptual stages of analysis, which involved the development of abstract concepts. These concepts were verified by relating the data to the literature (Richards & Morse, 2007; Roper & Shapira, 2007) on malaria diagnosis and guideline implementation in resource-constrained settings.

**Reflexivity**

Reflexivity describes a researcher's continuous process of reflection on how their personal values, behavior or interaction with the participants can affect the interpretation of participants' responses (Doyle, 2013; Parahoo, 2006). This study involved non-participant observations, interviews and focus groups all of which include varying degrees of researcher interaction with participants in the setting (Bogdewic, 1999; Roberts, 2009). Reflexivity was essential to understand the potential influences of the researcher's biases and preconceptions on the processes of data collection and interpretation (Jootun, McGhee, & Marland, 2009) in this study. Continuous personal scrutiny and internal dialogue were key reflexive processes engaged in this study (Doyle, 2013). This process allowed greater clarification and allowed the researcher to 'prompt, probe and encourage' participants to share their views to ensure that data interpretation was grounded in the participants' meaninngs (Hertz, 1997). Reflexive processes included documenting the researcher's biases held prior to conducting field investigations (Morse & Field, 1999; Roper & Shapira, 2000). These memos were important for ongoing self-evaluations to identifying how these perceptions may have changed during the research process. Reflexivity was therefore essential to ensure the researcher's sense of self-awareness throughout the research process (Parahoo, 2006; Richards & Morse, 2007; Shenton, 2004). Maintaining careful documentation of background knowledge acquired prior to field investigations was also essential to ensure that this information did not prevent NYB from learning primarily from participants' perspectives in the field (Jootun, McGhee, & Marland, 2009; Parahoo, 2006).

**Rigor**

Rigor addresses measures of quality applied before, during, and after conducting a study that determine the trustworthiness of its findings (Morse et al. 2002; Nicholls, 2009c). Lincoln & Guba (1985) outlined criteria of confirmability, dependability, credibility, and transferability of findings as measures of rigor in qualitative research. This study employed various strategies to ensure rigor (Appendix 2 A, Table 2.11). The study ensured methodological coherence, which involves a 'good fit' between the underlying philosophical assumptions, the methodology of choice, and the prescribed method in this study (Nicholls, 2009c). This established confirmability, credibility and dependability of the findings. Strategies that ensured rigor included purposive sampling to generate specific data based on informed rather than generalized, representative perspectives (Higginbottom, 2004). This in turn enabled in-depth

understanding of guideline compliance. Maximum phenomenal variation (within-sample variation) enabled full representation of the possible range of perspectives surrounding guideline compliance (Miles, Huberman, & Saldaña, 2014). Methodological and data triangulation using document analysis, observations, informal and in-depth interviews, focus group interviews allowed verification of preliminary findings through subsequent data collection. Verification in this study also included careful comparison of interview transcripts to the audio-recordings before analysis. Concurrent data collection and manual transcript analysis allowed NYB to identify areas needing further investigation through subsequent interviews (Nicholls, 2009c). Key points from transcripts were summarized and discussed with participants for clarification. This enhanced the authenticity, confirmability, and dependability of data interpretation (Lincoln & Guba, 1995; Richards & Morse, 2007). Regular memoing of NYB's guiding assumptions and rationale for decision-making during data collection and analysis ensured a transparent process and provided audit trails (Shenton, 2004), which enable independent assessment of the transferability of the findings to other contexts. Continually negotiating consent from participants throughout the duration of the study ensured that no participants provided data under duress, coercion or other undue influence (Roper & Shapira, 2000), further enhancing the credibility and dependability of the findings.

**Conclusion**

This research is the first in-depth study on healthcare providers' compliance with guidelines for rapid malaria testing in Ghana since the policy was introduced in 2010. Previous studies explored the notions of test kit accuracy and quality, extent of use among providers, and patients' or caregivers' comfort with testing procedures. At the time of this study, one previous study conducted prior to the introduction of the confirmatory malaria testing policy in Ghana had reported on how district health workers integrated RDT use with routine malaria management. In this appendix, further details were supplied to support the methodological procedures outlined in Chapter 2 including the strategies employed to ascertain the relevance of the research, to establish congruence within the philosophical, theoretical and methodological foundations of the study design, and the rationale for the approach used to address the research objectives. These procedures substantially enhanced the trustworthiness of the data and findings generated in this research.

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**Appendix 3-1: Conceptual model for investigating healthcare providers' compliance with the confirmatory malaria testing guideline in Ghana**

Guideline compliance in this study

This study defines guideline compliance for rapid malaria testing as a healthcare provider's commitment to test a patient suspected of having malaria using a RDT, and to further treat or otherwise manage the case consistently with the test results, as recommended by current case management guidelines for malaria in Ghana [1, 2]. Previous studies established the appropriateness of considering healthcare providers' use of RDTs and their recommended application of test results as a measure of compliance with current malaria management guidelines in endemic regions [3-6].

RDT implementation and guideline compliance

The conceptual model that provided direction for this investigation of compliance [Appendix 3 B, Figure 3.2] was based on relevant literature on RDT acceptance and use within the context of test-based malaria management in sub-Saharan African settings [4, 6-9]. RDTs are essential to the implementation of confirmatory malaria testing in developing country settings where limited laboratory infrastructure restricts the availability, functionality, and quality of microscopy for malaria diagnosis [10-13]. The utility of RDTs is further emphasized at the peripheral level where the impact of healthcare delivery capacity constraints are heightened by the scarcity of basic amenities such as clean, pipe-borne water and electric power supply to ensure proper preparation, treatment and storage of laboratory samples [10, 14]. RDTs are therefore the *modus operandi* for enabling parasitological confirmation of malaria in the majority of primary healthcare settings in sub-Saharan Africa [10, 11, 15, 16].

Implementation context and guideline compliance

Evidence on the acceptance, uptake and utilization of new research evidence [17, 18], digital or health technologies [19, 20] underscores the importance of cultural, organizational, human and other factors impinging on the implementation context [21-23]. The recent introduction of RDTs for malaria diagnosis in sub-Saharan settings represents a health technology innovation in these settings, for which Asiimwe and colleagues documented various factors influencing the acceptance and use in Ugandan settings [4]. A study conducted in Ghana prior to national adoption of a test-before-treat approach for malaria also demonstrated the significance of the implementation context to the success of RDT use in a Ghanaian

setting [7]. Central findings of this study were that providers' perceived RDTs through various interactions including those with peers, patients, the healthcare system, and other stakeholders such as technology developers, manufacturers, and distributors. Additionally, the authors highlighted the importance of emphasizing consistent policy guideline information to providers in order to facilitate policy implementation. The import of context with specific reference to malaria diagnosis has previously been established in Tanzanian settings [24]. Guideline compliance as it relates to RDT use in diagnosing malaria is therefore influenced by the healthcare providers' acceptance and utilization of RDTs. The wide variety of acceptance and use factors themselves indicate a multifactorial landscape surrounding the introduction of new health technologies in resource-constrained areas. These include individual and health system factors, as well as socio-cultural, economic and political aspects of the implementation context. Findings from studies in Ghana [7, 8, 25], Nigeria [26], South Africa [27], and Tanzania [24, 28] among others lend support to this evidence.

The constructs of the model for investigating guideline compliance

Based on the above outline, this conceptual model presents guideline compliance as being influenced by three primary interactions involving: (1) Provider - Technology, where perceptions of RDT utility, suitability and effectiveness in practice are formed; (2) Provider - Policy Guideline, from which knowledge, perceptions, and understanding of current recommendations for case management of malaria are established; and (3) Provider - Patient, the primary locus where guideline compliance occurs and the hub of technology, policy and practice with regards to diagnosis and treatment of malaria in the study setting. These primary constructs are presented in the inner boxes of the model.

The model (Figure 3-2) was designed to anticipate and to accommodate contextual and structural influences including health system factors, historical, socio-economic, and political factors that influence practice and invariably malaria diagnosis in the study setting. These are presented as the 4 outer boxes which frame the primary constructs in the model. The arrows between the boxes representing the primary constructs denote interaction or relationships between these constructs. Bi-directional arrows indicate a mutual influence of each construct on their interactions of inter-relationship. Mutual interaction between the technology (RDTs) and Providers is demonstrated in the idea that perceptions of the technology influence providers' use of the technology. Sustained RDT use by providers in turn informs

the perceptions surrounding their accuracy, usefulness and suitability for malaria diagnosis in the setting. Similar inter-relations can be observed between providers and the policy guideline and between providers and their patients – the latter interaction being the central place where guideline compliance can be demonstrated, observed, measured, or otherwise investigated.

This thesis therefore investigates guideline compliance in the context of the primary healthcare providers' use of RDTs to guide case management of fever patients suspected of having malaria according to current national guidelines in Ghana [1].

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**Appendix 3-2: Interview Topic Guide**

Investigating healthcare providers compliance with the guideline for confirmatory malaria testing in Ghana

**Outline of topics or areas for discussion during interviews**

1. Basic demographic information
2. Healthcare providers' training and employment in health, healthcare, health services
3. Test-before-treat guideline awareness and knowledge, challenges, perceptions, suggestions,
4. RDT use, previous training, experience, perceptions, suggestions etc.
5. Any other insights

**Sample questions for discussion with participating:**

A) Healthcare providers - what can you tell us about:

- How you feel about the 'test-before-treat' guideline for malaria?
- Using RDTs for malaria testing in your health facility?
- Things about you/your work that might affect how you use RDTs for malaria testing?
- Things about you/your work that might affect how you work with test-before-treat guidelines for malaria?
- Making malaria testing better in your facility?

B) Consulted health policy administrators or officials - what can you tell us about:

- Implementation of the 'test-before-treat' guidelines in your (specify the administrator or official's unit of jurisdiction - e.g. facility/district/region?
- Factors that support test-before-treat guideline implementation in your unit of jurisdiction?
- Factors that do not support test-before-treat guideline implementation among healthcare providers in your unit of jurisdiction?
- Making guidelines easier to work with for healthcare providers in areas with few or no laboratories in your unit of jurisdiction?
- How to improve test-before-treat implementation among healthcare providers in your unit of jurisdiction?